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Banking regulation, stability and efficiency of Islamic banks : what works best? A comparison with conventional banks

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THÈSE

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Préparée au sein du **Laboratoire CERAG UMR CNRS 5820**
Au sein de l'**École Doctorale Sciences de Gestion (EDSG**
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**Banking regulation, Stability and
Efficiency of Islamic banks:
What works best?
A comparison with conventional banks**

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L'Université n'entend donner aucune approbation ni improbation aux opinions émises dans cette thèse. Celles-ci doivent être considérées comme propres à leur auteur.

To my parents

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“...A question in the mind of regulators is how to treat Sharia’a compliant finance? (...) Some regulators try to fit it into the existing regulatory framework and just work with exceptions (...) whereas others try to create a separate regulatory framework that deals specifically and explicitly with Sharia’a compliant finance...”

From the speech of Thorsten Beck, June 2014,
4th Islamic Banking and Finance Conference,
Lancaster University Management School,
United Kingdom

General Introduction

Characterized as the worst financial crisis since the Great Depression in the late 1920s/early 1930s, the 2007–2008 subprime crisis caused a rapid meltdown and triggered worldwide financial distress that threatened the existence of the financial system. It was often asked whether *too big to fail* banks should be bailed out in cases of extreme financial instability. The severity of the subprime crisis has shown for the first time in history that even *too big to fail* banks may face bankruptcy. In September 2008, Lehman Brothers, the fourth largest US bank went bankrupt, while other banks such as Merrill Lynch, Morgan Stanley, and Goldman Sachs faced financial difficulties. Not knowing the consequences of another large-scale bankruptcy on the financial strength of the system, the US government decided to intervene, along with the Federal Reserve, the US Treasury Department, and the Federal Deposit Insurance Corporation, to rescue the collapsing system and restore confidence in the US banking sector. This resulted in the biggest bailout package in history. A staggering \$9.7 trillion were injected into the U.S market¹ by requiring taxpayers to bailout financial institutions. UK and other European banks were also suffering from the financial crisis. Bloomberg² (2009) reported a \$1.4 trillion bailout plan for European banks and \$0.9 trillion for UK banks.

¹ For more details visit: <http://www.bloomberg.com/apps/news?pid=washingtonstory&sid=aGq2B3XeGKok>.

² For more information visit: <http://www.globalissues.org/article/768/global-financial-crisis>.

Kayed and Hassan (2011) have described a financial crisis as an event that includes sovereign default, stock markets crashes, and currencies crises. The two authors argued that in 2007–2008 the banking and financial crisis resulted in the accumulation of excessive liquidity, irresponsible lending policies, and the excessive use of complex financial products by banks, along with the quasi-absence of regulatory and supervisory authorities. This so-called diversification of risk between different financial parties did not minimize bank risk exposure as regulators believed that it encouraged financial institutions to benefit from financial derivatives. This led to more risk exposure and resulted in rapid contagion and the spread of losses when indications of financial distress started to appear.

Meanwhile, far removed from the excessive use of financial derivatives, a relatively small but promising financial system was flourishing. Notwithstanding the gravity of the 2007–2008 financial crisis, it was noted that, unlike conventional banks, Islamic Financial Services Institutions (IFSI) were not affected. For instance, the Saudi based Al-Rajhi Islamic bank³ reported an impressive return on average assets (ROAA) of 5.61%, compared to only 0.93% for the Bank of America in 2007 and 0.95% for Lehman Brothers in 2007. This rapid deterioration of the stability and performance of conventional banks triggered new reservations about this so-called classical financial system and drew greater attention to financial instruments that emphasize the profit and loss sharing concept (Mohieldin, 2012).

Kayed and Hassan (2011) argued that conventional banks were vulnerable to the financial crisis because they do not use profit and loss sharing principles; instead, they rely excessively on financial derivatives, and they prefer to take a more highly leveraged position as Central Banks and other financial authorities will intervene to rescue any defaulting *too big to fail* bank. However, this is not the case for Islamic banks that endorse *Sharia'a* principles.

³ The Saudi Al-Rajhi bank was classified as the third major Islamic bank after Bank Melli and Bank Mellat in Iran, according to the Banker, 2011.

Motivations and choice of thesis subject

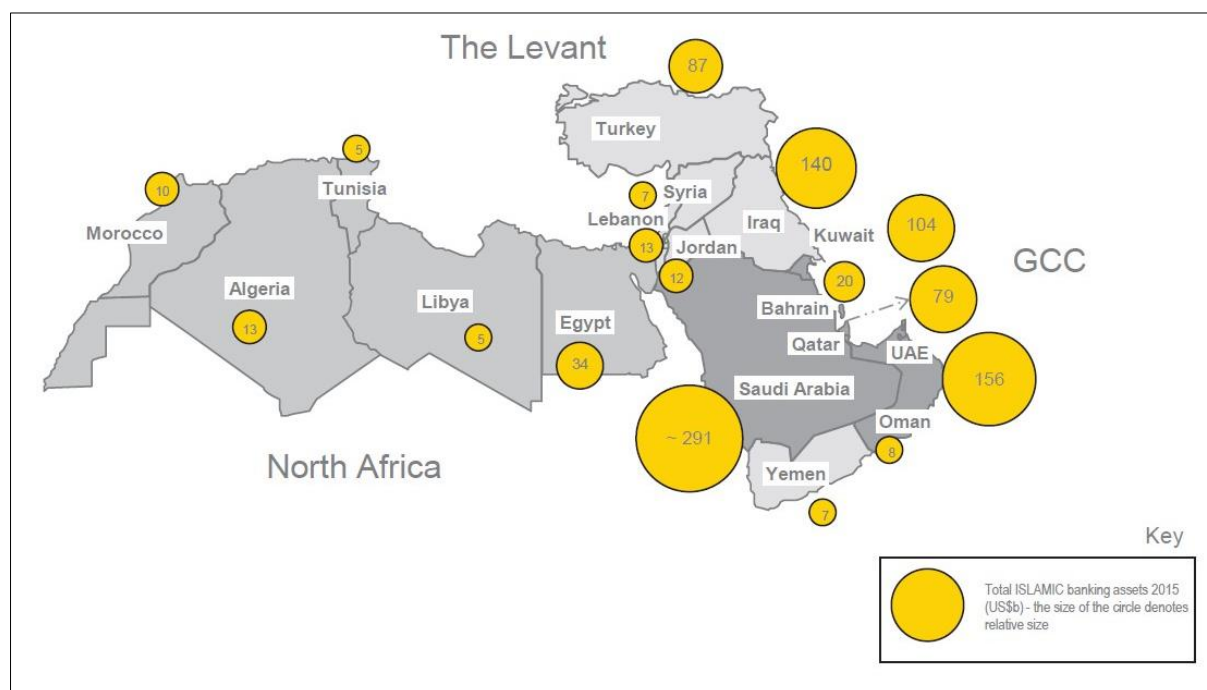
The motivation to choose Islamic finance as a thesis subject, and more precisely to study Islamic banking regulations, is related to four important factors that show that this industry is very important and can enhance the financial system's stability and efficiency. These factors are: (i) the rapid growth of the Islamic banking industry compared to the conventional banking industry; (ii) the remarkable development of Islamic bonds; (iii) the World Bank's Financial Inclusion policy for 2014–2020, and the role of Islamic banking and finance in that; and (iv) the newly emerged literature on Islamic banks that has started to appear in top-tier journals.

Islamic banks potentials

Although *Sharia'a* compliant banks account for only 1.5% of total assets of the worldwide banking sector (Abedifar, Molyneux, and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche 2013), they have experienced tremendous growth over the last 30 years (Mokhtar, Abdullah, and AlHabshi, 2007). According to the 2012 Ernst and Young report, the total amount of assets held by Islamic banks has grown from \$100 billion in 1996 to more than \$1.1 trillion in 2012, and currently account for \$ 1.7 trillion and expected to reach more than \$ 3.4 trillion in 2018 (Ernst and Young, 2013). The first Islamic finance experience can be traced back to Malaysia in the 1940s, followed Pakistan in the early 1950s, and Egypt in the 1960s while the first Islamic bank was not created until 1975. The development of this sector was intensified by the 1975 oil price boom and still continues today (Sufian, 2006; Viverita, Brown, and Skully, 2007). This can be explained by several factors including: (1) the oil revenues of the Gulf countries, and (2) the desire of the Muslim world to extend *Sharia'a* law to all economic activities. In fact, research has shown that between 2000 and 2012, Islamic banks have had an active annual asset growth rate between 19% and 20% compared with only 10% for conventional banks (Sufian, 2006, 2007; The New York Times, 2013). Not surprisingly, they are considered as the fastest growing sector in the banking system (Sufian, 2008). For instance, Islamic banks reported a staggering 17.6% assets growth in 2013 (Ernst and Young, 2013). In some countries, Islamic banks have become systemically important and in many cases are considered as “*too big to be ignored*” (Hassan and Dridi, 2010).

Islamic banks are mainly concentrated⁴ in the Middle East and North Africa (MENA) region (see Figure 1) and more precisely in the Gulf Cooperation Council (GCC) countries and Iran. There are also a considerable number of Islamic banks in South East Asia, primarily Malaysia. Islamic banks work either in a fully integrated Islamic financial system or in a dual banking system regime. For instance, some countries such as Iran, Sudan and (unsuccessfully) Pakistan, have adopted the vision of a fully Islamic banking regime, whereas countries like Indonesia, Malaysia, and Turkey allow both Islamic and conventional banks to co-exist (Viverita, Brown, and Skully, 2007).

Figure 1. Total Islamic banking assets forecast in the MENA region for 2015



Source: Ernst & Young, the world Islamic banking competitiveness report 2011–2012

The Islamic bonds market

The issuance of Islamic bonds or *Sukuk*⁵ has never been so in demand as it is today, which is an unprecedented development. This demand has become very clear over the last seven years (see

⁴ More details about the Islamic banking system’s history, concentration, growth, and business models are provided in chapter 1.

⁵ *Sukuk* is an Islamic financial certificate that complies with Islamic law. The main difference between a *Sukuk* and a conventional bond is that a *Sukuk* does not pay interest to *Sukuk* holders; rather it distributes a return that corresponds to a rent fee on a tangible asset. In fact, returns are called rental fees because *Sukuk* holders become partial owners in the

Figure 2): the *Sukuk* market was worth slightly more than \$20 billion in 2006 but is now expected to be worth more than \$120 billion at the end of 2013 (Malaysia International Islamic Financial Center, 2014). Several countries and financial institutions have expressed interest in *Sukuk* issuance. For example, in 2014 Goldman Sachs announced a plan to issue \$0.5 billion of Islamic bonds (Financial Times, 2014a). South Africa also declared its intention to issue \$0.5 billion of *Sukuk* in the fourth quarter of 2014 and aims to become the second non-Muslim country to issue Islamic bonds after the United Kingdom (Financial Times, 2014b). As for the Gulf Cooperation Council (GCC) countries, Morgan Stanley⁶ expects that *Sukuk* issuance will be between \$27 and \$30 billion for Saudi Arabia, Qatar, and the United Arab Emirates in 2014. These three countries represent more than 95% of the GCC region's total *Sukuk* issuance. South-East Asian countries are also respected key players in the *Sukuk* market. For instance, Moody's⁷ forecasts a staggering \$30 billion of *Sukuk* issuance in 2014 for both of Malaysia and Indonesia. In addition, the Hong Kong Monetary Authority (HKMA) raised over \$1 billion in 2014⁸, making it with the United Kingdom one of the two AAA-rated governments to issue *Sukuk*. The latter also issued £2.3 billion of *Sukuk* in 2014 (Financial Times, 2014c). Finally, countries such as Luxembourg are expected to issue €200 million of *Sukuk* in 2014 (Financial Times, 2014c), while other countries such as France, the Netherlands, and Japan are still working to benefit from this promising Islamic instrument.

Financial Inclusion and the Islamic banking industry

Another remarkable development that shows that Islamic banking and finance is now a high profile topic is a working paper released about financial inclusion⁹, which is the new policy and target for the World Bank for 2014–2020 (according to the Global Financial Development Report [GFDR], 2014). In this paper, Demirgüç-Kunt, Klapper, and Randall (2013) explored whether Islamic finance could serve as a way of improving financial inclusion in Muslim countries. The

investment project. At the *Sukuk*'s maturity date, the *Sukuk* issuer buys back the bond and pays returns to *Sukuk* holders (additional insight into the relationship between the *Sukuk* and Islamic banks is provided in chapter 3, note 80).

⁶ For more details: <http://blog.thomsonreuters.com/index.php/surge-2014-gcc-sukuk-will-growth-come/>.

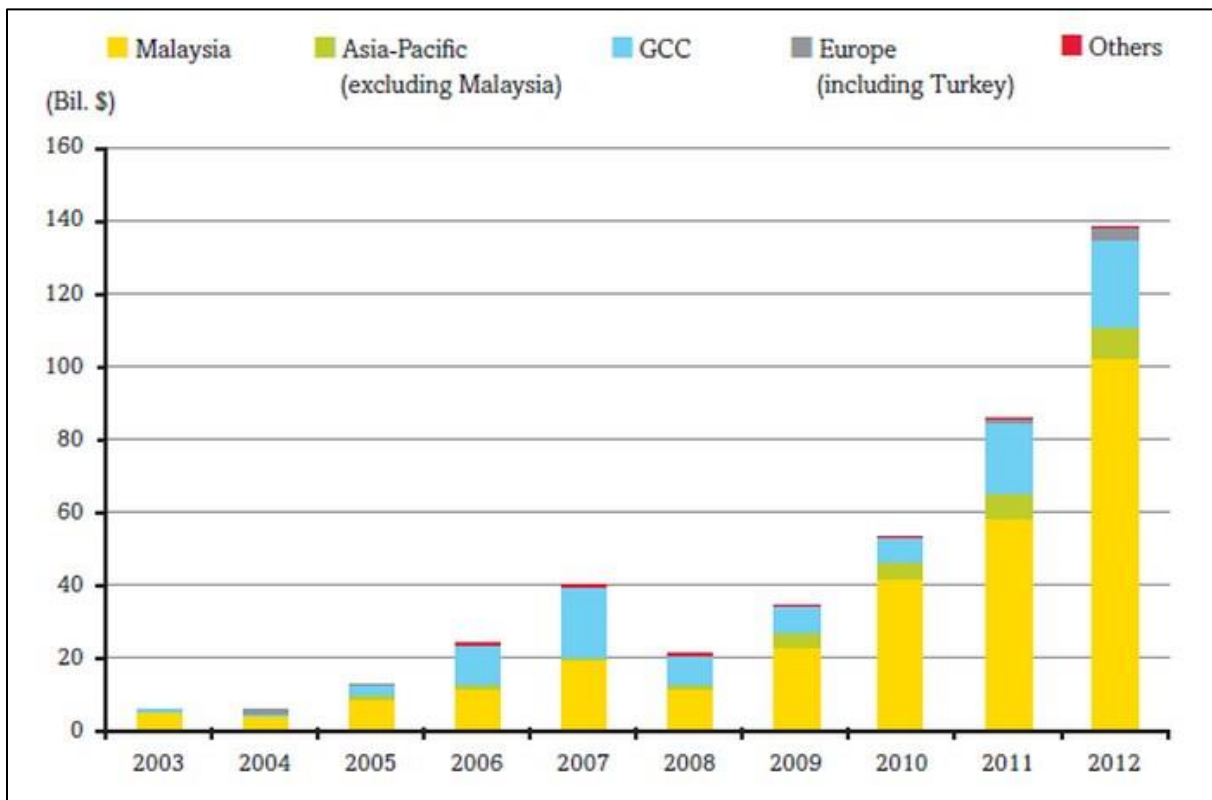
⁷ According to Moody's Investors Service. For additional information: <http://www.thesundaily.my/news/1160689>.

⁸ For more details: <http://www.reuters.com/article/2014/09/11/hongkong-sukuk-idUSL5N0RC01S20140911>.

⁹ The Global Financial Development Report (GFDR) 2014 defines financial inclusion as the percentage of individuals and firms that have access to financial services. According to this concept, having rapid access to financial services is an important indicator that can be used to trace poverty, and it therefore works to ameliorate inequalities and improve prosperity and sustainable economic development between countries.

authors' findings show that this industry is still relatively too small to achieve the targets for financial inclusion. This subject had already been elaborated by Mohieldin et al. (2011), who argued that Islamic finance can benefit financial inclusion by the promotion of risk-sharing transactions and mutual exchange in situations where profit is the result of liability, loss, and risk, and this can endorse economic relations and equality between economic agents and financial intermediaries. The Islamic banking industry could potentially improve financial inclusion by increasing the number of bank account holders and also the use of financial products that are *Sharia'a* compliant (GFDR, 2014). Moreover, Mohieldin et al. (2011) and Demirgüç-Kunt, Klapper, and Randall (2013) agree that in Muslim countries access to financial services such as a formal banking accounts is significantly less than in non-Muslim countries (see Table A.I in Appendix A). Accordingly, the Islamic banking sector should play a key role in inducing Muslims to access financial services through financial inclusion.

Figure 2. Total Islamic bonds issuance by major players



Source: Standard & Poor's Islamic finance outlook, 2014(p. 8)

Islamic banking: areas of interest for journals and international regulatory organizations

The importance of the Islamic banking sector¹⁰ has also been the subject of several special editions of journals such as that of the *Journal of Economic Behavior and Organization* (JEBO) in 2014. In its editorial introduction, JEBO said it was motivated to choose this topic because of three areas of interest. First, there is a need to understand the practices that differentiate Islamic banks from conventional banks, and to examine their impact on economic development. Second, regulators and researchers often ask whether Islamic banks are more efficient than their conventional counterparts, especially as the former are constrained in terms of religion, unlike the latter. Third, there is a growing interest in whether Islamic banks charge more for their services as they deal with complex and restrictive kinds of financial products. Finally, JEBO calls for researchers to give more attention to this rapidly growing and promising financial industry.

Other journals such as the *Review of Finance* and the *Journal of Banking and Finance* also show an interest in Islamic banking. In the former, Abedifar, Molyneux, and Tarazi (2013) examined the determinants of risk in the Islamic banking industry. In comparing the risk behaviors of Islamic and conventional banks, the authors find that small Islamic banks have a lower credit risk and are more stable than small conventional banks. In the latter, Beck, Demirgüç-Kunt, and Merrouche (2013) compared Islamic and conventional banks' business models, efficiency, and stability. The authors' found few significant differences between either type of bank. The World Bank and the International Monetary Fund have also shown an interest in studying Islamic banks. For instance, Errico and Farahbaksh (1998) explored the regulatory framework of Islamic banks. Solé (2007) defined and examined Islamic banks' infrastructure and challenges, while Hassan and Dridi (2010) studied the impact of the financial crisis on both banking systems. Čihák and Hesse (2010) found that small Islamic banks are more stable than small conventional banks, and that large Islamic banks face credit risk problems due to their complex profit and loss sharing transactions. Cevik and Charap (2011) found that conventional banks' deposit rates Granger cause the profit and loss sharing returns of Islamic banks when investigating the Malaysian and the Turkish context. Krasicka and Nowak (2012) asked about the reasons driving conventional investors to use Islamic

¹⁰ We only cite the most influential papers related to the Islamic banking industry. A complete literature survey is provided in Chapter 2 (for bank characteristics), Chapter 3 (bank stability) and Chapter 4 (bank efficiency).

instruments. However, what is interesting is that even though the Islamic banking literature is rapidly growing, empirical papers are not yet showing an interest in studying Islamic banks' regulatory frameworks. While Abedifar, Molyneux, and Tarazi (2013) and Beck, Demirgüç-Kunt, and Merrouche (2013) compared the risk, stability, and efficiency of Islamic and conventional banks, we find no empirical study that examines the impact of banking regulations on Islamic banks' stability and efficiency, in comparison to conventional banks. This dissertation is the first attempt to fill this gap in the literature.

Definition of Islamic banks

The institute of banking and Insurance¹¹ defines an Islamic banking system as a system where transactions and activities are consistent with Islamic law or *Sharia'a*. The institute argues that while Islamic banks have the same purpose as conventional banks, they operate by emphasizing the moral and the ethical values which encourage equality and the development of economies. The institute also explains that Islamic banking principles have been essential for a flourishing economy in the past, and today they have been revived again to provide an alternative to conventional banking activities and services.

The Dubai Islamic bank, the oldest Islamic commercial bank, defines Islamic banks as follows: *"Islamic banking, enlightened with the guidance of Islamic Sharia principles, emerged as an alternative financial system that neither gave nor took interest, thereby introducing a fair system of social justice and equality, while fulfilling the financial needs of people and maintaining high standards of ethics, transparency and a sense of responsibility"*.¹² The basic principle is simple: Islamic banking relies on trade to make a profit rather than interest, which is against Islamic religious law.

Consistent with *Sharia'a* principles and practices, Islamic banks adhere to the following five concepts¹³ (El-Hawary, Grais, and Iqbal, 2007; Abedifar, Molyneux and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013; Gheeraert, 2014): (i) the prohibition of interest, (ii) the risk-sharing principle (transactions must reflect a symmetrical risk and return distribution arrangements),

¹¹ See: http://www.islamic-banking.com/what_is_ibanking.aspx.

¹² For more details, see: <http://www.dib.ae/islamic-banking/what-is>.

¹³ More details are provided in Chapter 1, section 3.2.

(iii) the materiality of transactions (i.e., Islamic banking products should be linked to the real economy by asset-backed transactions), no exploitation of the other parties in transactions (i.e., prohibition of products that benefit from uncertainty or information asymmetries such as financial derivatives), and (iv) no financing of sinful activities (arms, alcohol, smoking, etc.).

Research Question

Literature is void on whether Islamic banks should be regulated in the same fashion as conventional banks. Islamic regulatory organizations such as the Islamic Financial Services Board (IFSB) and the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) have released several regulatory guidelines that fit the Basel I and Basel II frameworks to Islamic banks' specificities. At the 2014 Islamic Banking and Finance Conference, Thorsten Beck¹⁴ discussed the challenges that face Islamic banking regulators. In his speech, he argued that Islamic banking regulations are not yet conclusive on the treatment of *Sharia*'a-compliant finance. While regulatory guidelines are set to regulate Islamic banks' activities, no empirical research has examined whether Islamic banks should be regulated in the same way as conventional banks. This *ex ante* theoretical question is once again the subject of debate between regulators and bankers, especially after the subprime crisis and the call to restrict some banking activities, spearheaded by Basel III. Accordingly, based on the Islamic bank business model, we ask about – whether fitting conventional banks' regulatory guidelines to Islamic banks have the same impact on their stability and efficiency. Specifically, we take the Basel III new regulatory recommendations and compare the impact of higher capital, liquidity, and leverage ratios on Islamic banks' stability and efficiency compared to conventional banks. This is the first empirical work to investigate this. In addition, we use several methodologies (e.g., principal component analysis, quantile regressions, data envelopment analysis) to obtain more insight and understanding of the relationship between the regulations and Islamic banks' stability and efficiency. Accordingly, this dissertation answers the following research question:

¹⁴ Thorsten Beck is a leading scholar in the banking and financial industry. He is also the author of a paper called: "Islamic vs. conventional banking: Business model, efficiency and stability," published in the Journal of Banking & Finance in 2013.

Do banking regulations have the same impact on Islamic banks' stability and efficiency as they do on conventional banks?

This research question incorporates three sub-questions that we use to clarify the relationship between banking regulations and Islamic banks' stability and efficiency:

1. **What are the strengths and the weaknesses of Islamic banks' financial characteristics compared to conventional banks?**
2. **Do banking regulations – in the light of Basel III – improve or impede Islamic banks' stability compared to conventional banks?**
3. **Do banking regulations – in the light of Basel III – improve or impede Islamic banks' efficiency compared to conventional banks?**

Contents of the dissertation

Chapter 1

The **first chapter** of this dissertation explores Islamic banking history, its growth, and its specificities. First, we show that Islamic banks are undergoing rapid development compared to their conventional counterparts, and that the origin of this newly emerged industry can actually be traced back to the age of the prophet Mohammad. Second, Chapter 1 explores the reasons behind the existence and the proliferation of Islamic banking activities. Third, Chapter 1 examines Islamic banks' business models and financial orientations. Islamic banks' financial transactions can be categorized as two main types: the mark-up financing techniques and the profit and loss sharing techniques (PLS). The former includes *Muraraba* (trade with mark-up), *Ijara* (Islamic leasing), *Salam* (sales with immediate cash payment and deferred delivery), *Istisna* (sales with deferred cash payment and delivery), *Qard El-Hasan* (free interest loan), and *Jo'alah* (trust services). The latter combines *Musharaka* (joint venture) and *Mudaraba* (trustee finance). Along with PLS and non-PLS transactions, Islamic banks can benefit from three types of business model: The two-tier *Mudaraba* model, the *Mudaraba* on the liabilities side, and the *Musharaka* on the asset side; finally, the *Mudaraba* on the liabilities side and the mark-up of financing transactions on the asset side, which is the commonly

used business model. There is also the two windows business model which categorizes Islamic banks' liabilities side into demand and investment deposits.

Based on financial information from 115 Islamic banks¹⁵ for the period between 2000 and 2011, the fourth section of Chapter 1 looks into Islamic banks' business model and finds that, on their asset side, Islamic banks tend to use mark-up financing techniques instead of profit and loss sharing techniques. For instance, the *Murabaha* contract dominates Islamic banks' mode of finance, accounting for 79.85% of transactions, while PLS contracts (i.e., *Mudaraba* and *Musharaka*) only constitute 5.39% of the total share of Islamic banks' *Sharia'a* compliant transactions. These findings show that Islamic banks are not practicing what they are theoretically meant to do (Chong and Liu, 2009; Hassan and Dridi, 2010; Khan, 2010; Abedifar, Molyneux, and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013; Bourkhis and Nabi, 2013) but this does not mean that their non-PLS activities are not *Sharia'a* compliant. The results support the third business model mentioned above.

The last section of chapter one introduces the core subject of this dissertation. In this section, we compare Islamic and conventional banks regulatory frameworks. We show that Islamic banks responded positively to each of conventional banks' regulatory guidelines. In fact, before 1999, Islamic banks did not refer to any explicit or unified regulatory framework. However, in 1988 the Basel Committee on Banking and supervision (BCBS) launched the first set of banking regulatory guidelines, known as Basel I. In response, the Accounting and Auditing Organization for Islamic Financial Institutions issued the first regulatory framework for Islamic banks in 1999. Basel I reflected an interest in creating a unique risk-based capital regulatory ratio for conventional banks; then, the AAOIFI computed a similar capital ratio that was adapted to fit Islamic banks' specificities, but using the same methodology applied in Basel I.

However, the Basel I capital regulatory ratio was insufficient to prevent financial distress. As a result, the Basel Committee on Banking Supervision (BCBS) introduced a new set of regulatory guidelines in 2004. Basel II included three pillars: (i) a new and advanced measure of capital adequacy, (ii) a new framework that deals with bank risk assessment, and (iii) a more efficient way to disclose banks' financial situation. As for Islamic banks, in addition to the AAOIFI, the Islamic Financial Services Board (IFSB) launched in 2005 a new set of capital guidelines in response to Basel II. The new agreement proposed a new way to calculate capital adequacy ratio (CAR) for Islamic

¹⁵ We use data from the Islamic Banks and Financial Institutions database (IBIS).

banks. In contrast to the AAOIFI's CAR, the IFSB's CAR excludes all assets financed by investment accounts from the CAR's denominator.

Unsurprisingly, the subprime crisis showed once again that banking regulations (i.e., Basel II) were insufficient to avoid the financial crisis. Accordingly, the BCBS concluded a third set of banking regulation in 2010 after a deep re-examination of Basel II. The new regulatory framework considered for the first time that liquidity is equally important to a bank as capital requirements. In this context, Basel III exhibited two explicit liquidity ratios: the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). The former aims to determine whether a bank has a sufficient amount of highly tradable liquid assets to cover its net cash outflows. Such requirements should hold for a period of thirty days. The latter is set to ensure that a bank has sufficient funding resources as a percentage of stable financing (long term assets). The NSFR is a long term ratio and must hold for a period of one year.

In addition, Basel III required banks to improve the quality of their equity base. In contrast to Basel II common equity, Basel III increased the tier 1 capital as percentage of the risk-weighted assets from 4% to 6% (with a common equity tier 1 to risk-weighted assets ratio that equals 4.5%). It also recommended banks create a capital conservation buffer (CCB) that equals 2.5% of risk-weighted assets, and a countercyclical buffer (CB) that varies between 0% and 2.5% of the risk-weighted assets according to the economic situation. The objective of the CCB is to ensure there is sufficient bank capacity to resist financial distress, while the CB is used to ensure the continuation of bank lending activities during bad economic conditions.

Finally, Basel III proposed an explicit ratio to control bank leverage. In this last section, we adapt Basel III capital ratios to fit Islamic banks. As for liquidity, the challenge is more important, especially since Islamic banks suffer from several liquidity problems due to the constraints imposed by *Sharia'a*.

Chapter 2

The second chapter of this dissertation is an exploratory study that compares the financial characteristics of Islamic and conventional banks. We perform principal component analysis (PCA) on an array of 20 financial ratios to compare both bank types. In the literature there is an interest in studying several financial aspects of banking institutions. For instance, the subprime crisis prompted

a renewed interest in the regulatory stream of research in which Basel III is now considered to be the main focus of academia. However, this does not necessarily mean that something has changed. In fact, regulations and the risk literature have been concentrating on two contradictory hypotheses. The first hypothesis calls for regulators to simplify regulatory requirements (Haldane, 2012), and it argues that banking regulations encourage banks to engage more in risk (Altunbas et al., 2007). The second hypothesis is that more banking regulations will create a shield against risk, and therefore banks will be less vulnerable to financial distress (Vazquez and Federico, 2012; Lee and Hsieh, 2013; Imbierowicz and Rauch, 2014). What is more interesting is that some authors are now calling for the relationship between capital and risk to be extended to include profitability and efficiency. Yet, the literature also shows divergence of the relationship between regulation and profitability. For example, Barth et al. (2013) and Berger and Bouwman (2013) have shown that there is a positive association between capital and bank efficiency and profitability while Berger and Di Patti (2006) and Goddard (2010) found that higher capital ratios negatively affect bank efficiency and profit rates.

As for Islamic banks, despite the current focus on studying the reasons behind their survival during the subprime crisis, Islamic banking literature is still in its infancy compared to conventional banking literature. In addition, studies have shown contradictory results when comparing Islamic and conventional banks. Some authors have argued that there is no significant difference between Islamic and conventional banks' stability and risk (Abedifar, Molyneux and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013), while others have demonstrated that the stability comparison results change according to bank size (Cihak and Hesse, 2010) and region (Rajhi, 2013). Accordingly, there is no general consensus regarding the question of whether Islamic banks are different from their conventional counterparts in terms of stability and risk. The same logic applies also to profitability (Srairi, 2008; Johnes, Izzeldin, and Pappas, 2009; Beck, Demirgüç-Kunt, and Merrouche, 2013) and efficiency (Belanes and Hassiki, 2012; Johnes, Izzeldin, and Pappas, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013).

This is the first study that uses PCA to derive a new set of variables or components that we use to examine the financial strength of both bank types. As we have seen above, literature examines conventional banks and Islamic banks by studying bank risk, stability, performance and efficiency, capital, liquidity, and leverage; however, the literature uses different measures as proxies for these. This could be the reason behind the contradictory results. The purpose of the second chapter is thus

to fill this gap in the literature by creating new measures that are adequate for comparing both bank types. The objective is to retain the maximum necessary information without the loss of financial information related to each of our initial set of financial ratios.

To do this, we use an unbalanced sample of 8615 commercial and Islamic banks incorporated in 124 countries worldwide. The sample covers the period between 2006 and 2012. PCA shows that capital requirements, stability, liquidity, and profitability are the most informative components in explaining financial differences between Islamic and conventional banks. In addition, we use PCA components to compare both bank types. We employ logit, probit, and OLS regressions to compare Islamic and conventional banks' capital, stability, liquidity, and profitability. Our results show that Islamic banks are more capitalized, more liquid, and more profitable but less stable than their conventional counterparts. Our findings persist when US banks are excluded from our sample and when banks in countries where both banking systems co-exist are compared.

Chapter 3

The third chapter of this dissertation investigates the impact of banking regulation in light of Basel III on the stability of the banking sector. It particularly focuses on the impact of capital, liquidity, and leverage ratios on the stability and adjusted profits of Islamic banks compared to conventional banks.

To do this we use several measures of bank stability and regulation. The measure for bank stability incorporates the Z-score index (lnZS) and the adjusted return on average assets (AROA). The measures for regulation comprise the following: four measures of capital requirements, comprising two risk-based capital measures, which are total capital ratio (TCRP) and tier 1 capital ratio (T1RP), and two non-risk-based capital ratios, which are total equity to customers and short term funding (TECSTF) and total equity to total liabilities (TETLIP); two measures of liquidity, namely, liquid assets to total deposits and short-term borrowing (LATDBP), and liquid assets to total assets (LATAP); and two measures that are proxies for financial leverage, namely, the total equity to assets (TETAP) and the total liabilities to assets (TLTAP).

The total studied sample consists of 639 banks (with 125 Islamic banks) for banks located in 29 countries over the period 2006–2012. An earlier version of this chapter employed a sample of 11633 banks located in 76 countries. However, because U.S, European, and Japanese banks

dominated our bigger sample, we used only 29 countries. In addition, in this chapter we employ quantile regressions instead of ordinary least squares regressions. This approach has several advantages. First, quantile regressions allow for heterogeneous solutions to regulation by conditioning on bank stability and adjusted profits. The reason this might help is because literature is silent when studying the impact of banking regulation on different levels of bank stability. In other words, Islamic and conventional banks with lower stability may have different responses to regulation than high stability banks. Accordingly, we utilize quantile regressions to determine if banking regulations (i.e., higher capital, higher liquidity, lower leverage ratios) have a homogeneous effect on the successive quantiles of stability and adjusted profits. This provides a richer description of the relationship between regulation and bank soundness. Second, the results of quantile regressions are robust for outliers and distributions with heavy tails. Third, quantile regressions avoid the assumption that the error terms are identically distributed at all points of the conditional distribution.

We find that Islamic banks are less stable than conventional banks. This could be related to the business model employed by Islamic banks whereby assets and liabilities are becoming similar to those of conventional banks.

The liabilities side of Islamic banks benefit of profit and loss sharing (PLS) arrangements. However, these banks tend to diverge from the main principles of PLS where losses should be supported by investment account holders (IAH). In fact, where there is a high degree of competition between Islamic and conventional banks, some *Sharia'a* scholars allow these banks to distribute profits – using a smoothing mechanism – independently of the success or the failure of the investment. This is not only considered to be a violation of the relationship between profit and risk sharing but it might also encourage Islamic bank managers and shareholders to rely more on PSIA (at the expense of bank capital) by boosting leverage. Such behavior could be reflected in a lower Z-score and lower AROAA.

As we have seen in Chapter 1, Islamic banks privilege mark-up financing techniques over PLS contracts (Chong and Liu, 2009; Hassan and Dridi, 2010; Khan, 2010; Abedifar, Molyneux, and Tarazi, 2013; Bourkhis and Nabi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013). However, mark-up financing techniques are sometimes considered non-*Sharia'a* compliant as some scholars have argued that it could incorporate or benchmark interest rates. Accordingly, by relying more on

commercial transactions, Islamic banks can become exposed to credit risk, market risk, and operational risk, and this has a negative influence on their stability.

We also show that across the stability and risk quantiles, higher capital and lower leverage have a more positive impact on Islamic bank stability than on conventional bank stability, while there is no significant difference between Islamic and conventional banks concerning liquidity. Islamic banks rely on a smoothing mechanism to attract investment account holders (IAHs). This might have a negative influence on the banks' equity base, therefore Islamic banks prefer to maintain higher capital ratios than conventional banks. It appears that such a strategy has a positive impact on Islamic banks' AROAA. As for leverage, Islamic banks are somewhat more constrained than conventional banks regarding the excessive use of leverage. Accordingly, they are less leveraged than conventional banks and are required to deal with asset-backed transactions instead of debt-backed financial products, which hold firm against financial bubbles. However, this does not mean that higher leverage will protect Islamic banks against financial distress. Our results show that excessive leverage is negatively associated with Islamic banks' AROAA compared to conventional banks. Finally, liquidity is considered to be a major challenge facing Islamic banks. These banks have constrained liquidity access; they cannot use debt instruments and financial derivatives. Islamic banks also suffer from a weak interbank money market, lack of expertise, and non-harmonized regulatory standards. As a result, they prefer to hold higher liquidity buffers than conventional banks, which could serve as protection against liquidity risk. However, our results indicate that there is no significant difference between Islamic and conventional banks regarding the liquidity and the stability relationship, which could reflect a changing pattern in the business model of these institutions.

Finally, our sample shows that there was no significant difference between Islamic and conventional bank stability and regulation during the subprime crisis. Regulatory solutions show general consistency across quantiles.

Chapter 4

The last chapter of this dissertation examines the impact of banking regulations on the efficiency of Islamic and conventional banks in light of Basel III. In this chapter we focus on the impact of capital, liquidity, and leverage ratios on the efficiency of Islamic banks compared to conventional banks.

To do this, we employ several measures of bank efficiency and regulation. Bank efficiency includes four proxies for efficiency scores. These scores are calculated by comparing both bank types to a common efficiency frontier (EFF1 and EFF2) in the first step, and each bank type to its own efficiency frontier (EFF3 and EFF4) in the second step. We also compute efficiency scores with and without controlling for risk factors. For regulation, we use four measures of capital requirements (TCRP, T1RP, TECSTF, TELIP), three measures of liquidity (LADSTFP, LATAP, LATDBP), and one measure of financial leverage (TETAP).

In this chapter, we employ an unbalanced sample of 639 banks in 29 countries over the period 2006–2012 to investigate whether the Basel III regulatory framework is suitable for both Islamic and conventional banks.

We use Data Envelopment Analysis (DEA) to calculate efficiency scores, and quantile regressions to study the impact of different regulatory variables on the efficiency of Islamic banks. We chose DEA instead of traditional measures of bank performance (e.g., ROAAP and ROAEP) because it relies on the individual assessment of each banking unit rather than considering the entire sample average. DEA compares each bank to the most efficient one by creating a best practice efficiency frontier. In addition, DEA is a non-parametric technique and does not require any distributional form of the error term, which makes it more flexible than traditional regression analysis.

Our findings suggest that Islamic banks are significantly more efficient than conventional banks when compared to their own efficiency frontier. However, the Basel III requirements for higher capital and liquidity are negatively associated with the efficiency of Islamic banks, while the opposite is true for financial leverage. Our results are driven by small and highly liquid Islamic banks. In comparison with chapter 3 results, our findings reflect some kind of trade-off between efficiency and stability regarding capital requirements. In other words, whenever higher capital ratios have a positive impact on Islamic banks' stability the opposite is true for efficiency.

Our study also sheds light on the capital, liquidity, and leverage position of Islamic and conventional banks during the local and global financial crisis. We find little evidence that Islamic banks were more capitalized than conventional banks during the local crisis, while no significant difference is found during the subprime financial crisis. Furthermore, our findings show a negative trend in the capital (linked to a positive trend in the leverage) of Islamic banks compared to

conventional banks, which suggests a changing pattern in the capital position of this industry. Finally, we find that higher capital and liquidity positions resulted in greater efficiency in conventional than Islamic banks during the subprime crisis.

Appendix A

Table A.I. Islamic banking and some indicators of financial inclusion

Economy	Religiosity (%)	Account at a formal financial institution (% , age 15+)	Adults with no account due to religious reasons (% , age 15+)	Adults with no account due to religious reasons (thousands, age 15+)	Number of IFIs	Islamic assets per adult (US\$)	Number of IFIs per 10 million adults	Number of IFIs per 10,000 km2
Algeria	95	33.3	7.6	1,330	2	---	0.8	0.01
Bahrain	94	64.5	0.0	0	32	29,194	301.6	421.05
Bangladesh	99	39.6	4.5	2,840	12	14	1.2	0.92
Egypt	97	9.7	2.9	1,480	11	146	1.9	0.11
Indonesia	99	19.6	1.5	2,110	23	30	1.3	0.13
Iraq	84	10.6	25.6	4,310	14	98	7.4	0.32
Jordan	---	25.5	11.3	329	6	1,583	15.4	0.68
Kuwait	91	86.8	2.6	7	18	28,102	87.2	10.10
Lebanon	87	37.0	7.6	155	4	---	12.4	3.91
Malaysia	96	66.2	0.1	8	34	4,949	16.8	1.03
Mauritania	98	17.5	17.7	312	1	76	4.7	0.01
Morocco	97	39.1	26.8	3,810	0	0	0.0	0.00
Oman	---	73.6	14.2	78	3	---	14.4	0.10
Pakistan	92	10.3	7.2	7,400	29	40	2.5	0.38
Qatar	95	65.9	11.6	64	14	13,851	86.5	12.08
Saudi Arabia	93	46.4	24.1	2,540	18	1,685	9.2	0.08
Sudan	93	32.2	26.8	1,490	3	72	3.7	0.19
Syria	89	23.3	15.3	1,560	4	18	3.0	0.22
Tunisia	93	32.2	26.8	1,490	3	72	3.7	0.19
Turkey	82	57.6	7.9	1,820	5	538	0.9	0.06
UAE	91	59.7	3.2	84	22	9,298	33.5	2.63
West Bank and Gaza	93	19.4	26.7	502	9	0	38.5	14.95
Yemen	99	3.7	8.9	1,190	8	179	5.8	0.15

Source: *Global financial development report (2014)*, The World Bank (p. 175)

Chapter 1. Fundamental features of the Islamic banking system

Abstract

This first chapter explores Islamic banks' history, growth, and specificities. It defines Islamic banks and their *raison d'être* compared to conventional counterparts. Chapter one also examines Islamic banks' business models and shows that they tend to use mark-up financing techniques instead of profit loss sharing techniques. Accordingly, Islamic banking practices show divergence from their main theoretical principles. Such divergence poses several questions on whether they should be regulated in the same way as conventional banks. Thus, chapter one focuses on comparing Basel guidelines between both bank types with a special focus on Basel III capital, liquidity, and leverage requirements. If anything, we show that Basel III regulatory framework does not fit Islamic banks as it does for conventional counterparts. As a result, some issues should be addressed before requiring Islamic banks to fully acknowledge Basel III.

1. Introduction

The development of Islamic finance has occurred at a time when the international financial system is constrained by stricter and complex regulations (i.e. Basel III regulatory framework) in response to the 2007–2008 financial crisis. Another explanation for Islamic banks' development can also be the fact that these banks are capable of finding some kind of balance between the development of commercial activities with their customers and entrepreneurs, and the management of risk facilitated by the profit loss sharing arrangement. Such balance could eventually minimize bank failure risk.

Islamic banks are *Sharia'a* compliant financing firms. They rely on profit and loss sharing transactions (PLS) and commercial transactions (also called mark-up financing or non-PLS transactions) to finance their balance sheet growth. There are approximately 219 Islamic financial institutions according to the Association of Islamic Banking Institutions of Malaysia (AIBIM, 2014) and 149 according to the Bankscope database. Islamic banks are present in more than thirty countries with rapid growth in the Persian Gulf (65 banks), Malaysia (17 banks), and the UK (5 banks).¹⁶ In 2014, the World Bank¹⁷ created a special link on its website to report some features about Islamic banking institutions. This link includes a new platform that is still in progress. According to this platform, there are about 395 Islamic financial institutions distributed in 57 countries around the globe.

¹⁶ We refer to the Bankscope database.

¹⁷ Please visit: <http://econ.worldbank.org/>

This chapter explores the theoretical concepts behind the existence of the Islamic banking system. The subprime crisis has shown that Islamic banks were more resilient compared to their conventional counterparts. Accordingly, a new stream of research is developed to examine the reasons behind the prosperity, performance, stability, and efficiency of Islamic banks compared to conventional counterparts. The main objective of this first chapter is to define Islamic banks and their business model between theory and practice. Chapter one also examines similarities and differences between Islamic and conventional banks' regulatory guidelines. Section two divides Islamic banking and finance history into two phases. The first phase goes back to the early stages of Islam. It explains the reasons behind the need for an Islamic financial system. It also shows that Islamic finance is not as young as some authors argue. The second phase reflects three events. The first event created the foundation of Islamic banking institutions. The second event reports the creation of the first Islamic bank in the sense of a financial intermediary. The third event sheds light on the development of several Islamic international regulatory and supervisory organizations. This section also examines the development of Islamic banks in the recent period. Section three defines Islamic banks and explains the *raison d'être* of such industry. Section four illustrates Islamic banks' business models, while section five reports some empirical evidence and shows that Islamic banks privilege a commercialized business model that relies more on mark-up financing techniques instead of PLS financing techniques. Section six compares Islamic and conventional banks regulatory frameworks. It sheds light on Basel I and Basel II guidelines with a special focus on Basel III capital, liquidity, and leverage requirements. Finally, section seven concludes.

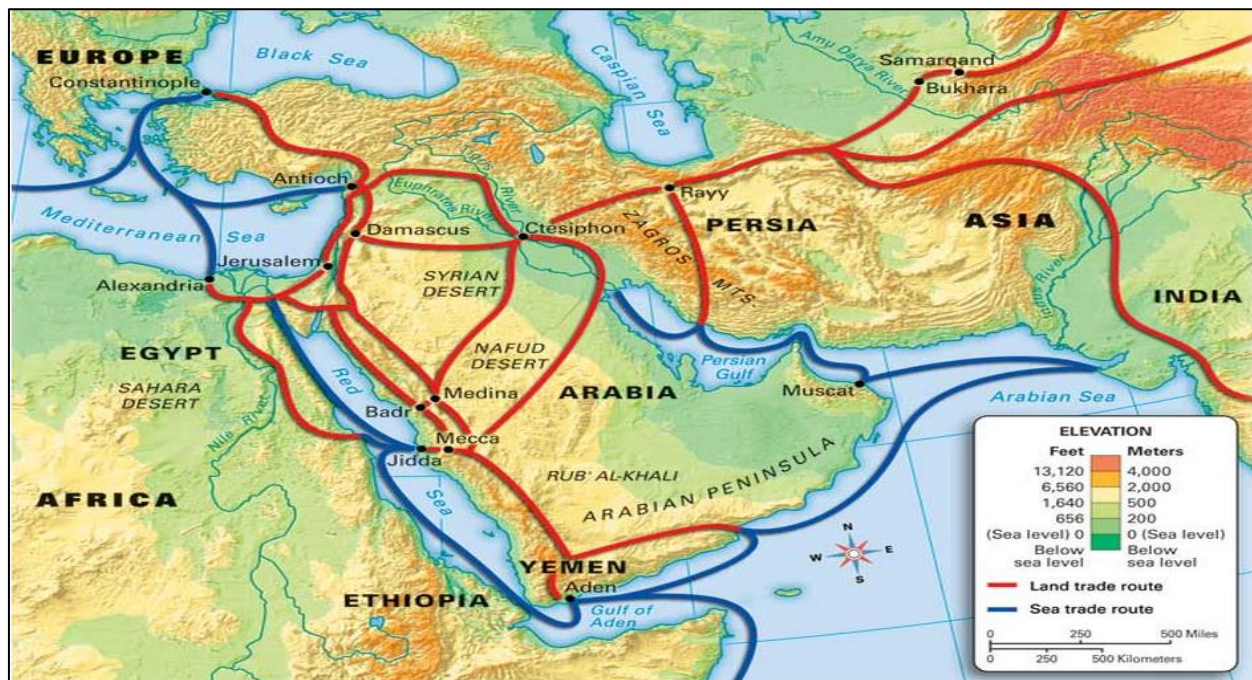
2. History of Islamic banking and finance

2.1. THE PRE WORLD WAR II ERA

The term Islamic finance can be traced back to the first days of Islam where the prophet himself was a merchant. However, this earlier mode of Islamic finance was underdeveloped and only conceived to settle trades between tribes in the Arabian Desert and other merchants mainly localized in Damascus. One main feature that made Islamic finance an important issue in the past as well as in the present is pointed out by Lieber (1968) who argues that it is related to "*The pilgrimage to the holy places*" (p. 230). In fact, Muslims need to fulfill their religious obligation by performing the

pilgrimage¹⁸ or *Hajj* at least once in a life period. Accordingly, Lieber (1968) explains that those pilgrims are also merchants and traders. Apart from the fact that the *Hajj* was mainly to fulfill religious obligations, it was also an opportunity to sell local products along the trip, and at the same time to buy foreign goods and sell them in other locations. As a consequence, the development of banking operations such as lending, borrowing, transferring, guaranteeing, and safeguarding came as a result of the development of these transactions over the years (see Figure 1.1).

Figure 1.1. Routes of trades in the early stage of Islam



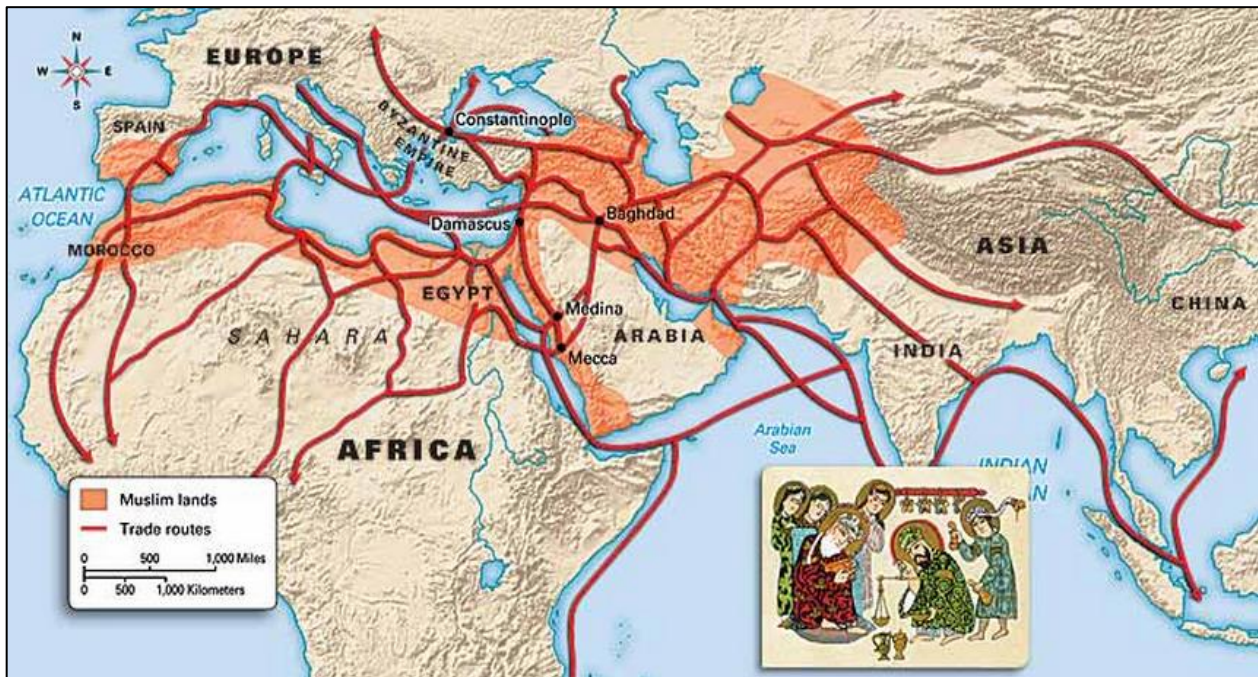
Source: <http://mrgrayhistory.wikispaces.com/>

Nevertheless, the Islamic golden age has shown no evidence for the emergence of any banking institution such as today. Also, in contrast to the statement of De Roover (1954) who mentions that “there can be no banking where there are no banks” (p. 43), Chachi (2005) argues that bankers and banking activities were already in proliferation without the existence of banks in the strict sense of financial intermediaries as it is today. Moreover, by the end of the 8th century, the Muslim state recognized the

¹⁸ The *Hajj* is one of the five main pillars in Islam. A faithful Muslim should fulfill his duties of visiting the great mosque in Mecca at least once in a lifetime. In addition to *Hajj*, A faithful Muslim must declare his faith to god or *Shahada*, pray five times a day, gives 2.5% of his money to poor people as a kind of charity or *Zakat*, and fast during Ramadan.

importance of banking activities by establishing financial institutions called *dawawin al-jahabidhab* to organize and maintain all banking functions without any use of interest (Chapra and Khan, 2000; Chapra and Ahmed, 2002). For instance, Chachi (2005) reports that Muslims by adapting the concept of profit and loss sharing (PLS) are capable of mobilizing resources to finance their investments and projects. Moisseron, Moschetto, and Teulon (2014) believe that the expansion of the Islamic state around the Mediterranean basin in the 10th century and the prosperity of Islamic merchants' transactions inspired Italian traders who became very well known as merchants in the medieval period (see Figure 1.2). This early Islamic financial system has a known end in the late 12th century.¹⁹

Figure 1.2. Routes of trades in the golden age of Islam



Source: <http://mrgrayhistory.wikispaces.com/>

¹⁹ Chachi (2005) offers six main explanations for the deterioration of the golden age of the Islamic state and Islamic financial system: (i) the deviation from *Sharia'a*, (ii) the excessive and absurd expenditure, (iii) the lack of organization, (iv) the breakdown of the political authority of the Muslim state, (v) the rise of new Muslim confessions, and (vi) the unending wars with the crusaders, the Mongols, the Tartars, and the Persians.

2.2. THE POST WORLD WAR II ERA

Gafoor (1995) calls the post-World War II period as the interest free era. He splits this period into two stages. The first one reports the period where the interest free banking system was only a theoretical concept whereas the second one represents the application of this concept on a practical basis where Islamic banks and other Islamic financial institutions (see Table 1.I for different categories of Islamic financial institutions) became a tangible reality.

2.2.1. A Theoretical Framework for Islamic Banks

Gafoor (1995) argues that the interest free banking concept can be traced back to the late forties with the work of Qureshi (1946), Siddiqi (1948)²⁰, and Ahmad (1952) who proposed an Islamic banking system that uses the concept of *Mudaraba* to avoid interest. Still, this period²¹ was described as the period where Islamic finance remained dormant (Bintawim, 2011; Moisseron, Moschetto and Teulon, 2014). This period could also be also defined as the period of “*Islamic economics*.” According to Moisseron, Moschetto and Teulon (2014), the 1950s is considered the time where the concept of individualism started to replace Islamic socialism. This was followed by the development of the concept of the “*Islamic business man*” that balances between materialism and spirituality. However, the growing economic activities and the success of this concept in combining both worlds—Islamic and business—became a concern for Islamic scholars. In fact, such success could unleash “*the force of human nature towards acquisitiveness*” (Moisseron, Moschetto and Teulon, 2014, p. 3). Therefore, the solution was the creation of an ethical code where all Islamic businessmen must adhere and respect. This code was later known as *Sharia’a* law where all financial transactions should be *Sharia’a* compliant.

²⁰ Siddiqi’s earliest work is only available in Arabic. In the references section, we cite the latest English version of this work.

²¹ Greuning and Iqbal (2008) refer to this period as the period where the first conceptual framework of Islamic banking was established. It was based on two theoretical models: (i) two-tier *Mudaraba* model (profit loss sharing contracts) and (ii) *Amana* model.

2.2.2. The Creation of the First Islamic Commercial Bank

The second period is mainly the realization of what was theoretically set for Islamic banking and finance. This period started with three Islamic banking experiences. The first bank was located in Malaysia and operating in the mid-forties. The second bank was located in Pakistan and was operating in the late-fifties and the third one was established in Egypt in 1963.²² However, these three banking institutions were unsuccessful for many reasons. In addition, they cannot be considered as real banks in the sense that includes all the complexity of a banking institution as they are today. Yet, considering the growing demand by the Muslim population for *Sharia'a* compliant products, the Organization of Islamic Cooperation (OIC)²³ established the Islamic Development Bank (IDB) in 1974. Here forward several Islamic banks were created and the idea of a non-interest banking system started to take place (Bintawim, 2011). Owing to the rapid development of the Gulf region governmental infrastructure boosted by oil expenditure returns (Moisseron, Moschetto and Teulon, 2014), the modern Islamic banking system emerged by the establishment of the first Islamic commercial bank, the Dubai Islamic bank, in 1975, followed by the Sudanese Faisal Islamic bank in 1977 and the Bahrain Islamic Bank in 1979.

In February 1979, Pakistan announced its intentions to replace the interest banking system with an Islamic banking system (Hassan and Zaher, 2001). In 1980, Pakistani legislators succeeded in passing legislation to make the establishment of *Mudaraba* companies possible in the country. The main purpose was to convert assets and liabilities of the traditional banking sector into profit and loss sharing financing modes (Khan and Mirakhor, 1989). At the same time, Iran was working on the Islamization of its own banking sector. Countries such as Sudan have also facilitated the emergence of Islamic banking concepts and instruments. As for Malaysia and Bahrain, which are considered the pioneer countries in Islamic finance, the establishment of Bank Islam Malaysia Berhad (BIMB) in 1983 is considered the cornerstone for the development of the Islamic banking

²² For Example, the Mit Ghamr bank, in Egypt, was established as the first Interest-free Arabic banking institution. According to the Institute of Islamic Banking and Insurance (IIBI) the bank flourished between 1963 and 1966. Despite the success of the bank, the project was abandoned for political reasons.

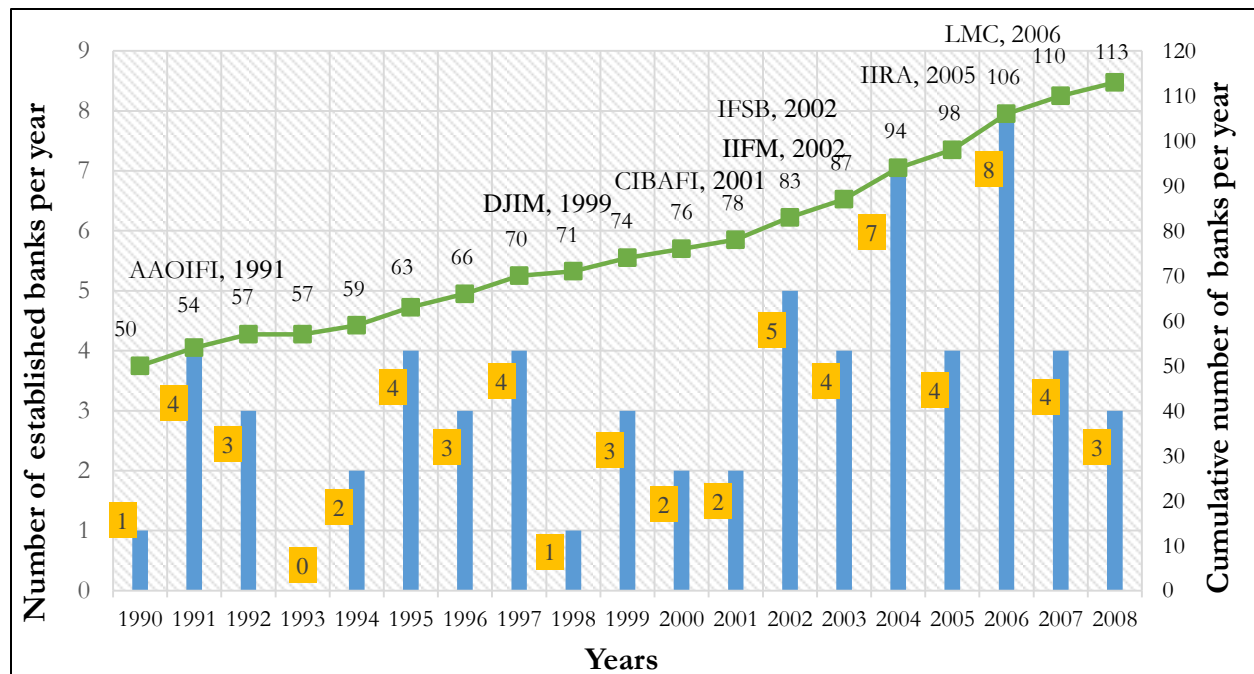
²³ The Organization of Islamic Cooperation or the Organization of the Islamic Conference is the second largest inter-governmental organization after the United Nations. It includes 57 countries with an objective of promoting peace, harmony, solidarity, and the development of the Muslim world (for more details about the OIC, please visit to the OIC website: <http://www.oic-oci.org>).

industry in South East Asia. In addition, the establishment of the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) in Bahrain in 1991—as an international institution that works to make sure that Islamic financial practices and financial reports are *Sharia'a* compliant—is also considered as another development in Islamic banking infrastructure. AAOIFI is a regulatory organism for Islamic banks that plays a key role in the development and standardization of regulatory guidelines of this industry. This was followed by the establishment of the Dow Jones Islamic Market Index, also in Bahrain in 1999.

2.2.3. Emergence of a Modern Islamic Banking System

In the last decade, Islamic banks continued to emerge in the Persian Gulf and the South East Asia region. Although the modern Islamic banking system is still in its infancy, the last few years have shown remarkable facts (see Figure 1.3). Nowadays, the Islamic financial system, once again, regained its lost place but this time it became modernized and shares the market with a very powerful Occidental financial system. What is more interesting is that western international commercial banks such as HSBC, Standard Chartered, Citi, and UBS are starting to offer products and contracts that are *Sharia'a* compliant through the establishment of Islamic branches (called Islamic windows) thereby acknowledging the potential of such industry.

Figure 1.3. The development of the Islamic banking industry between 1990 and 2008



Furthermore, in 2001, the General Council for Islamic Banks and Financial Institution (CIBAFI) was established in Bahrain. In 2002, the Islamic Financial Services Board (IFSB) was established in Malaysia and considered as another international regulatory organism for Islamic banks—after the establishment of the AAOIFI in Bahrain—followed by the launch of the International Islamic Financial Market (IIFM) in Bahrain. In 2005, the Islamic International Rating Agency (IIRA) was founded and started operating. In 2006, Bahrain succeeds in creating the Liquidity Management Center (LMC). In 2007, the Arab Chamber of Commerce Industry launched the Hong Kong Islamic Index. In the same year, the United Kingdom became the European hub of Islamic financial industry (Ainley et al., 2007). In 2011, Thomson Reuters launched the first Islamic Interbank Benchmark Rate (IIBR) followed by the establishment of the Bangladesh Islamic Interbank Money market in 2012. Finally, recognizing the potential of this industry, the Ruler of Dubai announced in 2013 his intention to make UAE an international hub of Islamic finance. This arrives after a similar announcement by UK Prime Minister David Cameron (The New York Times, 2013) and France’s ex-minister of economy and head of the IMF Christine Lagarde (Le Parisien, 2008).

2.2.4. Growth of Islamic Banking System in the Recent Period

Using financial data collected from the Bankscope database, Figure 1.4 illustrates the development of total assets held by Islamic banks for the period between 2006 and 2011. We breakdown our sample of Islamic banks into six geographical regions²⁴ where Islamic finance is strongly present.

²⁴ These regions are: MENA1 region (Middle East and North Africa) and includes the Middle East and North African countries excluding the Gulf Cooperation Council (GCC) and Iran, the South East Asian countries (SEA), the Islamic Republic of Iran (IRAN), the European Union (UE), and the Gulf Cooperation Council (GCC). Finally, we use a sixth sub-sample, MENA2 that consists of MENA1 and Iran but excludes the GCC countries. Recent research on Islamic banks shows that Iran is the largest hub of Islamic finance (Global Islamic Finance Report (GIFR), 2013). However, other studies do not consider Iran in their sample of Islamic banks for reasons related to its financial system completely Islamized or because of a lack of financial information. Accordingly, we consider separately Iran as an independent sub-sample but also as part of the MENA region (i.e. MENA2) to study its regional weight in terms of Islamic finance. To do this, we use three types of financial information: total assets, total equity, and total operating income.

We notice that assets held by these institutions have grown rapidly between 2005 and 2008. However, in 2008 assets growth of Islamic banks become much lesser than before 2008. It also shows a decreasing pattern in Iran. This could be explained by the fact that the financial crisis has strongly affected the real economy. As a matter of fact, Islamic banks primarily use assets backed transactions and thus the price of properties and other tangible assets fell sharply during and after the crisis period.²⁵ This mechanically affects the valuation of Islamic banks' assets and thus shrank their balance sheets (Financial Times, 2009). Despite, the financial crisis, the amount of assets held by the GCC countries and the SEA continued to grow rapidly compared to the rest of regions.

Figure 1.4. Assets of Islamic banks between 2005 and 2011

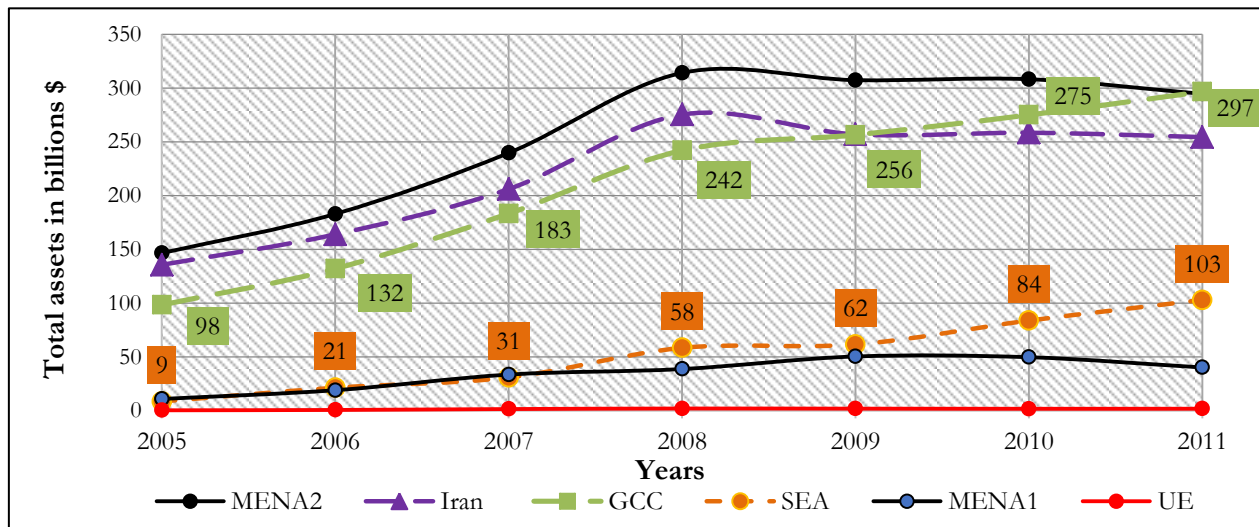


Figure 1.5 shows that Iranian banks hold alone 28% of Islamic banks' assets. In second place are the GCC countries with 27% of total assets share. Third place is dominated by the SEA countries with 6.75%, followed by MENA1 countries with 4.71% and finally the EU with less than 1%.

²⁵ For instance, Dubai has witnessed a deep recession and real estate crash as a result of the subprime crisis. Banks such as the Dubai Islamic bank was immediately impacted by the crisis as *Sharia'a* requires transactions to be asset backed.

Figure 1.5. Assets breakdown by region 2005-2011

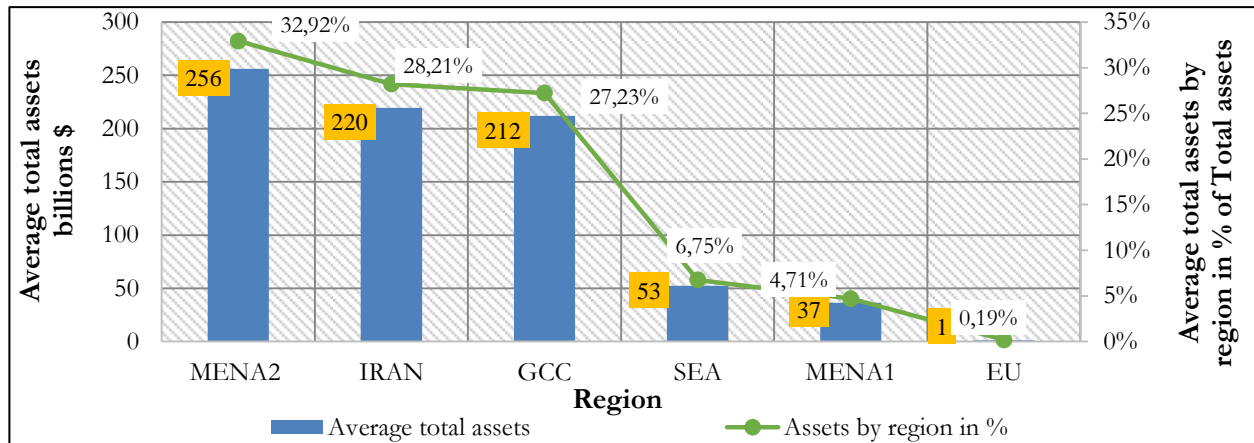
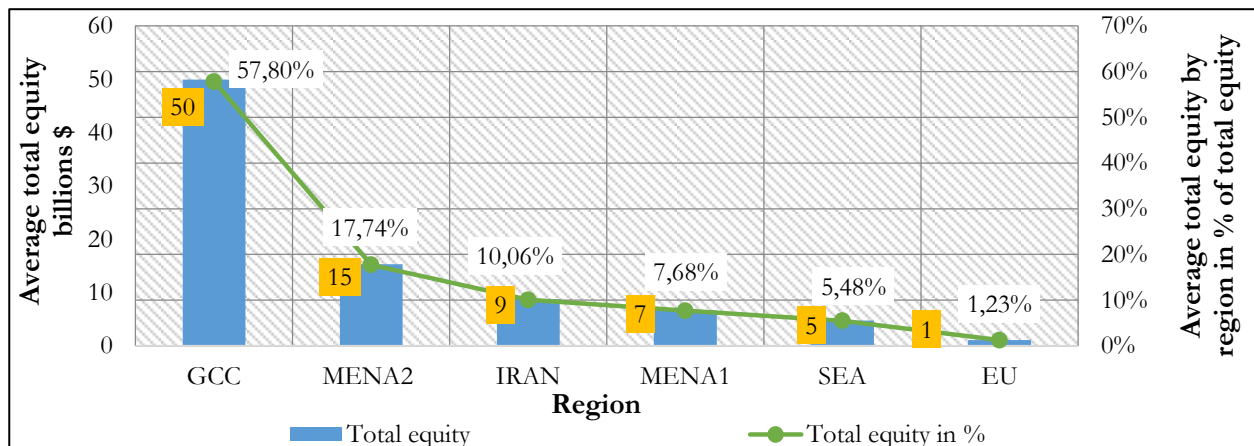


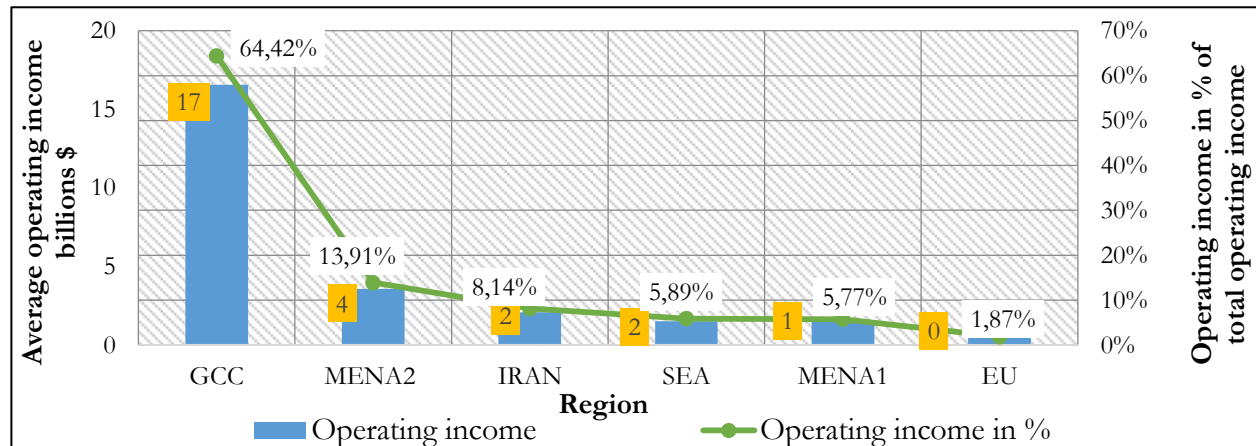
Figure 1.6 shows that GCC countries come first in terms of capitalization (\$50 billion). Accordingly, the amount of their equity corresponds to almost 19.5% of their total assets. The Iranian banks hold \$9 billion of equity, which covers only 4.09% of their total assets while the rest of the MENA countries (i.e. MENA1) hold \$7 billion, followed by SEA banks with \$5 billion and the EU with \$1 billion, and this a considerable amount compared to the total assets held by EU banks.

Figure 1.6. Total equity by region 2005-2011



Finally, in term of operating income, the GCC region represents 64% of total operating income of Islamic banks (see Figure 1.7). However, despite high leverage and balance sheet growth, Iranian banks occupy the second position with only 8% of Islamic banks total operating income, followed by SEA countries with 6%, the rest of MENA countries (i.e. MENA1) with 6%, and finally the EU with almost 2%.

Figure 1.7. Operating income by region 2005-2011



The results clearly show the superiority of GCC Islamic banks in terms of capitalization and turnover. It also shows that Iranian banks are the most important in terms of assets growth. This means that Iranian banks are more leveraged compared to GCC countries' Islamic banks. This could also explain why Iranian banks are undercapitalized (i.e. average equity to assets=4.09%) compared to GCC Islamic banks (i.e. average equity to assets=19.5%). As for the rest of the countries, we show that Islamic banks are developing in SEA countries as well as in the EU but at a very small scale compared to GCC or Iranian banks.

3. Why do Islamic banks exist?

The combination of the two words “*bank*” and “*Islamic*” appear to be somehow paradoxical (Bitar and Madiès, 2013). Therefore, it is necessary to clarify, on the one hand, why Islamic banks are considered financial intermediaries in the strict definition of banking theory. On the other hand, how it is possible for such institutions to be fully compliant with *Sharia’a* law while they deal with business transactions and profit maximization activities?

3.1. ISLAMIC BANKS: DEFINITION AND RAISON D’ÊTRE

A banking institution is considered an Islamic banking institution if all of its operations are consistent with *Sharia’a* law.²⁶ Thus, every Islamic bank possesses a *Sharia’a* committee that examines the compliance of its activities and banking products with Islamic law. In short, every financial transaction must be in a lawful (*Halal*) position and completely excludes the use of interest (Maali, Casson and Napier, 2006). According to the International Association of Islamic Banks (AIBI), the *Sharia’a* committee is an independent organ that consists of three to seven specialized advisors in Islamic finance and jurisprudence. Islamic banks must finance socially²⁷ useful projects and participate in the development of the community by respecting the codes of ethical finance conceived from *Sharia’a* law.²⁸

As explained by Toussi (2010), although Islamic banks are consistent with *Sharia’a* law, they perform some similar functions to those of conventional banks. He defines a bank as Islamic “*When it works as an administrator of payment system and as a financial intermediary. Therefore, the need for an Islamic banking system is precisely for the same reason related to the existence of a traditional banking system. Accordingly, Islamic banks exist as a response to financial market imperfections*” (Toussi, 2010, p. 37).

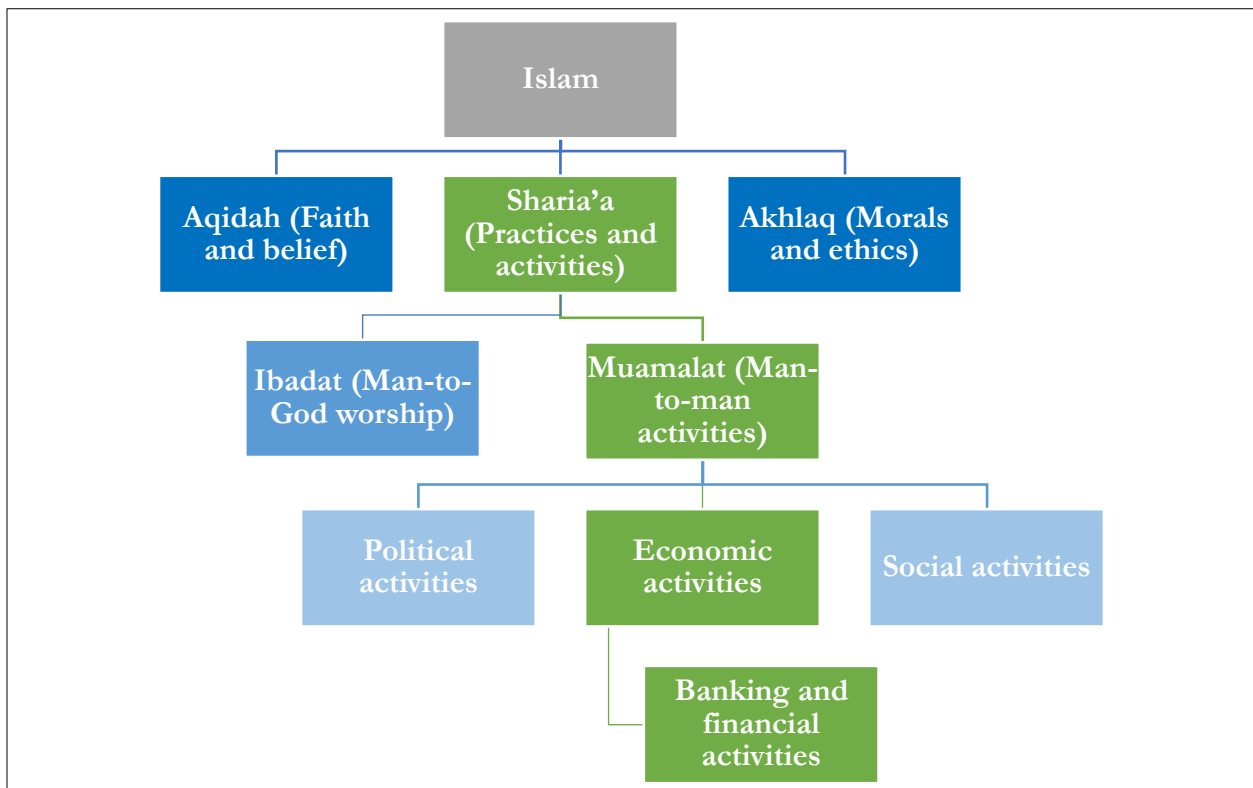
²⁶ *Sharia’a* is considered the main source of Islamic law (see Figure 1.8). It found its origins in the *Qur’an* and the *Sunna*. The *Qur’an* is the holy book of God. It contains general information related to every aspect of life of Muslims. The *Sunna* is the second source of Islamic law. It is derived from the prophet’s speeches and some of his companions.

²⁷ Conventional banks such as Crédit Foncier de France, la Caisse d’épargne and Crédit Mutuel (mutual and cooperative banks) have also followed in the nineteenth century similar objectives to those maintained by Islamic banks today.

²⁸ By relying on *Qur’anic* precepts, Islamic banks consider prohibited businesses or investments related to gambling, pornography, alcohol, tobacco, and the porcine industry.

The existence of these banks is thus explained from an economic point of view, in the same way as conventional banks, even if the former have some distinctive characteristics from the latter. Islamic banks as conventional banks possess information about customers, companies, and projects, which can help a single client (or investment depositor) in minimizing information asymmetries and also the transaction cost of any investment or engagement with other economic agents. An Islamic bank plays a key role in channeling funds toward projects that are considered to be beneficial for its clients and itself. Furthermore, according to the profit and loss sharing concept, any losses regarding failed projects must be shared with clients. Accordingly, Islamic banks should be very prudent with their investments compared to conventional banks, as they are afraid of losing confident clients if severe losses occur.

Figure 1.8. Sharia'a and Islamic banking



Source: Kettell, p. 15

In addition, Diamond (1984) shows that according to microeconomic theory, conventional banks collect the surplus of liquidity from small depositors to finance via bank loans investment projects.²⁹ They are also more experienced and more informed compared to small depositors, which reduces the latter's transaction costs. Besides, banks can finance a large number of projects at the same time, which can help in reducing risk compared to an individual investor's risk. Hence, it is easy to understand the reason behind choosing to work via financial intermediaries and the same principle applies to Islamic banks. They perform the role of "*deputy supervisor*" between depositors and investors. All in all, both bank types are more informed, experienced, and they minimize transaction cost and risk of individual investors.

3.2. CORE CONCEPTS OF THE ISLAMIC BANKING SYSTEM

From a conceptual point of view, Islamic banks have a number of significant differences when compared to conventional banks. These so-called "*specificities*" explain the reasons behind their existence compared to conventional counterparts.

Toussi (2010) reports that Islamic banks perform differently financial intermediation. For instance, Islamic banks' depositors undergo true investors' risk. Accordingly, depositors share losses as well as profits related to each *Sharia'a* compliant investment project financed through their own funds (i.e. Unrestricted Investment Accounts and Restricted Investment Accounts). In addition, Islamic banks' depositors are not aware of the exact rate of return related to the undertaking transaction (Errico and Farahbaksh, 1998); they do not receive any guarantee on the principal and neither on the returns because they are treated like the banks' investors. In contrast, conventional banks' depositors receive a fixed rate of interest independently of the success or the failure of projects; they do not receive any information about the destination of their funds and their principal is insured by the deposit insurance scheme. For example, the European Union explicit deposit insurance system has been compulsory since 1994. At the present time and in addition to the united banking supervisory unit, the European Central Bank (ECB) is planning to create a united deposit insurance system at the European Union level to replace different deposit insurance schemes of every single country (Bitar and Madiès, 2013). Such arrangement does not exist and could not be applied to Islamic banks.

²⁹ Please refer to Allen and Santomero (1998) for an extensive literature review.

Another feature of Islamic banks is the prohibition of an interest rate (Beck, Demirgüç-Kunt and Merrouche, 2013) or *riba*,³⁰ which can also be defined as excessive interest. As noted by Schaeffer (1984), the conventional banking system uses interest as a primary source of remuneration of depositors' savings. In contrast, Islamic banks use a return rate instead of an interest rate (depositors are treated like investors; they receive returns on their investments). In this case, a borrower (*Mudarib*) ensures the daily management of the financed project while the account holder (*Rab-El-Mal*) provides the needed funding (*Mudaraba*) or equally participates in the management of the project (*Musharaka*). The outcome of such investment is shared between the bank and the borrower, and between the bank and the depositor according to a predetermined ratio of profits and losses (Bitar and Madiès, 2013).

A third distinguishable characteristic of Islamic banks is the materiality aspect of every financial transaction (El-Hawary et al., 2007). In other words, all transactions should be linked to the real economy through a tangible asset. Therefore, Islamic banks' products must be asset backed in order to fulfill *Sharia'a* requirements as part of Islamic financing tools.

Fourth, Islamic banks' contracts, operations, and products must be clearly announced and explained to different transaction parties. Thus, exploitation (*gharar*) of other party is prohibited and speculation or uncertainty is not permitted. According to *Sharia'a* law each business transaction must be written and explicitly examined by partners to avoid ambiguity and any future disagreements (Ismail, 2001).

Finally, Islamic banks are prohibited from engaging in sinful transactions such as weapons, alcohol, drugs, pornography, and the porcine industry. The *Sharia'a* board must verify the coherence of projects with Islamic law. Accordingly, Islamic banks must use their funds in non-harmful sectors as defined by the *Qur'an* (Lewis, 2001).

It is also worth mentioning that Islamic banks suffer from the absence or the quasi-absence of an Islamic interbank money market, where banks can refinance between themselves. This important

³⁰ According to Kettell (2011), there are four revelations in the *Qur'an* that prohibit dealing with interest. The first revelation argues that dealing with interest rates deprives wealth from God's blessings. The second revelation explains that interest puts properties in the hands of wrong owners. The third revelation demands of Muslims to avoid interest for the sake of their own welfare. The last revelation distinguishes between interest and trade, and declares war with those who deal with interest.

fact has an ambivalent role in the three main themes that we are going to discuss in this dissertation, namely the stability, efficiency, and regulation of the Islamic banking sector. Indeed, the fact that such market does not exist prevents the propagation of failures between banks and thus limits the systemic risk as observed with conventional banks during the financial crisis (Bitar and Madiès, 2013). Moreover, Islamic banks cannot borrow liquidity from other banks. In addition, the Central Bank plays only a marginal role in controlling Islamic banks and it cannot act as a lender of last resort. This is understandable insofar as Islamic banks do not have the power to create money, because according to *Sharia'a* money does not create money by itself without investments (Ariff, 1988). However, they do perform maturity transformation activities, which make them, on the one hand, vulnerable to liquidity problems, and on the other hand, possibly face a counterparty risk related to the projects that they are investing in.

4. Islamic banks' business model

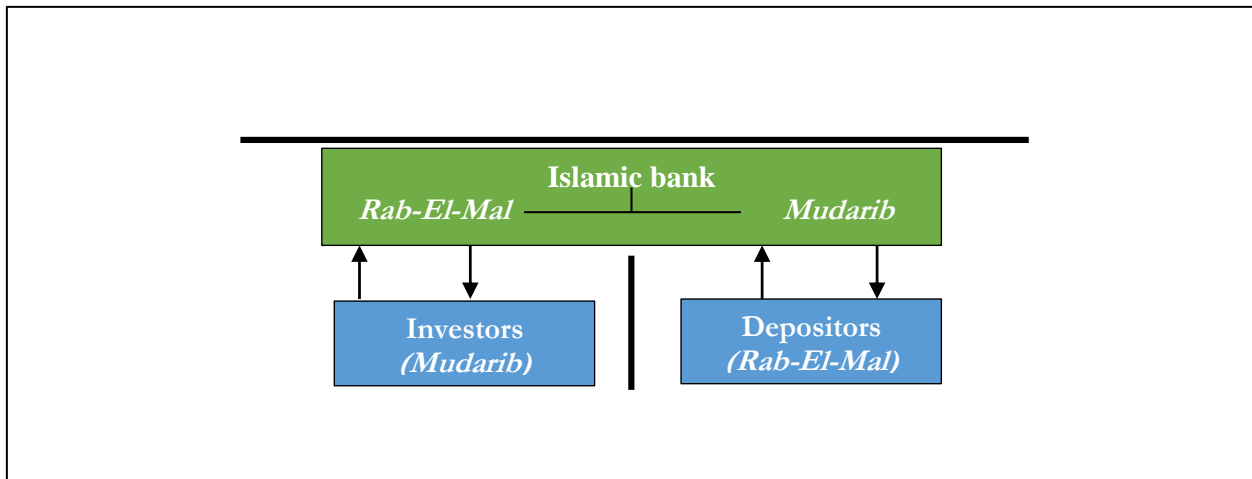
Theoretically, the rules under which Islamic banks operate are different from those of conventional banks. As we have seen in section 3.2, *Sharia'a* law imposes constraints on Islamic banking activities. These constraints are not of the same nature of the banking guidelines imposed by the Basel Committee on Banking and Supervision. This appears very normal as Islamic banks tend to maximize ethical value, solidarity, and equality between society members while conventional banks seek to maximize profits and gains. In practice, however, Islamic banks operations are somehow similar to conventional banks. One would expect that under *Sharia'a* law PLS instruments—as a core of Islamic banking and finance—dominate Islamic banks' activities. Yet, unsurprisingly, non-PLS mode of finance such as *Murabaha* and *Ijara* predominate (Chong and Liu, 2009; Hassan and Dridi, 2010; Khan, 2010; Abedifar, Molyneux and Tarazi, 2013; Beck, Demirgüç-Kunt and Merrouche et al., 2013; Bourkhis and Nabi, 2013). In this section, we present four business models that reflect this divergence between theory and practice (see Appendix B for definitions and different types of mark-up and PLS transaction techniques).

4.1. TWO-TIER MUDARABA

Adapted to suit Islamic banks, the two-tier *Mudaraba* model is a *Mudaraba* contract extended to include three parties (see Figure 1.9): the depositors, the Islamic bank, and the entrepreneur. On the liabilities side, a bank's funds—which are provided by special depositors called investment account

holders—are used in unrestricted *Mudaraba*. According to this arrangement, a bank can invest funds in all types of *Halal* investments. On the asset side, an Islamic bank applies the restricted form of *Mudaraba*. In this case, the Islamic bank has the right to determine the duration of the project, the location and also the supervision (Kettler, 2011). However, Islamic banks cannot directly interfere in the management of the project. Hence, the role of bank is to act as *Mudarib* with depositors and *Rab-El-Mal* with investors. This is the concept of *Mudarib youdarib* whereby the bank acts as a financial intermediary through special two-tier *Mudaraba* operations. Firstly, depositors provide the bank with funds. They are treated as *Rab-El-Mal* whereas the bank plays the role of *Mudarib*. Secondly, the bank invests these funds in investment projects that are *Sharia'a* compliant. Thus, it performs the role of *Rab-El-Mal* while the entrepreneur is considered as *Mudarib*. As a consequence, Islamic banks that are considered as the agent of investment accounts holders cannot guarantee depositors funds or returns because they cannot interfere directly in the entrepreneur's work. In addition, the rate of profit is assigned according to a ratio and not to a pre-fixed amount. Furthermore, the entrepreneur shares the profits with the Islamic bank that distributes the profit between shareholders, reserves, and investment accounts holders. In cases where losses occur, the entrepreneur is only responsible for his effort and time except when providing evidence of negligence.

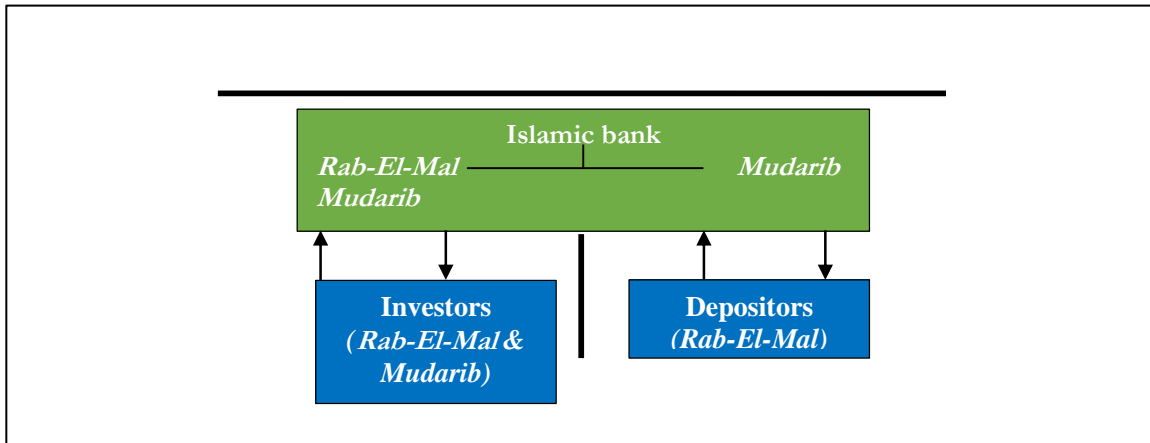
Figure 1.9. Two-Tier Mudaraba



4.2. MUDARABA LIABILITIES SIDE AND MUSHARAKA ASSET SIDE

Similar to the previous operation, the bank plays the role of *Mudarib* with depositors but it jointly participates with the entrepreneur in combining both effort and capital to finish the project (see Figure 1.10).

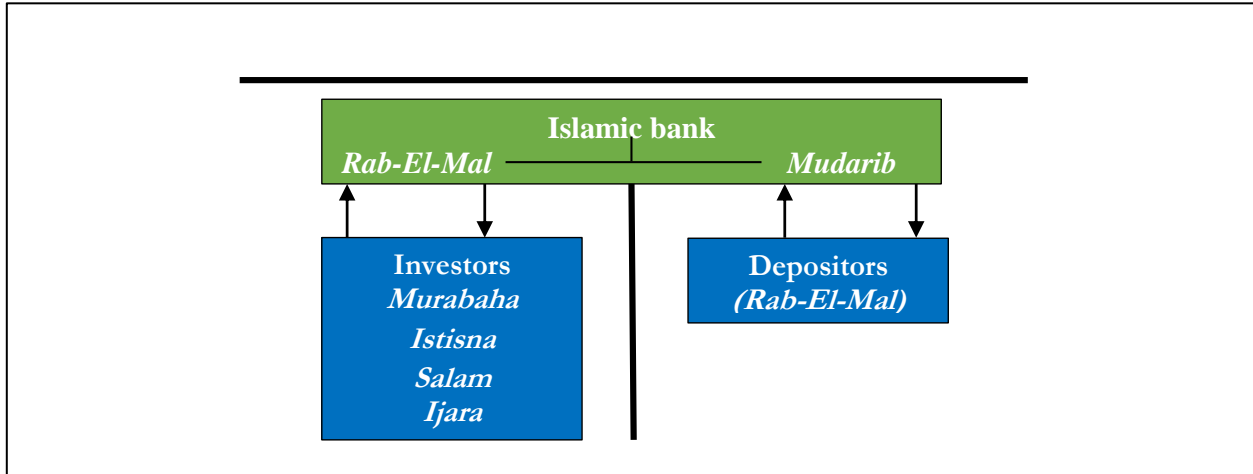
Figure 1.10. Mudaraba liabilities side and Musharaka asset side



4.3. MUDARABA LIABILITIES SIDE AND MARK-UP FINANCING ASSET SIDE

Unlike the first and the second business models, the third model incorporates mark-up financing techniques instead of PLS instruments on the Islamic banks' asset side (Figure 1.11). Accordingly, this model uses *Murabaha*, *Ijara*, *Istisna*, and *Salam* transactions on the Islamic banks' asset side while it operates under *Mudaraba* on the liabilities side. This model is considered less compatible with *Sharia'a* law because it privileges non-PLS Islamic financing tools. Yet, this model is the most commonly practiced by Islamic banks.

Figure 1.11. Mudaraba liabilities side and mark-up financing asset side



4.4. TWO WINDOWS

According to the two windows model (see Table 1.II), Islamic banks' liabilities side is divided into two main categories: (i) demand or current deposits and (ii) investment deposits (i.e. equity investments rather than liabilities in the sense of conventional banks). As a result, the choice of the right category is left to the customers of Islamic banks.

Under this structure, demand deposits—which are almost identical to current deposits of conventional banks—are placed under *Amana* or *Wadi'ah* (safekeeping) and *Qard El-Hasan* (Abedifar, Molyneux and Tarazi, 2013; Beck, Demirgüç-Kunt and Merrouche, 2013). These accounts are risky because they are demanded and fully repayable at any time (Errico and Farahbaksh, 1998). Thus, Islamic banks apply a 100% reserve requirement on these accounts (El-Hawary et al., 2007). Islamic banks charge, however, service fees for safekeeping and administrative fees if funds are used as interest-free loans or *Qard El-Hasan* for charitable purposes. The current account holders do not receive any remuneration on their invested funds. However, Hassan and Dicle (2005) argue that current account holders should receive compensation if their funds are mixed with other types of risky investments.

In addition to demand deposits, Islamic banks also offer savings deposits (Turk-Ariss and Sarriddine, 2007; Beck, Demirgüç-Kunt and Merrouche, 2013; Bitar and Madiès, 2013). These accounts give the right for Islamic banks to use resources without depositors' authorization regarding the nature of the investment decisions. Accordingly, the initial value of deposits is

guaranteed. In addition, savings deposits do not give any right to a fixed income and account holders can withdraw their funds after notifying the bank. Savings accounts are rarely demanded in Islamic banks because they are close in structure to conventional banks' savings accounts, even if the latter do offer a fixed rate of interest. In addition, Islamic banks encourage the use of investment accounts instead of savings accounts (Gafoor, 1995). This is because Islamic banks can channel losses to investment account holders, which it is not the case when working under savings accounts (Gafoor, 1995).

Finally, Islamic banks offer investment accounts by establishing a business partnership with their customers. These accounts are divided into two types: 1) Restricted Investment Accounts (RIA) where: (i) funds are invested according to investment account holders' indications, (ii) initial deposits are not guaranteed, and (iii) there is no fixed rate of return. As a result, AAOIFI considers RIA as off-balance sheet items (Turk-Ariss and Sarieedine, 2007); 2) Unrestricted Investment Accounts (UIA) where account holders (IAH) leave the choice to the Islamic bank on how and where funds should be invested. In addition, Islamic banks do not guarantee capital or returns. In contrast to RIA, UIA funds can be combined with those of the bank to build an investment pool. These accounts are normally used to finance PLS transactions.

In sum, Table 1.II and Table 1.III report a maturity profile and a stylized balance sheet of an Islamic bank. The liabilities side includes three categories of resources: 1) current accounts where the principal is guaranteed by the bank, and savings accounts where the depositors participate in bank profits (Beck, Demirgüç-Kunt and Merrouche et al., 2013); 2) the investment accounts (Restricted and Unrestricted) where the principal is not guaranteed and profits are usually reinforced by two smoothing reserves (Profit Equalization Reserve (PER) and Investment Risk Reserve (IRR)); and 3) the equity base. On the asset side, *ceteris paribus*, Islamic banks operate under two financing modes: asset backed transactions and profit and loss sharing transactions.

5. Which business model for Islamic banks? An empirical treatment

In this section, we provide some statistics about Islamic banks' balance sheets. Accordingly, we examine the assets and liabilities side and show that Islamic banks use *Mudaraba* transactions with depositors (i.e. investment account holders) and non-PLS transactions such as *Murabaha* and *Ijara* with customers and entrepreneurs. Therefore, their assets side does not really reflect their liabilities

side where Islamic banks PLS resources (i.e. RIA and UIA) should be mirrored by PLS transactions such as *Mudaraba* and *Musharaka* transactions.

Table 1.IV reports Islamic banks' assets side transactions. It includes information about PLS (*Mudaraba* and *Musharaka*) and non-PLS arrangements³¹ (*Murabaha*, *Ijara*, *Istisna*, and *Salam*). Accordingly, we compare Table 1.IV results with the three business models presented above.

Khan (2010) argues that Islamic bank advocate refers to "*Islamic banks as predominately risk-taking institutions committed to long-term productive investment on a partnership or equity basis*" (p. 808). Table 1.IV clearly shows that this is not the case. PLS-arrangements only account for 5.39% of Islamic banks' assets side total operations. The results show that PLS-transactions vary between 4.69% and 7.12% of total Islamic banks' transactions for the period between 2000 and 2011. This means that Islamic banks have a marginal use of PLS transactions. Table 1.IV also shows that non-PLS transactions are predominant. *Murabaha* transactions account for 79.85% of Islamic banks total transactions on average for the entire period. Other non-PLS financial transactions such as *Ijara*, *Istisna*, and *Salam* account for 6.8%, 2.03%, and 0.89% of Islamic financing techniques respectively. It worth noting that *Ijara* contracts account for more than the total of both *Mudaraba* and *Musharaka* financing techniques.

The literature shows that the choice of PLS and non-PLS financing is yet still a subject of debate. For instance, Sundarajan and Errico (2002) explain that non-PLS transactions are acceptable only in cases where PLS contracts are unsuitable. Khan (2010) suggests that non-participatory Islamic financing modes are permissible as long as they include some level of risk sharing. Yet, *Sharia'a* law shows no justification for the superiority of one financing technique compared to the other (El-Gamal, 2000). Therefore, theoretically speaking there is no explanation for why the Islamic bank business model privileges mark-up financing over PLS-financing. At a practical level, Islamic banks compete with conventional banks. Therefore, they are somehow required to provide a minimum level of profits to their account holders compared to interest rates proposed by conventional banks. Furthermore, Khan (2010) quotes from (Financial Times, 2009) that "*if you let banks share losses right and left, the whole system will collapse in any downturn*" (p. 812). This shows again the

³¹ We also report the percentage of PLS and non-PLS transactions for each available Islamic bank in Table BI in the Appendix.

paradox between the theoretical background of Islamic banks and their practices as it is between the word “Bank” and the word “Islamic”.

These figures invite us to ask several questions about the business model of Islamic banks. A bank that uses non-PLS transactions to serve the expansion of its balance sheet can be considered as “non-practicing” bank that does not consider PLS principles, the prohibition of interest and especially the spread of human and ethical values instead of maximizing earnings and profits. This could harm the reputation and confidence in the bank vis-à-vis its customers and investors.

For a general assessment, we present in Table 1.V the proportion of Islamic financing modes (i.e. mark-up and PLS transactions already presented in Table 1.IV) on the Islamic banks’ assets side. Islamic financing modes represent on average 50% of the total activities of Islamic banks for the period of 2000–2011 and that 80% of these activities represents *Murabaha* contracts. In addition, cash, and investment operations (financial and real estate) represent 27% and 19% of total assets, respectively. Accordingly, the results show that Islamic banks have a high amount of liquid assets. This can be explained by the fact that these institutions do not enjoy the same facilities to refinance their balance sheet as do conventional banks. In fact, Islamic banks have a weak interbank money market. In addition, they cannot sell their debts (Beck, Demirgüç-Kunt, and Merrouche, 2013), they do not have relations with conventional banks, or with Central Banks as lender of last resort because of the constraints imposed by *Sharia’a* law.

Finally, Table 1.VI examines the nature of Islamic banks’ resources and their compliance with *Sharia’a* law. According to the three models of Islamic banks outlined above, we find that restricted and unrestricted investment accounts represent on average 52% of Islamic banks’ resources. Investment accounts are based on *Mudaraba* contracts between depositors and the bank. Still, one must note that current accounts (i.e. *Wadiab* or *Amana* deposits) and savings accounts constitute nearly one third of Islamic banks’ liabilities side over the period 2000–2011. However, these accounts are very much like current accounts of conventional banks.

6. Islamic banks and the Basel framework

Banking regulation and supervision has always been a subject of debate between bankers and policy makers. The literature shows no general consensus regarding the relationship between banking regulation, stability, and efficiency. In fact, the literature reports contradictory results. Theoretical and empirical research defines regulation as a necessity for the development of the banking sector. Accordingly, prudential regulation and supervision is a prescription to ameliorate the stability and efficiency of banking institutions and the financial system in general. The main advocates of this approach are: the Basel Committee on Banking and Supervision (BCBS), the Islamic Financial Services Board (IFSB), and the Accounting and Auditing Organization of Islamic Financial Institutions (AAOIFI). For instance, Depuis (2006) explains that the development of lending and other commercial activities give rise to different types of bank risk exposures and this could explain the need for prudential banking regulation. In contrast, a sizeable body of research also reports that such explanation is inadequate and that the occurrence of financial crisis is a good example of financial authorities' shortness and misguidance regarding regulatory guidelines.

Moreover, Haldane³² (2012) contends that achieving what regulation was meant to achieve is closely associated with the degree of complexity of banking regulatory frameworks. The author's paper called "The Dog and the Frisbee" emphasizes the fact that after a decade of complex and costly banking regulation, the financial system has become even more fragile to financial crisis. Investigating the impact of capital, liquidity, and leverage requirements on the banking sector's probability of default, the author's findings show no conclusive evidence that complex and prudential banking measures impede banks' probability of default. Hence, he criticizes the "*Basel tower*" approach where more stability requires more regulation and calls for simplicity when supervising the banking sector.

Therefore, in this section, we review the history of banking sector regulation. We also discuss concerns about the validity and accuracy of such regulatory frameworks on Islamic banks compared to conventional counterparts.

³² Andrew Haldane is an economist at the Bank of England. Here we refer to the author's paper "The Dog and the Frisbee" that was presented at the 36th Economic Policy Symposium at the Federal Reserve Bank of Kansas City.

6.1. BASEL I: ISLAMIC VS. CONVENTIONAL BANKS

Since the conclusion of the first Basel accord in 1988, several important considerations have been set to regulate conventional banks. This first agreement concentrates on conventional banks' capital requirements.³³ It requires banks to hold a minimum of 8% of capital to risk weighted assets.³⁴ Accordingly, this so-called *Cooke*³⁵ ratio combines, on the one hand, bank capital to its appropriate level of risk exposure and, on the other hand, it standardizes conventional banks' risk into four categories (0%, 20%, 50%, and 100%), which represent credit and counterparty risk (Turk-Ariss and Sarriddine, 2007).

According to Basel I, bank capital consists of shareholders' equity, retained earnings, reserves, and hybrid items (that include debt and equity). The Basel I agreement was originally set for banks of G-10 countries. Yet, it was adopted by Central Banks of more than 100 countries around the globe. This reflects a desire of banking institutions to adopt a unique and recognizable measure of capital adequacy (BCBS, 2013, p. 1-2). Basel I is the first complex agreement that was released *"to encourage leading banks around the world to retain strong capital positions and to promote fair competition by reducing inequalities in capital requirements among different countries"* (Turk-Ariss and Sarriddine, 2007, p. 48).

As for Islamic banks, El-Hawary et al. (2007) refer to the early 1990s as the period where Islamic banking regulators started to pay attention to regulatory aspects of Islamic banks. Yet, no explicit or conclusive reference was made before 1999. Here we refer to the AAOIFI who issued the first capital adequacy framework for Islamic banks and was based on the same methodology used in Basel I. This was considered a milestone step for Islamic banking institutions.

In this context, Errico and Farahbaksh (1998) acknowledge that Islamic banks must have a regulatory framework and that regulators of conventional banks should recognize with an open

³³ Dupuis (2004) argues that the erosion of banking capital is one of the reasons behind requiring banks to hold a minimum capital ratio. For example, Hazel (2000, p. 328) reports that the average ratio of capital to assets of all US insured banks fell from 12% to 6.5% for the period between 1935 and 1990.

³⁴ It is true that the minimum level of capital requirements is set to 8%. However, some countries prefer to hold a higher ratio to avoid any banking sector unexpected losses and to ameliorate investors' confidence. For instance, Bahraini banks are required to hold a minimum capital ratio of 12% according to Basel II (<http://www.cbb.gov.bh/page-p-supervision.htm>), while Canadian banks need to hold a minimum amount of 10% (<http://www.cbb.gov.bh/page-p-supervision.htm>).

³⁵ It refers to Peter Cooke, the president of the BCBS between 1988 and 1991.

mind the Islamic banking approach. Islamic banks use RIA and UIA where a PLS arrangement is applied. Funds are mainly channeled toward operations that are asset-backed and thereby closely related to the real economy. Islamic banks prohibit speculation, selling of debt, and usage of derivatives. Nevertheless, the two authors explain that Islamic banks should be regulated because under the two-tier *Mudaraba* model, insolvency risk is not avoided. For instance, IAHs are fully responsible if losses occur. This could trigger a massive withdrawal of depositors' money and lead to crisis of confidence between depositors, investors, and Islamic banks. To avoid this problem, Islamic banks distribute profits to investment account holders from IRR and PER even if losses occur. In addition, Islamic banks might adjust their equity base in cases where IRR and PER are not enough to avoid withdrawal risk. This could explain why Islamic banks maintain higher levels of capital ratios compared to conventional banks.

Table 1.VII documents the minimum capital requirements as recommended by BCBS for conventional banks and AAOIFI for Islamic banks. As we have explained in section 4.4 and Tables 1.II, 1.III and 1.VI, Islamic banks use RIA and UIA and this is reflected in the AAOIFI's denominator of capital ratio compared to the BCBS's denominator in the same table.

All in all, the Basel I agreement is the first international recognition of the importance of creating a transparent and harmonized regulatory framework for banks around the world. Yet, due to the rapid development of the banking sector, the *Cooke* ratio was found to be insufficient.³⁶ Dupuis (2006) argues that relying on credit risk as a sole determinant of banks' risk exposure does not reflect banks' actual risk. Hence, in the period between 1999 and 2004, BCBS launched a new modified and more complex version of banking guidelines known as Basel II.

6.2. BASEL II: ISLAMIC VS. CONVENTIONAL BANKS

Basel II accord was introduced in 2004 and updated several times between 2005 and 2009. Acknowledging the weaknesses in Basel I, Basel II includes three pillars. Accordingly, it combines a more complex measure of capital requirements, a new framework for banking supervision, and new tools to improve market discipline.

³⁶ For example, the Basel I agreement considers short-term instruments less risky than long-term instruments and thereby it encourages banks to invest more in short-term instruments which could harm financial stability (Turk-Ariss and Sareddine, 2007).

The first pillar—capital requirements—defines three types of risk that the banking industry faces. First, the credit risk reports the failure of a bank borrower to repay its loan and therefore incapacity of meeting its contractual obligations. Second, market risk refers to the fact that banking institutions could bear losses due to wrong positioning in the financial markets (e.g., interest rate risk, currency risk, commodity risk, etc.). Finally, operational risk is described as the risk “*of loss resulting from inadequate or failed internal processes, people and systems or from external events*” (BCBS, 2006, p. 144). Operational risk mainly reflects a human error, a system failure and other administrative issues. The second pillar—supervision of capital—deals with different techniques and procedures that could be used to determine a comprehensive and soundly based capital measure. The third pillar—market discipline—focuses on the importance of disclosing key financial information about the soundness of the financial position and risk exposure of each banking institution. The Basel II implementation period differs from one country to another. For instance, the Federal Reserve Board (FRB, 2005) planned to implement Basel II in the period between 2008 and 2011 while the European Union preferred the end of 2007 as a final date to put the agreement into action (Depuis, 2006).

As for Islamic banks, the establishment of the Islamic Financial Services Board (IFSB) in November 2002 was another milestone in the development of Islamic banking regulation. The new organism was founded in Kuala Lumpur, Malaysia, following the decision of the governors of Central Banks and financial authorities of several Islamic countries³⁷ with the help and support of the IDB, the International Monetary Fund (IMF) and AAOIFI. According to Foot (2004) and Turk-Ariss and Saredidine (2007), the IFSB serves in “*promoting, spreading and harmonizing best practices in the regulation and supervision of Islamic financial services industry*” (Turk-Ariss and Saredidine, 2007, p. 51). In this context, the IFSB launched in 2005 a new set of capital guidelines in response to the Basel II regulatory framework. It mainly adapted Basel II pillar 1 to Islamic banking institutions.

The main difference between the AAOIFI capital standards and the IFSB new capital guidelines is that the former computes capital adequacy ratio by focusing mainly on Islamic banks’ sources of funds; whereas, the IFSB capital adequacy standards reflect, on the one hand, Islamic banks’ sources of funds and, on the other hand, it assigns, by following the same methodology proposed by Basel II, the appropriate weights of risk exposure for Islamic banks’ assets.

³⁷ It mainly consisted of countries where Islamic banks’ operate and compete with conventional banks in a dual banking system.

Tables 1.VIII and 1.IX exhibit the main differences between Basel II and IFSB capital guidelines. Moreover, and in contrast to what AAOIFI considers regarding the exclusion of RIA as well as the 50% of weights assigned for all assets funded by UIA, IFSB capital standards exclude all assets funded by RIA and UIA together from the calculation of the capital ratio's denominator. This is because the IAH agrees to bear losses—under the PLS arrangement—which does not require any protection of customers' funds compared to conventional bank deposits. Accordingly, there is no need for additional capital requirements. As for the three risk categories mentioned in Basel II, IFSB (2005b) defines credit risk as *“the risk of a counterparty's failure to meet their obligations in term of receiving deferred payment and making or taking delivery of an asset”* (p. 6). It also defines market risk as the risk of loss due to wrong positions or unexpected movements in market prices. IFSB considers losses that could result from wrong internal procedure or unqualified human resources as operational risk.

6.3. BASEL III: ISLAMIC VS. CONVENTIONAL BANKS

After the 2007–2009 financial crisis, which turned out to be a systemic and contagious crisis, the BCBS introduced in 2010 a third set of banking regulation (after being reviewed by members of G-20 countries). This new agreement seeks to render regulatory frictions and to evolve Basel II guidelines for better stability and efficiency of the banking sector. Accordingly, the Basel III framework introduces new liquidity and leverage standards. It also requires banks to hold more capital of good quality.

As for Islamic banks, in this section we present what Basel III identifies as a new set of regulation for conventional banks in terms of capital, liquidity, and leverage. In addition, we identify what should be kept as it is and what should be subject to special treatment as a response to Islamic banks' business model. Accordingly, we examine the following features that were set for conventional banks and that should also be applied to their Islamic counterparts³⁸ (Bitar and Madiès, 2013):

- Redefinition of banks' equity base (especially common equity);
- The implementation of a Capital Conservation Buffer (CCB) and a Countercyclical Buffer (CB);

³⁸ In this section we do not report how Basel III deals with systemic banks as no Islamic bank is yet considered as a systemic one.

- The introduction of two new liquidity ratios: the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR); and
- The introduction of an explicit ratio to deal with banks' leverage.

6.3.1. More Stringent Capital Guidelines

6.3.1.a. Redefinition of capital adequacy ratio (CAR)

Basel III aims to improve and increase the quality of the bank equity base (see Table 1.X). Accordingly, this new agreement considers three inter-correlated measures of capital requirements (Rizwan, Khan and Khan, 2012):

$$\text{Capital adequacy ratio} = \frac{\text{Tier 1} + \text{Tier 2}}{\text{RWA}} \geq 8\% \text{ (6\% for tier 1 and 2\% for tier 2)}$$

$$\text{Tier 1 capital} = \frac{\text{Tier 1}}{\text{RWA}} \geq 6\% \text{ (4\% under Basel II)}$$

$$\text{Tier 1 common equity} = \frac{\text{Tier 1 common equity}}{\text{RWA}} \geq 4.5\%$$

The main feature of Islamic banks is the existence of investment accounts (i.e. RIA and UIA). At a theoretical level, these accounts should be used to finance profit sharing and loss bearing projects (i.e. *Mudaraba* and *Musharaka*) that are fully compliant with *Sharia'a* law. Yet, considering the fact that IAHS are treated like investors, therefore, they are fully aware and acknowledge the risk related to each project financed using their deposits. Given these particularities, assets financed by Islamic banks' investment accounts should be treated differently in terms of risk weighting.

In addition, Islamic banks compete with conventional banks under a dual banking system. In this context, the rate of return on investment accounts (especially UIA) must be at least equal or very close to the interest rates proposed by conventional banks. Otherwise, investors can easily withdraw their funds from Islamic banks³⁹ to benefit from higher interest rates of conventional banks. However, this argument is still very relative. In other words, Islamic banks' clients may prefer Islamic banks to conventional banks—even if conventional banks are more profitable—due to many

³⁹ In this case, depositors should notify their banks of their intention to withdraw money according to a one-month notice period.

factors such as religiosity. For instance, Abedifar, Molyneux and Tarazi (2013) indicate that religiosity is an important determinant of individuals' risk aversion. Indeed, religiosity beliefs can play a disciplinary role at the depositors' side of Islamic banks' balance sheet and can encourage banks' borrowers (i.e. investors or entrepreneurs) to respect their contractual obligations with Islamic banks.

However, Islamic banks can use three types of profit smoothing techniques to ameliorate IAHs' returns. The objective is to improve the performance of UIA by making them more attractive compared to conventional banks' interest rates (see Figure B1 in Appendix B). By doing so, Islamic banks can avoid withdrawal risk and solvency problems. We define the three smoothing mechanisms as follows (Bitar and Madiès, 2013):

- Profit Equalization Reserves (PER): this reserve collects a proportion of profits that generate projects financed by investment accounts. The rest of the profits are distributed between IAHs (i.e. UIA) and banks' shareholders (IFSB, 2010). As a result, this reserve improves the return rate of these accounts and helps, according to Islamic bankers, in reducing the fluctuation of return rates that could arise from the flux of income, provisioning, and total deposits (see Figure B2 in Appendix B). The Islamic bank manages this reserve.
- Investment Risk Reserve (IRR): is used to cover losses that generate projects funded by investment accounts but cannot be used to smooth profits. This reserve, by deducting returns from past operations, grants a minimum level of return for the holders of UIA in stress or bad situations (see Figure B3 in Appendix B). The Islamic bank also manages it.
- The *hiba* or donation: is the amount of money that corresponds to all or part of Islamic banks' profits (i.e. the share of the bank for its role as a *mudarib*). The concept is to donate part or all of the bank shareholders' profits to UIA holders to improve their returns when compared to high interest rates of conventional banks.

Nevertheless, according to *Sharia'a* law, Islamic banks should not guarantee the initial capital and returns of the UIA and that profit smoothing should normally be prohibited (especially if there is no competition between Islamic banks and conventional banks and thus there is no need for Displaced Commercial Risk (DCR). Accordingly, losses should be fully supported by the IAH.

In this case, assets financed by investment accounts (RIA and UIA) do not give rise to any regulatory capital requirements because IAHs bear all the risk. Thus, these assets should be excluded

from the calculation of the capital adequacy ratio denominator, as they do not generate any risk exposure for Islamic banks (Harzi, 2011). As a result, the Capital adequacy ratio (CAR) of Islamic banks takes the following form (IFSB, 2005a):

$$CAR = \frac{\text{Tier1} + \text{Tier2}}{RWA - RWA_{RIA} - RWA_{UIA}}$$

In some other cases, Islamic banks compete with conventional banks. Owing to the fact that conventional banks are much more experimental and more developed compared to Islamic banks, the latter seeks to increase investment accounts' rates of return using smoothing techniques to ensure the same level of competition with conventional banks. The main objective is to avoid withdrawal risk. By doing so, the UIAs are treated as a *Sharia'a* compliant substitute of conventional banks deposits (IFSB, 2011), and Islamic banks create some kind of illusion of stable returns on investment accounts even in the worst scenario.⁴⁰ Consequently, in a competitive environment and to avoid withdrawal risk, the supervisory authorities such as IFSB and AAOIFI may require Islamic banks to support investment account holders by using PER, IRR or donation as mentioned above. Therefore, the capital adequacy ratio of Islamic banks should be calculated according to the following ratio (IFSB, 2005a):

$$CAR = \frac{\text{Tier1} + \text{Tier2}}{RWA - RWA_{RIA} - (1 - \alpha) \times RWA_{UIA} - \alpha \times RWA_{UIA}(\text{PER and IRR})}$$

α is a parameter that represents the share of the added value on the real amount of returns on assets financed by the UIA. In other words, α is defined as the risk transferred to bank shareholders in case of DCR (IFSB, 2011). Therefore, it aims to improve the rate of profits on investment accounts since, in the case of DCR, a part of *mudarib* or shareholders' returns is transferred to investment account holders to avoid withdrawal risk.

⁴⁰ Accordingly, the IFSB illustrated that, "By maintaining stable returns to (unrestricted investment account holders) regardless of whether it rains or shines (an Islamic bank) automatically sends a signal that (it) has a sustainable and low-risk earnings stream for (those account holders), while the reality may be quite different" (IFSB, 2010, p. 9).

6.3.1.b. A new capital conservation buffer (CCB)

In addition to the capital adequacy ratio, BCBS recommends banking institutions to create a capital conservation buffer (CCB) that equals 2.5% of RWA and consists of common equity tier1 (CET1) to ensure bank capacity to resist and absorb losses during stressful situations. As a result, Basel III will require banks to hold a minimum ratio of CET1 that equals 7% (4.5% +2.5%). However, if a bank fails to maintain the minimum required, it might find itself subject to penalties such as constraints on the payments of dividends and distribution of bonuses (Boumediene, 2011; Harzi, 2011).

Likewise, Islamic banks should maintain 2.5% of RWA composed of CET1 (Bitar and Madiès, 2013). Nevertheless, due to Islamic banks specificities, assets financed by profit sharing investment accounts (PSIA) should be excluded from the calculation of the 2.5% of risk-weighted assets. Harzi (2011) and Boumediene (2011) argue that the reason behind not considering assets financed by PSIA in the calculation of the CCB of Islamic banks is due to the fact that IAHs agreed to bear the risk themselves. Moreover, profits generated from operations financed by investment accounts should not be retained in the construction of the CCB as well. However, in cases of DCR, a proportion of profits of IAHs should be retained in the building of the CCB (Boumediene, 2011; Harzi, 2011; Bitar and Madiès, 2013). Hence, the CCB should be computed using the following formula:

$$CCB = [RWA - RWA_{RIA} - (1 - \alpha) \times RWA_{UIA} - \alpha \times RWA_{PER \& IRR}] \times 2.5\%$$

6.3.1.c. A new countercyclical buffer (CB)

Basel III also requires banking institutions to hold a countercyclical buffer (CB). A CB is calibrated between 0% and 2.5% of risk-weighted assets and combines items of a bank's core capital. However, a CB varies according to economic conditions—periods of excessive economic growth—and requires banks to hold more CET1. The supervisory authorities can decide, in a stress situation, to decrease the CB amount by channeling funds to ensure lending activities and thereby supporting economic growth in bad economic conditions. In general, Islamic banks do not need to create a CB because their business model does not generate a counterparty risk and therefore, there is no need for this type of regulatory capital.

However, Islamic banks' business model relies on a heterogeneous number of activities and instruments such as *Mudaraba*, *Musharaka*, *Murabaha*, *Ijara*, *Salam*, and *Istisna*. Boumediene (2011) argues that the first two tools (*Mudaraba* and *Musharaka*) are based on the principle of PLS. As a result, banks' customers will bear the risk and not the Islamic bank. In this case, these accounts do not require any regulatory capital. As for the remaining contracts, the calculation of the CB varies according to the nature of the contract and the type of risk. For instance, the author argues that only *Murabaha* contracts could lead to credit risk exposure. In this contract, the bank purchases a given product on behalf of its client (i.e. entrepreneur or investor). In a second step, the Islamic bank sells the product in installments to a customer at a predetermined price concluded at the beginning of the contract between the two parties. Therefore, the product is considered a part of an Islamic bank's assets for the entire period of the contract (from the first day of purchasing until the payment of the last installment). This could generate a credit risk if the borrower does not pay on time. Hence, the calculation of Islamic banks' CB takes the following shape (Boumediene, 2011; Bitar and Madiès, 2013):

$$CB = RWA_{Mur} - RWA_{Mur}^{RIA} - (1 - \alpha) \times RWA_{Mur}^{UIA} - \alpha \times RWA_{Mur}^{PER \& IRR}$$

6.3.2. New Liquidity Reforms

One of the challenges that Islamic banks face is the management of liquidity risk (Abdullah, 2010; Harzi, 2011; Ali, 2012; Rizwan, Khan and Khan, 2012). Liquidity is the capacity of a bank to meet its immediate commitments and thus to control its cash obligations. The subprime crisis has shown the vulnerability of the financial system and the need for strict and prudential regulatory requirements. Moreover, Basel I and Basel II capital requirements are found to be insufficient to strengthen the stability of the banking sector. Thus, the Basel III framework introduces for the first time two explicit liquidity ratios, namely the LCR and NSFR, as recognition of the importance of liquidity risk (see Table 1.XI). The two liquidity ratios are now following a preparatory period and they will be put into action between 2016 and 2019, respectively.

As for Islamic banks, there are an important number of factors that are at the origin of the liquidity challenge that faces this industry. Bitar and Madiès (2013) illustrate them as follows:

- There is a large mass of liquid assets on Islamic banks' balance sheets. The reason behind holding such amount of liquidity is that Islamic banks cannot sell their own debt (*bai'a al dayn*) or benefit from conventional derivatives as they are prohibited by *Sharia'a* law.
- Islamic banks cannot borrow money from other banks due to constraints on borrowing and dealing with conventional banks even in stress situations.
- The existence of a weak Islamic interbank money market where Islamic banks can refinance followed by a quasi-absence of appropriate *Sharia'a* compliant financial instruments.
- In contrast to conventional banks, Islamic banks cannot benefit from Central Banks as lenders of last resort; a function traditionally exercised by the Central Bank. Nevertheless, the Malaysian dual financial system allows Islamic banks to refinance from conventional banks and from the Central Bank.

For these reasons, Islamic financial institutions need to work on adapting some of Basel III liquidity standards to their own management of liquidity risk given the limited number of instruments they possess.

6.3.2.a. Liquidity Coverage Ratio (LCR)

The Liquidity Coverage Ratio (LCR) aims to determine whether banking intermediaries have sufficient amount of high quality liquid assets (i.e. risk-free and very tradable assets) to deal with cumulative net cash outflows for a thirty-day period. Risk-free assets include high quality governmental and corporate bonds. However, the calculation of LCR is still very complicated and very far from being set. Bankers and regulators are still arguing about the advantages of applying LCR and its consequences on economic growth. We also note that in the following chapters we do not compute LCR for conventional banks or for Islamic banks because it incorporates so many details in which it is impossible to collect. Accordingly, we use several liquidity ratios employed in the banking literature. Yet, as a response for this constraint, Vazquez and Federico (2012) propose calculating LCR (or short-term funding ratio, STFR) as follows:

$$\text{STFR} = \frac{\text{Liabilities with maturity} < 1\text{year}}{\text{Total Liabilities}}$$

6.3.2.b. Net Stable Funding Ratio (NSFR)

The Net Stable Funding Ratio (NSFR) aims to limit bank excessive use of maturity transformation. During the financial crisis, short-term funding has been very difficult and expensive to find and maintain by conventional banks that were incapable of renewing their financing agreements. Therefore, the NSFR was set to ensure that funding resources are enough to cover the needs of stable financing. NSFR is expected to be applied at the beginning of 2019. For this dissertation, we do not have data details to calculate NSFR as recommended by BCBS. The data are private and too complex to find for conventional banks, as well as for Islamic banks. We also note that the application of NSFR is still a subject of debate between regulators and bankers and that its final form is not yet known. Accordingly, we content with several liquidity ratios used in the banking literature instead of computing NSFR. However, Vazquez and Federico (2012) propose a simplified proxy to calculate NSFR using what is currently available of financial data (see Table BII in Appendix B). It is computed as the sum of risk-weighted liabilities (RW_iL_i) divided by the sum of risk-weighted assets (RW_jA_j):

$$NSFR = \frac{\sum_i RW_iL_i}{\sum_j RW_jA_j} \geq 1$$

RW_i and RW_j weights vary between 0 and 1. They reflect the relative stability of the different components of banks' balance sheets. According to Basel III guidelines, this ratio must be greater than 1. An important value indicates a lower liquidity risk. However, given the specificities of Islamic banks, the two liquidity ratios of Basel III are not yet suitable for Islamic banks (Harzi, 2011): On the one hand, Basel III does not take into consideration when computing LCR the fact that Islamic banks do not have enough *Sharia'a* compliant short-term instruments when compared to conventional counterparts. On the other hand, the calculation of NSFR is theoretically possible for Islamic banks. However, it should take into account some of Islamic banks' specifications. Thus, Vazquez and Federico's (2012) NSFR measure is not yet suitable for Islamic banks.

6.3.3. A Framework for Leverage Ratio

The 2007–2008 financial crisis has shown that conventional banks can be highly leveraged even if they are very well capitalized. Recognizing this fact, the Basel III framework imposes an explicit measure of leverage to control for the level of bank debt. This ratio is calculated by dividing banks' capital measure with banks' exposure measure instead of risk-weighted assets (see Table 1.XII). By eliminating the RWA from the calculation of leverage ratio, regulators are now more confident because, by doing so, they avoid any errors or misguidance related to various risk models used in calculating RWA (Blum, 2008; Rizwan, Khan and Khan, 2012). Leverage ratio prevents bank excessive risk exposure in periods of financial turmoil. It is calculated as follows (BCBS, 2011):

Capital measure corresponds to tier1 capital and contains banks' tier1 common equity plus additional tier1 as defined by Basel III. Nevertheless, Islamic banks do not have the same capital structure because of *Sharia'a* constraints. As a matter of fact, the capital of these banks is mainly constituted of tier1 capital, which makes the impact of the Basel III leverage ratio weaker on Islamic banks compared to conventional banks. Indeed, the latter will be forced to reduce their tier2 and to increase their tier1, contrary to Islamic banks. However, to calculate the regulatory capital for Islamic banks, regulators need to not consider investment accounts because IAHs can withdraw their money after notifying their bank (one-month notice).

Exposure measure integrates balance sheet and off-balance sheet asset items of conventional banks. Yet, for Islamic banks, assets financed by investment accounts should be excluded from the exposure measure since they are already excluded from the additional tier1 capital. However, when it comes to DCR, a proportion of these assets should be included in the exposure measure. The leverage ratio will be put into action in 2018 after a preparatory period between January 2013 and 2017.

7. Conclusion

In this chapter about Islamic banks, we exhibit the history and growth of the Islamic financial system. We explain that some of Islamic banks' financial transactions used today could be traced back to the age of the prophet. Accordingly, the Islamic financial system is not in infancy as some authors believe, but the early stage of Islamic financial transactions does not really correspond

to what we are witnessing today, from the rapid development of Islamic commercial banks to the creation of international Islamic financial regulatory organizations. Chapter one defines Islamic banks and examines the reasons behind their existence. Except for the religiosity factor, Islamic banks exist for the same reasons that explain the existence of conventional banks. As financial intermediaries Islamic banks play the role of an administrator of payment between different financial parties. They minimize transaction costs and information asymmetries and thus impede market imperfections. However, the religiosity factor means that Islamic banks must adhere to *Sharia'a* law. To be *Sharia'a* compliant, Islamic banks' depositors must share losses as well as profits and therefore undergo true investors' risk. Islamic banks must prohibit interest rate and use return rate instead. In addition, they have to respect the materiality aspect where each financial transaction must be asset-backed. Furthermore, Islamic banks should avoid financial products that encourage speculation or uncertainty. They must also respect the ethical value by not dealing with sinful activities such as tobacco and the weapons industry.

Chapter one also represents Islamic banks' business model. It shows that PLS transactions (i.e. *Mudaraba* and *Musbaraka*) are the core products of the Islamic banking industry. However, the modern Islamic banking business model privileges mark-up products (*Murabaha*, *Ijara*, *Salam*, and *Istisna*) instead. We show that *Murabaha* dominates Islamic banks' financial transactions at 79.85% while PLS transactions only cover 5.39% of Islamic banks' modes of finance. This commercial business model shows an important divergence between theory and practice.

Finally, chapter one compares Islamic and conventional banks regulatory frameworks. It shows that Islamic regulatory organizations such as AAOIFI and IFSB responded to BCBS guidelines by implementing several regulatory standards to harmonize the work of Islamic banking institutions. Most of these Islamic banking guidelines show interest in capital requirements. However, the subprime crisis demonstrates that liquidity is also a key element to strengthen the financial system. This was obvious in Basel III with the introduction of LCR and NSFR. As for Islamic banks, liquidity management is an important challenge this industry faces. *Sharia'a* law puts constraints on Islamic banks and prohibits them from dealing with the Western financial system (commercial banks, Central Banks, financial markets, etc.), which makes them more vulnerable to liquidity shocks than conventional banks. Accordingly, implementing LCR and NSFR will be a great deal to this industry.

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Tables

Table 1.I. Islamic financial system institutions

Institution	Objective and main activities
International regulatory and supervisory organisms	
<i>IFSB</i>	<p><i>Islamic Financial Services Board</i></p> <p>IFSB promotes transparency, cooperation, and coordination to standardize regulatory guidelines between Islamic financial institutions and the rest of the financial system.</p>
<i>AAOIFI</i>	<p><i>Auditing and Accounting Organisation of Islamic Financial Institutions</i></p> <p>AAOIFI works on preparing and adapting different regulatory standards of accounting, auditing, governance, ethics, and <i>Sharia'a</i> on Islamic financial institutions. The AAOIFI is considered along with the IFSB as the equivalent of the Basel Committee on Banking and Supervision for Islamic banks.</p>
<i>IDB</i>	<p><i>Islamic Development Bank</i></p> <p>IDB objective is to improve and promote economic and social development of Muslim countries. IDB is considered the World Bank of Islamic countries.</p>
<i>CIBAFI</i>	<p><i>General Council for Islamic Banks and Financial Institutions</i></p> <p>CIBAFI defines and develops <i>Sharia'a</i> compliant financial products. CIBAFI also shows interest in the development of human resources as well as the development of information systems for the Islamic financial industry.</p>
<i>IIFM</i>	<p><i>International Islamic Financial Market</i></p> <p>IIFM promotes the development of an Islamic financial market by issuing guidelines and recommendations as well as developing new infrastructures for Islamic financial products. IIFM's main objective is to connect the Islamic financial market with the global financial market.</p>
<i>LMC</i>	<p><i>Liquidity Management Center</i></p> <p>LMC promotes the creation and the development of an Islamic interbank money market to invest short and medium term surplus liquidity of Islamic banks using instruments specifically structured to comply with <i>Sharia'a</i> law.</p>
<i>IIRA</i>	<p><i>Islamic International Rating Agency</i></p> <p>Recognized by the Islamic Development Bank, IIRA's main purpose as a rating agency is to assess risks associated with Islamic financial products to make them more transparent and recognizable by international capital markets.</p>
<i>AIBIM</i>	<p><i>Association of Islamic Banking Institutions in Malaysia</i></p> <p>AIBIM works on implementing sound practices to promote the development of the Islamic banking system and improving managers' and employees' expertise in Malaysia.</p>

Table 1.II. Islamic financial system institutions – Continued.

Institution	Objective and main activities
Islamic financial institutions	
<i>Islamic banks</i>	Islamic banks are <i>Sharia'a</i> compliant financial institutions. Their business model relies on mark-up financing techniques and profit loss sharing transactions (PLS). There are approximately 219 Islamic banking institutions worldwide according to AIBIM.
<i>Islamic windows</i>	Conventional banks introduce Islamic windows to propose some <i>Sharia'a</i> compliant products to their religious clients. AIBIM reports 170 conventional financial institutions with Islamic windows worldwide. However, some Islamic scholars believe that Islamic windows are not <i>Sharia'a</i> compliant because they are connected to conventional banks and this is not permissible.
<i>Insurance companies</i>	According to the IFSB, <i>Sharia'a</i> compliant insurance companies or " <i>Takaful</i> " are the Islamic equivalent to conventional insurance companies. They offer life insurance products (also called family insurance) and damage insurance. According to AIBIM there are 132 Islamic insurance companies around the world.
<i>Microfinance institutions</i>	Help people and very small businesses to promote economic and social activities and create community solidarity.
Market indexes	
<i>DJIM</i>	<i>Dow Jones Islamic Market</i> Launched by the Bahraini government, the DJIM measures the performance of investable equities that are <i>Sharia'a</i> compliant according to the DJIM methodology. DJIM includes stocks that meet Islamic principles and excludes businesses that promote alcohol, conventional banking and insurance, casinos and gambling, pornography, tobacco, and weapon industries.

Table 1.III. Sources of funds: Islamic vs. conventional banks

Characteristics	Islamic banks	Conventional banks
1. Current accounts	Yes	Yes
2. Saving accounts	Yes	Yes
3. Investment accounts		
- <i>Restricted Investment Accounts (RIA)</i>	Yes	No
- <i>Unrestricted Investment Accounts (UIA)</i>	Yes	No
4. Equity		
- <i>Tier 1 (share capital + reserves)</i>	Yes	Yes
- <i>Tier 2 (cumulative preferred shares + subordinated debt)</i>	Yes (no debt is allowed)	Yes
- <i>Tier 3 (subordinated debt to cover market risk)</i>	No	Yes
5. Reserves ⁴¹ (IRR and PER)		
- Investment Risk Reserve (IRR)	Yes	No
- Profit Equalization Reserve (PER)	Yes	No

Source: Errico and Farabbaksh, 1998; Turk-Ariss and Sarieddine, 2007; Bitar and Madiès, 2013; Saeed and Izzeldin, 2014).

⁴¹ See section 6.3.1.a for more details about IRR and PER.

Table 1.IV. Stylized balance sheet of an Islamic bank

Assets	Liabilities
1. Fee-based services	1. Demand deposits
- <i>Qard El-Hasan</i>	- <i>Amana</i>
2. Asset-backed transactions	2. Savings deposits
- <i>Murabaha</i>	3. Investment accounts
- <i>Ijara</i>	- <i>Restricted Investment Accounts (RIA)</i>
- <i>Istisna</i>	- <i>Unrestricted Investment Accounts (UIA)</i>
- <i>Salam</i>	4. Reserves
3. PLS transactions	- <i>Profit Equalization Reserve (PER)</i>
- <i>Mudaraba</i>	- <i>Investment Risk Reserve (IRR)</i>
- <i>Musharaka</i>	5. Equity

Source: Bitar and Madiès (2013)

Table 1.V. Islamic banks' assets side for the period between 2000 and 2011

	2000–2007	2008–2009	2010–2011	2000–2011
PLS transactions				
<i>Mudaraba</i>	2.34	3.05	2.54	2.49
<i>Musharaka</i>	2.35	3.36	4.62	2.90
Total PLS transactions	4.69	6.41	7.12	5.39
Mark-up financing techniques				
<i>Murabaha</i>	81.09	79.58	75.12	79.85
<i>Ijara</i>	4.60	11.69	10.73	6.8
<i>Istisna</i>	2.22	1.98	1.32	2.03
<i>Salam</i>	1.27	0.03	0.22	0.89
Total non-PLS transactions	89.18	93.28	87.39	89.57
Fee-based operations				
<i>Qard El Hasan</i>	0.96	0.13	0.87	0.8
Other operations	5.17	0.18	4.62	4.24

Source: Islamic Banks and Financial Institutions Information database (IBIS).

Table 1.VI. General view of Islamic banks assets side

	2000–2007	2008–2009	2010–2011	2000–2011
Cash	28.22	25.65	22.46	26.71
Islamic banks' financing tools	48.59	48.66	50.85	49.01
Investments portfolio	17.18	19.75	22.34	18.59
Others (fixed and other assets)	6.01	5.94	4.35	5.69

Source : *Islamic Banks and Financial Institutions Information database (IBIS)*

Table 1.VII. Resources of Islamic banks

	2000–2007	2008–2009	2010–2011	Average
Current and Savings accounts	32.74	27.80	28.04	30.99
Investment accounts	52.34	53.55	53.56	52.79
Other	14.92	18.65	18.40	16.22

Source : *Islamic Banks and Financial Institutions Information data base (IBIS)*

Table 1.VIII. Basel I and AAOIFI agreement on banking regulation and supervision

Conventional banks	Islamic banks
<i>First Basel agreement proposal (1988)</i>	<i>First AAOIFI agreement proposal (1999)</i>
$CAR = \frac{\text{Tier1} + \text{Tier2}}{[0, 10, 20, 50, 100]. RWA} > 8\%$	$CAR = \frac{\text{Tier1} + \text{Tier2}}{[E + CA]. RWA + RWA_{UIA} \cdot 50\%}$
<ul style="list-style-type: none"> - 0 RWA (e.g., cash, gold, OECD obligations, and U.S. treasuries). - 20 RWA (e.g., claims on OECD banks, U.S. securities). - 50 RWA (residential mortgage loans). - 100 RWA (e.g., claims on non-OECD countries). 	<ul style="list-style-type: none"> - <i>ULAs</i> lie “<i>in between</i>” equity and deposits and therefore it should be integrated in CAR risk weighted assets. - Islamic banks’ capital largely consists of <i>tier1 capital</i>. - <i>Tier2</i> is almost non-existent (no debt). - <i>E</i> represents equity and <i>CA</i> represents current and savings accounts.

Table 1.IX. Basel II and IFSB agreements on banking regulation and supervision

Conventional banks	Islamic banks
<p><i>Basel II agreement proposal (2004)</i></p> $CAR = \frac{\text{Tier1} + \text{Tier2} + \text{Tier3}}{[\text{CR} + \text{MR} + \text{OR}]. \text{RWA}} > 8\%$ $\text{Core tier1} = \frac{\text{Core Tier1}}{\text{RWA}} > 2\%$ $\text{Tier1} = \frac{\text{Tier1}}{\text{RWA}} > 4\%$ <ul style="list-style-type: none"> - CR, MR, and OR represent credit risk, market risk, and operational risk, respectively. 	<p><i>First IFSB agreement proposal (2005a)</i></p> $CAR = \frac{\text{Tier1} + \text{Tier2}}{[\text{CR} + \text{MR} + \text{OR}]. \text{RWA} - [\text{CR} + \text{MR}]. \text{RWA}_{RIA} - (1 - \alpha)[\text{CR} + \text{MR}]. \text{RWA}_{UIA} - \alpha. \text{RWA}_{PER \& IRR}}$ <ul style="list-style-type: none"> - <i>RWA</i> includes all investments financed by the <i>RIA</i> and <i>UIA</i> supported by investment account holders (<i>LAH</i>) - Projects financed by the <i>RIA</i> and the <i>UIA</i> of <i>LAH</i> must be excluded from the calculation of the <i>CAR</i> denominator. - <i>PER</i> and <i>IRR</i> represent Profit Equalization Reserve and Investment Risk Reserve, respectively. - α represents the proportion of assets funded by <i>UIA</i>. Its calculation depends on the banking stability in each country.

Table 1.X. Risk profile of Islamic and conventional banks according to Basel II and IFSB

Type of risk	Islamic banks	Conventional banks
1. Credit risk	Yes, except for <i>Mudaraba</i> and <i>Musbaraka</i>	Yes
2. Market risk		
- <i>Equity risk</i>	Yes	Yes
- <i>Commodity and Inventory risk</i>	Yes	Yes
- <i>Foreign exchange risk</i>	Yes	Yes
- <i>Interest rate risk</i>	Yes (benchmarking LIBOR)	Yes
3. Operational risk		
- <i>Price risk</i>	Yes (changes in the price of an underlying asset)	---
- <i>Fiduciary risk</i>	Yes (negligence in <i>Mudaraba</i> contracts)	---
- <i>Displaced commercial risk</i>	Yes (channeling profit from reserves to face competition)	---

Table 1.XI. Preparatory phases of Basel III capital requirements

	<i>Islamic banks</i>	<i>Conv. banks</i>	2013	2014	2015	2016	2017	2018	2019 (Total)
CET1	---	---	3.5%	4%		4.5%			4.5%
CCB	---	---				0.625%	1.25%	1.875%	2.5%
CET1+CCB	---	---				5.125%	5.75%	6.375%	7%
T1RP	21.37	14.32	4.5%	5.5%		6%			6%
TCRP	23.49	15.22				8%			8%
TCRP+CCB	---	---		8%		8.625%	9.25%	9.875%	10.5%

Source: Basel III phase-in arrangements, BCBS website, and Bitar and Madiès (2013)

This table reports Basel III capital requirements for the transitional period of 2013–2019. It includes the following items: Common Equity tier 1 (CET1), Capital Conservation Buffer (CCB), Minimum tier1 Capital (T1RP), and Minimum Capital ratio (TCRP). Table 1.X also presents Islamic and conventional banks' T1RP and TCRP averaged in the period between 2007 and 2011.

Table 1.XII. Basel III liquidity requirements in Islamic and conventional

Conventional Banks	Islamic banks
$\text{NSFR} = \frac{\sum_i W_i L_i}{\sum_j W_j A_j} \geq 1$	$\text{NSFR} = \frac{\sum_i W_i L_i}{\sum_j W_j A_j} \geq 1$
<ul style="list-style-type: none"> - NSFR is the sum of Weighted (W) Liabilities (L) divided by the sum of Weighted (W) Assets (A). - Weights are between 0 and 1. On the asset side larger weights imply a less liquid position. On the liabilities side, larger weights imply more stable funding sources. - A higher value of NSFR signifies that a bank is more stable. 	<p>Computing NSFR for Islamic banks is very different due to their particularities:</p> <ul style="list-style-type: none"> - On the liabilities side, Islamic banks use unguaranteed investment accounts to finance their activities. Depositors may also withdraw their deposits in a very short period (withdrawal risk). Also, Islamic banks possess specific reserves (PER and IRR). - On the asset side, Islamic banks use inventory, asset-backed transactions, profit sharing transactions, and fee-based services. Therefore, assigning weights must be different from those calculated for conventional banks.
$\text{STFR} = \frac{\text{Liabilities} < 1 \text{ year}}{\text{total Liabilities}}$	<ul style="list-style-type: none"> - Basel III ignores that Islamic banks suffer from a lack of <i>Sharia'a</i> compliant short-term instruments. Hence, it is quite difficult for Islamic banks to cover short-term funding gaps within a 30-day period in case of a liquidity shortage.
<ul style="list-style-type: none"> - A higher value of STFR implies a higher reliance on short-term funding and greater financial fragility (Vazquez and Federico, 2012). 	

Table 1.XIII. Basel III leverage requirements for Islamic and conventional banks

Conventional Banks	Islamic Banks
$LR = \frac{\text{Capital Measure}}{\text{Exposure Measure}} \geq 3\%$ <ul style="list-style-type: none"> - Capital measure will be computed by using regulatory Common Equity ratio (CET1) or the tier 1 Capital ratio (T1RP) or the Total Capital ratio (TCRP). - Exposure measure represents on- and off-balance sheet exposures. 	$LR = \frac{\text{Capital Measure}}{\text{Exposure Measure}} \geq 3\%$ <ul style="list-style-type: none"> - PSIAs must not be included in the capital measure because it does not meet Basel III requirements for capital measure. - PSIAs are also excluded from the exposure measure. Yet, assets financed by these accounts must be considered when it is the case of displaced commercial risk (Boumediene, 2012).

Appendix B

Islamic Banks' Transaction Techniques

MARK-UP FINANCING TECHNIQUES

This type of contract requires each transaction to be linked to the real economy by relying on a tangible asset (El-Hawary et al., 2007). Mark-up financing is also called non-profit loss sharing mode of finance (Beck, Demirgüç-Kunt and Merrouche, 2013). This trade-based mode of finance or mark-up financing includes *Murabaha*, *Salam*, *Ijara*, and *Istisna*. These instruments combined with PLS-based instruments make Islamic banks activities more capable of accommodating all kinds of customers' financial satisfaction, especially when comparing Islamic banks to a very competitive and powerful Occidental and complex banking system. However, mark-up financing techniques are not considered as core *Sharia'a* compliant techniques. The advocates of such interpretation explain that mark-up instruments can only work as an interim measure or where PLS techniques are unsuitable (Warde, 2000; Hassan and Zaher, 2001; Sundarajan and Errico, 2002; Khan, 2010). In addition, some authors such as Siddiqi (2002) describes trade-based financing techniques as a weak form of Islamic finance while others like Bourkhis and Nabi (2013) argue that "*Islamic banks may lose their comparative advantages against their conventional peers due to the deviation of the current practices (i.e. mark-up finance) from the theoretical model (PLS-finance)*" (p. 69). Under such circumstance, Chong and Liu (2009) express concerns about the resemblance between these techniques and the conventional interest-based financing techniques. The two authors refer to Pakistan's Council of Islamic Ideology who warns that: "*such non-PLS modes of financing should be restricted or avoided to prevent them (i.e. Islamic banks) from being misused as a back door for interest-based financing*" (p. 130). This was also clear in the work of El-Gamal (2000), who states that there is no *Qur'anic* preference for mark-up financing modes over PLS financing techniques. Below we present the main asset-backed financing techniques of Islamic banks.

Murabaha

Trade with mark-up (Errico and Farahbaksh, 1998; El-Hawary et al., 2009) or cost plus sale known as *Murabaha* refers to the sale of products with a pre-agreed profit margin on their costs. *Murabaha* is a term of Islamic *Fiqh* that simply means sale (Kettler, 2011, p. 43). This type of contract, which resembles a conventional bank leasing contract (Beck, Demirgüç-Kunt and Merrouche, 2013), is considered as one of the most used and demanded short-term instruments of Islamic banks. It involves two main partners: the Islamic bank that purchases the product and makes it available for sale and the customer or the demander of the product who acquires it. However, AAOIFI distinguishes between the ordinary *Murabaha* and the *Murabaha* for the purchase orderer. Accordingly, the first type does not require any promise to purchase the product by the customer from the banking institution, while the second involves the customer's promise to purchase the product according to a pre-agreed selling price, which includes the cost of the purchased product plus a mark-up price as a percentage of the cost of the purchased item. The *Murabaha* contract can also be arranged with or without deferred payments. This type of contract is currently used in working capital and trade financing (Chong and Liu, 2009). Apart from the wide usage of *Murabaha*, some scholars prefer PLS instruments instead. They argue that profit margin might incorporate or benchmark traditional interest rates. For instance, Beck, Demirgüç-Kunt and Merrouche (2013) explain that this contract gets around interest rates to make some kind of return on money lending. Khan (2010) also speaks about getting around interest or *Hiyal* and quotes from the work of Coulson (1964) who argue that such policy is “*designed to achieve purposes fundamentally contrary to the spirit of the Sharia'a*” (p. 139).

Ijara

Ijara is a term of Islamic *Fiqh* that simply refers to the rent of an object (Kettler, 2011, p. 89). It might also end with transferring ownership of the underlying asset or the equipment for an agreed upon consideration (Bintawim, 2011). It is a kind of leasing contract (Chong and Liu, 2009) that involves three main players: the depositors of the bank, the customer of the bank and the manufacturer, seller of the property. This type of contract is a medium and long-term instrument that could involve several financing projects such as transportation, real estate, and equipment. *Ijara* includes two forms of contracts: (i) the simple *ijara* contract and (ii) the lease-purchase *ijara* contract.

The first form refers to the transfer of equipment usage in exchange for a rent claimed by the lessor (*mujir*) bank who owns the rented asset. At the end of the leasing contract the lessee (*mustajir*) has three different choices: (i) return the equipment to the bank, (ii) purchase the property from the bank by signing a new contract between both parties, and (iii) the lessee renews the *ijara* contract with the lessor.

The second form is called a lease-purchase contract, *Ijara wa Iqtina* or *Ijara Muntabia Bittamleek* in Arabic terminology. In contrast to the case where the lessee can decide at the end of the contract if he/she wants to buy the goods or not, the *Ijara wa Iqtina* is the case where a bank's customer promises the bank to buy the equipment at the end of the renting period. In other words, given the customer's promise to lease equipment from the bank, the bank will purchase, at the request of the client and in the bank's name, an asset in order to be rented by the customer in such way that by the end of the contract the bank will transfer ownership of the asset to the customer after recovering the purchasing cost and the profit margin.

Bai'Salam

It is a contract of sale with deferred delivery (Errico and Farahbaksh, 1998) of goods that do not exist at the time of signing the contract. This contract requires an immediate cash payment (El-Hawary et al., 2007). According to the AAOIFI, the *Salam* contract requires the purchase of a product for future delivery or forward sale (Chong and Liu, 2009) in exchange for a price (cost plus profit margin) fully paid in advance. *Salam* operation is very suitable for agriculture projects (Kettler, 2011, p. 126). The buyer of the future commodity is called *Muslim*, the seller is called *Muslim ileihi*, the amount of payment is called *Ras ul Mall* and the future commodity is called *Muslim fibi*. Normally, *Salam* should be considered as illegal since, according to *Sharia'a*, we cannot sell what we do not have. However, in some exceptional cases and under the principle of necessity, *Salam* can be used, for example, to enable farmers to obtain the needed funds when waiting for the harvest. Furthermore, paying the price of goods in advance is vital for the validity of a *Salam* contract. Since, in the absence of spot payment by the customer, the operation can be considered as a sale of debt against debt (Kettler, 2011, p. 125), which is prohibited by the Islamic law. Yet, uncertainty may render the accuracy of such instrument. To circumvent the prohibition of *gharar*, the object of the contract must be accurately indicated (the commodity must be a product, but it cannot be gold,

silver, or currency) and at the time of delivery, if the harvest for example was insufficient, the farmer has to find the needed supplies in order to honor his/her commitments.

Istisna

The term *Istisna* is an Arabic term that means rare or exclusive. The *Istisna* contract also called *Bai'Muajjal* or deferred payment sale (Errico and Farahbaksh, 1998), is a sale contract that refers to the production of particular types of commodities (Kettler, 2011), construction or manufacturing projects (Chong and Liu, 2009). In this contract, a bank's customer (*Al-mustasni*) requires equipment that needs to be built according to some provided specifications. Therefore, the item (*Al-masnoo*) does not exist and the bank will provide the needed funds to the manufacturer for future delivery (*Al-musania'a*) of the goods (El-Hawary et al., 2007). At the end of manufacturing, the customer's bank delivers the equipment and receives its funds plus a profit margin. The customer can pay the price directly or in installments (in contrast to a *Salam* contract where the price needs to be paid in advance). In the meantime, the customer's bank enters simultaneously in two parallel contracts; the first one is between the bank and its customer, while the second one is between the customer's bank and the manufacturer (Kettler, 2011).

Qard al-Hasan

The zero-return loan (Errico and Farahbaksh, 1998; El-Hawary et al., 2007) known as "*Qard al-Hasan*"⁴² is, according to the Dubai Islamic Bank website⁴³, a free interest loan delivered to needed customers in order to "*save them from undesirable circumstances and exploitation*". The term "*Qard*" is an Arabic term that means lend and "*Hasan*" is also an Arabic word derived from the word "*Ihsan*", which means "*to be kind to others*". Thus, the term "*Qard al-Hasan*" refers to a benevolent loan, gratuitous loan or interest free loan. Still, this type of loan allows banks to charge the borrowers administrative fees to cover managerial expenses, but it does not require any financial gains. The main objective of *Qard al-Hasan* is to promote and encourage solidarity and a healthy Islamic community. Accordingly, this loan serves for marriage occasions, medical treatment, and education tuition. However, the main criterion of eligibility differs between countries and from one bank to

⁴² Chapra (1995) defined *Qard al-Hasan* as: "*a loan which is returned at the end of the agreed period without any interest or share in the profit or loss of the business*" (p. 68).

⁴³ For additional information: <http://www.dib.ae/community-services/qard-al-hassan>.

another. For example, in Lebanon, a specialized institution called “*Al Qard al-Hasan Association*” provides loans to people guaranteed with gold, equipment or by the shareholders of the association.

Jo’alah

It refers to charges paid by one party to the other as a charge for rendering a specified service according to the terms of a contract signed between the two parties. El-Hawary et al. (2007) and Errico and Farahbaksh (1998) refer to *Jo’alah* in transactions such as consultations and trust services.

PLS FINANCING TECHNIQUES

As we have mentioned earlier, one specific feature of Islamic banks is participation in profits and losses. Theoretically, under the profit and loss sharing (PLS) arrangement, the conventional banks’ pre-fixed rate of interest is replaced with a rate of returns determined *ex-post* by the Islamic bank on a profit-sharing and loss-bearing basis. Only the profit-sharing percentage is determined *ex-ante*. The PLS instruments are considered as the “*core of Islamic banking*” (Hassan and Zaher, 2001; Khan, 2010) and they are widely recognized by Islamic jurists. Iqbal and Molyneux (2005) argue that relying on PLS instruments ameliorate Islamic banks’ efficiency and promote banking system stability. This is in line with Khan (2010) who argues that using PLS instruments leads to eliminating inflation, unemployment, exploitation, and poverty. Nevertheless, some scholars argue that guaranteeing profits even when losses occur—by channeling funds from special Islamic banks’ reserves—violates the core of the PLS principle where returns and risk should be related. Accordingly, neither capital nor returns should be guaranteed by Islamic banks. The PLS mode of finance includes two contracts that are *Musharaka* (joint venture) and *Mudaraba* (profit-sharing).

Musharaka

Musharaka is derived from the Arabic term *Shirka* which means partnership. It is a joint venture (Chong and Liu, 2009) or equity participation contract. This contract can be defined as an agreement between two or more partners who combine either their capital or labor together (Kettler, 2011, p. 77) to carry a project. The main difference with *Mudaraba* is that all partners (*Moucharikin*) participate in both capital and management of the projects. Kettler (2011) defines *Musharaka* as “*a form of partnership between Islamic bank and its clients whereby each party contributes to the partnership capital, in equal or varying degree, to establish a new project or share in an existing one, and whereby each*

of the parties becomes an owner of the capital on a permanent or declining basis” (p. 77). *Musharaka* can take two forms: (i) *Musharaka mufawada* and (ii) *Musharaka inan*. If the inputs are equal and the sharing of profits and losses is equal in percentages between partners, the contract is called *Musharaka mufawada*. However, if partners’ inputs are different and profit loss sharing percentages in the project are not the same, in this case, it is called *Musharaka inan*. *Musharaka* like *Mudaraba* are partnership agreements that mirror the specificities of Islamic banks’ liabilities side and more precisely the investment accounts.

A *Musharaka* contract exist under two different types: (i) the *Musharaka Sabita* known as the constant *Musharaka* and (ii) the *Musharaka Mutanakisa* also called diminishing *Musharaka*. In the former type, partners participate in the project capital from the beginning until the end of the contract period. The latter type includes a diminishing share in the ownership of the project along with the project period. As a result, the Islamic bank share declines over time and the other partner share increases until the latter becomes the sole owner of the *Musharaka* project.

Musharaka is considered a long-term contract (Errico and Farahbaksh, 1998; Greuning and Iqbal, 2008), which can be used in financing fixed assets, working capital of industrial or commercial projects (Causse-Broquet, 2012). *Musharaka*—as a PLS contract—is considered very risky and unpopular mode of financing. As a result, some Islamic banks guarantee profits (Kettler, 2011), which can be considered, according to many scholars, a violation to the basic principle of *Sharia’a* that requires a link between profits and risk. Still, *Musharaka* and *Mudaraba* as profit and loss sharing arrangements are considered more *Sharia’a* compliant than the rest of interest free modes of finance.

Mudaraba

Mudaraba is a trustee finance contract (Errico and Farahbaksh, 1998; El-Hawary et al., 2007) derived from an old practice used in the time of the prophet. It refers to a partnership between capital and work. It includes two main parties: the first one is the holder of investment account, as he/she owns the funds. The second one is the entrepreneur or the investor who brings his/her personnel effort, expertise, and time to the business venture. However, in the banking sector, two-tier *Mudaraba* is conducted and in this case it includes three main parties: firstly, depositors or investment account holders (*Rab-El-Mal*) who bring capital funds; secondly, the Islamic bank who plays two roles at the same time: on the one hand, it plays the role of *Mudarib* with depositors on the

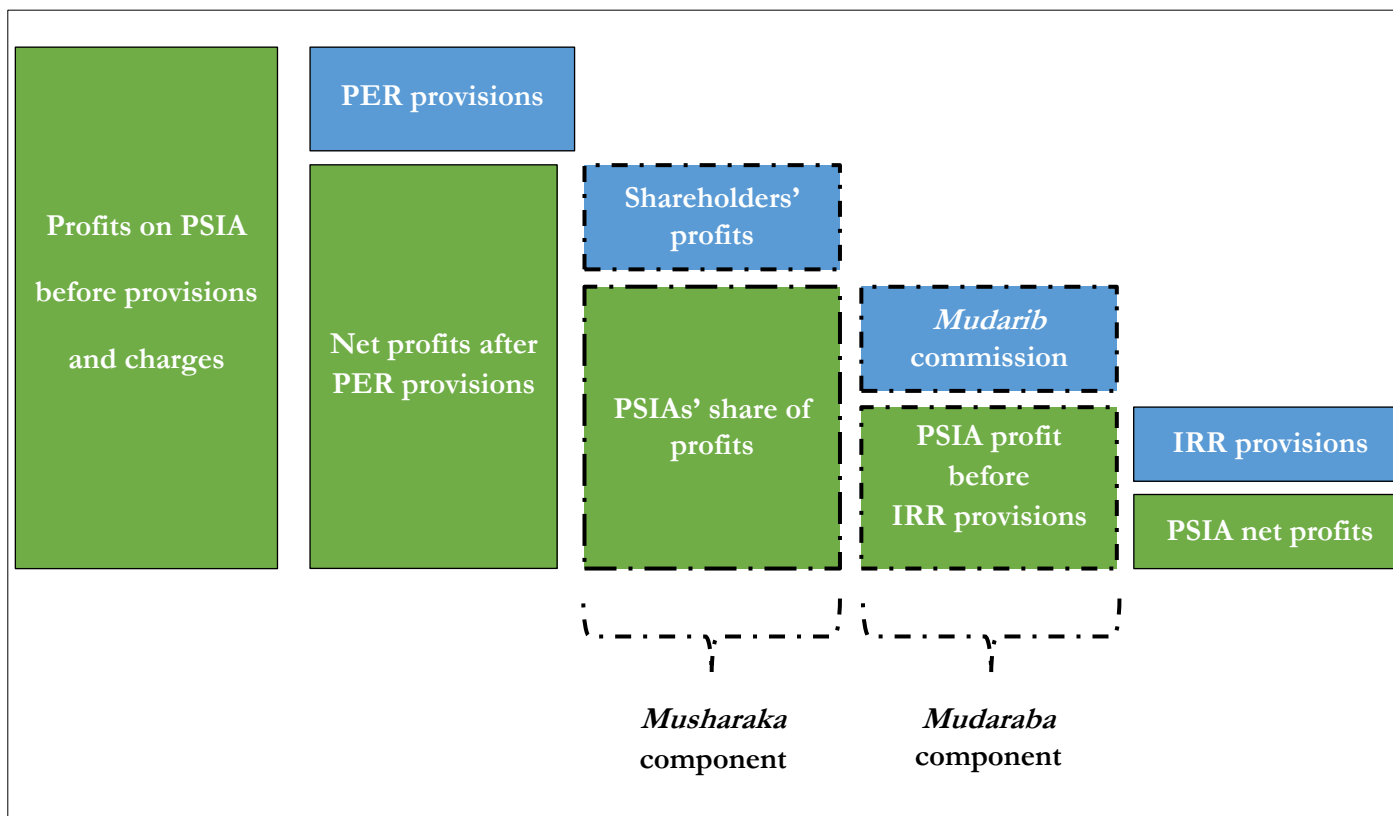
bank liabilities side and, on the other hand, it plays the role of *Rab-El-Mal* with the entrepreneur on the bank assets side; and thirdly, the investor that plays the role of *Mudarib* at the assets side. At the end of the operation, the three parties share the profits according to a pre-determined ratio (Beck, Demirgüç-Kunt and Merrouche, 2013), whereas the losses are exclusively supported by *Rab-El-Mal*. The entrepreneur only loses his/her work, time, and management fees, except in cases of managerial negligence. Nevertheless, *Mudaraba* is a very risky operation and banks should be very careful when engaging in such operation. In fact, Islamic banks must carefully examine the solvency of the entrepreneur, the feasibility of the project, and their own capacity in supervising the investments. In addition, Islamic banks do not have the right to interfere directly in the management of the project. Accordingly, an Islamic bank can be referred to as a silent partner. Therefore, this instrument is very risky for banks' shareholders and investment account holders.

Table B.I. Breakdown of Islamic banks' operations between PLS and non-PLS transactions for the period between 2000 and 2011

Year	Classification <i>The Banker</i> 2011	2000–2007			2008–2009			2010–2011					
		% PPP			% Non-PPP			% PPP			% Non-PPP		
		<i>Mudaraba</i>	<i>Musharaka</i>	<i>Murabaha</i>	<i>Mudaraba</i>	<i>Musharaka</i>	<i>Murabaha</i>	<i>Mudaraba</i>	<i>Musharaka</i>	<i>Murabaha</i>	<i>Mudaraba</i>	<i>Musharaka</i>	<i>Murabaha</i>
<i>Middle East and North Africa (MENA)</i>													
Asia													
<i>Bank Asya</i>	21	--	--	82.67	--	--	82.36	--	--	--	--	96.62	
<i>Jordan Islamic bank</i>	44	0.01	3.53	98.18	--	1.48	87.15	--	1.33	--	--	85.90	
<i>Meezan bank</i>	60	--	7.77	62.59	--	15.07	61.76	--	28.56	--	--	42.23	
<i>Tadhamon International</i>	61	13.09	1.69	83.62	0.47	24.54	66.88	24.63	13.26	--	--	58.87	
<i>Arab Islamic bank</i>	92	16.68	--	69.73	6.55	--	45.88	4.76	--	--	--	49.94	
Africa													
<i>Faisal Islamic bank</i>	31	--	--	99.90	--	--	99.90	--	--	--	--	86.37	
<i>Bank of Khartoum</i>	63	7.16	18.04	65.58	3.43	7.84	71.67	4.89	5.94	--	--	60.97	
<i>Faisal Islamic Sudan</i>	69	--	14.03	72.23	0.17	2.61	69.51	10.71	3.24	--	--	56.56	
<i>Al-Baraka Tunisia</i>	88	--	--	72.12	--	--	97.24	--	--	--	--	99.90	
<i>Gulf Cooperation Council (GCC)</i>													
<i>Al-Rajhi Bank</i>	3	--	--	89.59	--	--	99.90	--	--	--	--	99.90	
<i>Kuwait Finance House</i>	5	--	--	87.99	--	--	77.02	--	--	--	--	85.54	
<i>Dubai Islamic bank</i>	8	5.49	8.29	64.22	19.54	11.97	35.28	6.73	14.43	--	--	26.00	
<i>Abu Dhabi Islamic bank</i>	9	4.14	0.25	68.35	6.75	0.12	51.48	4.68	--	--	--	47.02	
<i>Al-Baraka Bahrain</i>	13	3.87	1.50	91.94	2.77	4.06	90.06	3.43	8.72	--	--	82.35	
<i>Qatar Islamic bank</i>	14	3.55	0.26	78.71	5.84	0.13	59.89	3.13	0.20	--	--	67.08	
<i>Iran</i>													
<i>Bank Mellī</i>	1	--	--	94.56	--	--	100	--	--	--	--	100	
<i>Banl Mellat</i>	2	--	--	99.90	--	--	99.90	--	--	--	--	99.90	
<i>Bank Saderat</i>	4	--	--	92.39	6.97	--	68.39	4.57	--	--	--	81.70	
<i>Bank Sepah</i>	7	--	--	100	--	--	100	--	--	--	--	100	
<i>South East Asia (SEA)</i>													
<i>Bank Rakyat Malaysia</i>	10	--	--	94.82	--	0.04	97.10	--	0.14	--	--	98	
<i>Bank Syariah Mandiri</i>	64	7.27	13.42	79.18	22.82	21.15	53.83	15.79	17.62	--	--	55.38	
<i>European Union (EU)</i>													
<i>Bank of London and the Middle East</i>	61	0.73	0.90	43.82	2.77	8.26	90.06	3.43	8.72	--	--	82.35	

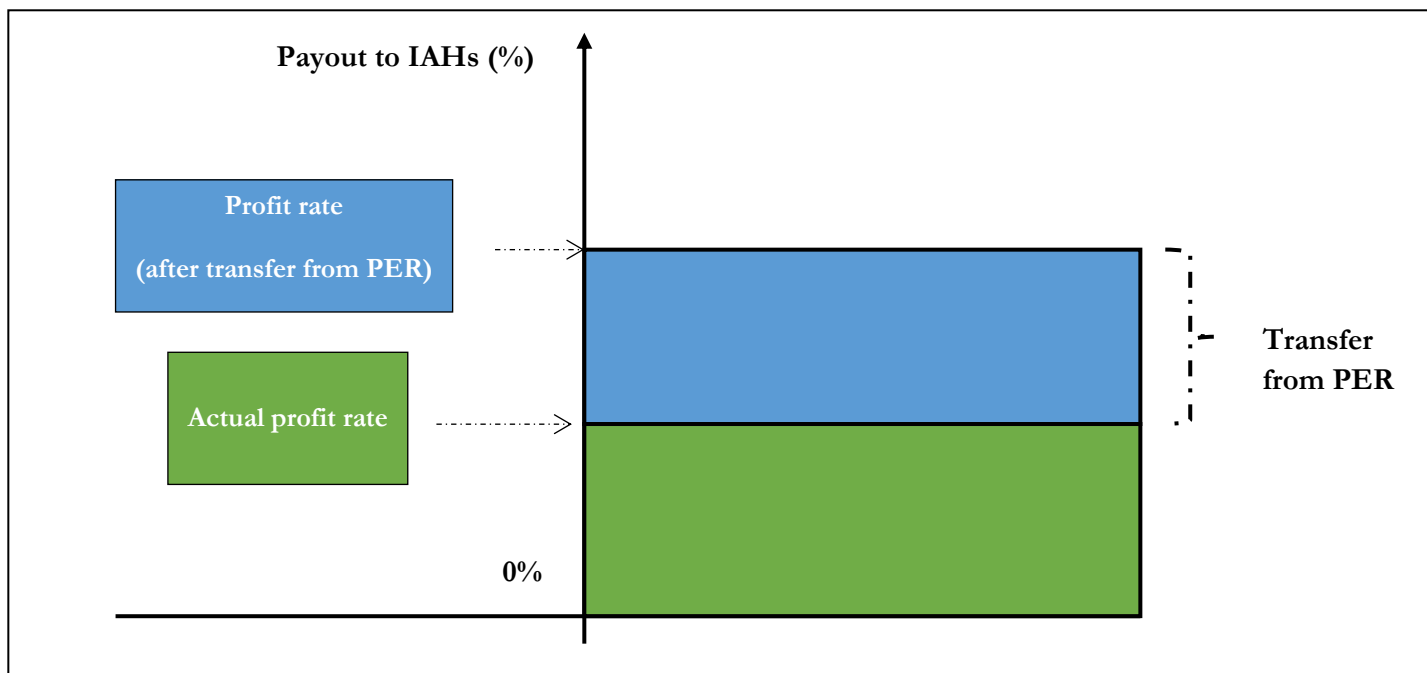
Source: Author calculation based on Islamic Banks Financial Institutions Information (IBIS)

Figure B.1. Returns between Islamic banks and PSIA holder



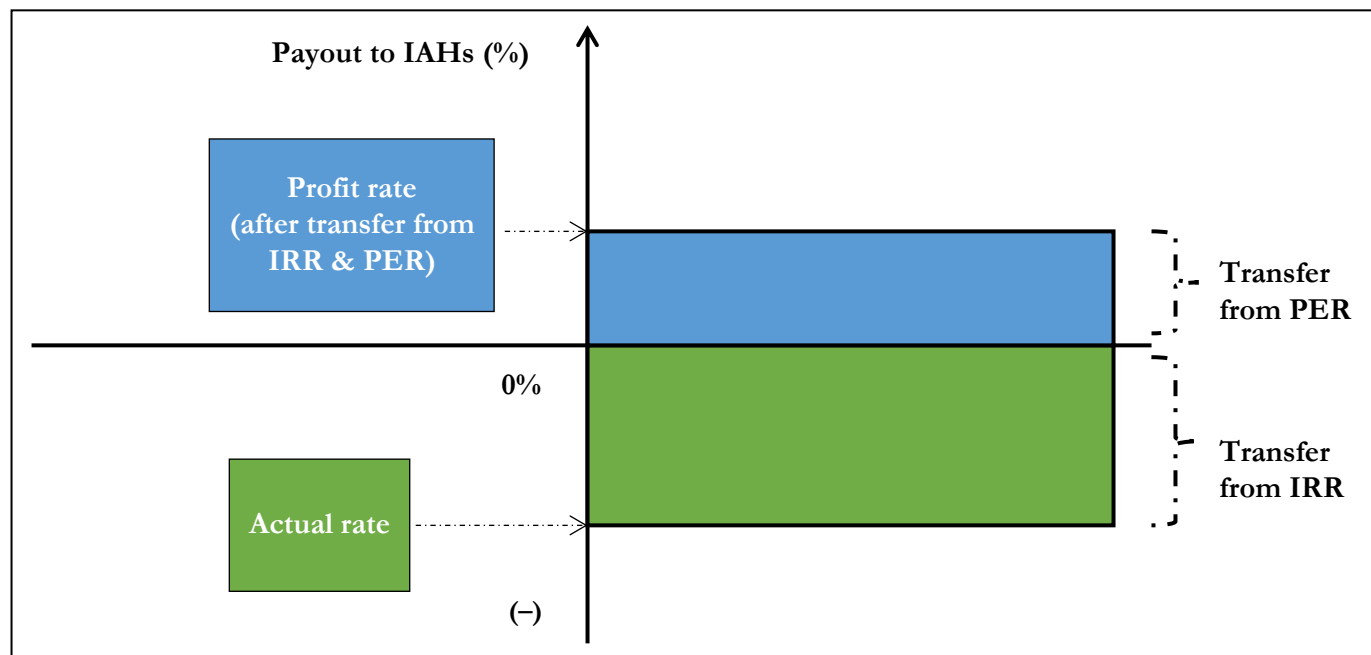
Source: Laramée (2008, p. 104)

Figure B.2. Smoothing mechanism using PER



Source: IFSB (2010, p. 22)

Figure B.3. Coverage Mechanism Using IRR and Smoothing technique using PER



Source: IFSB (2010, p. 23)

Table B.II. Vazquez and Federico's (2012) proposition to calculate NSFR

Assets	W_i (%)	Liabilities & Equity	W_j (%)
1. Total earning assets	---	1. Deposits and short-term funding	
1.1 Loans	100	1.1 Customer deposits	
1.1.1 Total customer loans	---	1.1.1 Customer deposits – current	85
a. Mortgages	---	1.1.2 Customer deposits – savings	70
b. Other mortgage loans	---	1.1.3 Customer deposits – term	70
c. Other customer/retail loans	---	1.2 Deposits from banks	0
d. Corporate and commercial loans	---	1.3 Other deposits and short-term borrowing	0
e. Other loans	---		
1.1.2 Reserves for impaired loans/NPLs	---	2. Other interest bearing liabilities	
1.2 Other earning assets	35	2.1 Derivatives	0
1.2.1 Loans and advances to banks	---	2.2 Trading liabilities	0
1.2.2 Derivatives	---	2.3 Long-term funding	100
1.2.3 Other securities	---	2.3.1 Total long-term funding	100
a. Trading securities	---	a. Senior debt	
b. Investment securities	---	b. Subordinated borrowing	
1.2.4 Remaining earning assets	---	c. Other funding	
2. Fixed assets	100	2.3.2 Pref. shares and Hybrid capital	100
3. Non-earning assets	---	3. Other (non-interest bearing)	100
3.1 Cash and due from banks	0	4. Loan loss reserves	100
3.2 Goodwill	100	5. Other reserves	100
3.3 Other intangibles	100		
3.4 Other assets	100	6. Equity	100

Source: Vazquez and Federico (2012, p. 23)

This table presents a stylized balance sheet of a conventional bank. W_i are the weights assigned to different categories of bank assets while W_j are the weights assigned to different categories of bank liabilities and equity.

Chapter 2. Comparing Islamic and conventional banks' financial strength: A multivariate approach

Abstract

We perform principal component analysis (PCA) on an array of 20 financial ratios to explore and compare conventional and Islamic banks' financial characteristics. In contrast to the existing literature, this is the first study to use PCA to derive four components to examine the financial strength of both bank types. The PCA shows that capital requirements, stability, liquidity and profitability are the most informative components in explaining the financial differences between Islamic and conventional banks. We further employ logit, probit and OLS regressions to compare Islamic and conventional banks' financial strength. Our results show that Islamic banks are more capitalized, more liquid and more profitable but less stable than their conventional counterparts. The findings in term of capitalization and liquidity are driven by small Islamic banks. Finally, Islamic banks were more resilient than conventional banks in terms of capital, liquidity and profitability during the subprime crisis. Our findings generally persist when excluding US banks and when comparing banks in countries where the two banking systems co-exist.

1. Introduction

Since the 2007–2008 financial crisis many banking institutions have been bankrupted and many regulatory reforms have been imposed. The subprime crisis not only uncovered the weaknesses of the traditional financial system but also revealed the strength of Islamic banks. This can be seen in the fact that Islamic banks were more stable during the global crisis⁴⁴ and they did not encounter any losses or solvency problems, unlike their conventional counterparts.

In a general context, there are a limited number of studies that examine the reasons behind the survival of Islamic banks during the subprime crisis. However, recently, a new stream of research on Islamic banks has started to emerge. Beck, Demirgüç-Kunt and Merrouche (2013) compare Islamic and conventional banks' business model, efficiency and stability. Abedifar, Molyneux and Tarazi (2013) examine risk in Islamic banks, while Johnes, Izzeldine and Pappas (2013) report the performance of Islamic and conventional banks. Saeed and Izzeldin (2014) investigate the relationship between efficiency and risk in Islamic banks compared with conventional banks. Papers such as Chong and Liu (2009) and Abedifar, Molyneux and Tarazi (2013) show that Islamic and conventional banks can be compared due to the fact that the former mimic the latter in terms of financial behavior even though they are somehow different at the operational level. While few

⁴⁴ Although there was no direct impact on Islamic banks at the beginning of the subprime crisis, these banks were indirectly affected when a second wave of financial distress hit the real economy (Bourkhis and Nabi, 2013). Hasan and Dridi (2010) argue that the Islamic bank business model (lower leverage and higher capital ratios) helped them to resist the crisis in 2008 while poor risk management was behind the decline of their profitability in 2009.

empirical studies use principal component analysis (PCA) to study the conventional banking sector's financial strength, there is no study that uses PCA to compare Islamic and conventional banks' financial characteristics. This work is set to fill this gap in the literature.

The intuition for choosing PCA is as follows: the literature uses different accounting measures to examine the same financial phenomena; for instance, studies show that capital requirements can be measured using the equity to assets ratio, the capital adequacy ratio or the tier 1 capital ratio. The same logic applies to risk, for which authors might use the Z-score, the loan loss reserves to gross loans or the standard deviation of ROAA or NIM. However, the results of these studies are often contradictory. This could explain why the literature results are not unified when it comes to subjects such as banking regulation, stability, performance and efficiency. This paper first employs PCA to derive the PCA components. PCA is a powerful tool that can be used to explore and examine any possible association between different financial ratios to create a few variables (i.e. components) instead of the measures initially introduced. Second, we use these components as independent variables – instead of the 20 original financial ratios (i.e. capital, liquidity, leverage, stability, risk and profitability/cost ratios) that are extensively used in the literature – in several regression techniques (logit, probit and OLS regressions) to investigate whether they are able to distinguish between Islamic banks' and conventional banks' financial characteristics. Our initial sample is unbalanced and includes 8615 commercial and Islamic banks incorporated in 124 countries. The sample covers the period between 2006 and 2012.

Our findings suggest that capital, stability, liquidity and profitability are the most informative financial characteristics extracted from the PCA. The logit and probit regressions show that banks with higher capital, liquidity and profitability but lower stability are more likely to be Islamic ones. The findings of the OLS regressions confirm the logit and probit results. We also compare small and large Islamic banks and banks during the subprime crisis period. Our results show no significant difference between large and small Islamic banks except for the capital and liquidity components in our sample of 28 countries. Finally, Islamic banks were more capitalized, more liquid and more profitable during the subprime crisis. The results generally persist when excluding US banks and when comparing Islamic banks in countries with similar financial characteristics.

The rest of this paper is organized as follows. Section two reviews the literature. It focuses on papers that: (i) use principal component analysis to study banking system characteristics, (ii) examine

conventional banks’ characteristics and (iii) compare Islamic and conventional banks. Section three describes the data, the variables and the methodology. Section four introduces the PCA results and analyzes and compares conventional and Islamic banks’ financial characteristics using parametric approaches. The last section concludes.

2. Literature review

2.1. LITERATURE SURROUNDING PRINCIPAL COMPONENT ANALYSIS

Canbas, Cabuk and Kilic (2005) examine the default probability of Turkish commercial banks using PCA on a sample of 40 banks for the period between 1994 and 2001. The results show that capital adequacy, income expenses and liquidity ratios are the most important dimensions in explaining the total variation of Turkish banks’ internal structures. In line with this, Shih, Zhang and Liu (2007) perform PCA to measure the financial intermediation of the Chinese banking sector. The authors show that insolvency risk (i.e. capital ratios), liquidity risk, credit risk and profitability represent more than 64% of the total variance of the financial ratios employed in PCA. They conclude that capital⁴⁵ is the most informative indicator of Chinese banks’ overall financial health. Their results are similar to those obtained by Canbas, Cabuk and Kilic (2005) and Pegnet (2011), who find that capital measures constitute an important factor in explaining the credit supply of banking institutions. Adeyeye et al. (2012) also use principal component analysis with discriminant analysis to investigate the failure probability of Nigerian banks. The authors show that profitability, liquidity, credit risk and capital adequacy are good predictors of banks’ bankruptcy and that PCA is an important but complementary tool that can be used to explore banking institutions’ financial structure. Furthermore, Badarau and Leveiu (2011) assess the potential strength of banks’ capital channel in eight European countries using PCA. Their findings show that countries such as Germany and Italy might be exposed to financial shocks through banks’ capital channel while other countries, such as France, are the least exposed to financial shocks. Finally, Andreica (2013) examines the financial distress of 66 Romanian banks in 2011. Using PCA factors and logistic regression, the author demonstrates that replacing the initial set of financial ratios with their components increases the performance of the early distress warning model by 12%.

⁴⁵ The authors use four indicators to measure capital. These indicators are: (i) the core capital ratio, (ii) the capital risk ratio, (iii) the asset profitability ratio and (iv) the doubtful loan ratio.

The literature clearly shows that PCA is a powerful tool that adds value and concatenates a large set of financial measures in a few components that represent the key information needed to compare several aspects of banking activities and financial strength. Below, we report the main topics covered by the banking literature on conventional and Islamic banks. The objective is to choose an initial set of financial ratios and perform PCA to create a new set of components that can be used to compare the two bank types later on.

2.2. LITERATURE SURROUNDING BANKS' CHARACTERISTICS

The first stream of literature investigates the relationship between banking regulation and risk. In the aftermath of the subprime crisis, the debate has once again made it very clear to the regulatory authorities that further work should be carried out to prevent any future financial crises. For instance, Haldane (2012) calls on regulators to simplify the regulatory guidelines by arguing that requiring banks to respect complex guidelines made them more vulnerable to the financial crisis. Blum (2008) criticizes the Basel II capital guidelines and argues that risk-based capital measures generate moral hazard behavior because of market imperfections and information asymmetries. He concludes that banks should maintain a risk-independent leverage ratio to induce any untruthful risk disclosure that could affect banks' capital adequacy requirements. By the same token, Demirgüç-Kunt and Detragiache (2011) investigate the association between compliance with the Basel core principals and banks' soundness. Employing an overall index of 25 Basel principles, the authors find no evidence of a significant relationship between compliance with Basel rules and banks' Z-score. Furthermore, Altunbas et al. (2007) find a positive relationship between capital, liquidity and credit risk when studying the European context. On the contrary, another set of papers emphasizes the important role of banking regulation in maintaining the soundness of the banking system. For example, Vazquez and Federico (2012) argue that higher liquidity and capital ratios reduce banking default probability. Imbierowicz and Rauch (2014) also show that combining liquidity risk and credit risk has an additional influence on banks' probability of default. Accordingly, they recommend that banks should increase their efforts and create joint management for both credit and liquidity risk, which could ameliorate their soundness. In the same context, Anginer and Demirgüç-Kunt (2014) examine the relationship between capital requirements and bank systemic stability in 43 countries for the period between 1998 and 2012. Using several measures of capital, their findings suggest that capital is an important factor in containing economic shocks and ameliorating bank stability. Stiroh (2004a) also finds that the equity to assets ratio is negatively associated with the standard deviation

of ROE but positively associated with banks' adjusted profits and Z-score when examining American banks.

The second stream of literature argues that the relationship between regulation and risk should be extended to include profitability. Lee and Hsieh (2013) analyze the relationship between capital, risk and profitability. Examining a sample of Asian banks, the authors provide evidence of a positive association between capital and profitability and a negative association between capital and risk. Berger and Bouwman (2013) also find that capital has a positive impact on small banks' probability of survival. Capital is positively associated with medium and large banks' probability of survival but only during crisis periods. In addition, Barth et al. (2013) examine the relationship between regulation, supervision and monitoring, and bank efficiency. Based on a sample that covers 72 countries, their findings show that capital stringency and the equity to assets ratio are positively associated with bank efficiency. Their results find support in several studies, such as Pasiouras (2008), Banker, Chang and Lee (2010), Hsiao et al. (2010) and Fiordelisi, Marques-Ibanez and Molyneux (2011). However, other studies, such as Berger and Di Patti (2006), show a negative relationship between capital and profit efficiency. Moreover, Goddard et al. (2010) examine the association between profit rates and a vector of bank characteristics for 8 European countries. The authors' findings suggest that a higher equity to assets ratio has a negative influence on banks' profit rates.

Finally, the third stream of literature considers competition⁴⁶ and market power as equally important factors that may also influence banking system stability, efficiency and risk. Following three steps to analyze the relationship between competition, efficiency and bank stability, Schaeck and Cihák (2013) investigate the mechanism by which competition affects financial stability using the Boone indicator. The authors' findings show that the Boone indicator is positively linked to banks' stability. In addition, decomposing the Z-score into capital, profitability and volatility of profits shows that the Boone indicator's positive association with the Z-score is driven by higher capital and return on assets. Likewise, Anginer, Demirgüç-Kunt and Zhu (2014) find that bank competition has a positive impact on banks' systemic stability when examining a sample of publicly traded banks in 63 countries. In a similar framework, Schaeck and Cihák (2012) pose the following

⁴⁶ In this study, we do not consider competition and market power as they are not directly related to the context of our study.

question: “Why do banks maintain capital level above regulatory requirements?” (p. 836). They note that competition is the main factor in increasing capital for commercial, cooperative and saving banks. They also provide evidence that large banks operate with lower capital ratios than small banks and that capital requirements are more important in countries that focus on shareholders' rights. Furthermore, Turk-Ariss (2010a) examines the relationship between market power, stability and banks' efficiency in developing countries. The author's results show a negative correlation between banks' market power and their cost efficiency while the relationship with banks' stability is positive. Likewise, Berger, Klapper and Turk-Ariss (2009) document two theories to explain banks' competition (when examining the relationship between competition and banks' stability), specifically the traditional “competition-fragility” theory, according to which more bank competition deteriorates banks' market power, decreases their profitability and encourages them to take more risk, and the alternative “competition-stability” approach, which shows that an increase in interest rates makes it difficult for customers to repay their loans, which may lead to higher banking credit risk exposures. The authors' finding indicates that banks with higher market power express higher risk exposure, thereby supporting the traditional competition-fragility approach. Mercieca, Schaeck and Wolfe (2007) investigate the impact of diversification on the performance of small European banks. Their results report a divergence from the traditional intermediation theory in which diversification leads to higher performance. Accordingly, they find a negative association between non-interest income and risk-adjusted performance. Their study also provides evidence that small European banks encounter difficulties in achieving benefits from diversification.

2.3. LITERATURE COMPARING ISLAMIC AND CONVENTIONAL BANKS

Čihák and Hesse (2010) investigate whether Islamic banks are more stable than commercial banks and find that large conventional banks have more experience and tend to be more stable than large Islamic banks. In addition, small Islamic banks that concentrate on low-risk investments are more stable than large Islamic banks that concentrate on profit- and loss-sharing investments. Such results reflect the credit risk management challenges that face large Islamic banks due to moral hazard and adverse selection. Rajhi (2013) also analyzes the insolvency risk of Islamic and conventional banks in the Middle Eastern, North African and Southeast Asian countries using the Z-score. The author's finding shows that Islamic banks are more stable than conventional banks and that credit risk and income diversity ratios are a common factor in Islamic banks' insolvency, thereby demonstrating that Islamic banks, like conventional banks, can become bankrupt. Furthermore,

Boumediene and Caby (2013) focus on Islamic banks' stability. Employing E-Garch and GJR-Garch techniques, their results show that Islamic banks' stock returns are less volatile than those of conventional banks. However, the authors indicate that Islamic banks should not underestimate their specific risk, which needs to be examined differently from conventional banks' risk exposure. In another study about financial soundness, Bourkhis and Nabi (2013) compare conventional and Islamic banks' capital, profitability, asset quality, efficiency and liquidity ratios before, during and after the financial crisis and find no significant difference in terms of stability between the two bank types during the crisis period.

In a closely related framework, Beck, Demirgüç-Kunt, and Merrouche (2013) examine whether differences in conventional and Islamic banks' business model, efficiency, asset quality and stability can be mirrored in their respective financial ratios. The authors find that Islamic banks' equity-based business model is not very different from that of conventional banks. Their results also show that Islamic banks are less cost efficient and have a higher intermediation ratio; they are more robust in terms of capitalization and asset quality than conventional banks. In a recent study, Abedifar, Molyneux and Tarazi (2013) exploit the differences between Islamic and conventional banks' risk exposure. They use credit risk, insolvency risk and net interest margin to measure the differences between the two bank types. They also examine whether the bank size, leverage, Muslim share, legal system, domestic interest rate and share of net loans in the total earning assets have the same impact on the risk of Islamic banks as on the risk of their conventional counterparts. They find that Islamic banks have lower credit risk but do not show any significant differences in terms of insolvency risk and net interest margin compared with conventional banks. In addition, the legal system and domestic interest rates have a negative impact on Islamic banks' credit risk, while leverage and banks' size are positively associated with banks' credit risk. Finally, Abdul-Karim et al. (2014) find that higher capital ratios have a positive influence on conventional and Islamic banks' deposits and credit growth when comparing the association between capital requirements and lending and deposit behavior. The authors also show that capitalization may put some pressure on low-capitalized Islamic banks' activities compared with those of conventional banks.

Authors also show an interest in studying the competition and the profitability of Islamic banks. For instance, Turk-Ariss (2010b) finds that Islamic banks are more concentrated and less competitive than conventional banks. The findings also show no significant difference between conventional and Islamic banks' profitability ratios. The author explains that Western banks, by

benchmarking Islamic banks, are diversifying their portfolio and therefore tending to reduce their exposure to systemic shocks. Weill (2011) compares conventional and Islamic banks' market power and finds that Islamic banks have lower market power than conventional banks due to their norms and different economic incentives. Srairi (2008) compares conventional and Islamic banks' financial characteristics using liquidity, credit risk, leverage, cost efficiency and bank size. The author's findings show that the cost to income ratio has a negative impact on the profitability of both bank types. He also finds that leverage has a negative impact on conventional banks' profitability, while the effect is positive for Islamic banks. Liquidity is positively associated with Islamic banks' profitability, but it shows no significant effect on conventional banks' profitability. In a general context, Pappas, Izzeldin and Fuertes (2012) compare the failure risk of Islamic and conventional banks using conditional survival-time models. Using CAMELS measures, the authors' results suggest that Islamic banks with higher leverage, liquidity and net interest revenue and lower concentration have lower failure risk than conventional banks. The results also show that Islamic banks are more sensitive to cost because of their large operational risk.

In the third category of investigation, authors use efficiency scores to evaluate the financial strength of Islamic banks compared with conventional banks. For instance, Belans and Hassiki (2012) employ data envelopment analysis (DEA) to investigate the impact of profitability, liquidity, risk, corporate governance and bank size on the efficiency of Islamic banks compared with conventional banks. They find that liquidity is positively associated with the efficiency of both bank types and that leverage and reserves for loan loss have a positive impact but only on conventional banks' efficiency scores. They also find that bank size and return on equity are negatively associated with conventional banks' efficiency while the effect is not significant for Islamic banks. Similarly, Romzie, Wahab, and Zainol (2014) examine the efficiency determinants of Islamic banks in several Middle Eastern and Asian countries. Using three efficiency models, they find that profitability, capital and credit risk are an important determinant of Islamic banks' efficiency in both regions. In the same context, Johnes, Izzeldin and Pappas (2013) compare the efficiency scores of conventional and Islamic banks and suggest that Islamic banks are more efficient than conventional banks when compared with their own efficiency frontier. Finally, Saeed and Izzeldin (2014) investigate the association between efficiency and distance to default for Islamic and conventional banks. Their results show that a decrease in default risk is associated with a decrease in efficiency, yet, in contrast to conventional banks, the findings do not show any trade-off between risk and efficiency for

Islamic banks. Below, we report the data, the variables and the methodology that we use to investigate the differences between Islamic and conventional banks in terms of capital, liquidity, leverage, risk/stability and profitability.

3. Data, variables and methodology

3.1. DATA

The sample covers the period from 2006 to 2012 and contains different categories of financial ratios of an initial unbalanced data for 8615 banks⁴⁷ (including 124 Islamic banks) incorporated in 124 countries. The data are mainly compiled from the Bankscope database. The choice of Bankscope as a primary source of data is because it is widely used in empirical work related to the banking literature.⁴⁸ After reviewing the literature, we find that the capital adequacy, liquidity, leverage, profitability, stability and risk indicators are the most important and are used in identifying the key differences between Islamic and conventional banks. It is also worth mentioning that the Bankscope database lacks observations regarding some capital ratios. Therefore, whenever possible, we download the annual reports from the website of each of Islamic bank to cover for the missing data of the capital adequacy ratio (TCRP) and tier 1 capital ratio (T1RP). For the regression section of the results, we collect data about the Muslim population (RELP) and legal system (LEGAL) in each country from the Pew Research Center and the World Factbook.

3.2. VARIABLES

Table 2.I describes the variables employed in the PCA, their sources in the previous literature and their impact on the banking system's financial strength (e.g. capital, liquidity, leverage, stability, risk, efficiency and profitability). Table 2.I also reports the expected results regarding the comparison between Islamic and conventional banks when using regression techniques (i.e. logit, probit and OLS regressions). Table 2.I breaks down the financial indicators into five main panels. Each panel expresses structural, institutional and specific bank-level characteristics.

⁴⁷ We only compare commercial banks with Islamic banks because of data availability. Accordingly, investment banks, savings banks, cooperative banks and real estate and mortgage banks are excluded from the sample.

⁴⁸ See the work of: Čihák and Hesse (2010); Abedifar, Molyneux and Tarazi (2013); Beck, Demirgüç-Kunt and Merrouche (2013); Johnes, Izzeldin and Pappas (2013); Abdul-Karim et al. (2014); Rosman, Wahab and Zainol (2014); and Saeed and Izzeldin (2014).

Panel A characterizes the bank capital requirements. Abdul-Karim et al. (2014) argue that the objective behind requiring banks to hold a minimum amount of capital is: “to ensure that banks set aside capital from their own money for each set of investments they make” (p. 2) and that “the riskier the banks or their businesses, the more capital is required to put aside” (p. 2). Canbas, Cabuk and Kilic (2005) and Shih, Zhang and Liu (2007) argue and find that capital ratios represent the most informative factor when using PCA. Accordingly, Panel A consists of four capital measures. We refer to Demirgüç-Kunt, Detragiache and Merrouche (2013) and Anginer and Demirgüç-Kunt (2014) and use two risk-weighted capital measures – the total capital ratio (TCRP) and tier 1 capital ratio (T1RP) – as recommended by regulatory authorities (e.g. the Basel Committee on Banking and Supervision). We also employ two traditional measures of risk-independent capital ratios: total equity to net loans (TENLP) and total equity to deposits and short-term funding (TEDSTF). We expect Islamic banks to be more capitalized than conventional banks due to their high level of engagement in non-PLS transactions (Table 2.I, *hypothesis H1*).

Panel B identifies liquidity requirements. Vazquez and Federico (2012) define liquidity using the financial intermediation theory. They explain liquidity creation as “financing long term projects with relatively liquid liabilities such as transaction deposits and short term funding” (p. 5). In this study, we use liquid assets to deposits and short-term funding (LADSTF), liquid assets to total assets (LATAP), liquid assets to total deposits and borrowing (LATDBP) and net loans to total assets (NLTAP) to proxy for liquidity. Except NLTAP, the higher these ratios are, the more liquid and less vulnerable to run the bank will be in a situation of stress (Lee and Hsieh, 2013; Anginer and Demirgüç-Kunt, 2014). However, it is important to note that excessive liquidity might also be explained as a bank’s inefficiency in managing its own resources (Rajhi, 2013). The NLTAP is – in contrast to the first three measures – inversely related to liquidity. It reflects credit risk exposure, which can negatively affect banks’ financial strength (Mercieca, Schaeck and Wolfe, 2007; Männasoo and Mayes, 2009; Turk-Ariss, 2010b; Demirgüç-Kunt and Detragiache, 2011). We expect Islamic banks to be more liquid than their conventional counterparts (Table 2.I, *hypothesis H4*). Islamic banks lack short-term liquidity instruments, they have a weak interbank money market and liquidity management and they cannot sell debt or collaborate with conventional banks. They cannot borrow from central banks as lenders of last resort. For these reasons, Islamic banks prefer to protect against any liquidity shortages by holding higher amounts of liquidity buffers. This could protect against maturity mismatches but at the same time it could be considered as management inefficiency

in maturity transformation and therefore it could be negatively associated with bank stability and profitability.

Panel C includes three measures of financial leverage. Toumi, Viviani and Belkacem (2011) define leverage as: “(...) the fact that the involving of new resources is efficient for the bank, respectively when the resources cost is lower than the return costs” (p. 7). Accordingly, we use the ratio of liabilities to assets (TLTAP), which is also called the debt ratio (Sanusi and Ismail, 2005; Anginer, Demirgüç-Kunt and Zhu, 2014), the ratio of total assets to equity (TATE), which is also called the equity multiplier (Hassan and Bashir, 2003; Oslon and Zoubi, 2008), and the ratio of liabilities to equity (TLTE) as the third variant of financial leverage (Pappas, Izzeldin and Fuertes, 2012). The literature shows ambiguous results regarding the association between leverage and financial strength. For instance, Galloway et al. (1997) argue that leveraged banks express higher stock returns volatility, while Berger and Di Patti (2006) explain that higher leverage is positively associated with bank profit efficiency. In this study, we expect Islamic banks to be less leveraged than conventional banks (Table 2.I, *hypothesis H7*) (Pappas, Izzeldin and Fuertes, 2012; Abedifar, Molyneux and Tarazi, 2013). Islamic banks use investment accounts to engage in leverage. However, these accounts are not insured and therefore any losses will be supported by the investment account holders. Accordingly, banks should use investment accounts in a safer way to protect depositors' money and to prevent any withdrawal risk, which creates sensitivity to leverage. Islamic banks also promote asset-backed investments, which make them close to the real economy and more prudent. Accordingly, they do not contribute to financial bubbles in the same way as investments made by conventional banks (Hassan and Dridi, 2010; Saeed and Izzeldin, 2014).

Panel D controls for stability and risk indicators. The literature shows that it is difficult to provide a standard measure of bank financial risk and stability. Oosterloo and Haan (2003) argue that there is no general consensus on the exact meaning of financial stability. Houben, Kakes, and Schinasi (2004) define financial stability as the capacity of the financial system to maintain the following aspects: “(i) allocating resources efficiently between activities and across time, (ii) assessing and managing financial risks, and (iii) absorbing shocks” (p. 11). As the literature provides a variety of indicators that could be used in measuring stability and risk, we implement six proxies.⁴⁹ First, we

⁴⁹ We also use loan loss reserves, loan loss provisions and impaired loans, all divided by gross loans, as additional measures of credit risk (Abedifar, Molyneux and Tarazi 2013; Beck, Demirgüç-Kunt and Merrouche 2013). However, we

use the Z-score index (LnZS) as a measure of bank distance from insolvency (Stiroh, 2004a; Houston et al., 2010). The Z-index estimates how many standard deviations a bank is away from bankruptcy, under the assumption of normality of bank returns (Boyd and Graham, 1986; Čihák and Hesse, 2010; Gamaginta and Rokhim, 2011). It is the inverse measure of the overall bank risk (Horváth, Seidler and Weill 2012) and equity to assets for the bank capitalization level. A larger value of the Z-score indicates a more stable banking system. Second, we employ the risk-adjusted return on average assets (AROA) and the risk-adjusted return on average equity (AROE) as two alternative measures of bank stability. The two ratios are approximated by dividing ROAA and ROAE by their respective standard deviation (Abedifar, Molyneux and Tarazi, 2013). The latter ratio is also called the Sharpe ratio (Jahankhani and Lynge, 1980; Boyd and Graham, 1986; Stiroh, 2004a, b). A higher AROA and AROE indicate good risk-adjusted profits and more banking stability (Mercieca, Schaeck and Wolfe, 2007; Turk-Ariss, 2010a, b). Finally, we use the standard deviation of return on average assets (SDROA), the standard deviation of return on average equity (SDROE) and the standard deviation of net interest margin (SDNIM) to measure risk. A higher ratio can be interpreted as higher volatility in banks' profits and therefore a higher risk profile (Stiroh, 2004a, b; Mercieca, Schaeck and Wolfe, 2007; Agusman et al., 2008; Demirgüç-Kunt and Huizinga, 2010; Houston et al., 2010; Schaeck and Cihák, 2013). We expect a negative or a no significant difference between Islamic and conventional banks' stability (Table 2.I, *hypothesis H8* or *hypothesis H10*) because Islamic banks tend to mimic conventional banks by relying on non-PLS transactions (Abedifar, Molyneux and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013; Bourkhis and Nabi, 2013).

Panel E defines profitability and banks' cost efficiency. We use the return on average assets (ROAAP) and return on average equity (ROAEP), which are the two traditional and most commonly used profitability ratios (Oslo and Zoubi, 2008; Johnes, Izzeldin and Pappas, 2009; Turk-Ariss, 2010b; Pappas, Izzeldin and Fuertes, 2012; Abedifar, Molyneux and Tarazi, 2013; Lee and Hsieh, 2013). In addition, we employ the cost to income ratio (CIRP) as a measure of cost inefficiency (Abedifar, Molyneux and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013). We expect Islamic banks to be more profitable than their conventional counterparts (Table 2.I, *hypothesis H11*), especially because they prefer to deal with commercial transactions instead of PLS

exclude the three variables because they did not appear in our components especially because the three variables' communalities are very low, which means that these measures cannot be predicted by any of the extracted components.

transactions. They also benefit from their involvement in huge governmental infrastructure projects (Pappas, Izzeldin and Fuentes, 2012) due to their asset-backed *Sharia'a*-compliant business model. Finally, Olson and Zoubi (2008) argue that Islamic banks are more profitable than conventional banks because they rely on investment deposits instead of equity to finance the expansion of their balance sheet.

3.3. DESCRIPTIVE STATISTICS

Table 2.II presents the mean, the median, the standard deviation, the tenth percentile (P10), the lower quantile (Q1), the upper quantile (Q3) and the ninetieth (P90) percentile of the different categories of financial ratios that we use in the initial data set before conducting the PCA.

Following the work of Canbas, Cabuk and Kilic (2005), we test for the equality of group means for each ratio. We use one parametric test (i.e. t-student) and one non-parametric test (i.e. the Wilcoxon⁵⁰ rank sum test). The tests' results and the degree of significance are shown in the last two columns of Table 2.II. Below, we explain the methodology. The final objective is to use the PCA components in a regression analysis to compare Islamic and conventional banks' key financial characteristics. The definitions and data sources of all the variables are provided in Table CI in Appendix C.

Table 2.II shows that Islamic banks are more capitalized, more liquid, more profitable and more volatile but cost inefficient, less leveraged and less stable than conventional banks. TCRP, T1RP, TENLP and TECSTF show a significant difference between Islamic and conventional banks. The mean average for Islamic banks' capital measures is 30.136%, 27.787%, 80.520% and 64.083%, respectively, while the mean average for conventional banks is 17.327%, 15.880%, 21.493% and 13.824%, respectively. Likewise, the mean average of Islamic banks of LADSTF, LATAP and LATDBP is 75.968%, 27.085% and 44.235%, respectively, while the mean average for conventional banks is 18.325%, 14.886% and 15.511%, respectively. Regarding leverage, the descriptive statistics show that conventional banks' mean average of TLTAP, TATE and TLTE is 87.766%, 10.602% and 9.618%, respectively, while the mean average for Islamic banks is 72.916%, 7.199% and 6.472%, respectively. The profitability measures show that Islamic banks have a higher ROAAP and ROAEP

⁵⁰ We use a non-parametric test to avoid the assumption of normality and the outliers' effect and to validate the results of the t-statistics. The null hypothesis tested by the Wilcoxon test is that the two populations in question (i.e. conventional and Islamic banks) are identical.

than conventional banks. The cost efficiency, risk and stability measures show that Islamic banks are costlier, more volatile and less stable than their conventional counterparts. The t-test and Wilcoxon test show a high degree of significance between the two bank types for the six panels.

3.4. METHODOLOGIES

3.4.1. Principal component analysis

We use PCA to minimize the dimensionality of different variables by creating a new platform of optimal components that correspond to the most important part of the necessary information. This procedure allows the identification and feeding of regression models with a few components that represent as much of the information of the variables initially introduced. According to Canbas, Cabuk and Kilic (2005) and Andreica (2013), principal component analysis is a procedure for understanding different patterns in data, whereby correlated variables – which measure the same financial characteristics – are examined to determine the most valuable indicators in reporting changes in banking institutions’ financial position. Thus, using this technique is a way to highlight the similarities and differences by reducing the initial data set and channeling a complex array of correlated variables into a small number of uncorrelated variables or factors called components. Before proceeding with the PCA, several tests are performed to evaluate the validity of such a technique for our analysis.

First, we include a Pearson⁵¹ correlation matrix to capture any potential subgroups of highly correlated variables. Beaumont (2012) argues that it is a waste of time to carry out PCA if the correlation matrix does not spot any possible clusters between variables. Table 2.III reports the correlation matrix of our 20 initial financial ratios. The correlation between each category of financial ratios is clear. In fact, the literature shows that each category of financial indicators (e.g. capital, stability, liquidity, leverage and profitability) can be measured by a variety of financial ratios. These ratios are highly correlated, which provides support for continuing with the PCA.

Second, we follow the work of Canbas, Cabuk and Kilic (2005) by computing the Bartlett’s test of sphericity⁵² to evaluate the appropriateness of our financial data set before engaging in PCA. This test compares the correlation matrix with an identity matrix. In other words, it tests the null

⁵¹ We also report the Spearman correlation matrix in Table CII in Appendix C.

⁵² Bartlett’s test of sphericity and the principal component analysis are performed using the SPSS 20 package program.

hypothesis that the diagonal of a correlation matrix is equal to one and the rest of the elements are equal to zero. The results are reported in Table 2.IV. The value of the chi-square is very important and the observed significance is very small (<0.01 significance level). Therefore, we reject the null hypothesis that the correlation matrix is an identity matrix. Third, we examine the overall Kaiser–Meyer–Olkin (KMO) measure and each variable's measure of sampling adequacy (MSA). According to Beaumont (2012), the KMO measure should be consulted as well as Bartlett's test of sphericity because the latter is not enough to decide whether to proceed with the PCA or not. Wuensch (2012) considers that variables with an MSA higher than 0.9 are “marvelous”, while variables with an MSA lower than 0.5 are considered as “inacceptable” and should be removed from the analysis. Table 2.IV reports an overall KMO of 0.753, greater than 0.7, which indicates that it is good to continue with PCA. The anti-image correlation matrix is presented in Table CIII in Appendix C and shows partial correlations. The anti-image diagonal of this matrix represents the MSA of each variable included in our initial model. These MSAs should be at least equal to 0.5.

Fourth, all the financial ratios are standardized with a mean of 0 and a standard deviation of 1. In our PCA study, we use 20 variables; the standardized variance is 1 and the total variance is 20. The choice of our latent variables depends on the eigenvalues and (%) of total variance. According to Canbas, Cabuk, and Kilic (2005), Shih, Zhang, and Liu (2007) and Adeyeye et al. (2012), components with eigenvalues >1 should be included in the analysis. Therefore, we only consider the components with eigenvalues greater than 1 and variance greater than 10%. Table 2.V shows that we should keep 4 components.⁵³ These components explain 73.312% of the total changes in the financial conditions of conventional and Islamic banks.⁵⁴

Finally, we perform a varimax factor rotation to ameliorate the interpretability of the retained components by maximizing the sum of the squared correlations between variables and factors. In

⁵³ We also compute three years' rolling standard deviation of LnZS_3, AROAA_3, AROAE_3, SDROAA_3, SDROAE_3 and SDNIM_3 for robustness tests. The findings show very similar results and are provided in Table CIV, Figure CI and Figure CII in Appendix C.

⁵⁴ As our sample period includes the 2008–2009 financial crisis, we decided to re-estimate our model and drop the years 2008 and 2009 for robustness checks. We find the same results for the rest of the period. The capital component (C1), stability component (C2), liquidity component (C3) and profitability component represent 28.647%, 21.606%, 12.446% and 11.972% of the total variance, respectively. For the choice of the subprime crisis period, please see our explanation in note 64.

other words, varimax rotation reduces the number of indicators that have a higher loading on a single factor, which helps to identify variables in every single component. Therefore, this technique ameliorates the capacity for analyzing and explaining the extracted key components.

3.4.2. Logit and probit regressions

In the second step, we employ logit and probit regressions to capture any financial differences between conventional and Islamic banks. Canbas, Cabuk, and Kilic (2005) explain that the logit model provides the probability by which a bank could be categorized as belonging to one category instead of another, based on the bank characteristics provided by the financial ratios. Accordingly, in this paper, we benefit from PCA to employ four extracted components as explanatory variables.⁵⁵ Our model is a binary logistic model in which the response variable (i.e. bank type) takes one of two possible answers: zero for conventional banks and one for Islamic banks. We suppose that Bank is the vector of explanatory variables (C_1 to C_4). Bank also includes the logarithm of total assets (LnTA) to control for the bank size and fixed assets to assets (FATAP) to control for the opportunity costs that arise from having non-earning assets on banks' balance sheet (Beck, Demirgüç-Kunt, and Merrouche, 2013). Equation (1) also includes two indicators of religion: the share of a country's Muslim population (RELP) and a country's legal system (LEGAL). $P = \Pr(Y = 1|Bank)$ is the response probability to be modeled. Accordingly, the logit regression model can take the following form:

$$\text{logit}(p) = \log\left(\frac{p}{1-p}\right) = \alpha + \varphi \times \text{Bank} + \beta \times \text{RELP} + \gamma \times \text{LEGAL} \quad (1)$$

where α is the intercept.

We also use the probit model to gauge the association between the PCA components and their subsequent probability of being Islamic banks. Accordingly, we formulate the following equation:

$$\Pr(Y = 1|Bank) = \alpha + \varphi \times \text{Bank} + \beta \times \text{RELP} + \gamma \times \text{LEGAL} \quad (2)$$

⁵⁵ Mingione (2011) uses PCA to forecast financial vulnerability. The author implements PCA components as regressors in a multiple regression model. His findings suggest that the PCA methodology outperforms various benchmark models.

where α is the intercept and Y is a dummy variable that takes the value of zero for conventional banks and one for Islamic banks. Vector **Bank** also contains the components retained from the PCA and the bank control variables. RELP and LEGAL are the two indicators of country religion, as mentioned above.

3.4.3. Ordinary least square regression

In the third step, we implement multiple regressions (OLS) to check the robustness of our results. We investigate the differences regarding the PCA components across the bank types using the following OLS equation:

$$C = \alpha + \varphi \times IBDV + \beta \times \text{Bank} + \delta \times \sum_{j=1}^N \text{RFE}_j + \mu \times \sum_{t=1}^T \text{YFE}_t + \varepsilon \quad (3)$$

where C is a vector of the four components extracted from the PCA. IBDV is a dummy that takes the value of one for Islamic banks and zero for conventional banks. **Bank** includes LnTA, FATAP and OVERTAP (i.e. the overhead to asset ratio). RFE is the region fixed effects⁵⁶ while YFE is the year fixed effects. ε is an error term.

4. Empirical results

4.1. INTERPRETATION OF THE LOADING FACTORS

As we mentioned earlier, we extract four components, which represent 73.312% of the total changes in the financial conditions of our banking sample. Table 2.VI represents the components’ score coefficient matrix estimated by PCA, while Table 2.VII exhibits the component loadings.⁵⁷ The first component, C1, combines three proxies for capital requirements with the total capital ratio (TCRP), tier 1 capital ratio (T1RP) and equity to customers and short-term funding (TECSTFP).

⁵⁶ We use region fixed effects instead of country fixed effect to avoid excessive use of country dummies. Thus, countries are divided into eight regions according to the World Bank 2014 country groups. These regions are: Sub-Saharan Africa, East Asia and Pacific, Europe and Central Asia, the European Union, the Gulf Cooperation Council, the Middle East and North Africa, South Asia and the United States. We also add another region as the World Bank does not cover some countries.

⁵⁷ In this table, components with small loadings (<0.5) are omitted.

Therefore, this component represents the *overall solvency* of the banking sector (Canbas, Cabuk and Kilic, 2005; Altunbas et al., 2007; Shih, Zhang and Liu, 2007; Weill, 2011; Turk-Ariss, 2010a; Lee and Hsieh, 2012; Vazquez and Federico, 2012; Gamagnita and Rofikon, 2011; Pappas, Izzeldin and Fuertes, 2012; Abedifar, Molyneux, and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013; Shaeck and Cihák, 2013; Bourkhis and Nabi, 2013; Abdul Karim et al., 2014). However, C1 also shows a negative correlation with leverage ratios. Indeed, capital ratios are on the opposite side with TLTAP, TATE and TLTE, which demonstrates a categorization of banking institutions between capitalized and leveraged banks. In this context, Blum (2008) calls for a combination of a risk-based capital ratio and an additional risk-independent leverage measure that holds as a backstop against leverage. It appears that C1 reflects a trade-off between two banking strategies: being capitalized or being leveraged. This component represents 28.015% of the total variance of the financial indicators that we use to assess banking institutions' overall financial strength. The findings are in line with the results of Canbas, Cabuk and Kilic (2005) and Shih, Zhang and Liu (2007) but differ from the results of Adeyeye et al. (2012), who find that economic conditions and staff productivity constitute the most informative measures of banks' financial strength. All in all, the results confirm the regulators' argument that higher capital ratios serve as a blockage against leverage and are positively correlated with banks' financial strength.

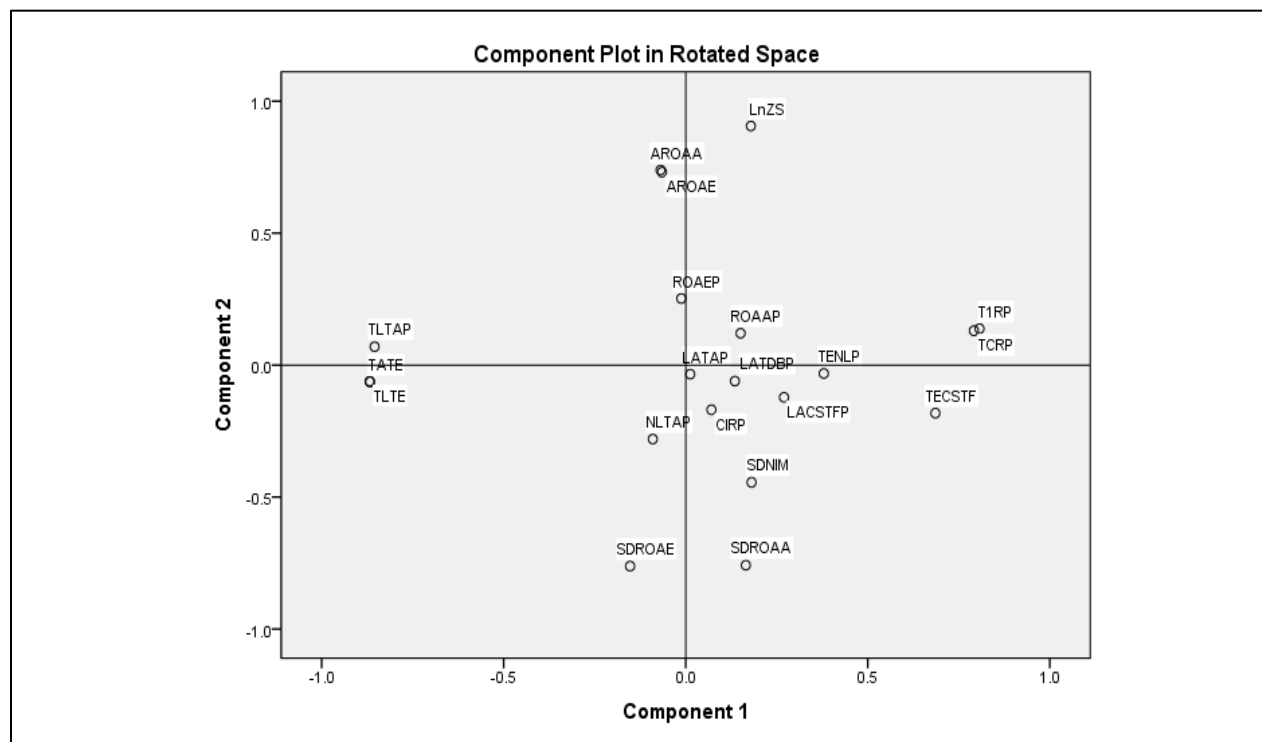
The second component, C2, reflects the *banking system stability*. It combines five measures of stability and volatility risk and represents 22.133% of the total variance of the financial measures. The literature considers the Z-score (Mercieca, Schaeck and Wolfe, 2007; Berger et al., 2009; Čihák and Hesse, 2010; Houston et al., 2010; Turk-Ariss, 2010a; Demirgüç-Kunt and Detragiache, 2011; Pappas, Izzeldin and Fuertes, 2012; Abedifar, Molyneux, and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013; Bourkhis and Nabi, 2013; Shaeck and Cihák, 2013), adjusted return on assets and adjusted return on equity (Boyd and Graham, 1986; Mercieca, Schaeck and Wolfe, 2007; Demirgüç-Kunt and Huizinga, 2010; Turk-Ariss, 2010a) to be the most used indicators of financial stability, of which higher values indicate a healthier banking system. A higher C2 suggests that a bank is doing well and maintaining a good level of the Z-score and adjusted profitability. C2 also includes two measures of risk. The volatility of return on average assets (SDROAA) and the volatility of return on average equity (SDROAE) enter C2 with opposite signs. Therefore, the second component shows a negative association between stability and the volatility of returns. It reflects a trade-off between two groups of banks: stable versus riskier banks. Accordingly, a higher

Z-score, AROAA and AROAE increase the banking sector's financial strength and decrease the volatility of ROAAP and ROAEP.

Figure 2.1 presents the composition of both the first and the second component. C1 clearly shows a strong and positive correlation with capital ratios (i.e. T1RP, TCRP and TECSTF) and a strong and negative correlation with leverage ratios (i.e. TLTA, TATE and TLTE). It thus appears that in countries with higher capital requirements, the amount of leverage held by commercial and Islamic banks is lower than in countries where banks' capital ratios are thinner. Therefore, we conclude that holding higher capital buffers reduces the leverage behavior of banking institutions, thus confirming the regulatory and supervisory authorities' argument about the role of capital guidelines in maintaining the strength of the banking system. C2 reports a positive and significant correlation with the stability measures (i.e. LnZS, AROAA and AROAE) and a negative relationship with the volatility risk indicators (i.e. SDROAA and SDROAE). Therefore, this component demonstrates that commercial and Islamic banks with higher volatility risk are probably less stable than banks that are less volatile in terms of ROAAP and ROAEP.

C3 reflects the *overall banking liquidity*. It represents 12.562% of the total variance of the financial indicators and combines three liquidity indicators, which are liquid assets to deposits and short-term funding (LADSTFP), liquid assets to assets (LATAP) and liquid assets to total deposits and borrowings (LATDB). C3 also includes a measure of credit risk – loans to total assets (NLTAP) – that examines banks' loan engagement activities as a percentage of their total assets (Oslon and Zoubi, 2008; Čihák and Hesse, 2010; Pappas, Izzeldin and Fuertes, 2012; Vazquez and Federico, 2012; Beck, Demirgüç-Kunt and Merrouche, 2013; Bourkhis and Nabi, 2013; Rajhi, 2013). This component denotes the relationship between liquidity and banks' financial strength. It also shows an inverse association with NLTAP. As we have shown for C1 and C2, C3 reveals a trade-off between two strategies: highly liquid and less liquid banks. Therefore, this component opposes prudent liquid banks to riskier banks that have a higher loan appetite and therefore a lower liquidity position. In other words, it categorizes highly liquid banks against banks that engage more in loan activities, which could result in liquidity mismatches and credit default risk.

Figure 2.1. Component plots: C1 and C2

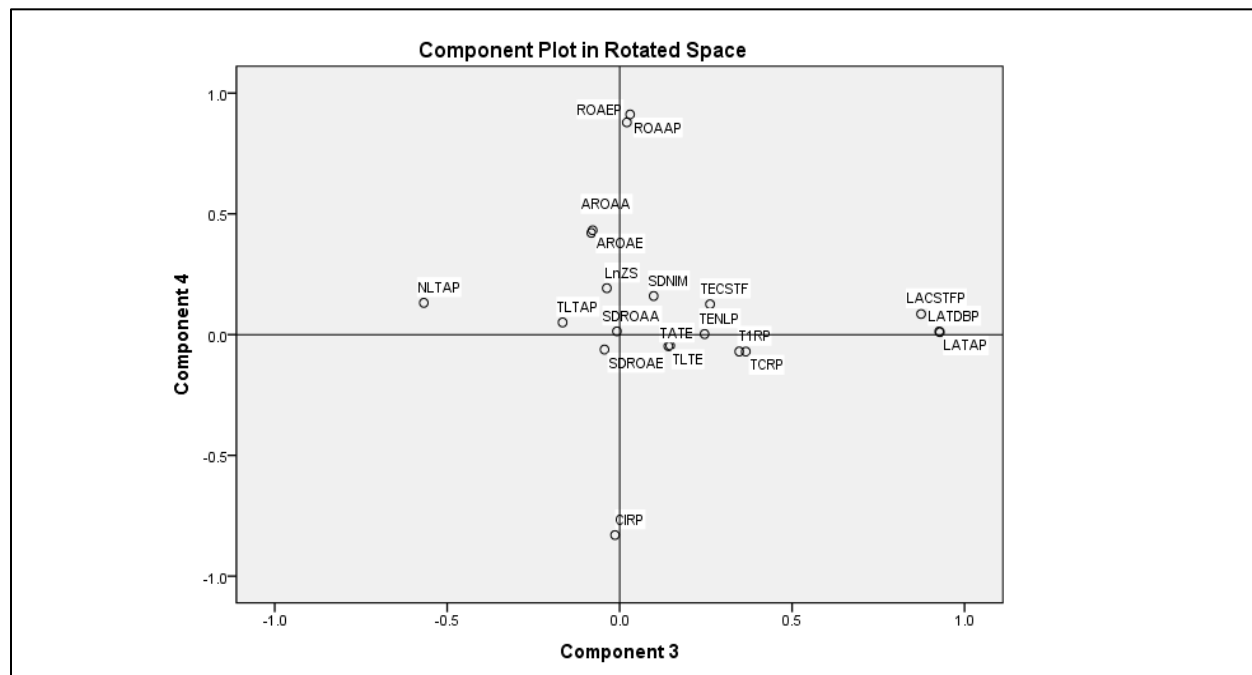


C4 consists of two *profitability measures*: return on average assets (ROAAP) and return on average equity (ROAEP). It also includes the cost to income ratio (CIRP), which controls for bank cost (Mercieca, Schaeck and Wolfe, 2007; Oslon and Zoubi, 2008; Demirgüç-Kunt and Huizinga, 2010; Turk-Ariss, 2010a; Toumi, Viviani and Belkacem 2011; Anginer, Demirgüç-Kunt and Zhu 2014; Shaeck and Cihák, 2012; Abedifar, Molyneux, and Tarazi, 2013; Bourkhis and Nabi, 2013; Lee and Hsieh, 2013). C4 reflects bank performance and represents 10.602% of the total variance of the financial measures. According to Shih, Zhang and Liu (2007) and Adeyeye et al. (2012), an increase in the level of profitability has a positive impact on bank financial strength. In other words, banks with higher profitability are more cost efficient and less likely to fail or become bankrupt. For this reason, CIRP, which represents cost inefficiency, is negatively associated with ROAAP and ROAEP and therefore with banks' overall financial strength. Thus, banks with higher costs are probably less profitable and vice versa.

Figure 2.2 shows the relationship between components C3 and C4 and financial ratios. C3 depicts the importance of liquidity in preventing any liquidity shortage or liquidity mismatch. The positive association of this component with LADSTF, LATAP and LATDBP and the negative

correlation with NLTAP support this idea. C4 is positively associated with profitability and opposes profitable banks to cost-inefficient banks. Such a situation shows the importance of efficiency in reducing commercial and Islamic banks’ cost and thereby increasing banks’ profitability.

Figure 2.2. Component plots: C3 and C4



4.2. COMPARISON OF COMPONENTS: ISLAMIC VS. CONVENTIONAL BANKS

4.2.1. Logit and probit models

In this section, we use logit and probit models to examine whether the capitalization, risk, liquidity and profitability components extracted by PCA are a good discriminant between Islamic and conventional banks. As American and European banks dominate our sample, we first examine the discriminant character of the four components for the entire banking system sample. Second, we exclude American banks, and third, we compare components between Islamic and conventional banks in countries with similar financial characteristics and where the two banking system co-exist.⁵⁸

⁵⁸ Some researchers argue that the United Kingdom should be excluded when comparing Islamic and conventional banks because UK banks are structurally very different from those in our 27 remaining countries, where the two banking systems co-exist. Some studies, such as Beck, Demirgüç-Kunt, and Merrouche (2013), include the UK when studying

Table 2.VIII reports the logistic regression results. The findings show that the higher the capital component, the higher the probability of a bank to be an Islamic one (models 1 to 4). The findings also show that the higher are the liquidity and the profitability components, the higher is the probability of a bank to be an Islamic one as well. However, the stability component shows discriminant results only in models (2) and (3), in which we do not control for bank- and country-level variables. In addition, Table 2.VIII shows similar results for capital, liquidity and profitability when controlling for bank- and country-level characteristics (models 5 to 7). The results are also robust when excluding the USA from our sample (models 8 and 9) and when comparing Islamic and conventional banks in countries with similar financial characteristics (models 10 and 11). Nevertheless, the stability component remains insignificant when adding bank and country control variables and also when excluding the USA, but it becomes negative and significant when limiting the sample to 28 countries.⁵⁹ This means that Islamic banks are not different from conventional banks in terms of stability when comparing them with the bigger sample of conventional banks. Meanwhile, they are probably less stable than conventional banks in MENA (i.e. the Middle East and North Africa), SEA (i.e. South East Asia) and the UK (models 10 and 11). As for the control variables, it appears that Islamic banks are probably bigger than conventional banks in the large sample and this could be explained by the large disparity of banks in this sample and especially US banks. The results become clearer when excluding the USA and when controlling for 28 countries where the bigger the bank is, the lower the probability of being an Islamic one is (models 9 and 11). Beck, Demirgüç-Kunt and Merrouche (2013) argue that banks with a higher FATAP have higher deposit funding, higher overheads, higher loan loss provision, higher loan loss reserves, higher non-performing loans, higher liquidity reserves and a higher Z-score. Our results show that the higher the FATAP, the greater the likelihood that the bank is an Islamic one. However, the FATAP solution does not persist when excluding the USA and when reporting the results for 28 countries. Finally, the higher is the share of Muslim population in a country (RELP) and the higher is the

Islamic banks, while others, such as Abedifar, Molyneux, and Tarazi (2013), exclude the UK. Although the UK banking system is very different from that of the rest of our sample countries, we believe that the inclusion of the UK in our sample implies that Islamic banks exist and work in this country regardless of the environment and the macroeconomic structure of the system. Accordingly, excluding the UK might bias our results.

⁵⁹ Specifically, our small sample covers the following countries: Algeria, Bahrain, Bangladesh, Egypt, Gambia, Indonesia, Iran, Iraq, Jordan, Kuwait, Lebanon, Malaysia, Mauritania, the Maldives, Oman, Pakistan, the Palestinian Territories, the Philippines, Qatar, Saudi Arabia, Singapore, Syria, Sudan, Tunisia, Turkey, the UAE, the UK and Yemen.

probability of adopting *Sharia'a* rules within a country's legal system (LEGAL), the higher is the likelihood that the banks in this country are Islamic ones (models 6 to 11). This positive correlation with RELP and LEGAL shows that Islamic banks prefer to work in countries where Muslim are majority.

The probit regressions show very similar results to the logit regressions results above. Islamic banks appear to be more capitalized, more liquid and more profitable but less stable than conventional banks. Yet, the marginal difference between Islamic and conventional banks' liquidity component becomes insignificant when when controlling for 28 countries (Table 2.IX, model 11).

4.2.2. Main financial characteristics: Islamic versus conventional banks

4.2.2.a. Capitalization

Table 2.VIII and 2.IX shows the superiority of Islamic banks in terms of capitalization (models 1 to 11). However, the literature shows that there is no general consensus regarding the impact of capital guidelines on conventional banks' financial strength. From the regulatory point of view, higher capital requirements reduce banking institutions' leverage behavior and help to absorb any external shocks, especially in situations of distress (Furlong and Keely, 1989; Keeley and Furlong, 1991; Jacques and Nigro, 1997; Aggarwal and Jacques, 1998; Ediz, Michael and Perraudin, 1998; Demirgüç-Kunt, Detragiache and Merrouche, 2013). Capital requirements are also important in protecting depositors' money (Abdul Karim et al., 2014). However, the theoretical and empirical findings do not always support the regulatory hypothesis. Some papers argue that higher capital ratios have a perverse effect on banking stability. This could be explained by the moral hazard hypothesis, whereby an increase in capital is followed by higher risk-taking behavior (Koehn and Santomero, 1980; Kim and Santomero, 1988; Avery and Berger, 1991; Shrieves and Dahl, 1992; Blum, 1999; Iannotta, Nocera and Sironi, 2007; Blum; 2008; Fiordelisi, Marques-Ibanez and Molyneux, 2011).

As regards Islamic banks, although the research is still in its infancy, a number of emerging working papers and lately some published works report ambiguity regarding the need to maintain a minimum level of capital ratios, such as the 8% of risk-weighted assets required by the Basel Committee on Banking and Supervision. However, in contrast to conventional banks, Islamic banks use profit- and loss-sharing accounts called investment accounts. Accordingly, depositors of

investment accounts share the profits with their banks, but they bear losses when they occur, which reduces the Islamic banks' overall risk (Pellegrina, 2007). Therefore, there is no need for capital requirements to be commensurate with depositors because they agree to support risk as required by the profit- and loss-sharing concept. Nevertheless, such an arrangement increases the moral hazard behavior of Islamic banks' managers, who may tend to attract more investment deposits and benefit from leverage to engage more in riskier activities (Hamza and Saadaoui, 2013). This could be even worse with market imperfections and information asymmetries (Khan and Ahmed, 2001; Sundararajan and Errico, 2002; Abedifar, Molyneux, and Tarazi, 2013; Abdul Karim et al., 2014). Moreover, if competition exists between conventional and Islamic banks, a negative return on the investment accounts of Islamic banks compared with interest rates on the deposits of conventional banks may increase the withdrawal risk between investment account holders. To prevent withdrawal risk, Islamic banks distribute profits from special reserves⁶⁰ to make their return rates more competitive with the interest rates proposed by conventional banks. However, the higher distribution of profits along with the higher leverage behavior of Islamic banks' managers shrinks Islamic banks' capital buffers (Hamza and Saadaoui, 2013). This could explain the capitalized position of Islamic banks, whereby higher capital ratios (Beck, Demirgüç-Kunt and Merrouche, 2013; Bourkhis and Nabi, 2013) are considered as a safety net against insolvency problems compared with their conventional counterparts (Hassan and Chowdhury, 2010; Hassan, Hussain and Kayed, 2011; Abdul Karim et al., 2014; Abedifar, Molyneux, and Tarazi, 2013; Abdul Karim et al., 2014). All in all, the need to keep higher capital buffers is due to the fact that Islamic banks do not apply practically what they mean to do theoretically (Errico and Farahbaksh, 1998; Chong and Liu, 2009; Bourkhis and Nabi, 2013) and that is to work under the profit- and loss-sharing concept in which capital requirements should no longer be an issue for these institutions. Our results therefore support *hypothesis H1* (or *hypothesis H7*) in Table 2.I, which shows that Islamic banks are more capitalized (or less leveraged) than their conventional counterparts.

⁶⁰ Islamic banks use two reserves – investment risk reserves (IRR) and profit equalization reserves (PER) – to smooth the profit returns of investment account holders and thereby minimize the withdrawal risk.

4.2.2.b. Stability

In terms of stability, in contrast to our expectations, we find evidence that Islamic banks are less stable than their conventional counterparts, which confirms *hypothesis H8* in Table 2.I. However, Table 2.VIII's and 2.IX's solutions for C2 only persists in models (2), (3), (10) and (11). Abedifar, Molyneux, and Tarazi, (2013), Beck, Demirgüç-Kunt and Merrouche (2013) and Bourkhis and Nabi (2013) find no significant difference between Islamic and conventional banks' stability. Čihák and Hesse (2010) show that large Islamic banks are less stable than large conventional banks while small Islamic banks are more stable than small conventional banks. In contrast, Rajhi (2013) reports that large Islamic banks tend to be more stable than large conventional banks while small Islamic banks tend to be less stable than small conventional banks. Furthermore, Faye, Triki and Kangoye (2013) conclude the superiority of Islamic banks when examining the stability of the banking sector in 45 African countries. Logit and probit regressions report that the lower the stability component, the greater the probability that the bank operates under Islamic principles. However, the results are insignificant when employing bank and country control variables. They also remain insignificant when excluding the USA, but they become significant when comparing Islamic and conventional banks' components in the sample of 28 countries. Several reasons might explain why Islamic banks are less stable than conventional banks. First, profit- and loss-sharing instruments, such as *Musharaka* and *Mudaraba*, are considered very risky, especially in a context of information asymmetries. Second, Islamic banks lack a standardized and transparent regulatory framework, though several regulatory organisms have been established to fill the gap of regulation.⁶¹ Third, there is a wide consensus that Islamic banks are diverging from what was originally set for them. At a theoretical level, Islamic banks should endorse equity participation as the core of the Islamic financing mode. However, at the practical level, commercial activities or non-profit- and loss-sharing instruments, such as *Mudaraba* and *Ijara*, are considered the cornerstone of the Islamic banking system (Khan, 2010; Bourkhis and Nabi, 2013). This weak form of Islamic finance sheds some doubt on the entire industry, which might negatively affect the reputation of such a newborn sector and eventually make it more exposed to the insolvency risk that conventional banks face. On one

⁶¹ The first Islamic regulatory organism – the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) – was established in Bahrain in 1991. This was followed by the establishment of the Islamic Financial Services Board (IFSB) in Malaysia in 2002. The main objective of the two organizations is to make sure that the Islamic financial practices are *Sharia'a* compliant.

hand, this could explain why Islamic banks maintain higher capital ratios than conventional banks, but it could also explain the insignificant results obtained with the rest of the models (i.e. models 4 to 9), on the other hand. In fact, endorsing non-PLS transactions over PLS instruments might explain why Islamic banks are not very different from conventional banks in terms of stability (Abedifar, Molyneux, and Tarazi, 2013; Beck, Demirgüç-Kunt and Merrouche, 2013; Bourkhis and Nabi, 2013).

4.2.2.c. Liquidity

The logit and probit regressions clearly suggest that the higher the liquidity component, the greater the likelihood that a bank is an Islamic one (Krasicka and Nowak, 2012; Pappas, Izzeldin and Fuertes, 2012). This matches *hypothesis H4* in Table 2.I, in which Islamic banks are more liquid than conventional banks. Abdul Karim et al. (2014) explain that banks should finance short-term loan activities from depositors' funds and that using short-term funding to finance long-term securities might result in maturity mismatches; this was reflected in the 2007–2008 subprime crisis. However, *Sharia'a* prohibits any investment in securities because they benefit from uncertainty and because they are not asset-backed. Islamic banks possess higher liquidity buffers because of the *Sharia'a* constraints imposed on their business model. For instance, Abdullah (2010) argues that Islamic banks lack a cross-border Islamic interbank money market and short-term *Sharia'a*-compliant liquidity instruments (Iqbal and Llewellyn, 2002; Sundarajan and Errico, 2002; Čihák and Hesse, 2010). They also cannot benefit from short-term financing provided by central banks (Beck, Demirgüç-Kunt, and Merrouche, 2013). Moreover, Islamic banks cannot channel a liquidity surplus to conventional banks (Akhtar, Ali and Sadaqat, 2011). Therefore, they possess higher liquidity buffers to protect against their weak liquidity infrastructure. Furthermore, Abdullah (2010) notes that “in some countries (...) the legal framework for public debt and financing arrangements does not explicitly allow for the design and issuance of Islamic financial instruments” (p. 14). This may also reflect some constraints when not adjusting the legal and financial frameworks of some countries to be compliant with Islamic banks' liquidity management specificities. Finally, Rajhi (2013) explains that Islamic banks possess higher amounts of liquidity simply because they are inefficient in managing their own resources. Nevertheless, this significant difference of liquidity component becomes marginally significant (Table 2.VIII, model 11) or insignificant (Table 2.IX, model 11) when limiting the sample to 28 countries. If, anything, this means that conventional banks also hold higher liquidity buffers especially in MENA and SEA regions not because of *Sharia'a*

constraints – like Islamic counterparts – but because banks in these countries, like other developing countries, suffer from weak liquidity infrastructure and management inefficiency compared to conventional banks in Europe and the United States.

4.2.2.d. Profitability

Table 2.VIII and 2.IX shows that the higher the profitability component, the greater the likelihood that a bank is an Islamic one (models 4, 5, 6, 7, 8, 10 and 11). In fact, the literature almost agrees that Islamic banks are more profitable than conventional banks. For instance, Oslon and Zoubi (2008) find significantly higher ROA and ROE for Islamic banks than for conventional banks in the GCC region at the 10% and 5% level, respectively. Johnes, Izzeldin and Pappas (2009) also report the superiority of Islamic banks in terms of ROAA and ROAE compared with conventional banks for the same region. Belans and Hassiki (2012) examine a sample of 14 MENA countries and show that Islamic banks have a higher ROA and ROE than conventional banks. Likewise, Turk-Ariss (2010b) finds that Islamic banks are more profitable than conventional banks in 13 Middle Eastern and Southeast Asian countries for the period between 2000 and 2006. Analyzing the strength and the profitability of Islamic and conventional banks in the Malaysian context, Krasicka and Nowak (2012) suggest that Islamic banks had a higher ROE in the pre-crisis period while conventional banks had a higher ROE during and after the crisis period. In contrast, Beck, Demirgüç-Kunt and Merrouche (2013) and Bourkhis and Nabi (2013) find no significant difference between Islamic and conventional banks' profitability ratios. Johnes, Izzeldin and Pappas (2013) argue that the performance of Islamic banks is due to their higher level of managerial competency. It could also be related to asset-backed transactions. Pappas, Izzeldin and Fuertes (2012) suggest that the involvement of Islamic banks in major governmental infrastructure projects offers safer income and a higher ROA than conventional banks,⁶² while Olson and Zoubi (2008) argue that the reliance on investment deposits rather than equity is the reason behind the superiority of Islamic banks in terms of ROE. However, we must not forget that Islamic banks' returns were also vulnerable to a second wave of financial distress in which major infrastructure projects were put on hold and several financial development companies faced default. For instance, Nakheel – the development arm of Dubai World for investment – announced the rescheduling of more than \$4 billion of Islamic

⁶² For example, Standard and Poor's (2014) explain that Qatar's Islamic banks' balance sheets are expected to reach \$100 billion by 2017 compared with only \$54 billion in 2012. This rapid growth is due to Islamic banks' engagement in a large number of Qatar's governmental infrastructure projects.

bonds, which could have triggered a crisis for the Islamic banking system if Nakheel had faced bankruptcy. Standard and Poor's (2014) also questions the Islamic banks' dependency on real estate infrastructure projects. The report argues that the rapid growth of Islamic banks, such as Qatar's Islamic banks, cannot persist in the long term and that Islamic banks need to expand overseas. All in all, our findings confirm *hypothesis H11* in Table 2.I, in which Islamic banks are more profitable than their conventional counterparts.

4.2.3. Robustness checks: Regression models

To check the robustness of the results, we perform a series of ordinary least square regressions. We use Equations (3) and follow the work of Beck, Demirgüç-Kunt and Merrouche (2013). In contrast to Tables 2.VIII and 2.IX, we employ PCA components as dependent variables and we use an Islamic bank dummy variable (IBDV) – which equals 0 for conventional banks and 1 for Islamic banks – as the independent variable. Accordingly, we compare Islamic and conventional banks' capital, stability, liquidity and profitability components. Table 2.X reports the OLS results.⁶³

Panel A shows that Islamic banks are more capitalized, more liquid, more profitable and less stable than conventional banks (models 1, 4, 7 and 10). The results persist when we exclude US banks (models 2, 5, 8 and 11) and when we compare Islamic and conventional banks in countries with similar characteristics (models 3, 6 and 12), except for the liquidity component, for which we find no significant difference between the two bank types in model (9). In addition, Table 2.X reports the regression results after controlling for the bank size, fixed assets to assets and overheads to assets ratios. The findings show that large banks are less capitalized, less liquid, less stable and more profitable. We also find that banks with a higher LnTA become more stable (model 6) and more liquid (model 8) for the sample of 28 countries and the sample that excludes US banks. Furthermore, we show that banks with a higher FATAP are less stable and less liquid. However, the association between FATAP, capital and profitability enters with opposite signs when excluding US banks (models 1, 2, 10 and 11). Finally, overheads have a negative impact on bank stability, liquidity

⁶³ In our unreported results, we follow the work of Beck, Demirgüç-Kunt and Merrouche (2013) and cluster the error terms on the bank level across years and banks. We choose to cluster on the bank instead of the country or region level because some countries dominate our sample compared with others. The results are very similar except for the stability component, for which we find no significant difference between the two bank types for the bigger sample and when we exclude the US banks, which again confirms our logit and probit findings.

and profitability, while the opposite is true for capital. It appears that banks react to higher overheads by increasing their capital ratios.

Table 2.X Panel B examines whether the capital, stability, liquidity and profitability components’ comparison varies between small and large Islamic banks. Thus, we split banks according to the median of their asset size by developing the following Equation:

$$C = \alpha + \beta \times \text{Bank} + \gamma \times \text{IBDV} \times \text{SMALL} + \omega \times \text{IBDV} \times \text{LARGE} + \delta \times \sum_{j=1}^N \text{RFE}_j + \mu \times \sum_{T=1}^T \text{YFE}_t + \varepsilon \quad (4)$$

. As in Table X Panel A, we include region and year fixed effects, in addition to the bank-level control variables (i.e. LnTA, FATAP and OVERTAP). We find no significant difference between small and large Islamic banks’ components for our bigger sample (models 1, 4, 7 and 10). We also find that small and large Islamic banks are more capitalized, less stable, more liquid and more profitable than conventional banks in 124 countries. The results persist when excluding US banks, except for the liquidity component (model 8), for which we find that small Islamic banks are more liquid than large Islamic banks and conventional banks. The results become clearer when comparing banks in countries where the two banking systems co-exist. Specifically, we show that small Islamic banks have higher capital and liquidity ratios than large Islamic and conventional banks (models 3 and 9). Our findings are similar to those of Beck, Demirgüç-Kunt and Merrouche (2013), who find that small Islamic banks have higher equity to asset and maturity match ratios than large Islamic banks in a sample of 22 countries. We argue that small Islamic banks are more capitalized and more liquid because they are more sensitive to withdrawal risk and liquidity access and they do not benefit from diversification tools and economies of scale. These make them more vulnerable in cases of financial distress and therefore they prefer to hold higher capital and liquidity buffers than large Islamic banks and conventional banks. Finally, similar to Beck, Demirgüç-Kunt and Merrouche (2013) findings, our smaller sample shows no significant differences between small and large Islamic banks in term of stability and profitability (model 6 and 12).

Table 2.X Panel C investigates whether Islamic banks were more positioned in terms of capital, stability, liquidity and profitability during the global financial crisis.⁶⁴ Panel C also introduces

⁶⁴ We add a dummy (GLOBAL) that equals 1 for 2008–2009 and 0 otherwise. Beck, Demirgüç-Kunt, and Merrouche (2013) place the global financial crisis between Q4–2007 and Q4–2008, while Abedifar, Molyneux, and Tarazi (2013)

a trend dummy (TREND) that varies between 1 and 7. We interact TREND with IBDV to distinguish between the impact of the financial crisis and any differences in trend between the two bank types. Accordingly, we use the following Equation:

$$C = \alpha + \varphi \times IBDV + \beta \times Bank + \gamma \times IBDV \times GLOBAL + \omega \times IBDV \times TREND + \delta \times \sum_{j=1}^N RFE_j + \mu \times \sum_{T=1}^T YFE_t + \varepsilon \quad (5)$$

The results show that capitalization and profitability of Islamic banks were higher during the financial crisis compared with those of conventional banks (models 1, 2, 10 and 11). The same applies to liquidity but only in model (7). The results become insignificant when reporting for our sample of 28 countries, which means that Islamic banks were not different from their conventional counterparts during the crisis period in countries where the two banking systems co-exist. The trend dummy suggests a negative trend for Islamic banks in terms of stability (models 4 and 5) and profitability (models 10 and 12) during the 7-year period. If anything, the findings suggest a decreasing pattern in terms of capital (model 3) and profitability (model 12) but an increasing pattern in terms of stability (model 6) in countries where the two banking systems co-exist.

5. Conclusion

In this paper, we use principal component analysis and logit and probit models to compare the financial characteristics of conventional and Islamic banks. In the first step, we extract four components that represent the capital, stability, liquidity and profitability of both bank types. Then, in the second step, we employ the PCA components in logit and probit regressions to compare Islamic and conventional banks’ financial characteristics, as extracted from the PCA. Our results show that Islamic banks are more capitalized, more liquid and more profitable but less stable than conventional banks. Our results also show no significant difference between large and small Islamic banks except for the liquidity component when we exclude US banks and the liquidity and capital components when we limit the sample to 28 countries. Finally, we find that Islamic banks were more capitalized, more liquid and more profitable during the subprime crisis. The results generally

refer to the Bank for International Settlements’ eightieth annual report and label the crisis period between July 2007 and March 2009. However, due to the unavailability of quarterly data, we follow the work of Abedifar, Molyneux, and Tarazi (2013) and consider 2008–2009 as the crisis period.

persist when excluding US banks and when comparing Islamic banks in countries with similar financial characteristics.

For future work, we encourage the use of this research methodology in papers that adopt empirical models. PCA is an important procedure that helps in the choice of dependent and independent variables. Combining PCA with other parametric approaches reduces the dimensionality and correlations between exogenous variables and helps to create stronger parametric models that capture most of the financial information needed but in a summarized form. Our results have important implications for regulatory organizations and, more precisely, Islamic banks' policy makers.

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Tables

Table 2.I. Bank and financial indicators: The existing literature and hypotheses tested

Indicator	Reported literature for Islamic and conventional banks	Expected results
<i>Panel A: Capital requirements</i>		
a. Capital adequacy ratio (TCRP)	<i>Capital is positively (negatively) associated with banks' financial strength and stability (risk).</i> Stiroh, (2004a); Canbas, Cabuk and Kilic, (2005); Mercieca, Schaeck and Wolfe, (2007); Shih, Zhang and Liu, (2007); Pasiouras (2008); Demirgüç-Kunt and Huizinga (2010); Chortareas, Girardoneb, and Ventouric, 2012; Vasquez and Federico (2012); Barth et al. (2013); Beck, Demirgüç-Kunt and Merrouche, 2013;; Berger and Bouwman (2013); Lee and Hsieh (2013); Pessarossi and Weill (2013); Anginer and Demirgüç-Kunt (2014); Imbierowicz and Rauch (2014); Rosman, Wahab, and Zainol 2014.	H1: Islamic banks have higher capital requirements than conventional banks.
b. Tier 1 ratio (T1RP)	<i>Capital is negatively (positively) associated with banks' stability (risk).</i> Pettway (1976); Kahane (1977); Koehn and Santomero (1980); Kim and Santomero (1988); Berger and Di Patti (2006); Altunbas et al. (2007); Goddard et al. (2010); Abedifar, Molyneux and Tarazi (2013).	H2: Islamic banks have lower capital requirements than conventional banks.
c. Total equity to net loans (TENLP)	<i>Capital has no significant effect on banks' stability and risk.</i> Peltzman (1970); Rime (2001); Ariff and Can (2008); Demirgüç-Kunt and Detragiache (2010).	H3: There is no significant difference between Islamic and conventional banks regarding capital requirements.
d. Total equity to deposits (TEDSTFP)		
<i>Panel B: Liquidity requirements</i>		
a. Liquid assets to deposits (LADSTFP)	<i>Liquidity is positively (negatively) associated with banks' financial strength or stability or efficiency (risk or default risk).</i> Canbas, Cabuk and Kilic (2005); Shih, Zhang and Liu (2007); Srairi (2008); Čihák and Hesse (2010); Belans and Hassiki (2012); Pappas, Izzeldin and Fuertes, 2012; Vasquez and Federico (2012); Beck, Demirgüç-Kunt and	H4: Islamic banks have higher liquidity requirements than conventional banks.
b. Liquid assets to total assets (LATAP)		
c. Liquid assets to deposits and borrowing (LATDBP)		H5: Islamic banks have lower liquidity requirements than

Indicator	Reported literature for Islamic and conventional banks	Expected results
d. Net loans to total assets (NLTAP)	Merrouche (2013); Rajhi (2013); Anginer and Demirgüç-Kunt (2014). <i>Liquidity is negatively associated with banks' profitability or efficiency.</i> Ariff and Can (2008); Alam (2012).	conventional banks.
<i>Panel C: Leverage requirements</i>		
a. Total liabilities to total assets (TLTAP)	<i>Leverage is positively associated with banks' efficiency or profitability.</i> Berger and Di Patti (2006); Srairi (2008); Männasoo and Mayes (2009); Belans and Hassiki (2012).	H6: Islamic banks have higher leverage ratios than conventional banks.
b. Total assets to equity (TATE)	<i>Leverage is negatively associated with Islamic banks' credit risk or failure risk.</i> Pappas, Izzeldin and Fuertes (2012); Abedifar, Molyneux and Tarazi (2013).	
c. Total liabilities to equity (TLTE)	<i>Leverage is positively associated with conventional banks' failure risk.</i> Pappas, Izzeldin and Fuertes (2012); Vazquez and Federico (2012). <i>Islamic banks are less leveraged than conventional banks.</i> Belans and Hassiki (2012); Pappas, Izzeldin and Fuertes 2012; Abedifar, Molyneux and Tarazi (2013).	H7: Islamic banks have lower leverage ratios than conventional banks.
<i>Panel D: Stability and risk</i>		
a. Logarithm of Z-score	<i>Competition is an important determinant of bank stability.</i>	
b. Adjusted return on average assets (ARAAA)	Berger, Klapper, and Turk-Ariss (2009); Turk-Ariss (2010a, 2010b); Schaeck and Cihák (2013).	H8: Islamic banks are less stable than conventional banks.
c. Adjusted return on average equity (ARAAE)	<i>Islamic banks are more stable than conventional banks</i> Boumediene and Caby (2013); Faye et al. (2013); Rajhi (2013).	H9: Islamic banks are more stable than conventional banks.
d. Volatility of return on average assets (SDROAA)	<i>Islamic banks are less stable than conventional banks.</i>	
e. Volatility of return on average equity (SDROAE)	Čihák and Hesse (2010).	
f. Volatility of net interest margin (SDNIM)	<i>There is no significant difference between Islamic and conventional banks' stability.</i> Abedifar, Molyneux and Tarazi (2013); Beck, Demirgüç-Kunt and Merrouche (2013).	H10: There is no significant difference between Islamic and conventional banks' stability and risk.

(continued)

Indicator	Reported literature for Islamic and conventional banks	Expected results
<i>Panel E: Profitability and efficiency</i>		
a. Return on average assets (ROAAP)	<i>Profitability (cost) is positively (negatively) associated with bank efficiency.</i> Goddard et al. (2010); Rosman, Wahab, and Zainol (2014).	H11: Islamic banks are more profitable than conventional banks.
b. Return on average equity (ROAAP)	<i>Profitability (cost) has no significant impact on bank efficiency or a negative impact on bank stability.</i> Ariff and Can (2008); Belans and Hassiki ⁶⁵ (2012); Anginer, Demirgüç-Kunt, and Zhu (2014). <i>Profitability has no significant impact on bank efficiency.</i> Pasiouras (2008); Belans and Hassiki ⁶⁶ (2012). <i>Islamic banks are more profitable than conventional banks.</i> Olson and Zoubi (2008); Belans and Hassiki (2012); Pappas, Izzeldin and Fuertes (2012); Johnes, Izzeldin and Pappas (2013).	H12: Islamic banks are less profitable than conventional banks. H13: There is no significant difference between Islamic and conventional banks regarding profitability ratios.
c. Cost to income ratio (CIRP)	<i>There is no significant difference between Islamic and conventional banks’ profitability.</i> Abedifar, Molyneux and Tarazi (2013); Beck, Demirgüç-Kunt and Merrouche (2013); Bourkhis and Nabi (2013).	

(Continued)

⁶⁵ When employing ROE.

⁶⁶ When employing ROA.

Table 2.II. General descriptive statistics for commercial and Islamic banks

	N	Mean	STD	P10	Q1	Median	Q3	P90	Islamic banks	Conv. banks	Wil-test	t-test
<i>Panel A: Capital requirements</i>												
TCRP	54207	17.461	8.137	10.87	12.420	15.090	19.600	27.940	30.136	17.327	0.000***	0.000***
TIRP	53069	15.995	7.688	9.5000	11.100	13.770	18.300	26.500	27.787	15.880	0.000***	0.000***
TENLP	59043	22.115	22.139	3.402	12.350	16.233	23.597	39.181	80.520	21.493	0.000***	0.000***
TECSTF	59434	14.422	16.992	7.659	9.595	11.677	15.080	21.786	64.083	13.824	0.000***	0.000***
<i>Panel B: Liquidity requirements</i>												
LADSTF	59494	18.900	24.378	3.232	5.704	11.061	21.957	43.362	75.968	18.325	0.000***	0.000***
LATAP	60281	15.034	16.086	2.698	4.848	9.452	18.433	34.543	27.085	14.886	0.000***	0.000***
LATDBP	55486	15.688	17.737	2.986	5.233	9.984	18.809	34.285	44.235	15.511	0.000***	0.000***
NLTAP	60065	59.323	18.984	32.797	49.369	62.816	72.983	80.384	59.490	44.983	0.000***	0.000***
<i>Panel C: Leverage requirements</i>												
TLTAP	60298	87.585	10.485	82.44	87.344	89.965	91.635	93.358	72.916	87.766	0.000***	0.000***
TATE	60298	10.560	5.353	5.647	7.883	9.951	11.936	14.952	7.199	10.602	0.000***	0.000***
TLTE	59911	9.581	5.235	4.766	6.919	8.963	10.934	13.891	6.472	9.618	0.000***	0.000***
<i>Panel D: Stability and risk</i>												
LnZS	59529	3.185	1.063	1.730	2.523	3.303	3.931	4.458	2.829	3.189	0.000***	0.000***
AROOA	60044	2.927	3.653	-0.571	0.450	2.041	4.426	7.541	1.893	2.937	0.000***	0.000***
AROAE	60032	2.860	3.528	-0.550	0.445	2.023	4.350	7.332	2.383	2.865	0.000***	0.000***
SDROAA	8615	0.950	1.513	0.130	0.225	0.441	1.051	2.280	3.262	0.915	0.000***	0.000***
SDROAE	8615	8.686	12.760	1.271	2.223	4.346	9.038	20.106	8.994	8.682	0.320	0.000***
SDNIM	8615	0.630	0.877	0.155	0.244	0.395	0.703	1.292	2.485	0.602	0.000***	0.000***
<i>Panel E: Profitability and efficiency</i>												
ROAAP	60166	0.702	1.618	-0.615	0.298	0.807	1.306	1.949	1.462	0.693	0.000***	0.000***
ROAEP	60152	6.931	11.650	-5.286	2.961	7.652	12.772	18.730	9.636	6.897	0.000***	0.023***
CIRP	59730	72.232	31.054	45.937	57.137	67.782	79.937	95.898	74.560	72.205	0.467	0.000***
<i>Bank-level control</i>												
LnTA	60305	12.608	1.902	10.630	11.340	12.209	13.405	15.358	14.002	12.591	0.000***	0.000***
FATAP	59854	1.814	1.712	0.260	0.685	1.413	2.439	3.749	3.591	1.792	0.000***	0.000***
OVERTAP	60107	3.284	2.767	1.432	2.181	2.813	3.533	4.669	3.748	3.273	0.000***	0.1128

***, **, and * represent significance at the 1%, 5% and 10% level, respectively. See Table CI in appendix for the variable definitions.

Table 2.II presents descriptive statistics on the financial characteristics of commercial and Islamic banks. It includes a series of regulatory variables that measure capital, liquidity and leverage. It also includes stability, risk and profitability indicators. Our sample contains 8615 banks for the period 2006–2012. TCRP is the total capital ratio, also called the capital adequacy ratio. This ratio is generally calculated by dividing a bank's tier 1 and tier 2 capital ratios by its risk-weighted assets. The tier 1 capital ratio represents the Basel II tier 1 regulatory ratio. This ratio is generally calculated by dividing a bank's tier 1 capital ratio by its risk-weighted assets. TENLP and TECSTF are the ratio of bank equity to net loans and bank equity to customer and short-term funding. LADSTF (also called the maturity match ratio) is the ratio of liquid assets to deposits and short-term funding. It represents the liquidity of a banking institution. LATAP or the liquidity ratio is the ratio of liquid assets to assets. It represents the amount of liquid assets available and therefore the liquidity position of a banking institution. LATDBP is similar to LADSTF and is computed by dividing a bank's liquid assets by its total deposits and borrowing. TLTAP (also called the debt ratio) is the proportion of a bank's debt (liabilities) to its assets. TATE is the assets to equity and is also called the equity multiplier. TLTE is the proportion of a bank's debt to its equity base. ROAAP is the return on average assets ratio, ROAEP is the return on average equity ratio, CIRP is the cost to income ratio, LnZS is the natural logarithm of the distance to default, AROAA is the adjusted return on average assets, AROAE is the adjusted return on average equity, SDROAA is the volatility of returns on average assets, SDROAE is the volatility of returns on average equity and SDNIM is the volatility of the net interest margin. LnTA is the logarithm of total assets, FATAP is the ratio of fixed assets to assets and OVERTAP is the ratio of overheads to assets. We perform a series of T-tests of the null hypothesis that the means derived for our Islamic and conventional bank sample are equal (specifically, we use Satterthwaite tests because they allow the subsample variances to be different). Wilc-test represents a Wilcoxon rank test, which tests the null hypothesis that the two samples are derived from different distributions (in which normality is not assumed).

Table 2.III. Pearson correlation matrix

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
TCRP [1]																
T1RP [2]	0.99***															
TENLP [3]	0.70***	0.69***														
TECSTF [4]	0.51***	0.50***	0.62***													
LADSTF [5]	0.41***	0.37***	0.50***	0.45***												
LATAP [6]	0.35***	0.33***	0.39***	0.15***	0.84***											
LATDBP [7]	0.38***	0.35***	0.46***	0.32***	0.93***	0.94***										
NLTAP [8]	-0.54***	-0.54***	-0.57***	-0.18***	-0.55***	-0.60***	-0.55***									
TLTAP [9]	-0.67***	-0.66***	-0.62***	-0.64***	-0.43***	-0.28***	-0.38***	0.33***								
TATE [10]	-0.55***	-0.58***	-0.36***	-0.37***	-0.05***	0.002	-0.02***	0.07***	0.56***							
TLTE [11]	-0.55***	-0.58***	-0.37***	-0.37***	-0.05***	0.02***	-0.02***	0.06***	0.58***	0.99***						
ROAAP [12]	0.11***	0.11***	0.06***	0.02***	0.004	0.02***	-0.02***	-0.02***	-0.09***	-0.12***	-0.20***					
ROAEP [13]	0.00***	0.01	-0.01***	-0.04***	0.002	0.02***	-0.01**	-0.05***	0.04***	-0.09***	-0.10***	0.81***				
CIRP [14]	0.09***	0.10***	0.09***	0.11***	0.07***	0.05***	0.09***	-0.04***	-0.14***	0.01***	0.02***	-0.68***	-0.64***			
LnZS [15]	0.20***	0.23***	0.09***	0.04***	-0.08***	-0.09***	-0.07***	-0.07***	-0.23***	-0.23***	0.30***	0.35***	0.35***	-0.31***		
AROOA [16]	0.02***	0.04***	-0.04***	-0.05***	-0.11***	-0.10***	-0.11***	-0.01***	0.08***	-0.06***	-0.07***	0.43***	0.51***	-0.41***	0.72***	
AROAE [17]	0.02***	0.04***	-0.04***	-0.05***	-0.10***	-0.09***	-0.10***	-0.02***	0.08***	-0.06***	-0.06***	0.43***	0.52***	-0.41***	0.69***	0.92***
SDROAA [18]	0.21***	0.16***	0.26***	0.28***	0.25***	0.19***	0.19***	-0.12***	-0.40***	-0.14***	-0.12***	-0.13***	-0.20***	0.29***	-0.61***	-0.36***
SDROAE [19]	-0.14***	-0.17***	-0.04***	-0.03***	0.05***	0.05***	0.03***	0.05***	0.04***	0.22***	0.22***	-0.27***	-0.29***	0.25***	-0.73***	-0.39***
SDNIM [20]	0.25***	0.20***	0.36***	0.36***	0.32***	0.23***	0.22***	-0.19***	-0.36***	-0.17***	-0.16***	0.03***	-0.03***	0.13***	-0.27***	-0.18***

***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. See Table CI for the variable definitions.

This table exhibits the pair-wise Pearson correlations between the different panels of variables used in our analysis.

Table 2.III. Pearson correlation matrix – Continued

	[17]	[18]	[19]	[20]
AROAE [17]				
SDROAA [18]	-0.35***			
SDROAE [19]	-0.41***	0.62***		
SDNIM [20]	-0.17***	0.53***	0.22***	

***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

See Table CI for the variable definitions.

Table 2.IV. KMO and Bartlett's test of sphericity

Overall KMO	0.753
<i>Bartlett's test of sphericity</i>	
Chi-square	1076707
Degree of freedom	190
Significance	0.000

This table examines the results of KMO and Bartlett's test of sphericity.

Table 2.V. Eigenvalues of the components

Components	Eigenvalues	Variance %	Cumulative %
C_1	5.603	28.015	28.015
C_2	4.427	22.133	50.148
C_3	2.512	12.562	62.710
C_4	2.120	10.602	73.312
C_5	1.076	5.380	78.692
C_6	0.957	4.785	83.477
C_7	0.841	4.205	87.683
C_8	0.663	3.317	91.000
C_9	0.388	1.942	92.942
C_{10}	0.338	1.690	94.632
C_{11}	0.305	1.524	96.156
C_{12}	0.196	0.978	97.135
C_{13}	0.168	0.839	97.974
C_{14}	0.115	0.575	98.549
C_{15}	0.095	0.477	99.026
C_{16}	0.093	0.465	99.491
C_{17}	0.076	0.380	99.871
C_{18}	0.014	0.071	99.941
C_{19}	0.011	0.054	99.995
C_{20}	0.001	0.005	100.000

This table reports the eigenvalues of the PCA components.

Table 2.VI. Component score coefficients matrix

	TCR	T1R	TENL	TECSTF	NLTA	LADSTF	LATA	LATDB	TLTA	TATE
C_1	0.178	0.185	-0.024	0.194	0.101	0.021	-0.074	-0.041	-0.198	-0.237
C_2	0.042	0.043	0.083	-0.118	-0.186	-0.068	-0.002	-0.014	0.016	-0.001
C_3	0.062	0.055	-0.023	0.053	-0.139	0.292	0.318	0.307	0.027	0.125
C_4	-0.046	-0.046	-0.068	0.103	0.145	0.072	0.012	0.017	0.021	-0.007

This table documents the component score coefficients matrix for the initial financial ratios and our new PCA components.

Table 2.VI. Component score coefficients matrix – Continued

	TLTE	ROAA	ROAE	CIR	LnZS	AROAA	AROAE	SDROAA	SDROAE	SDNIM
C_1	-0.237	0.028	-0.008	-0.006	0.029	-0.061	-0.058	-0.003	-0.045	-0.042
C_2	0.000	-0.086	-0.042	0.088	0.279	0.223	0.218	-0.203	-0.225	-0.091
C_3	0.124	-0.003	0.015	-0.036	-0.020	-0.038	-0.036	-0.070	-0.027	-0.051
C_4	-0.009	0.363	0.336	-0.347	-0.052	0.046	0.053	0.071	0.067	0.068

Table 2.VII. Component loadings

Code	Ratios	C_1	C_2	C_3	C_4
TLTE	Total liabilities/total assets	-0.868			
TATE	Total assets/total equity	-0.867			
TLTAP	Total liabilities/total assets	-0.855			
T1RP	Tier 1 capital/risk-weighted assets	0.807			
TCRP	(Tier 1+Tier 2)/risk-weighted assets	0.792			
TEDSTF	Total equity/deposits and short-term funding	0.686			
LnZS	(ROAAP+TETAP)/SDROAA		0.906		
SDROAA	Standard deviation of return on average assets		-0.762		
SDROAE	Standard deviation of return on average equity		-0.758		
AROAA	ROAAP/SDROAA		0.739		
AROAE	ROAEP/SDROEA		0.731		
LATAP	Liquid assets/total assets			0.929	
LATDBP	Liquid assets/total deposits and borrowing			0.926	
LADSTFP	Liquid assets/deposits and short-term funding			0.874	
NLTAP	Net loans/total assets			-0.568	
ROAAP	Return on average assets				0.912
ROAEP	Return on average equity				0.879
CIRP	Cost to income				-0.830

This table reports the component loadings of each of our four components retained from the PCA

Table 2.VIII. Logit regressions: Islamic banks vs. conventional banks' financial characteristics

	All sample C1	All sample C1 & C2	All sample C1, C2 & C3	All sample C1, C2, C3 & C4	All sample C1, C2, C3, C4 & bank control	All sample C1, C2, C3, C4 & country control	All sample C1, C2, C3, C4 & all control	All sample [excluding USA]	All sample [excluding USA]	All sample [28 countries]	All sample [28 countries]
Model #	1	2	3	4	5	6	7	8	9	10	11
C1 – Banking capitalization	0.8185*** (0.1045)	0.8115*** (0.0991)	0.5311*** (0.0825)	0.5843*** (0.1001)	1.2526*** (0.1132)	0.3428*** (0.1192)	0.3708*** (0.1235)	0.4094*** (0.1147)	0.3839*** (0.1179)	0.3661*** (0.1137)	0.2882** (0.118)
C2 – Banking stability		-0.4515*** (0.0771)	-0.4794*** (0.0832)	0.0422 (0.0904)	0.0425 (0.0967)	-0.0901 (0.1061)	-0.1063 (0.1161)	-0.0483 (0.1029)	-0.0382 (0.1179)	-0.2826** (0.1118)	-0.2513** (0.1191)
C3 – Banking liquidity			0.6483*** (0.0446)	0.662*** (0.0471)	0.5835*** (0.0528)	0.3124*** (0.3124)	0.3118*** (0.0715)	0.2077*** (0.0689)	0.1779** (0.0721)	0.1834*** (0.0704)	0.1306* (0.0751)
C4 – Banking profitability				1.4973*** (0.1226)	1.1185*** (0.1239)	0.3018*** (0.1255)	0.2243* (0.1313)	0.2465** (0.1229)	0.2091 (0.1273)	0.3006*** (0.1297)	0.3759*** (0.1352)
LnTA					0.5629*** (0.0377)		-0.0351 (0.063)		-0.1321** (0.0615)		-0.1845*** (0.0653)
FATAP					0.2266*** (0.0512)		-0.0643 (0.0592)		-0.0843 (0.0576)		0.0533 (0.0589)
REL						0.0602*** (0.0035)	0.0634*** (0.0041)	0.0404*** (0.0038)	0.0426*** (0.0041)	0.0207*** (0.0039)	0.0229*** (0.0041)
LEGAL						0.8422*** (0.1447)	0.7883*** (0.1579)	0.8294*** (0.142)	0.8725*** (0.1583)	0.4336*** (0.1472)	0.5457*** (0.1603)
Intercept	-8.3127*** (0.3692)	-5.0904*** (0.6412)	-6.1034*** (0.6539)	-16.2879*** (1.1341)	-24.7466*** (1.3415)	-10.9836*** (0.0001)	-10.2342*** (1.4536)	-9.0123*** (1.1481)	-6.8138*** (1.4999)	-5.1035*** (1.1725)	-2.7735* (1.5046)
N	50055	50055	50055	50055	49996	50042	49983	5839	5783	1445	1432
RFE	No	No	No	No	No	No	No	No	No	No	No
Pseudo R ²	0.020	0.033	0.0932	0.1708	0.2661	0.5416	0.5452	0.3451	0.3509	0.1148	0.1291

Standard errors are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. See Table CI in appendix C for variable definitions.

This table presents the results of binary logit regressions for a sample of 8615 conventional and Islamic banks in 124 countries for the period 2006–2012. The dependent variable equals 0 for conventional banks and 1 for Islamic banks. The independent variables are the 4 components extracted from the PCA. These components are: C1, which represents capital requirements, C2, which stands for the stability component, C3, which combines liquidity measures, and C4, which stands for profitability. As for the control variables, we use the bank size measured by the logarithm of total assets (LnTA) and the ratio of fixed assets to assets (FATAP). We also use 2 country-level control variables. RELP and LEGAL represent the percentage of the Muslim population and the legal system of each country, respectively.

Table 2.IX. Probit regressions: Islamic banks vs. conventional banks' financial characteristics

	All sample C1	All sample C1 & C2	All sample C1, C2 & C3	All sample C1, C2, C3 & C4	All sample C1, C2, C3, C4 & bank control	All sample C1, C2, C3, C4 & country control	All sample C1, C2, C3, C4 & all control	All sample [Excluding USA]	All sample [Excluding USA]	All sample [28 countries]	All sample [28 countries]
Model #	1	2	3	4	5	6	7	8	9	10	11
C1 – Banking capitalization	0.2407*** (0.0422)	0.2359*** (0.0415)	0.1992*** (0.0332)	0.2534*** (0.0398)	0.4904*** (0.0454)	0.1508*** (0.0584)	0.1667*** (0.0609)	0.183*** (0.0576)	0.1784*** (0.0602)	0.1782*** (0.0608)	0.1367** (0.0637)
C2 – Banking stability		-0.138*** (0.0282)	-0.1579*** (0.0308)	-0.0398 (0.033)	0.0051 (0.0372)	-0.0128 (0.0509)	-0.0258 (0.0609)	-0.0042 (0.0511)	-0.0082 (0.0555)	-0.1227** (0.0584)	-0.1104* (0.0635)
C3 – Banking liquidity				0.2859*** (0.0193)	0.2487*** (0.0217)	0.125*** (0.0347)	0.1246*** (0.036)	0.0894** (0.0358)	0.0778** (0.0376)	0.0922** (0.0387)	0.06321 (0.0412)
C4 – Banking profitability				0.6005*** (0.0473)	0.4684*** (0.0506)	0.1469** (0.0635)	0.1115* (0.0663)	0.1254* (0.0641)	0.1052 (0.0664)	0.1739** (0.0707)	0.2076*** (0.0746)
LnTA					0.2126*** (0.0146)		-0.0231 (0.0307)		-0.0636** (0.0315)		-0.1127*** (0.0353)
FATAP					0.0738*** (0.0211)		-0.0431 (0.0299)		-0.0509* (0.0298)		0.0161 (0.0323)
REL						0.0233*** (0.0025)	0.0249*** (0.0018)	0.018*** (0.0017)	0.0192*** (0.0018)	0.0108*** (0.0018)	0.0118*** (0.0019)
LEGAL						0.5371*** (0.0775)	0.5032*** (0.0839)	0.509*** (0.0759)	0.5102*** (0.0824)	0.2791*** (0.0806)	0.3348*** (0.0864)
Intercept	-3.4707*** (0.1438)	-2.4732*** (0.2322)	0.2622*** (0.0179)	-6.8114*** (0.4198)	-10.1304*** (0.5279)	-5.1036*** (0.5658)	-4.6044*** (0.7025)	-4.5393*** (0.5719)	-3.4246*** (0.7533)	-3.0052*** (0.618)	-1.4445* (0.8045)
N	50055	50055	50055	50055	49996	50042	49983	5839	5783	1445	1432
RFE	No	No	No	No	No	No	No	No	No	No	No
Pseudo R ²	0.0161	0.0259	0.0941	0.1814	0.2733	0.5594	0.5618	0.3560	0.3607	0.1149	0.1293

Standard errors are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. See Table CI in appendix C for variable definitions.

This table presents the results of binary probit regressions for a sample of 8615 conventional and Islamic banks in 124 countries for the period 2006–2012. The dependent variable equals 0 for conventional banks and 1 for Islamic banks. The independent variables are the 4 components extracted from the PCA. These components are: C1, which represents the capital requirements, C2, which stands for the stability component, C3, which combines liquidity measures, and C4, which stands for profitability. As for the control variables, we use the bank size measured by the logarithm of total assets (LnTA) and the ratio of fixed assets to assets (FATAP). We also use 2 country-level control variables. RELP and LEGAL represent the percentage of the Muslim population and the legal system of each country, respectively.

Chapter 2 – Comparing Islamic and conventional banks' financial strength: A multivariate approach - Tables

Table 2.X. Comparing the financial characteristics of Islamic and conventional banks

<i>Panel A: Comparing Islamic and conventional banks' components after controlling for banks' characteristics</i>												
Model #	C1 – Capitalization (leverage)			C2 – Stability (risk)			C3 – Liquidity (loans)			C4 – Profitability (cost)		
	All sample	Ex. USA	28 countries	All sample	Ex. USA	28 countries	All sample	Ex. USA	28 countries	All sample	Ex. USA	28 countries
	1	2	3	4	5	6	7	8	9	10	11	12
IBDV	0.6604***	0.5992***	0.3151***	-0.1953***	-0.1664***	-0.2124***	0.1782***	0.2938***	0.0322	0.4587***	0.4119***	0.2939***
	(0.0386)	(0.0056)	(0.0596)	(0.0622)	(0.0625)	(0.0638)	(0.0594)	(0.0975)	(0.0920)	(0.0476)	(0.0518)	(0.0519)
LnTA	-0.0959***	-0.1651***	-0.1442***	-0.0759***	0.0048	0.0289**	-0.0942***	0.0196**	-0.1248***	0.0558***	-0.0060	0.0369***
	(0.0016)	(0.0056)	(0.0128)	(0.0027)	(0.0062)	(0.0137)	(0.0025)	(0.0097)	(0.0197)	(0.0020)	(0.0052)	(0.0111)
FATAP	-0.0273***	0.0135*	0.0353**	-0.0546***	-0.0529***	-0.0637***	-0.0692***	-0.1221***	-0.0863***	-0.0499***	0.0127*	0.0194
	(0.0016)	(0.008)	(0.0141)	(0.0026)	(0.0089)	(0.01514)	(0.0025)	(0.0139)	(0.0218)	(0.0020)	(0.0074)	(0.0123)
OVERTAP	0.0392***	0.0628***	0.0109	-0.1231***	-0.0857***	-0.0538***	-0.0266***	0.0249**	-0.1104***	-0.0628***	-0.0146***	-0.0727***
	(0.0015)	(0.0057)	(0.0135)	(0.0025)	(0.0063)	(0.0144)	(0.0024)	(0.0099)	(0.0208)	(0.0019)	(0.0053)	(0.0118)
Intercept	4.3355***	5.213***	5.3329***	8.7077***	7.4874***	6.9976***	5.1245***	3.2286***	6.1630***	3.7736***	4.4065***	3.801***
	(0.043)	(0.1088)	(0.2245)	(0.0693)	(0.1210)	(0.2404)	(0.0066)	(0.1887)	(0.3468)	(0.0476)	(0.1003)	(0.1956)
RFE	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	49996	5809	1435	49996	5809	1435	49996	5809	1435	49996	5809	1435
R2	0.1723	0.229	0.1587	0.0865	0.111	0.081	0.1965	0.0391	0.0712	0.1076	0.0252	0.1226
<i>Panel B: Comparing small and large Islamic and conventional banks' components</i>												
Model #	All sample	Ex. USA	28 countries	All sample	Ex. USA	28 countries	All sample	Ex. USA	28 countries	All sample	Ex. USA	28 countries
	1	2	3	4	5	6	7	8	9	10	11	12
SMALL	4.1241***	3.8061***	0.7829***	-2.9625***	-0.2549***	-0.2824**	1.5469***	3.2203***	0.5107***	2.269***	2.1174***	0.3512***
	(0.3502)	(0.5059)	(0.1058)	(0.5646)	(0.5640)	(0.1144)	(0.5389)	(0.1888)	(0.1644)	(0.4323)	(0.4677)	(0.0931)
LARGE	0.6198***	0.5621***	0.1328*	-0.1629***	-0.1389***	-0.1851**	0.1622***	1.9055**	-0.1543	0.4375***	0.3922***	0.2716***
	(0.0388)	(0.0563)	(0.0682)	(0.0625)	(0.0627)	(0.0738)	(0.0597)	(0.8808)	(0.1060)	(0.0479)	(0.0520)	(0.0600)
Intercept	4.3325***	5.1958***	5.1273***	8.7102***	7.4996***	7.0284***	5.1233***	0.2752***	5.9527***	3.7720***	4.3977***	3.7758***
	(0.0430)	(0.1084)	(0.2257)	(0.0693)	(0.1209)	(0.2441)	(0.0661)	(0.0980)	(0.1644)	(0.0530)	(0.1002)	(0.1985)
N	49996	5809	1435	49996	5809	1435	49996	5809	1435	49996	5809	1435
R2	0.1739	0.2949	0.1752	0.0869	0.1138	0.0814	0.1966	0.0396	0.0791	0.1079	0.0275	0.123
<i>Panel D: Comparing Islamic and conventional banks' components during the subprime crisis</i>												
Model #	All sample	Ex. USA	28 countries	All sample	Ex. USA	28 countries	All sample	Ex. USA	28 countries	All sample	Ex. USA	28 countries
	1	2	3	4	5	6	7	8	9	10	11	12
GLOBAL	0.7565***	0.6337***	0.0793	-0.3124	-0.2064	-0.0022	0.2218*	0.3172	0.0318	0.18836*	0.1852*	0.0217
	(0.0827)	(0.1214)	(0.1323)	(0.1934)	(0.1354)	(0.142)	(0.1273)	(0.2113)	(0.2055)	(0.1021)	(0.1123)	(0.1149)
TREND	-0.0278	-0.0124	-0.1196***	-0.0993***	-0.1032***	0.1064***	-0.05721*	-0.0158	-0.0028	-0.0644**	-0.022	-0.1353***
	(0.0218)	(0.0318)	(0.0339)	(0.0351)	(0.0355)	(0.0364)	(0.0335)	(0.0554)	(0.0527)	(0.0269)	(0.0294)	(0.0295)
Intercept	4.3392***	5.2412***	5.4126***	8.710***	7.5023***	6.9315***	5.127***	3.2453	6.167***	3.7762***	4.4191***	3.8863***
	(0.0430)	(0.1087)	(0.2243)	(0.0693)	(0.1212)	(0.2407)	(0.0661)	(0.1891)	(0.3484)	(0.0530)	(0.1005)	(0.1948)
N	49996	5809	1435	49996	5809	1435	49996	5809	1435	49996	5809	1435
R2	0.1741	0.2941	0.168	0.0866	0.1124	0.0872	0.1967	0.0396	0.0712	0.1078	0.026	0.1374

Standard errors are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. See Table CI in appendix C

for the variable definitions.

Table 2.IX reports OLS regressions for a sample of 8615 conventional and Islamic banks in 124 countries for the period 2006–2012. The dependent variables are: capital component (C1), stability component (C2), liquidity component (C3) and profitability component (C4). The independent variable is the Islamic Bank Dummy Variable (IBDV). Table X Panel A controls for bank-level characteristics using the natural logarithm of total assets ($\ln TA$), the fixed assets to total assets ratio (FATAP) and the overheads to assets ratio to control for bank-level financial characteristics. RFE and YFE represent region and year fixed-effect dummy variables.

Appendix C

Table C.I. Variables' definitions and data sources

Variable	Definition	Data Sources
<i>Panel A. Capital ratios</i>		
TCRP	This ratio is the capital adequacy ratio. It is the sum of bank tier 1 plus tier 2 capital as a percentage of risk-weighted assets. This includes subordinated debt, hybrid capital, loan loss reserves and valuation reserves as a percentage of risk-weighted assets and off-balance-sheet risks. This ratio must be maintained at a level of at least 8% under the Basel II rules.	Bankscope and banks' annual reports
TIRP	Similar to the capital adequacy ratio. This measure of capital adequacy measures tier 1 capital divided by risk-weighted assets computed under the Basel rules. Banks must maintain minimum tier 1 capital of at least 4%.	Bankscope and banks' annual reports
TENLP	The traditional equity to net loans times 100.	Bankscope
TECSTF	Another ratio of bank capitalization. It measures the amount of bank equity relative to bank deposits and short-term funding.	Bankscope
<i>Panel B. Liquidity ratios</i>		
LADSTFP	The ratio of liquid assets to deposits and short-term funding. It measures and assesses the sensitivity to bank runs; therefore, it promotes financial soundness but it can also be interpreted as excess of liquidity coverage.	Bankscope
LATAP	The ratio of liquid assets to total assets. The ratio measures assets that are easily convertible to cash at any time and without any constraints.	Bankscope
LATDBP	The ratio of liquid assets to total deposits and borrowing. Similar to the liquid assets to deposits and short-term funding ratio, this ratio considers the amount of liquid assets available not only to depositors but also to borrowers.	Bankscope
<i>Panel C. Leverage ratios</i>		
TLTAP	The ratio of total liabilities to total assets measures the share of bank debt relative to bank assets. This ratio is also considered a measure of risk.	Bankscope
TATE	The ratio of total assets to total bank equity. This ratio is also called the equity multiplier. It can be used to proxy risk and engagement in debt to finance bank activities.	Authors' calculation based on Bankscope
TLTE	The ratio of total liabilities to total bank equity. This is a variant of the leverage ratio.	Authors' calculation based on Bankscope
<i>Panel D. Stability and risk ratios</i>		
Z-index	A measure of bank insolvency calculated as the natural logarithm of $((ROAAP + TETAP)/SDROAA)$, where ROAAP is the return on average assets, TETAP represents the equity to assets ratio and SDROAA stands for the standard deviation of the return on average assets.	Authors' calculation based on Bankscope

Variable	Definition	Data Sources
AROOA	A measure of risk-adjusted return on average assets. It is calculated as the return on average assets divided by the standard deviation of ROAA.	Authors' calculation based on Bankscope
AROAE	A measure of risk-adjusted return on average equity. It is calculated as the return on average equity divided by the standard deviation of ROAA.	Authors' calculation based on Bankscope
SDROAA	The standard deviation of ROAA for a six-year period (banks need to have at least three of seven observations)	Authors' calculation based on Bankscope
SDROAE	The standard deviation of ROAE for a six-year period (banks need to have at least three of seven observations)	Authors' calculation based on Bankscope
SDNIM	The standard deviation of NIM for a six-year period (banks need to have at least three of seven observations)	Authors' calculation based on Bankscope
<i>Control variables</i>		
1. Bank control variables		
LnTA	The natural logarithm of total assets	Bankscope
FATAP	The ratio of bank fixed assets to total assets times 100	Bankscope
OVERTAP	The ratio of bank overheads to total assets times 100	Authors' calculation based on Bankscope
2. Country control variables		
RELP	The percentage of the Muslim population in each country	PEW Research Center and the CIA World Factbook
LEGAL	A dummy that takes a value of 0 if a country does not apply <i>Sharia'a</i> rules in its legal system, a value of 1 if <i>Sharia'a</i> law and other legal systems are considered and a value of 2 if <i>Sharia'a</i> is the only accepted law	The CIA World Factbook
IBDV	A dummy variable that equals 1 for Islamic banks and 0 otherwise	Authors' calculation

(continued)

Table C.II. Spearman correlation matrix

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
TCRP [1]																
T1RP [2]	0.98***															
TENLP [3]	0.83***	0.84***														
TECSTF [4]	0.70***	0.71***	0.73***													
LADSTF [5]	0.29***	0.25***	0.34***	0.12***												
LATAP [6]	0.27***	0.24***	0.32***	0.06***	0.99***											
LATDBP [7]	0.29***	0.26***	0.32***	0.08***	0.99***	0.99***										
NLTAP [8]	-0.52***	-0.50***	-0.67***	-0.13***	-0.46***	-0.47***	-0.43***									
TLTAP [9]	-0.73***	-0.75***	-0.76***	-0.97***	-0.11***	-0.08***	-0.09***	0.17***								
TATE [10]	-0.73***	-0.74***	-0.75***	-0.96***	-0.11***	-0.08***	-0.09***	0.17***	0.99***							
TLTE [11]	-0.72***	-0.74***	-0.75***	-0.96***	-0.11***	-0.08***	-0.09***	0.16***	0.99***	0.99***						
ROAAP [12]	0.15***	0.15***	0.18***	0.18***	-0.03***	-0.01***	-0.03***	-0.08***	-0.20***	-0.20***	-0.19***					
ROAEP [13]	-0.05***	-0.06***	-0.03***	-0.10***	-0.00	-0.02***	-0.05***	-0.03***	0.10***	0.10***	0.10***	0.90***				
CIRP [14]	-0.02***	-0.00	-0.05***	-0.07***	-0.09***	0.01**	0.03***	-0.00	0.05***	0.04***	0.05***	-0.70***	-0.68***			
LnZS [15]	0.27***	0.29***	0.20***	0.18***	-0.09***	-0.09***	-0.06***	-0.11***	-0.18***	-0.18***	-0.18***	0.28***	0.23***	-0.24***		
AROAA [16]	0.13***	0.13***	0.09***	0.04***	-0.09***	-0.09***	-0.08***	-0.08***	-0.04***	-0.03***	-0.03***	0.71***	0.71***	-0.56***	0.79***	
AROAE [17]	0.12***	0.13***	0.08***	0.02***	-0.09***	-0.09***	-0.08***	-0.08***	-0.02***	-0.01***	-0.01***	0.69***	0.71***	-0.56***	0.76***	0.98***
SDROAA [18]	-0.05***	-0.06***	0.04***	0.13***	0.14***	0.13***	0.10***	0.04***	-0.16***	-0.17***	-0.16***	-0.16***	-0.24***	0.20***	-0.90***	-0.75***
SDROAE [19]	-0.26***	-0.28***	-0.19***	-0.16***	0.09***	0.09***	0.06***	0.11***	0.16***	0.15***	0.15***	-0.22***	-0.17***	0.19***	-0.95***	-0.72***
SDNIM [20]	0.08***	0.08***	0.15***	0.20***	0.24***	0.23***	0.20***	-0.05***	-0.22***	-0.22***	-0.21***	-0.02***	-0.09***	0.09***	-0.42***	-0.36***

***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. See Table CI for the variable definitions.

This table exhibits the pair-wise Spearman correlations between the different panels of variables used in our analysis.

Table C.II. Spearman correlation matrix – Continued

	[17]	[18]	[19]	[20]
AROAE [17]				
SDROAA [18]	-0.73***			
SDROAE [19]	-0.74***	0.87***		
SDNIM [20]	-0.34***	0.55***	0.41***	

Table C.III. Anti-image correlation matrix

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]
TCRP [1]	.762^a	-.958	-.047	.000	.056	.005	.011	-.015	.101	-.220	.211	.038	-.023	.047	.021	-.019	.014	.018	-.008	.003
TIRP [2]	-.958	.762^a	.054	-.095	.045	.000	-.032	.030	-.012	.215	-.204	-.063	.056	-.049	-.052	.028	-.013	-.004	-.013	.022
TENLP [3]	-.047	.054	.850^a	.033	.428	-.055	.061	-.032	.154	.029	-.028	-.038	.060	.051	-.092	.020	.007	-.119	.040	-.319
TECSTF [4]	.000	-.095	.033	.783^a	-.140	-.654	.050	.139	.239	-.019	.014	-.052	.057	.056	.085	-.026	-.009	-.008	.065	-.087
NLTAP [5]	.056	.045	.428	-.140	.842^a	.028	.100	-.033	.127	.012	-.007	.014	.028	.081	.042	.007	-.017	.012	-.027	-.091
LACSTFP [6]	.005	.000	-.055	-.654	.028	.809^a	.073	-.346	-.204	.009	-.011	-.024	-.006	-.045	.007	-.002	.006	.045	-.030	.021
LATAP [7]	.011	-.032	.061	.050	.100	.073	.636^a	-.944	-.513	.118	-.103	.037	.018	.034	-.051	.034	-.014	-.010	.001	-.114
LATDBP [8]	-.015	.030	-.032	.139	-.033	-.346	-.944	.643^a	.573	-.126	.111	-.015	-.027	-.004	.069	-.033	.010	.012	.012	.078
TLTAP [9]	.101	-.012	.154	.239	.127	-.204	-.513	.573	.795^a	-.058	.022	-.034	.042	.143	.177	-.064	-.014	.207	-.033	-.012
TATE [10]	-.220	.215	.029	-.019	.012	.009	.118	-.126	-.058	.688^a	-.998	.045	-.014	.076	-.035	.013	-.001	-.012	-.054	-.020
TLTE [11]	.211	-.204	-.028	.014	-.007	-.011	-.103	.111	.022	-.998	.693^a	-.040	.012	-.081	.044	-.018	.001	.020	.048	.014
ROAAP [12]	.038	-.063	-.038	-.052	.014	-.024	.037	-.015	-.034	.045	-.040	.692^a	-.741	.470	-.084	.019	.025	-.141	.041	-.193
ROAEP [13]	-.023	.056	.060	.057	.028	-.006	.018	-.027	.042	-.014	.012	-.741	.765^a	.000	.071	-.052	-.107	.108	.007	.053
CIRP [14]	.047	-.049	.051	.056	.081	-.045	.034	-.004	.143	.076	-.081	.470	.000	.829^a	-.045	.048	.000	-.101	.043	-.128
LnZS [15]	.021	-.052	-.092	.085	.042	.007	-.051	.069	.177	-.035	.044	-.084	.071	-.045	.814^a	-.421	-.073	.492	.306	-.082
ARAAA [16]	-.019	.028	.020	-.026	.007	-.002	.034	-.033	-.064	.013	-.018	.019	-.052	.048	-.421	.741^a	-.744	-.170	-.147	.064
ARAAE [17]	.014	-.013	.007	-.009	-.017	.006	-.014	.010	-.014	-.001	.001	.025	-.107	.000	-.073	-.744	.798^a	-.034	.059	.001
SDROAA [18]	.018	-.004	-.119	-.008	.012	.045	-.010	.012	.207	-.012	.020	-.141	.108	-.101	.492	-.170	-.034	.737^a	-.441	-.464
SDROAE [19]	-.008	-.013	.040	.065	-.027	-.030	.001	.012	-.033	-.054	.048	.041	.007	.043	.306	-.147	.059	-.441	.822^a	.177
SDNIM [20]	.003	.022	-.319	-.087	-.091	.021	-.114	.078	-.012	-.020	.014	-.193	.053	-.128	-.082	.064	.001	-.464	.177	.766^a

^a The measures of sampling adequacy (MSA).

This table presents the anti-image correlation matrix. It shows the MSA for each individual measure of our 20 variables used in the PCA. See Table CI for the variable definitions.

Table C.IV. Component loadings

Code	Ratios	C_1	C_2	C_3	C_4
TLTAP	Total liabilities/total assets	-0.909			
TLTE	Total liabilities/total assets	-0.872			
TATE	Total assets/total equity	-0.871			
T1RP	Tier 1 capital/risk-weighted assets	0.802			
TCRP	(Tier 1+tier 2)/risk-weighted assets	0.784			
TEDSTF	Total equity/deposits and short-term funding	0.671			
TENLP	Total equity/net loans	0.579			
LnZS_3	(ROAAP+TETAP)/SDROAA_3		0.902		
SDROAA_3	Standard deviation of return on average assets over three years		-0.808		
SDROAE_3	Standard deviation of return on average equity over three years		-0.768		
AROA_3	ROAAP/SDROAA_3		0.685		
AROE_3	ROAEP/SDROEA_3		0.654		
LATAP	Liquid assets/total assets			0.925	
LATDBP	Liquid assets/total deposits and borrowing			0.925	
LADSTFP	Liquid assets/deposits and short-term funding			0.863	
NLTAP	Net loans/total assets			-0.645	
ROAAP	Return on average assets				0.893
ROAEP	Return on average equity				0.870
CIRP	Cost to income				-0.807

This table reports the component loading of each of our four components retained from the PCA. In this table, we run the PCA using a three-year rolling standard deviation when computing LnZS_3, AROAA_3, AROAE_3, SDROAA_3 and SDROAE_3.

PCA components after using a 3 years rolling standard deviation

Figure C.1. Component plots C1 and C2

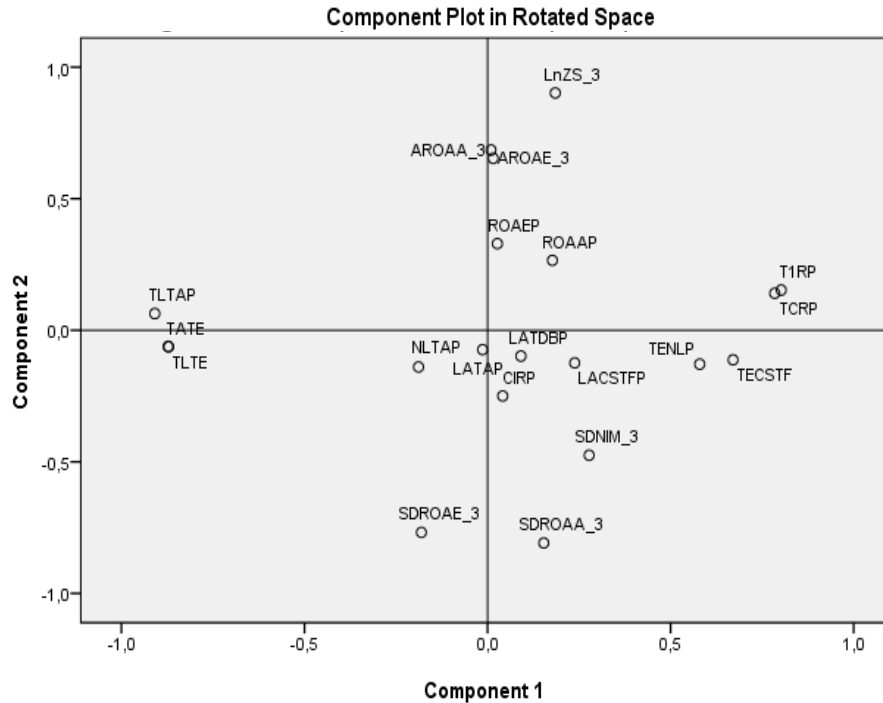
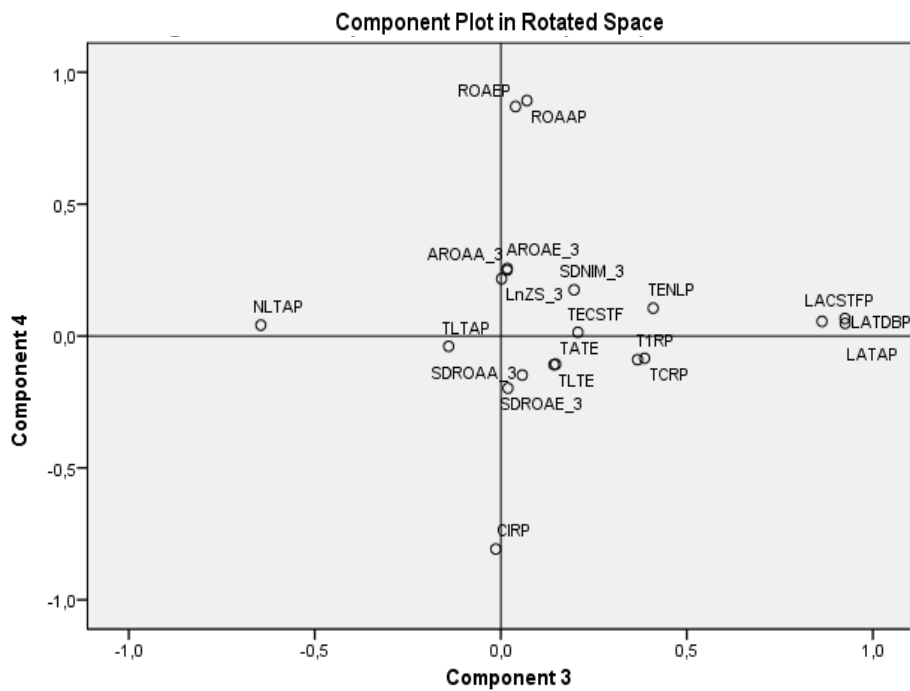


Figure C.2. Component plots C3 and C4



**Chapter 3. Basel III and Stability of Islamic
banks: Does one solution fit all?
A comparison with conventional banks**

Abstract

This study aims to empirically determine the Basel III regulatory relationship between Islamic and conventional banks. It particularly focuses on the impact of capital, liquidity, and leverage ratios on the stability and adjusted profits of Islamic and conventional banks using conditional quantile regression models. The total studied sample consists of 4473 bank-year observations (with 875 bank-year observations for Islamic banks) for banks located in 29 countries over the period 2006-2012. We find that Islamic banks are less stable when compared to conventional banks. We also show that across stability quantiles, higher capital and lower leverage have a positive impact on Islamic bank stability than on conventional bank stability, while there is no significant difference between Islamic and conventional banks concerning liquidity. In the robustness tests, we show that non-risk based capital and liquidity ratios ameliorate the stability and the adjusted profits of small and highly liquid Islamic banks while the leverage ratio have a negative association on small and highly liquid Islamic banks. Finally, our sample shows no significant difference between Islamic bank and conventional bank stability and regulation during the subprime crisis. Our findings provide several important implications for both regulators and policymakers.

1. Introduction

In the late 1980s, the Basel committee on banking and supervision launched the first set of guidelines (Basel I) to harmonize banking regulations. It was meant to improve banking system stability and to fill the harmonization gap that had caused previous financial crises. However, the Basel I agreement was inefficient due to the rapid development of financial innovation. As a result in 2004 Basel II, a new framework was published. This new agreement was based on three pillars: minimum capital requirement, supervisory review and market discipline. Basel II implementation was slow and difficult. Yet the 2007–2008 financial crisis showed that even Basel II was insufficient to prevent bank failure. For instance, many of the banks that were bailed out by governments appeared to hold adequate required minimum capital shortly before the beginning of the crisis (Demirguc-Kunt, Detragiache and Merrouche, 2013). This situation drove the Basel committee on banking and supervision toward implementing yet another new framework for banking regulation. This new framework was developed after a deep re-examination of all previous banking regulatory frameworks (especially Basel II) and resulted in the Basel III guidelines. It was put into action after review by the G20 members. This new agreement requires banks to be more stringent by redefining capital structure. It also introduces two liquidity ratios, i.e. the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR) to control for bank liquidity shortage in the short term (30 days) and in the long term (one year). Finally, Basel III suggests an additional non-risk based leverage ratio as a security measure against any capital requirement deficiencies.

Interestingly, despite extreme instability in the financial system, it was noted that, unlike conventional banks, Islamic financial services institutions were not affected by the crisis. This triggered further reflection regarding the classic western financial system. These reflections

resulted in new lines of research discussing the role of Islamic financial institutions and explaining how and why Islamic banks survived the crisis. Previous research has analyzed the performance, the efficiency and the risk of this system by comparing it to conventional banks. The objective was to identify the key differences between the two systems to understand which system is more reliable under specific circumstances. However, no empirical study was set to examine the impact of banking regulation on Islamic bank stability and adjusted profits compared to conventional banks. Our intention is to fill this gap in the literature.

The purpose of this chapter is to empirically evaluate the effectiveness of banking regulation imposed by Basel III. We intend to analyze and compare the impact of capital, liquidity and leverage requirements on the stability and adjusted profits of the banking sector by emphasizing differences and similarities between Islamic and conventional banks. Our pooled sample consists of Islamic and conventional commercial banks, resulting in an unbalanced total sample of 4473 bank-year observations (with 875 bank-year observations for Islamic banks) located in 29 countries over the period 2006-2012. We run parametric and non-parametric tests, and a conditional quantile regression to assess whether Basel III requirements can be applied to both Islamic and conventional banks. Our research contributes to the existing literature in several ways. First, we examine whether Basel guidelines have the same effect on Islamic and conventional banks stability and adjusted profits. Second, we utilize conditional quantile regression to determine if banking regulations have a homogenous effect on the successive quantiles of stability and adjusted profits. Third, the paper examines whether during the financial crisis capital, liquidity and leverage had the same impact on stability and adjusted profits for Islamic and conventional banks.

We find that higher capital requirements have a positive impact on Islamic banks' adjusted profits compared to conventional banks. Liquidity ratios show no significant difference between Islamic and conventional banks' stability while leverage ratios have a negative influence on adjusted profits of Islamic banks. As for robustness check, we first split our sample into small and large banks. We find that non-risk based capital ratios ameliorate adjusted profits only for small Islamic banks while the results show no evidence of significant difference between large Islamic banks and conventional banks. Liquidity is positively associated with the stability of large Islamic banks compared to large conventional banks, while it shows a negative impact for small Islamic banks stability compared to small conventional banks. For leverage, we find that small Islamic banks are the reason behind the negative correlation between leverage and adjusted profits. Second, we show that highly-liquid Islamic banks do not share the same regulatory

behavior – with conventional banks – regarding the relationship between capital and leverage, and bank stability. Finally, our sample shows no significant difference between Islamic bank and conventional bank stability and regulation during the subprime crisis. Our findings show general consistency across the successive quantiles of our studied variables.

Chapter three is structured as follows. Section two establishes the theoretical framework used in analyzing banking regulation. In this section, the literature review is organized around three main initiatives carried out in the context of Basel III. Section three describes the data set, the choice of methodology, variables and analyzes the descriptive statistics. Section four discusses the quantitative results, the baseline quantile regression and the robustness tests. Section five concludes.

2. Literature review and tested hypotheses

2.1. RISK AND CAPITAL REQUIREMENTS

2.1.1. Capital requirements of conventional banks

Studying the impact of capital requirements on the stability of the banking system has always been ambiguous. VanHoose (2007) provides an extensive literature review on this subject. In his paper called *“Theories of bank behavior under capital requirements”* he argues that banking regulators are still searching for an appropriate method to calculate minimum capital requirements. The logic behind requiring capital buffers was and remains to protect depositors’ money when practicing intermediation activities. In this context, Pettway (1976) quotes from Williams (1914) that *“one dollar of capital to ten dollar of deposits”*.

There is an abundance of literature on both sides of the bank capital issue. A pioneering investigation of the relationship between bank portfolio behavior and regulation was the work of Peltzman (1970). The author shows that there is no evidence that bank capital investment behavior adheres to the standards that were set for it. Working in the American context, Mayne (1972) studies the relationship between supervisory and capital requirements and argues that in the absence of ideal and complete information about banks, capital adequacy⁶⁷ determinations

⁶⁷ The author’s model implements capital to assets ratio as a dependent variable.

may differ⁶⁸ from one supervisory agency to another. Barrios and Blanco (2003) investigate the reasons behind requiring banks to hold and respect capital guidelines. Employing two theoretical models that represent the market regime and the regulatory regime, their findings provide evidence that regulatory pressure is not the only reason behind higher capital requirements; rather, the pressure of market power is the main determinant of bank capital requirements. Exploring the association between bank capital and risk behavior, Rime (2001) concludes that regulatory pressure has a positive influence on capital-to-assets ratio of Swiss commercial banks. Yet, banking regulations did not show any association with the level of banking risk. The author further summarizes banks' capital risk relationship in two categories: the option price model (e.g. Furlong and Keeley, 1989; Keely and Furlong, 1990; Rochet, 1992) and the mean-variance framework (e.g. Koehn and Santomero, 1980; Kim and Santomero, 1988).

Lee and Hsieh (2013) also investigate the relationship between capital, risk and profitability by raising the following question: “*How does bank capital affect risk?*” Offering an extensive literature review, they suggest that an association between a banks' capital and its risk-taking⁶⁹ does exist. They also argue that the relationship between capital and risk can be explained using the “*moral hazard hypothesis*” and the “*regulatory hypothesis*”.

2.1.1.a. The moral hazard hypothesis

The “*moral hazard hypothesis*” refers to the behavior of undercapitalized banks in an unhealthy banking environment of engaging in risky activities. This implies the following: (i) troubled banks may find that raising capital is very costly⁷⁰, (ii) inducing them to diminish their leverage ratios because of higher capital requirements that may reduce the bank expected returns.

⁶⁸ This is due to: (i) the fact that the agencies may adhere to different standards of acceptable probability of bank failure; (ii) they disagree as to the level of capital funds necessary to conform to a specific bank safety probability constraint or (iii) both.

⁶⁹ One of implications of Lee and Hsieh's (2013) paper is that it considers that the impact of capital requirements on risk may also depend on the level of bank profitability ratios. The authors reinforce this proposition by the previous results provided by Hughes and Moon (1995), Hughes and Mester (1998) and Altunbas et al. (2007).

⁷⁰ Rime (2001) warns that capital buffers and adjustment costs are very much related and that sometimes adjusting the level of capital may become very costly: on one hand, issuing equity can be described as a negative signal and evaluated as a bad sign for a bank's economic value; on the other hand, a bank's shareholders may hesitate to participate in raising new capital, especially if they are severely undercapitalized because shareholders already know that raising capital will only be profitable for the bank's creditors. Accordingly, banks may prefer to hold on to more capital than the minimum regulatory requirement as a reserve to minimize the probability of failing to meet the legal capital requirements in stress situations, especially if their capital ratio is volatile.

As a consequence, bank owners may tend to choose a higher point on the efficiency frontier to improve their profits. This leads to investments in riskier portfolios (Fiordelisi, Marques-Ibanez and Molyneux, 2011). This behavior can also be explained by the “*cost skimming hypothesis*”, in which banks tend to ameliorate their profits by devoting more resources to riskier activities to compensate for poor returns (Peura and Keppo, 2006; Fiordelisi, Marques-Ibanez and Molyneux, 2011). Thus, increasing bank capital requirements is overcompensated with greater risk-taking behavior, leading to a higher probability of default. This first category mainly builds on a mean-variance framework to examine the impact of imposing a minimum level of capital requirements in an effort to reduce banking risk. We document the main references below.

Pettway (1976) shows that in the case where regulators impose higher levels of capital as compared to the level demanded by markets (for reasons that are not clear or soundly based), the results will be reflected in a decrease in the operational efficiency of the banking system. This was followed by Kahane (1977) who studies the association between the intermediary’s curve and the probability of bank ruin⁷¹ by employing a portfolio model to calculate the distribution of the return on equity. The author argues that regulatory constraints differ across countries and an intermediaries’ line of activity or business. Therefore, neither imposing minimum capital requirements, nor constraining the composition of bank assets and liabilities is enough to reduce the probability of a bank’s ruin. In a related context, Koehn and Santomero (1980) investigate the portfolio response of commercial banks when faced with regulatory changes. Their results promote the idea that a conservative banking institution tends to change its portfolio from low risk to a lower degree of risk and that a riskier banking firm tends to take on more risk when compared to a conservative institution. In such circumstances, the dispersion of risk taking will expand across the banking industry which may increase the variance of total risk for the entire banking sector. Thus, requiring a higher amount of capital may lead to a “*perverse effect*” as compared to the effect desired by regulatory intervention. At a later stage, Kim and Santomero (1988) employ a mean-variance approach to further investigate the relationship between capital requirements and risk behavior of banking institutions. Using a risk-based capital measure, the authors argue that such a mechanism will reconcile the disadvantages of the uniform capital measure thanks to the fact that it considers the quality of on- and off- balance sheet bank assets. As a result, they propose “*theoretically correct risk weights*” in calculating what they call a “*risk-based capital plan*”. The authors’ proposition was later elaborated in the Basel agreements by determining

⁷¹ Kahane (1978) defines the probability of ruin “*as the situation whereby a firm’s earnings fall below a certain level*”. He explains that this level cannot be determined and that it is related to extreme losses. In another words, ruin could result from a situation where bank equity capital is totally eliminated.

different approaches of defining risk weighted assets (Demirgüç-Kunt, Detragiache and Merrouche, 2013). However, Kim and Santomero (1988) also warn that restrictions on asset composition may alter the optimal portfolio choice of banking firms.

By the same token, Avery and Berger (1991) find that a risk-based capital concept may have a destabilizing effect on the financial system. Distinguishing between official risk and business risk, they explain that capital requirements improve capital ratio in terms of official standards, while business risk actually continues to increase. Shrieves and Dahl (1992) assess the relationship between changes in capital and risk. Their results provide evidence of a positive correlation between risk and capital justified by the leverage and risk-related cost avoidance and managerial risk aversion theories of capital structure and risk taking behavior in commercial banks. Blum (1999) also analyzes the link between bank capital and risk using a dynamic framework. Arguing that raising capital may eventually lead to increased risk, he explains that if it is too costly for the bank to increase capital levels to meet capital requirements in the future, then the only solution for the bank today is increasing the riskiness of its portfolio. Another contribution is the work of Iannotta, Nocera and Sironi (2007) who show that capital ratio is positively associated with risk when examining the European context. Blum (2008) criticizes Basel II risk based capital measures. He explains that since banks are free to determine their own risk exposure, this will give them incentives to understate their risk to avoid higher capital requirements. Therefore, this untruthful assessment leads to higher investment in riskier activities.

2.1.1.b. The regulatory hypothesis

Paradoxically, the “*regulatory hypothesis*” represents the supervisory argument for the relationship between capital and risk. In this scenario regulators encourage banks, in a certain way, to increase their capital commensurably with the amount of risk taken (Altunbas et al., 2007; Gropp and Heider, 2010; Lee and Hsieh, 2013). This can create blockages and sensitivity to risk by preparing banks to absorb shocks in stress situations. Rime (2001) categorizes regulatory hypothesis literature under “*the option price model*”. Accordingly, supporters of this category argue that in an unregulated environment, banks tend to take more risk if depositors’ money is insured by deposit insurance. All things being equal, banks know that if losses occur, depositors’ money will always be repaid. The same pattern goes with systemic banks where the idea of “*too big to fail*” produces a moral hazard behavior leading to excessive risk taking by exploiting deposit insurance and lenders of last resort. For this reason, regulators require banks to hold a minimum level of capital that reduces the moral hazard incentives. Such requirements force bank shareholders to

absorb a large part of losses when they occur, by holding a capital reserve that varies with the amount of risk taken, thereby reducing the value of the deposit insurance put option.

Furlong and Keely (1989) and Keeley and Furlong (1990) argue that employing a mean-variance approach to utility maximization by banks is inappropriate. The two authors disagree with the results of Kahane (1977), and Koehn and Santomero (1980) because they ignore the option value of deposit insurance when examining the relationship between capital and risk. This association prompts further investigation. To pursue their analogy, they address the impact of capital requirements on insured bank asset portfolios using a state-preference model. As they expect, the findings indicate that increasing capital standards will not lead to any increase in portfolio risk; rather it will reduce bank risk appetite. Moreover, Jacques and Nigro (1997) use a simultaneous approach to examine the impact of implementing risk-based capital requirements on the portfolio risk of the banking system. They incorporate 2570 FDIC-insured commercial banks for 1990 and 1991 and find that higher risk-based capital ratios may increase the level of capital ratios and decrease the bank's risk portfolio. Pursuing the same analogy, Aggarwal and Jacques (1998) adopt simultaneous equations on data from 2552 FDIC-insured commercial banks from 1990 through 1993 to investigate the impact of FDICIA, the new American regulation on bank capital ratios and portfolios of risk. Their results are similar to Jacques and Nigro (1997) suggesting that banks tend to hold capital ratios above the minimum capital requirement as a way to prevent failure in stress situations. Editz, Michael and Perraudin (1998) further examine the relationship between regulation and banking stability. Relying on a sample of British commercial banks, they show that establishing a minimum capital requirement is positively correlated with the safety and the soundness of banks and does not distort their lending activities.

However, some studies report that an increase in capital, when the amount of risk rises, can be also related to efficient market monitoring compared to markets where capital positions are deemed to be inadequate (Calomiris and Kahn, 1991; Berger, Herring and Szegö, 1995). Some other authors like, Karels, Prakash, and Roussakis (1989) examine the relationship between market and accounting measures of risk mainly using capital ratios. They progress by adopting a theoretical and empirical framework. Their covariance static framework indicates a negative relationship between capital adequacy and risk measure. Their findings intersect with their theoretical results suggesting that capital and risk are negatively associated. Likewise, Brewer and Lee (1986) compare the impact of accounting financial ratios on market, industry and interest rate risk by employing a multi-index market model. They conclude that the ratio of capital-to-assets is negatively associated with stock market risk and banking industry risk. Moreover,

Jahankhani and Lynge (1979) examine whether commercial bank management decisions are reflected in the accounting ratios of their financial statements. The authors' findings reflect a negative and significant association between equity-to-assets ratio and total bank risk. Finally, Demirgüç-Kunt, Detragiache and Merrouche (2013) find that capital requirements had a positive influence on bank stock market returns in the 2007 – 2008 financial crisis. Their results are even stronger with larger banks.

2.1.2. Capital requirements of Islamic banks

At a theoretical level, Islamic banks do not share the same risk as conventional banks. Their funding structure is very different from that of conventional banks and as a result the Basel III accord, which being based on the balance sheet of conventional banks, does not consider the particularities of the Islamic bank business model (Bitar and Madiès, 2013).

In contrast to conventional banks, the funding structure of Islamic banks does not guarantee several types of accounts. Islamic banks finance their balance sheet growth through three funding sources: capital, demand deposits and profit sharing investment accounts (PSIA) (Turk-Ariss and Saredidine, 2007; Beck, Demirgüç-Kunt, and Merrouche, 2010, 2013; Saeed and Izzeldin, 2014). The latter contain restricted and unrestricted investment accounts that are not guaranteed by the bank because investment account holders (IAH) are considered as investors. Hence, profit and initial capital invested by this category of depositors are related to the success of the investment and therefore deposit insurance is not required. Accordingly, exploitation of deposit insurance is a non-issue for Islamic banks.

Hamza and Saadaoui (2013) investigate the association between PSIA, risk and Islamic bank capital requirements. They argue that an increase in PSIA on the liability side of an Islamic bank's balance sheet will not jeopardize shareholders' wealth due to risk of loss of asset value. This suggests that in a case where a bank seeks to maximize shareholders' value, it will tend to rely more on PSIA by attracting more IAH (at the expense of bank capital) by boosting leverage. Further, Islamic banks tend to use PSIA in PLS modes of finance instead of non-PLS instruments leading Islamic banks to higher levels of risk exposure⁷². As a consequence, an increase in the number of PSIA in a context of moral hazard and asymmetric information

⁷² Authors like Baele et al. (2014), Chong and Liu (2009), Aggarwal and Yousef (2000), and Mills and Presley (1999) emphasize that Islamic banks avoid or marginally benefit from PLS contracts because it make them vulnerable and highly exposed to default, especially in a moral hazard context. Alternatively, Non-PLS mark-up *Sharia'a* compliant instruments are practiced instead.

increases the insolvency risk because of withdrawal risk (Khan and Ahmad, 2001; Sundararajan and Errico, 2002; Abedifar, Molyneux, and Tarazi, 2013) and this is negatively associated with bank capital level.

Here, Islamic banks have two choices. On the one hand, Islamic bank managers may decide to no longer take excessive risks because they know that if losses occur, the IAH⁷³ will withdraw their money (Khan and Ahmed, 2001). Moreover, poor return rates for IAHs lead to higher withdrawal risk, which in turn can lead to liquidity problems, and at a later stage, to solvency problems (Abedifar, Molyneux, and Tarazi, 2013). It is clear that in this case, Islamic bank managers should be careful when it comes to making project investment decisions, especially in countries where competition with conventional banks exists. Therefore, this special relationship between Islamic banks and their IAH serves as very effectively discipline (Abedifar, Molyneux, and Tarazi, 2013). Here, we refer to an “*averse management*” hypothesis (Saeed and Izzeldin, 2014) where in times of uncertainty, Islamic banks engage more in mark-up financing rather than PLS-transactions (Abedifar, Molyneux, and Tarazi, 2013; Bourkhis and Nabi, 2013). This comes in line with the regulatory hypothesis mentioned above. On the other hand in practice Islamic banks almost entirely rely on profit smoothing mechanisms. According to Islamic financial services board, IFSB (2005a), the return rate on PSIA depends on the level of competition between banks in a country. Higher interest rates proposed by conventional banks compared to profit rates proposed by Islamic banks may lead investors to withdraw their funds from Islamic banks⁷⁴. To maintain an acceptable level of profits in a competitive environment, Islamic banks tend to increase their Displaced Commercial Risk⁷⁵ (DCR). Nevertheless, relying on smoothing mechanisms may create moral hazard problems (Hamza and Saadaoui, 2013)

⁷³ Abedifar, Molyneux, and Tarazi, (2013) argue that the behavior of Islamic bank clients (i.e. IAH) may be somehow different from that of conventional bank clients. The authors identify religion as an important factor in influencing the behavior of Islamic bank depositors toward risk. They provide two explanations: (i) religiosity may positively influence the association between risk and depositors’ interests. In other words, religious depositors may be more loyal to their banks and willing to take lower profits than initially expected when Islamic bank performance deteriorates. (ii) Religious depositors may also be risk adverse. In this case, they will require higher level of profits than that initially expected to compensate for the increased amount of risk taken.

⁷⁴ Obaidullah (2005) reports that withdrawing depositors’ money in a competitive environment may encourage Islamic banks to distribute profits regardless of their actual performance level, which could be considered as a deviation from *Sharia’a* principles of sharing profits and losses.

⁷⁵ To avoid withdrawal risk, (i.e. unexpected losses when a bank is not able to ensure a competitive level with other banks) DCR (Displaced Commercial Risk) exists when transferring funds from IRRs (Investment Risk Reserve) and PERs (Profit Equalization Reserve) to smooth profit returns of IAH and thereby minimize the probability of withdrawal risk.

because Islamic bank managers can manipulate and hide information about the real profits on assets financed by the PSIA. As a result, bank managers will have “*incentive misalignment*” by engaging in risky investments which lead to higher risk and a lower level of bank capitalization⁷⁶ (IFSB, 2010; Abedifar, Molyneux, and Tarazi, 2013; Saeed and Izzeldin, 2014). For this reason, Islamic banks should, as we have shown in the previous section, retain higher capital ratios to confront special risks imposed by their special mode of financial intermediation (compared to conventional banks). However, in this case, there is no certainty on whether requiring Islamic banks to hold more capital ratios will impede investments in risky activities – if they are always capable of distributing profits and attracting more of IAH – rather than devoting more resources to riskier activities to compensate for any capital blockage against leverage. Such behavior reflects the moral hazard hypothesis as explained for conventional banks.

As financial intermediaries (Grais and Kulathunga, 2007), Islamic and conventional banks are required to maintain a minimum level of capital requirements, and both systems are exposed to insolvency risk. Abedifar, Molyneux, and Tarazi (2013) note that despite the nature of funds employed by conventional banks (debt holders) to finance their activities, Islamic bank investment deposits (equity holders⁷⁷) may be less effective in alleviating risk generated by customer loans or financing default when trying to meet depositors’ returns expectations. The simple explanation is embedded, on one hand, in the infancy of Islamic banks in developing wholesale funding activities and, on the other, the constraints imposed by *Sharia’a*.

All in all, the literature review shows divergence regarding the relationship between capital and risk for conventional banks. It also shows that Islamic banks need to maintain a minimum level of capital requirements. However, as conventional banks, Islamic banks higher capital ratios may induce bank managers to take excessive risks – by relying more on PSIA – which reduces their stability and make their returns more volatile (i.e. moral hazard hypothesis) or it could make Islamic banks more stable and less volatile – as bank managers become more sensitive to risk – compared to conventional banks (i.e. regulatory hypothesis). Accordingly, we formulate the following hypotheses:

Hypothesis 1.a: “A higher level of capitalization increases Islamic banks’ stability compared to conventional banks”.

⁷⁶ Islamic banks sometimes do not have enough money to cover DCR. In such cases, Islamic banks may adjust their equity base to preserve IAH confidence (Hamza and Saadaoui, 2013).

⁷⁷ Sundararajan and Errico (2002) indicate that Islamic bank depositors do not have the same rights as equity holders, but they do share the same risk.

Hypothesis 1.b: “A higher level of capitalization decreases Islamic banks’ stability compared to conventional banks”.

2.2. RISK AND LIQUIDITY REQUIREMENTS

2.2.1. Liquidity requirements and conventional banks

Bank funding structure is an important concept that was rarely discussed in the literature before the 2007–2008 financial crisis⁷⁸. The *financial intermediation* theory defines a bank as a liquidity creation and risk transformation firm (Berger and Bouwman, 2009). Accordingly, a bank’s role in liquidity creation is equally important as its role in risk transformation.

Notwithstanding the importance of capital ratios in determining the stability and the solvency of the banking sector, one outcome of the recent financial crises is the recognition that liquidity is important to bank stability, as are capital requirements. This was rapidly reflected in the Basel III guidelines. By reviewing the literature, we find that a new body of research is starting to emerge as a response to the financial crisis and related regulation, especially Basel III. This was reflected by papers such as Berger and Bouwman (2012), and Horváth, Seidler and Weill (2012). Nevertheless, these two papers mostly examine the causal relationship between capital and liquidity in single country samples. The former refers to a *risk absorption* hypothesis under which highly capitalized banks generate more liquidity and a *financial fragility* hypothesis under which an inverse relationship between capital and liquidity is expected when studying the correlation between banks’ liquidity and capital. The latter argues that a *trade-off* hypothesis, under which a regulatory constraint on one subject will severely harm the other and vice versa, exists between liquidity creation and capitalization. Yet, in the early 1980s, Bryant, Diamond and Dybvig (1983) make a major contribution to the liquidity creation literature. The two authors argue that the liquidity structure of bank assets and liabilities may raise questions about a bank’s liquidity position, especially if a bank uses short term liabilities to finance long term maturity asset projects. Nevertheless, nowadays, bank funding structure has significantly shifted toward new sources of funding that were marginally used before. This is reflected in the tremendous reliance on wholesale funding rather than retail funding before the 2007–2008 financial crisis (BCBS, 2013; Dewally and Shao, 2014). Dependency on wholesale funding was also accompanied by an unprecedented development of risky and complex financial innovation products. Borio (2008)

⁷⁸ Berger and Bouwman (2009) argue that though liquidity is important to bank survival, comprehensive measures of bank liquidity creation are still in their infancy.

reveals serious problems regarding the quality of underlying assets⁷⁹ which triggered the global systemic crisis in 2008. He argues that on one hand, providers of wholesale funding typically have little intention of monitoring banks and instead prefer to withdraw their money when market indicators show that the financial health of a client bank is no longer at a level that inspires confidence (Huong and Ratnovski, 2011). Such behavior can instantly create liquidity constraints for the affected bank. Moreover, if it happens on a large scale, it might generate a loss in confidence between market lead players thereby draining funding channels. On the other hand, leverage behavior during the recent bubble period (e.g. banks taking on more debt to finance their expansion in riskier investments and abnormal liquidity creation) (Berger and Bouwman, 2008, 2009), led to a rapid deterioration of the quality of the asset side of bank balance sheets and manifested in the financial crisis during the post-boom period. Ultimately, this led to a fire sale of assets which diminished their prices and shrank bank balance sheets.

In a lead IMF working paper that discusses the relationship between structure liquidity and the probability of banking default in the 2007 – 2008 financial crisis, Vazquez and Federico (2012), address the main changes provoked by the Basel III framework compared to Basel II guidelines. The authors argue that the reliance of banks on short-term wholesale funding to finance the expansion of their balance sheet, along with high leverage ratios in the period that preceded the financial crisis are the key components in the build-up of systemic risk and the proliferation of the worldwide bank failure phenomena (Bourkhis and Nabi, 2013). Using a panel of European and American banks, their results indicate that the probability of failure increased with banks that possessed lower NSFR and higher leverage ratios before the global financial crisis. They also find that small banks are more vulnerable to liquidity problems, whereas large cross-border banks are more vulnerable to capital buffers. Taken together, the authors' work demonstrates the importance of maintaining higher liquidity buffers and lower leverage which provide empirical support for the Basel III framework.

Offering a comprehensive explanation, another leading paper by Acharya and Mora (2014) investigates the importance of liquidity channel existence in the recent financial crisis. They explain that the toxic financial instruments – that increased banks' solvency risk – may force banks to attract more deposits by offering higher rates. This mainly reflects the banks' lending growth activities and their exposure to core deposit growth which puts pressure on deposits as a source of bank funding in periods of crisis. Further, liquidity problems may find a place not only on the liability side, but also on the asset side of a bank balance sheet. Such a situation aggravates

⁷⁹ For instance, asset-backed commercial paper and mortgage-backed securities.

a bank's liquidity position and exposes it to more liquidity tensions. The authors provide evidence that banks that failed during 2007–2008 suffered from liquidity shortage just before their bankruptcy. A more direct investigation is the work of Imbierowicz and Rauch (2014) that examines the impact of credit risk and liquidity risk separately and jointly on a banks' probability of default. The two authors argue that both credit and liquidity risk plays a significant role in alleviating bank risk and diminishing any occurrence of default. Relying on the American context, their findings suggest that both credit risk and liquidity risk individually affect a banks' probability of default. Further, the aggregate impact of both risks has an additional influence on a banks' probability of default. Accordingly, they call for joint management of credit risk and liquidity risk in the banking sector. Such action could ultimately ameliorate bank stability.

2.2.2. Liquidity requirements and Islamic banks

For Islamic banks, liquidity management is one of the most important challenges facing banking industry development (Ray, 1995; Vogel and Hayes, 1998; and Abdullah, 2010). Yilmaz (2011) defines Islamic bank liquidity risk as: “*the ability of a bank to maintain sufficient funds to meet its commitments, which may, in turn, be related to its ability to attract deposits or sell its assets*” (p. 1). Liquidity risk arises from maturity mismatches (Oldfield and Santomero, 1997) caused by the lack of liquid Islamic investment tools with short term maturities (Harzi, 2012), excessive reliance on long term equity financing tools such as *Mudaraba* (Metwali, 1997), or asset investment tools such as *Murabaha* (Ariffin, 2012). Therefore, a sudden, unexpectedly large withdrawal can lead to disparities of cash or liquid assets, making Islamic banks more vulnerable to runs than are conventional banks.

Authors argue that Basel III liquidity risk requirements will affect Islamic banks for several reasons. First, Islamic bank surplus liquidity cannot be transferred to conventional non-*Sharia'a* banks (Akhtar, Ali and Sadaqat, 2011). Second, access to liquidity during stressful situations is limited due to constraints on borrowing and selling of debt⁸⁰ (Anas and Mounir, 2008; Beck,

⁸⁰ Since Islamic banks are *Sharia'a* compliant, they cannot sell their own debt. Securities which are considered as liquid assets for conventional banks are considered as illiquid for Islamic banks. For example, if we compare government bonds and Islamic bonds (*Sukuk*), it is very clear that government bonds are very liquid and if banks are in need of cash, these securities can easily be sold. Therefore, government securities are eligible to be counted in the liquidity ratios for Basel III. *Sukuk*, on the other hand, cannot be traded easily and cannot be included in liquidity calculations. This is one of the major disadvantages Islamic banks face; their liquid assets can only be equity and there is a severe shortage of liquid equity based assets (Harzi, 2012).

Demirgüç-Kunt, and Merrouche, 2013) imposed by the *Sharia'a*. Third, Yilmaz⁸¹ (2011) expresses that Islamic banks operate within an undeveloped Islamic money market (Sundarajan and Erico, 2002; Iqbal and Llewellyn, 2002; Čihák and Hesse, 2010) and cannot benefit from the Central Bank as lender of last resort, which makes them more vulnerable to liquidity risk when compared to conventional counterparts.

Among other things, Abdullah⁸² (2010) explains that Islamic banks are moving toward the establishment of new techniques and infrastructures such as commodity *Murabaha*, interbank *Murabaha*, *Wakala* and unrestricted *Wakala*, Islamic debt securities, short-term *Ijara Sukuk*, Islamic repurchase agreements, government and Central Bank *Sharia'a* compliant instruments, and other specific short-term liquidity management tools. The author also invites regulators⁸³ to improve Islamic bank regulatory guidelines by considering factors such as establishing a unified *Sharia'a* supervisory council, standardized accounting measures and risk management guidelines for Islamic financial institutions. In a recent study on Islamic bank liquidity positions, Ali (2012) assesses the state of Islamic bank liquidity and shows that in spite of the fact that Islamic banks are more liquid than conventional banks, the 2007–2008 financial crisis indicated that Islamic banks are also vulnerable and may face liquidity shortages. Furthermore, he finds clear evidence that the liquidity position of Islamic banks decreases over the sample period, yielding a changing pattern over time in the business model of these institutions. On the whole, the author draws the same conclusion reported in the Basel III guidelines.

Thus, after considering both sides of the literature above, we can clearly acknowledge that higher liquidity should ameliorates stability and reduces risk of both bank types. However, Islamic banks lack of healthy liquidity management as the industry still in its infancy. Therefore, requiring Islamic banks to apply Basel III might penalize them compared to conventional counterparts. Accordingly, we propose the following hypotheses:

Hypothesis 2.a: “A higher level of liquidity increases Islamic banks’ stability compared to conventional banks”.

Hypothesis 2.b: “A higher level of liquidity decreases Islamic banks’ stability compared to conventional banks”.

⁸¹ Durmuş Yılmaz is the Governor of the Central Bank of Turkey.

⁸² Daud Vicary Abdullah is the Global leader of Deloitte’s Islamic Finance Group.

⁸³ See “Deloitte Middle East Islamic Financial Survey: Benchmarking Practices, 2010”.

2.3. RISK AND LEVERAGE REQUIREMENTS

The subject of leverage has never been a priority in banking literature. Whatever the reason behind this void, the subprime crisis demonstrated that underestimating the importance of the impact of financial leverage on the stability of the banking system was clearly a wrong research policy. For instance, the severity of the financial crisis that hit Russia in late 1998 was mainly related to excessively high leverage positions taken by financial institutions. Similarly, leverage has been diagnosed as one of the key factors that triggered the 2007–2008 financial crises. Therefore, one important feature of Basel III is the implementation of a non-risk based leverage ratio. The measure was formalized by dividing a banks' capital measure⁸⁴ by the bank exposure measure. It is calibrated to act as a credible measure in addition to other risk-based capital ratios⁸⁵. A handful of recent papers show interest in studying the relationship between risk and leverage requirements. Below we examine some of these papers for conventional banks as well as for Islamic banks.

2.3.1. Leverage and conventional banks

Papanikolaou and Wolff (2010) investigate the relationship between leverage ratio and risk of “*too big to fail*” US commercial banks. The authors argue that commercial banks' addiction to leverage led them to largely abuse the use of financial products. Their results show that relying on wholesale funding and modern financial instruments can lead to financial vulnerability and contribute to the fragility of the financial system. They also suggest that on the one hand, commercial banks' asset side should be more concentrated on traditional loan granting rather than derivatives and highly complicated financial products. On the other hand, commercial banks' liability side needs to rely more on traditional intermediation activities such as taking deposits instead of non-interest income activities. Overall, their results support the ongoing debate on the need for stricter banking rules by requiring explicit, non-risk-based leverage measure. Leverage requirements are also discussed by Vazquez and Federico (2012). The two authors provide evidence that the probability of failure increased with highly leveraged banks even before the global financial crisis. Männasoo and Mayes (2009) show similar results. Exploring factors that influence bank distress, they employ survival analysis combined with early warning indicators (i.e. CAMEL), macroeconomic indicators and banking sector structure measures. They find that higher leverage increases bank failure risk. Other working papers shed

⁸⁴ Yet, till now BCBS did not decide whether total regulatory capital or common equity tier 1 can be used as capital measure.

⁸⁵For detailed information; see: BCBS (2013): “*Revised Basel III leverage ratio framework and disclosure requirements*”.

light on the inverse effects of leverage requirements by arguing that imposing leverage guidelines with risk weighting technique does not provide any real incentives to stop engaging in leverage.

Blundell-Wignall and Roulet (2012) study the association between bank business models, leverage and distance-to-default. Employing data from 94 U.S. and EU listed commercial banks; they incorporate un-weighted and weighted leverage ratios to examine the relationship between leverage and risk. Their results provide clear evidence that a simple un-weighted leverage ratio is negatively correlated with bank stability, while the complex weighted leverage⁸⁶ ratio does not provide any significant association with bank stability. These results are consistent with the stream of literature that throws into doubt the effectiveness of such risk weighted measures. Likewise, in a recent study conducted by the Bank of Britain, Haldane (2012) defends “*the need to simplify regulation*” argument. The author questions the effectiveness of the “*more is more*” policy of the Basel committee. Criticizing the “*tower of Basel*” concept, he calls for banking regulation simplicity by relying on a “*less is more*” policy. His findings also show that a simple leverage measure is a good predictor of actual default, while the Basel risk-based leverage ratio is a poor indicator of default risk. BCBS was criticized once again by Blundell-Wignall and Atkinson (2010) who suggest that combining a capital risk weighted assets measure with no more than 3% of “*backstop*” leverage ratio does not provide enough incentive for banks to be adequately capitalized. This is due to the fact that the Basel risk weighting approach is ineffective in dealing with complex financial products such as CDS contracts that allow banks to extend their leverage without any limits. Accordingly, the Basel III leverage ratio should not be considered as a “*backstop*” mechanism, but rather a key indicator, given the extent to which capital adequacy risk-based measures are ineffective. Blum (2008) explains that the only response to risk based capital measure inefficiency is to employ a risk independent leverage ratio. This is supported by Demirgüç-Kunt, Detragiache and Merrouche (2013) who indicate that a minimum leverage ratio is important as a supplement to risk adjusted capital guidelines.

2.3.2. Leverage and Islamic banks

In the context of a conventional balance sheet structure, bank leverage refers to the use of liabilities in financing asset expenditure. According to Toumi, Viviani, and Belkacem (2011), this ratio illustrates how many times banks succeed in multiplying their invested capital by attracting new resources. Pappas, Izzeldin and Fuertes (2012) argue that Islamic banks are less leveraged

⁸⁶ The authors argue that Basel rules, by allowing banks to determine their own risk weighted assets, are encouraging them to arbitrage (usage of CDS and swaps to allow for risk transfer) which creates more incentives to rely more on leverage and risk taking.

than conventional banks. They further explain that these banks are required to work with asset-backed transactions rather than debt-backed financial products in order to conform to *Sharia'a* law. As a consequence, working under such circumstances puts pressure by constraining Islamic bank leverage as compared to conventional banks by making them closely associated to the real economy (Saeed and Izeldin, 2014). Moreover, the authors show that higher leverage increases the failure risk of conventional banks, whereas the same situation is favorable for Islamic banks due to their business model.

In contrast, Hamza and Saadaoui (2013) explain that Islamic banks use PSIA as leverage to invest in risky projects because bank managers and shareholders know that losses will only be supported by the IAH. Also, in a competitive environment, profit smoothing in asymmetric information and moral hazard contexts encourage Islamic banks to benefit more from leverage to the detriment of their IAH. This incurs greater risk behavior which may lead to undercapitalization and insolvency problems.

To sum up, literature almost agrees that highly leverage conventional banks are riskier and less stable than low leveraged banks. In contrast, *Sharia'a* constraints on Islamic banks' leverage make them, on the one hand, less leveraged, more stable and less risky than conventional banks, and on the other hand, more constraint regarding returns and interest margins. Yet, Islamic banks can benefit of PLS and smoothing policies to abuse leverage, which may lead to insolvency. Therefore, we put forth the following hypotheses:

Hypothesis 3.a: "A higher level of leverage increases Islamic banks stability compared to conventional banks".

Hypothesis 3.b: "A higher level of leverage decreases Islamic banks stability compared to conventional banks".

Table 3.I provides a summary of theoretical and empirical papers that examine the relationship between regulation, stability and adjusted profits for both Islamic and conventional banks. In the following sections, we present our data, the methodology and the empirical results.

3. Data and methodology

3.1. SAMPLE

In this section we describe the data sources used in this paper. We note that authors agree on using Bankscope as the primary source for obtaining bank financial information (Čihák and Hesse, 2010; Pappas, Izzeldin and Fuertes, 2012; Beck, Demirgüç-Kunt, and Merrouche, 2013; Abedifar, Molyneux, and Tarazi, 2013). Therefore, we chose Bankscope as our primary source of data for this study. We retrieve annual data for 639 banks (including 125 Islamic banks) across 29 countries⁸⁷ which results in an unbalanced sample of 4473 bank-year observations (including 875 bank-year observations for Islamic banks). Data is yearly, spanning 2006 to 2012. We also retrieve data to control for religiosity from the Pew Research Center website and the World Factbook. Macroeconomic data is derived from the World Development Indicator (WDI). We also refer to the website of some Islamic banks since Bankscope lacks complete information for risk based capital ratios.

3.2. CONDITIONAL QUANTILE REGRESSION METHODOLOGY

We use quantile regression to test whether our measure of banking regulation has a homogenous effect on banking stability and adjusted profits for both Islamic banks and conventional banks. Introduced by Koenker and Basset (1978), the quantile regression parameter estimates the change in a specified quantile⁸⁸ of the response variable $Y\{Y_{\tau 1}, Y_{\tau 2}, \dots, Y_{\tau n}\}$ produced by a one unit change in the predictor variables $\{X_1, X_2, \dots, X_n\}$. It is a generalization of median regression analysis to other quantiles of the response variable (Koenker and Hallock, 2001). As we know, least square regression is the minimization of the following optimization problem:

$$\hat{\mu} = \operatorname{argmin}_{\mu \in \mathbb{R}} \sum_{i=1}^n (y_i - \mu)^2 \quad (1)$$

⁸⁷ Specifically: Algeria, Bahrain, Bangladesh, Brunei, Egypt, Gambia, Indonesia, Iran, Iraq, Jordan, Kuwait, Lebanon, Malaysia, Mauritania, the Maldives, Oman, Pakistan, the Palestinian territories, the Philippines, Qatar, Saudi Arabia, Singapore, Syria, Sudan, Tunisia, Turkey, the UAE, the UK and Yemen.

⁸⁸ In our paper we look into the 25th, the 50th and the 75th quantiles (quartiles) of the dependent variables.

It is the same concept as that of the sample mean, which minimizes the sum squared of residuals in the OLS. This concept can be extended to the linear conditional mean function $E(Y|X = x) = x'\beta$ by solving⁸⁹:

$$\hat{\beta} = \operatorname{argmin}_{\mu \in \mathbb{R}^p} \sum_{i=1}^n (y_i - \mu(x_i, \beta))^2 \quad (2)$$

Let us now define the median as the solution to the problem of minimizing a sum of absolute residuals (Fitzenberger, 2012; Koenker and Hallock, 2001). The median of a random sample $\{y_1, y_2, \dots, y_n\}$ of Y can be interpreted as the minimizer of the sum of absolute deviations.

$$\text{Median} = \operatorname{argmin}_{\xi \in \mathbb{R}} \sum_{i=1}^n |y_i - \xi| \quad (3)$$

Thereby, the general τ -th sample quantile can be expressed as the solution of the following optimization problem:

$$\operatorname{argmin}_{\xi \in \mathbb{R}} \sum_{i=1}^n \rho_{\tau}(y_i - \xi) \quad (4)$$

The linear conditional quantile function $Q(\tau|X = x) = x'\beta(\tau)$ can be estimated by solving (Koenker and Hallock, 2001):

$$\hat{\beta}(\tau) = \operatorname{argmin}_{\beta \in \mathbb{R}^p} \sum_{i=1}^n \rho_{\tau}(y_i - x_i'\beta) \text{ with } \tau \in (0, 1) \quad (5)$$

To sum up, the τ th quantile regression is the solution of minimization of the following optimization problem:

$$\min_{\beta \in \mathbb{R}^p} \left[\sum_{i \in \{i: y_i \geq x_i'\beta\}} |y_i - x_i'\beta| \cdot \tau + \sum_{i \in \{i: y_i < x_i'\beta\}} (1 - \tau) |y_i - x_i'\beta| \right] \quad (6)$$

Estimating a whole set of quantile functions provides a richer description of the heterogeneous relation between regulation and bank soundness. Quantile regression⁹⁰ results are robust for outliers and distributions with heavy tails. It also avoids the restrictive assumption that the error terms are identically distributed at all points of the conditional distribution.

⁸⁹ See Colin Chen, An introduction to Quantile regression and the Quantreg procedure, paper 213-30, SAS institute Inc.

⁹⁰ We use the bootstrapping technique to compute standard errors for the parameter betas.

3.3. VARIABLES DESCRIPTION

The baseline quantile regression is given by:

$$Q(\text{Bank}_{ijt} | \text{REG}_{ijt}) = f \left\{ \begin{array}{l} \text{Banking regulation (BR)} \\ \text{Banking control level (BC)} \\ \text{Country control level (CC)} \\ \text{Degree of religiosity (DR)} \end{array} \right. \quad (7)$$

Where Bank_{ijt} is the vector of two measures of stability and adjusted profits of bank i in country j in year t . Our primary dependent variables are bank i 's Z-score⁹¹ and AROAA⁹² (Čihák and Hesse, 2010; Abedifar, Molyneux, and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013; Rajhi, 2013). REG_{ijt} ⁹³ is the vector of exogenous variables that includes four groups: (i) a list of regulatory variables (BR), (ii) bank characteristics (BC), (iii) country control variables, (CC), which includes macroeconomic variables, and (iv) a vector that controls for the degree of religiosity (DR). We further include interaction terms between key regulatory components and IBDV – to capture similarities and differences between Islamic banks and conventional banks – cross sectional, and time-series fixed effect variables.

BR is the vector of banking regulation. It refers to the Basel guidelines for banking regulation and supervision. We incorporate three regulatory vectors to proxy for the impact of the new Basel III guidelines. The first vector – Capital – employs two risk based capital measures (Fiordelisi, Marques-Ibanez and Molyneux, 2011; Demirgüç-Kunt, Detragiache and Merrouche, 2013) that are total capital ratio⁹⁴ (TCR), and tier1 capital ratio⁹⁵ (T1RP) which is calculated in a

⁹¹ The Z-score is one of the most popular measures of bank soundness. It is the inverse measure of overall bank risk, and equity to total assets for the bank capitalization level. It measures how close a bank is to insolvency (Boyd and Graham, 1986; Boyd and Runkle, 1993; Stiroh, 2004; Mercieca, Schaeck and Wolfe, 2007; Berger, Klapper and Turk-Ariss, 2009; Vazquez and Federico, 2012).

⁹² We follow the work of Mercieca, Shaeck and Wolfe (2007) called: “*The small European banks: benefits from diversification?*”, and also the work of Turk-Ariss (2010): “*On the implication of market power in banking: Evidence from developing countries*”.

⁹³ All explanatory variables are lagged by one year and winsorized at the 1 and 99 percent levels to mitigate the effect of outliers. Variables definitions and sources are explained in Table DI in Appendix D.

⁹⁴ According to Bankscope ratio definitions, the capital adequacy ratio measures tier 1 + tier 2 capital which includes subordinated debt, hybrid capital, loan loss reserves and the valuation reserves as a percentage of risk weighted assets and off-balance sheet risks. This ratio must be maintained at a level of least 8% under Basel II rules.

⁹⁵ Bankscope defines tier 1 ratio as the percentage of the sum of shareholder funds plus perpetual non-cumulative preference shares divided by the bank risk weighted assets. Banks should hold a tier1 ratio of at least 4% under Basel II guidelines.

very similar way as the total capital ratio. Capital also includes two non-risk based capital ratios, such as equity to customers and short term funding (TECSTF), and equity to liabilities (TETLIP) ratios as traditional measures of degree of bank capitalization. The second vector – Liquidity – employs the ratio of bank liquid assets to total deposits and short term borrowing (LATDBP), and the ratio of liquid assets to assets (LATAP). The former gives a picture of the proportion of liquidity available to meet short term bank obligations while the latter provides a general view of a bank's liquidity position. Vector 3 – Leverage – uses the equity to assets (TETAP) as a measure of financial leverage. This traditional measure of financial leverage is considered as being in line with Basel III as Vazquez and Federico (2012) claim. A higher amount indicates a lower leveraged bank position (or higher capital position). Vector 3 also employs the liabilities to assets (ILTAP) as a variant of leverage ratio (Anginer, Demirgüç-Kunt and Zhu, 2014). This ratio is also called the debt ratio. We argue that this ratio is an indicator of lower capital or greater leverage. A leveraged bank can be considered at risk of bankruptcy because at some level, it might not be able to repay its debt which could lead to difficulties in getting new future funding (Toumi, Viviani, and Belkacem, 2011; Anginer, Demirgüç-Kunt and Zhu, 2014).

We further control for factors that may influence the relationship between regulation and risk by including two vectors: **BC** is the vector of bank portfolio characteristics. It measures for bank size proxied by the natural logarithm of total assets (LnTA), which may arguably increase (Stiroh, 2004; Houston et al., 2010) or decrease bank stability and risk (Demirgüç-Kunt and Huizinga, 2010; Schaeck and Cihák, 2012; Beck, Demirgüç-Kunt, and Merrouche, 2013); fixed assets to assets (FATAP) and the net loans to total earning assets (NLTEAP) to control for bank financing activities (Abedifar, Molyneux, and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013). We also include the cost to income ratios (CIRP) and the overheads to assets (OVERTAP) to study the influence of cost inefficiency on the stability and the adjusted profits risk of the banking system (Abedifar, Molyneux, and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013; Rajhi, 2013). **CC** is the vector of three macroeconomic variables commonly used in the stability literature (Cihák and Hesse, 2010; Demirgüç-Kunt and Huizinga, 2010; González and Fonseca, 2010; Houston et al., 2010; Demirgüç-Kunt and Detragiache, 2011; Schaeck and Cihák, 2012; Abedifar, Molyneux, and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2010; Lee and Hsieh, 2013). It includes the logarithm of GDP per capita (GDPPC) to capture differences in income levels and thereby the prosperity and the growth of each nation, GDP growth (GDPG) to control for any potential cyclical behavior of regulation under Basel requirements and the inflation rate (INF) to capture for the country's general financial conditions. Finally, some authors argue that religiosity may represent an important determinant

of Islamic bank stability and risk, as compared to conventional banks. Therefore, a vector of degree of religiosity *DR* is included to control for religiosity factors (Cihák and Hesse, 2010; Abedifar, Molyneux, and Tarazi, 2013). It consists of the percentage of Muslim population in each country (REL_P); an index of the legal system (LEGAL) that controls for countries that adopt *Sharia'a* as their main legal system (e.g. Iran and Saudi Arabia), a traditional laws (French or English laws) or both systems combined. DR also controls for the presence of Islamic banks in each country's banking system, using the percentage of Islamic bank shares in a country's banking system assets (IBSP) and a measure of too big to be ignored (TBTI) which equals the sum of years where a bank's share in a country's total assets exceeds 10%.

4. Empirical results

4.1. DESCRIPTIVE STATISTICS

Table 3.II gives the variables, 10th percentile, lower quantile, mean, upper quantile, 90th percentile and the standard deviation over the sample period for all countries. We also report the mean for Islamic banks and for conventional banks. For the sample average of our dependent variables, we find that the LnZS 10th percentile is 1.74 and 90th percentile is 4.41. We also find that LnZS is higher for conventional banks than for Islamic banks. AROAA varies between -0.28 at the 10th percentile and 6.49 at the 90th percentile, with an average of 2.94 for conventional banks and 1.77 for Islamic banks.

The basic descriptive statistics also indicate that Islamic banks are more capitalized than conventional banks. TCRP varies between 11.38% and 36% across banks over our sample period with an average of 20.14% for commercial banks and 29.95% for Islamic banks. T1RP varies between 8.7% and 32.39% with an average of 16.82% for commercial banks and 27.83% for Islamic banks. As for TECSTF and TETLIP, we find that Islamic banks have almost three times more capital ratios than do conventional banks. TECSTF and TETLIP have 24.82% and 20.43% for commercial banks, while Islamic banks have 62.92% and 59.57%, respectively.

Table 3.II also examines liquidity ratios. LATDBP varies from 11.3% to 70.86%, with a mean of 37.52% for commercial banks and 45.56% for Islamic banks. LATAP varies from 9.34% to 63.66%, with a mean of 31.99% for conventional banks and 27.84% for Islamic ones.

As for leverage, we find that TLTAP ratio varies between 66.42% and 94.55%, with a mean of 85.56% for conventional banks and 73.3% for Islamic banks. TETAP also shows that Islamic banks have a higher mean (lower leverage) than conventional banks.

Turning to our control variables, we find that conventional banks are bigger than Islamic banks with a mean of 14.58 for the former and 13.85 for the latter (Cihák and Hesse, 2010; Beck, Demirgüç-Kunt, and Merrouche, 2013; Bourkhis and Nabi, 2013). Islamic banks hold more fixed assets than do conventional banks (Beck, Demirgüç-Kunt, and Merrouche, 2013). The average is 1.63% for conventional banks and 3.45% for *Sharia*'a compliant banks. Descriptive statistics also show that the NLTEAP sample average is 55.62% with an average of 55.37% for conventional banks and 56.7% for Islamic banks (Abedifar, Molyneux, and Tarazi, 2013). Cost inefficiency indicators show that Islamic banks are significantly more cost inefficient compared to conventional banks (Cihák and Hesse, 2010; Demirgüç-Kunt, and Merrouche, 2013; Abedifar, Molyneux, and Tarazi, 2013). CIRP varies between 27.76% at the 10th percentile and 90.5% at the 90th percentile across banks and over time, with an average of 57.99% for commercial banks and 71.96% for Islamic banks. We also find similar results for OVERTAP. T-test and Wilcoxon rank test show that dependent, independent and bank level control variables are significantly different between Islamic and conventional banks (Cihák and Hesse, 2010; Beck, Demirgüç-Kunt, and Merrouche, 2013; Abedifar, Molyneux, and Tarazi, 2013). We also break down our sample per country. Table 3.III reports macroeconomic indicators, demographics and concentration variables for each given country.

4.2. MAIN RESULTS⁹⁶

4.2.1. Studying stability and risk: comparing Islamic and conventional banks

To assess differences in stability (LnZS), risk adjusted return on assets (AROA) and the components of the LnZS (i.e. equity to assets (TETAP), and return on average assets (ROAAP)) for Islamic and conventional banks, we conduct a series of quantile regressions. The first model is represented in Equation⁹⁷ (8) as follows:

$$Q(STA_{ijt}|REG_{ijt}) = \alpha + \varphi \times IBDV + \delta \sum_{j=1}^N \text{Country}_j + \mu \sum_{t=1}^T \text{Time}_t + \varepsilon \quad (8)$$

The results of Table 3.IV Panel A show that across countries and years Islamic banks have lower LnZS and AROAA but higher TETAP and ROAAP. Therefore, on the one hand, Islamic

⁹⁶ In chapter 3 and chapter 4 tables, we only report the main variables and their interactions with the IBDV to save space.

⁹⁷ We also reports Pearson and Spearman correlation matrices to check for multi-collinearity. We find that our measures of stability and risk are highly correlated. The correlations are even stronger when reporting for Spearman correlation matrix. Therefore, we regress each variable (i.e. dependent and independent) alone to avoid multi-collinearity problems.

banks exhibit lower stability⁹⁸ than conventional banks at the successive quantile (models 1 to 6 and models 10 to 11). On the other hand, Islamic bank are more capitalized and more profitable than conventional counterparts (models 7 to 9). These findings are similar to those of Čihák and Hesse (2010) who find that large Islamic banks are less stable than large conventional banks. The two authors suggest that large Islamic banks encounter difficulties when monitoring their credit risk especially that they tend to use PLS transactions over mark-up financing which make them more vulnerable to risk compared to small Islamic banks. However, our results show that Islamic banks are less stable than conventional banks for the entire sample and not only for large banks. Moreover, our findings do not support those of Beck, Demirgüç-Kunt and Merrouche (2013) and Abedifar, Molyneux, and Tarazi (2013) who find no significant difference between Islamic and conventional banks Z-score. Finally, our results oppose those of Rajhi (2013) who find that Islamic banks are more stable than conventional banks in Southeast Asian countries. One possible explanation is that Islamic banks are becoming less stable than conventional counterparts after the subprime crisis. These banks have also problems in monitoring credit risk related to PLS arrangements especially in a context of adverse selection and moral hazard.

In Table 3.IV Panel A, we only control for countries and year effects. Therefore, further investigation should be undertaken. Accordingly, we run the same regression model but this time we control for IBDV by including bank level (BC) and country level (CC) characteristics using Equation (9) presented below. The results are presented in Table 3.IV Panel B.

$$Q(STA_{ijt}|REG_{ijt}) = \alpha + \varphi \times IBDV + \beta \times BC_{ijt-1} + \gamma \times CC_{jt-1} + \delta \sum_{j=1}^N \text{Country}_j + \mu \sum_{t=1}^T \text{Time}_t + \varepsilon \quad (9)$$

IBDV shows the same results obtained in Panel A. As for control variables, it is clear that bank size increases bank adjusted return on assets (AROA) and return on assets (ROAAP) (only at the lower quantile for the ROAAP). The findings persist across the successive quantiles (Panel B, models 4 to 6 and model 10). The results are consistent with the work of Demirgüç-Kunt and Detragiache (2011) and Houston et al. (2010). Nevertheless, we find a negative

⁹⁸ In our unreported results, we run the model using the standard deviation of ROAAP (SDROAA) instead of LnZS and AROAA. We find that Islamic banks' ROAAP is more volatile than conventional banks. The results are positive and significant across quantiles. The higher volatility of Islamic banks' ROAAP is the reason behind the lower LnZS and AROAA compared to conventional banks. For robustness checks, we replace SDROAA with SDROAE and SDNIM and we find the same results.

relationship between bank size and Z-score in models (1) to (3) (Abedifar, Molyneux, and Tarazi, 2013). This can be explained by the fact that bank size is negatively associated with bank equity to assets ratio, a key component of the aggregate measure of stability (Panel B model 7 to 9). This was also confirmed by Demirgüç-Kunt and Detragiache (2011) and Bourkhis and Nabi (2013) who argue that larger banks have lower Z-score mainly because they possess less capital level compared to small banks. This behavior of large banks is due to the fact that they might be considered as more efficient (Fiordelisi, Marques-Ibanez and Molyneux, 2011) and more subject to “*too big to fail*” policy than small banks (Schaeck and Cihák, 2013). Therefore, they tend to be more flexible about their capital requirements. The negative association between bank size and the upper quantile of ROAAP reflects the fact that bank size may also have a perverse effect on highly profitable banks. We argue that highly profitable banks may be excessively leveraged and this could eventually harm their profitability position (Beck, Demirgüç-Kunt and Merrouche, 2013). The ratio of fixed assets to total assets (FATAP) is positively and significantly correlated with the LnZS, AROAA, TETAP, and ROAAP (only at the upper quantile for ROAAP) of the banking system in Table 3.V Panel B, models (1) to (9) and model (12). Our results are similar to those obtained by Beck, Demirgüç-Kunt and Merrouche (2013) that find a positive relationship between FATAP, Z-Score, and TETAP. However, our results also show that banks with higher FATAP enter at opposite signs between highly profitable and low profitability banks (model 10 and 12). We believe that higher FATAP deteriorates the profitability of low profitable banks because of the opportunity cost that arises from not having investments in profitable projects while the opposite is true for highly profitable banks that are invited to shift their investment policy towards having non-earning assets on their balance sheets. Net loans to total earnings assets (NLTEAP) shows no significant impact on LnZS and AROAA, while a higher share of a banks’ net loans in total earning assets is negatively associated with TETAP in Panel B, models (8) and (9). This means that higher engagement in loan activities accentuates credit risk exposures and this is negatively associated with bank capital level. However, we find that higher loans’ activities ameliorate the profitability of the banking sector (model 10 and 12). The coefficients estimate of cost to income ratio (CIRP) and overheads to assets (OVERTAP) ratio show negative association with LnZS, AROAA, TETAP, and ROAAP. Therefore, cost inefficient banks are less stable, less capitalized, and less profitable than cost efficient ones (Cihák and Hesse, 2010; Demirgüç-Kunt and Huizinga, 2010; Demirgüç-Kunt and Detragiache, 2011; Abedifar, Molyneux, and Tarazi, 2013; Bourkhis and Nabi, 2013).

Table 3.IV Panel B also includes an array of macroeconomic control variables. We find no evidence of a significant correlation between GDPG and AROAA, though the coefficient is

positive but not significant with LnZS. This becomes clearer when reporting the results for TETAP and ROAAP, two key elements of LnZS. We find that the insignificant solution of LnZS with GDPPG is mainly driven by TETAP while higher GDPPG is positively associated with bank ROAAP across different quantiles. The inflation rate appears to be positively associated with the LnZS, AROAA, and ROAAP but we find no significant relationship with TETAP. Lee and Hsieh (2013) argue that banks in countries with higher inflation rates tend to charge customers more, resulting in higher interest rates and bank profits (models 11 and 12). However, such behavior might be followed by less demand for loans and more expensive loan reimbursement leading to higher default rates (Koopman, 2009).

We further employ four measures⁹⁹ that control for the degree of religiosity (DR). We consider the share of Muslim population (Abedifar, Molyneux, and Tarazi, 2013), an index of legal system in each country (Abedifar, Molyneux, and Tarazi, 2013), a measure of Islamic banks' share of assets for each year and country (Čihák and Hesse, 2010) and finally a measure of too big to be ignored when studying the relationship between religiosity and bank stability. To do this, we use Equation (10). Results are presented in Table 3.V.

$$Q(\text{STA}_{ijt} | \text{REG}_{ijt}) = \alpha + \varphi \times \text{IBDV} + \varphi^* \times \text{IBDV} \times \text{DR}_{jt} + \beta \times \text{BC}_{ijt-1} + \gamma \times \text{CC}_{jt-1} + \delta \sum_{j=1}^N \text{Country}_j + \mu \sum_{t=1}^T \text{Time}_t + \varepsilon \quad (10)$$

The interaction term φ^* is introduced to investigate whether religion, legal system and Islamic bank share ameliorates or deteriorates stability and adjusted profits of Islamic banks compared to conventional banks. After controlling for each of the four variables, Table 3.V shows that IBDV remains negative and significant in all models of stability and adjusted profits (models 1 to 12). We find that the interaction between legal system (LEGAL) and LnZS shows a positive association for Islamic banks compared to conventional counterparts at the successive quantiles of the conditional distribution of LnZS (models 1 to 3). The quantile regression results in Table 3.V also show that religion (RELP) is positively associated with the AROAA of Islamic banks compared to conventional banks on the successive quantiles of the AROAA distribution (models 4 to 6). In this context, Abedifar, Molyneux and Tarazi (2013) argue that Islamic banks may be more stable than conventional peers due to the religiosity of their clients. Their results show that

⁹⁹ We include IBS and TBTI to control for the market share of Islamic banks. However, we categorize them as measures of DR.

religiosity impedes Islamic banks' credit risk. In addition, examining the correlation between *too big to be ignored* (TBTI) and LnZS shows that *too big to be ignored* Islamic banks tend to be more stable compared to conventional peers. Finally, the market share of Islamic banks (IBS) shows that the presence of Islamic banks ameliorates their AROAA compared to conventional banks. Finally, bank and country control variables show similar indications to Table 3.IV results, although the coefficient significance sometimes varies from one quantile to another.

4.2.3. Three-pronged regulation: Islamic banks versus conventional banks

We interact IBDV with our different measures of capital, liquidity and leverage to empirically capture the specifications of each system. We use Equation (11) to develop our model:

$$Q(STA_{ijt}|REG_{ijt}) = \alpha + \varphi \times IBDV + \vartheta \times REG_{ijt-1} + \varphi^* \times REG_{ijt-1} \times IBDV + \beta \times BC_{ijt-1} + \gamma \times CC_{jt-1} + \delta \sum_{j=1}^N Country_j + \mu \sum_{t=1}^T Time_t + \varepsilon \quad (11)$$

First, we examine the impact of capital requirements on the stability of Islamic banks compared to conventional banks. We also employ LnZS and AROAA as main dependent variables. The quantile regressions' results are provided in Table 3.VI.

The findings show that higher TECSTF and TETLIP are associated with higher AROAA for Islamic banks compared to conventional banks. The results persist for the median and the upper quantiles of AROAA (models 8 and 9) and for all quantiles of TETLIP (models 10 to 12). In addition, risk-based capital measures demonstrate that higher T1RP and TCRP are positively associated with the upper tail of the conditional distribution of AROAA for Islamic banks compared to conventional banks (models 3 and 6). Meanwhile, the two ratios show no significant difference in impact on lower and median quantiles of AROAA (models 1, 2, 4 and 5) between Islamic and conventional banks. Generally, the results provide evidence that Islamic banks are in line with the capital adequacy standard (models 3 and 6), suggesting that the capital stability relationship of Islamic banks supports the financial regulation hypothesis (*Hypothesis 1.a*) (Furlong and Keely, 1989; Keely and Furlong, 1991; Barrios and Blanco, 2003; Vazquez and Federico, 2012; Beck, Demirgüç-Kunt and Merrouche, 2013). This is due to the fact that the special relationship between Islamic banks and their IAH disciplines Islamic banks' managers and shareholders (Abedifar, Molyneux, and Tarazi, 2013). This risk averse association between Islamic bank management and risk requires more capital adequacy ratios and lower engagement

in risky investments (Saeed and Izzeldin, 2014). Thus, the level of a bank's capital strengthens the stability of Islamic banks compared to conventional banks. Our results provide empirical evidence that future capital guidelines (e.g. Basel III) may have different impact on Islamic banks AROAA as compared to conventional banks. However, this solution – *Hypothesis 1.a* – is dependable on different levels (e.g. quantiles: 0.25, 0.50, 0.75) of bank AROAA, especially for risk based capital measures, which shows that banking regulations may provide different solutions not only depending on bank types (i.e. Islamic vs. conventional banks) but also on the bank stability levels (e.g. highly stable vs. low stability banks). Such results show the superiority of quantile regressions over other regression techniques. For instance, if we incorporate OLS regression instead of quantile regressions, probably we will not be able to show that T1RP and TCRP have a positive impact on Islamic banks upper quantile of AROAA as compared to conventional banks. All in all, the results show the complexity of the elements that may influence the regulatory solution. In this section, we find that non-risk capital is positively associated with Islamic banks' AROAA compared to conventional banks. However, this solution shows that depending on bank stability levels, higher risk based capital requirements may also show no different impact on Islamic bank stability compared to conventional banks. We believe that the complexity of risk based capital measures is the reason behind the insignificant difference between Islamic and conventional banks. Haldane (2012) finds that simple non-risk based capital measures outperform 10 times risk based capital measures when studying the association between capital and bank failure. According to Blum (2008) this is due to the untruthful risk reporting when computing risk based capital measures. This sheds doubt about BCBS, IFSB and AAOIFI capital-risk sensitivity solution. As a result, risk based capital measures might be complex and unreliable for comparing Islamic and conventional banks regulatory frameworks.

Turning to models 1 to 6 of Table 3.VI Panel B, where we interact IBDV and liquidity ratios to investigate the liquidity effect on insolvency risk of Islamic banks. The results show no significant difference between Islamic and conventional banks (no support for *Hypothesis 2.a* and *2.b*). Quantile regression supports our findings across different quantiles (models 1 to 6). These results do not support the argument that Islamic banks' liquidity behavior is different from that of conventional banks. It appears that Islamic bank funding structures are becoming similar to those of conventional banks. This is in line with Syed's (2012) results that liquidity positions of Islamic banks are decreasing over time which yields a changing pattern in the business model of these institutions. This also supports the findings of Beck, Demirgüç-Kunt and Merrouche (2013) who find few significant differences in business orientation of Islamic banks compared to conventional banks. However, managing liquidity risk in Islamic banks is an important factor in

maintaining and improving the stability of *Sharia'a* compliant institutions. Pappas, Izzeldin and Fuertes (2012) find that a higher liquidity ratio reduces banks' failure risk. They explain that large liquidity buffers are vital for Islamic financial institutions for two reasons. First, Islamic banks suffer from limited access to liquidity due to *Sharia'a* constraints. Second, no hedging instruments are allowed to mitigate liquidity risk (there is a lack of *Sharia'a* compliant short term instruments). Although conventional banks hold a liquidity advantage over Islamic banks, our empirical findings clearly demonstrate that Islamic banks are adopting an increasingly similar approach to that of conventional bank funding structures, therefore, both Islamic banks and conventional banks need to adopt Basel III NSFR and LCR liquidity proposals. Thus, the Islamic Financial Services Board (IFSB) must implement a framework for Islamic bank liquidity risk management similar to that of the Basel III liquidity requirements. IFSB and other Islamic financial regulatory organizations should also be prudent when implementing such a liquidity framework. It is true that our results show no significant difference between the two banking categories, but we call for further investigation on this subject because, to date, there are only a handful of papers that have theoretically investigated the relationship between liquidity and the stability of Islamic banks compared to their conventional peers. In the next section, we decompose our sample between small and large banks and highly liquid versus low liquidity banks to investigate whether our findings persist.

In addition, our findings support the fact that higher equity to assets (TETAP) (low leverage) is positively and significantly associated with AROAA at the 5% and 1% level for Islamic banks compared to conventional banks (Panel B, models 8 and 9). Likewise, the debt ratio (TLTAP) is associated with lower AROAA for Islamic banks compared to conventional banks (models 11 to 12). Therefore, our results confirm *Hypothesis 3.b*. Thus, higher leverage ratios (low capital) have a negative impact on Islamic banks' AROAA. In fact, conventional banks have experienced massive losses on mortgages and mortgage backed securities (Borio, 2008; Pappas, Izzeldin and Fuertes, 2012). Their leverage ratio is built on debt-backed funding while Islamic banks work only with assets-backed investments. At the same time, conventional bank deposits are insured, motivating morally hazardous behavior. Toumi, Viviani and BelKacem (2011) explain that the lower value of leverage ratio of Islamic banks in comparison with conventional banks reflects the fact that Islamic financial institutions have a greater capacity to sustain shocks and asset losses.

Nevertheless, our results provide evidence that higher leverage ratios (lower capital) has a negative influence on the median and the upper quantiles of Islamic banks' AROAA. Hamza and

Saadaoui (2013) examine the relationship between investment accounts, Islamic bank risk taking and capital requirements. Using a sample of 59 Islamic banks, the authors' findings suggest that Islamic banks' managers and shareholders benefit of the nature of PSIA to engage more in risk at the expense of bank IAH and capital. Our findings are in line with those of Hamza and Saadaoui (2013). In contrast to the positive relationship between capital ratios and AROAA, we find that leverage deteriorates Islamic banks' adjusted profits. This means that besides the fact that Islamic banks promote asset backed transactions, excessive use of leverage could eventually harm Islamic banks, leading ultimately to misallocate PSIA (IFSB, 2010; Hamza and Saadaoui, 2013), high level of risk and undercapitalization.

4.3. ROBUSTNESS CHECKS

In order to check for the robustness of our findings, we run a number of robustness checks. In a first step, we split our sample between large and small banks. Then, in a second step, we compare banking regulations' influence on highly liquid versus low liquidity banks. Finally, we examine the association between stability and regulation of Islamic banks compared to conventional banks during the 2007–2008 financial crisis.

4.3.1. *The role of bank size*

To investigate whether banking regulation has the same impact on large and small banks, we split our sample of conventional and Islamic banks into two sub-samples according to the median of the logarithm of total assets of each bank category¹⁰⁰.

We use Equation (11) and include bank¹⁰¹ and country level characteristics in addition to country-year fixed effects. Applying conditional quantile regression, Table 3.VII reports that regulatory solution significantly differs between risk-based and non-risk based capital measures for large and small Islamic banks compared to conventional banks. Risk-based capital ratios do not provide any evidence for a significantly different impact on AROAA between Islamic and conventional banks except for the upper quantile of AROAA where T1RP and TCRP show a positive association at the 5% and 1% level of small Islamic banks compared to conventional banks (Panel A model 6). For instance, a one unit change in TCRP shows no significantly

¹⁰⁰ Islamic banks are classified as small banks when $\text{LnTA} \leq 14.2518$ and as large banks when $\text{LnTA} > 14.2518$. Likewise, conventional commercial banks are considered small when $\text{LnTA} < 14.5233$ and large when $\text{LnTA} > 14.5233$.

¹⁰¹ As we split Islamic and conventional banks according to their assets size, we no longer control for LnTA in Table 3.VII.

different impact on AROAA between Islamic banks and conventional banks at the 25th and the 50th percentile of the conditional distribution of AROAA, while TCRP increases the adjusted profits of Islamic banks by 0.0389 at the 75th percentile of the conditional distribution of AROAA. Accordingly, our results for risk based capital ratios are not conclusive or generalizable regarding any different behavior between Islamic or conventional banks sensitivity for the moral hazard and the regulatory hypotheses.

In contrast, our results suggest that this solution – *Hypothesis 1.a* – works well when replacing risk based capital measures with non-risk based capital ratios. On the one hand, we show that higher TECSTF have a positive impact on the median and upper quantile of AROAA for small Islamic banks (models 11 and 12) compared to conventional banks, and on the other hand, we find that higher TECSTF does not have a significantly different impact on large Islamic banks' AROAA compared to conventional banks (models 7 to 9). Likewise, we find that higher TETLIP is positively associated with AROAA of small Islamic banks compared to conventional banks (Panel A, models 10 to 12) suggesting a divergent positioning between small Islamic banks and conventional banks. Again, we find that higher TETLIP does not have a significantly different impact on large Islamic banks compared to conventional banks (models 7 to 9). It appears that Table 3.VI capital results are driven by small Islamic banks which provide support to the regulatory hypothesis – *hypothesis H1.a* – of a positive relationship between capital and stability of Islamic banks despite the fact that quantile regressions' capital solution does not hold its significance for risk based capital measures.

As for liquidity, the results show divergent behavior between small and large Islamic banks. While we find evidence that higher LATDBP have a positive influence on the stability of large Islamic banks compared to large conventional banks which supports *Hypothesis 2.a* (Panel B models 2 and 3), we show that in contrast to large Islamic banks, imposing higher LATDBP on small Islamic banks deteriorates their stability compared to small conventional banks which supports *Hypothesis 2.b* (Panel B models 5 and 6). We also find similar results when using LATAP (Panel B models 7, 8, 10, and 11). These opposite results between large and small Islamic banks could explain the reason behind some of the insignificant difference between Islamic and conventional banks in Table 3.VI Panel B. Beck, Demirgüç-Kunt and Merrouche (2013) find that small Islamic banks have higher liquidity than small conventional banks. We argue that small Islamic banks do not have the same capacities, compared to large Islamic banks or conventional banks. While the former opt for a prudent policy regarding their engagement in riskier activities, the latter have a greater margin for manoeuvring. They are reputable, very well-known and

treated in a “special” way by the government and financial authorities¹⁰². Therefore, requiring these small Islamic banks to hold more liquidity will severely damage their stability because of the opportunity cost of not investing these funds in profitable projects. As for large Islamic banks, our results show that requiring large Islamic banks to hold more liquidity buffers impedes their risky behavior compared to conventional banks. One possible reason for these results is that the opportunity cost of holding higher liquidity by conventional banks is higher than the opportunity cost of holding higher liquidity by large Islamic banks and this is due to the fact that the latter are used of holding higher liquidity buffers because of the constraints imposed by *Sharia’a* on their activities compared to conventional banks. Again, we insist on the fact that liquidity solution is dependent on different quantile levels where sometimes both bank types do not show significant difference. This pose several questions on whether small and large Islamic banks should be regulated in the same fashion compared to conventional banks. In addition, the insignificant signs show that depending on the stability level, higher liquidity may have no significantly different impact on Islamic banks’ stability compared to conventional banks. Accordingly, Basel III and Islamic regulatory organizations should consider the fact the banking regulations may have diverse effect not only because of bank size (large versus small banks) or bank type (Islamic versus conventional banks) but also depending on different stability levels (highly stable versus low stability banks).

As for leverage, we show that higher TETAP (low leverage) is positively correlated with AROAA of small Islamic banks. The solution holds on the successive quantiles except the 25th percentile of small Islamic banks where the results become insignificant. We also find that higher TLTAP is negatively associated with the 50th and the 75th percentile of the conditional distribution of adjusted profits for small Islamic banks compared to conventional peers (Panel B models 11 and 12). Our findings provide empirical evidence that small Islamic banks are the reason behind the negative association between leverage and AROAA – *Hypothesis 3.b* – compared to large Islamic banks. If anything, we believe that small Islamic banks misuse of leverage can be related to several factors. First, small Islamic banks are less experienced than large Islamic banks and conventional banks. Second, they have a weak credit risk management, they are less informed and more exposed to moral hazard and information asymmetries. Accordingly,

¹⁰² According to Warren (2013), this complacency policy sends a wrong signal and encourages investors to channel funds to these large banks instead of to small banks because of the insurance policy that guarantees government intervention to save *too big to fail* banks in stress situations. (Elizabeth Warren is a member in the Committee on Banking, Housing, and Urban Affairs and works on legislation related to financial services and other issues that are also related to the federal regulatory agencies).

they may improperly use the investment accounts in non-profitable projects resulting in higher credit risk exposure. Altogether, Table 3.VII findings show that the positive association between capital and AROAA and the negative impact of leverage on AROAA are driven by small Islamic banks.

4.3.2. The role of liquidity

As Basel III shows interest in banking system liquidity, Table 3.VIII reports the capital and leverage relationship between Islamic and conventional banks by decomposing our sample between highly liquid and low liquidity banks¹⁰³. Our results show that T1RP and TCRP appear to have a positive and significant impact on the AROAA of highly liquid Islamic banks compared to conventional banks at the median and the upper quantiles of AROAA for the former (Panel A models 2 and 3) and at the upper level of AROAA only for the latter (Panel A model 3) which confirms *Hypothesis 1.a*. Nevertheless, this solution does not work with low liquidity banks. Risk based capital ratios do not appear to have a significantly different impact on low liquidity Islamic bank AROAA compared to conventional banks. As for non-risk based capital measures, we find that higher TECSTF and TETLIP are associated with higher AROAA at the successive quantiles (except the lower quantile of TECSTF) for highly liquid Islamic banks compared to conventional banks (Panel A models 7 to 9). Accordingly, highly liquid Islamic banks tend to support the *Hypothesis 1.a* that higher capital requirements increases Islamic banks' AROAA compared to conventional banks. Meanwhile, we find that higher TECSTF and TETLIP does not appear to have a significantly different impact on the adjusted profits of low liquidity Islamic banks compared to conventional banks (Panel A model 10 to 12). As for Panel B, we see that the negative relationship between both leverage ratios and the AROAA of Islamic banks in Table 3.VI Panel B and Table 3.VII Panel B is driven by highly liquid Islamic banks compared to low liquidity Islamic banks (models 2, 3, 8 and 9). Accordingly, leverage ratios show that high liquidity Islamic banks tendency towards higher engagement in leverage activities could explain the negative association between higher leverage and the AROAA of small Islamic banks in Table 3.VII Panel B. This means that highly liquid Islamic banks have some kind of trade-off between being highly liquid and more stable or a shift towards a lower liquidity and a less stable position. All depends on bank profits, the theme of our fourth chapter. We believe that higher leverage position of Islamic banks ameliorate their efficiency. Accordingly, they will tend to use the

¹⁰³ Based on the median value of each bank category, Islamic banks are classified as having low liquidity when $LATAP \leq 27.119$ and high liquidity when $LATAP > 27.119$. Likewise, conventional banks are classified as having low liquidity when ≤ 31.014 and high liquidity when $LATAP > 31.014$.

surplus of liquidity to engage more in leverage and benefit of higher profits at the expense of their stability, which could explain the negative association with AROAA.

Overall, sections 4.3.1 and 4.3.2 provide evidence that higher capital, liquidity and leverage ratios may have different impact on the stability and the adjusted profits of small and highly liquid Islamic banks compared to conventional banks. First, the results show that higher capital and lower leverage is positively associated with adjusted profits of small and highly liquid Islamic banks compared to conventional banks. Second, liquidity shows a negative association with stability of small Islamic banks while the opposite is true for large Islamic banks.

4.3.3. Regulation and financial crisis: Islamic banks vs. conventional banks.

As our sample period ranges from 2006 to 2012 it includes the 2008 – 2009 financial crisis. Basel III guidelines require banks to hold more capital, liquidity and less leverage to prevent any future financial crisis and to ameliorate the capacity of banks to absorb losses in stress situations. Therefore, we interact T1RP, TETLIP¹⁰⁴, LATAP and TLTA¹⁰⁵ with GLOBAL¹⁰⁶ and also with IBDV to capture any difference in bank regulation, LnZS, and AROAA during the crisis period (REGULATION×GLOBAL) and also between Islamic and conventional banks (REGULATION×GLOBAL×IBDV). Table 3.IX shows that TETLIP have a positive but a marginal impact on the AROAA of Islamic banks compared to conventional banks during the crisis period. As for the rest of results, we find no significant difference between both bank types during the subprime crisis.

5. Conclusion

In this chapter about the relationship between Basel guidelines and banking stability, we use Z-score and AROAA to proxy the impact of the Basel III framework on the stability of Islamic and conventional banks. Our data is comprised of an unbalanced panel of 4473 bank-year observations (including 875 bank-year observations for Islamic banks) across 29 countries during the 2006 to 2012 period. We analyze and compare the impact of capital, liquidity and leverage requirements on the stability and the adjusted profits of the banking sector by emphasizing the differences and the similarities between Islamic and conventional banks. Our results suggest that:

¹⁰⁴ We also use T1RP and TECSTF and we obtain the same results.

¹⁰⁵ In our unreported results, we use TATE (equity multiplier; assets to equity) and TLTE. However, the results are not sensitive to this.

¹⁰⁶ GLOBAL is a dummy that control for crisis period and equals 1 in 2008 and 2009, and 0 otherwise.

First, our baseline model shows that non-risk based capital ratios have a positive impact on Islamic bank AROAA compared to conventional banks. Liquidity ratios show no significant difference between Islamic and conventional banks while leverage ratios report a negative influence on the AROAA of Islamic banks compared to conventional banks. The results also provide some evidence that depending on the stability level, banking regulations do not have the same influence on Islamic and conventional banks' stability and adjusted profits.

Second, a series of robustness checks show that non-risk based capital ratios ameliorate AROAA of small Islamic banks. Higher liquidity is positively associated with the stability of large Islamic banks compared to conventional banks, while it shows a negative impact on small Islamic banks compared to conventional banks. For leverage, we find that small Islamic banks are the reason behind the negative association between leverage and AROAA compared to conventional banks. We also show that highly liquid and low liquidity Islamic banks do not share the same regulatory behavior regarding the relationship between capital and leverage, and bank stability and adjusted profits.

Finally, our sample shows no significant difference between Islamic bank and conventional bank LnZS, AROAA and regulatory solutions during the subprime crisis.

We find a number of limitations in our study. First, the time period is relatively short which prevented us from computing several proxies of bank stability and risk. Second, we did not include market based financial measures because most of our Islamic banks are not listed. Third, we were not able to study the impact of other crises such as the Asian crisis due to the lack of availability of historical financial data. Finally, we encountered a lot of complexity when analyzing and considering our main variables, especially since Bankscope database does not take into account the particularities of Islamic banks and also lacks of observations regarding regulatory capital measures.

As for future work, the research must be intensified when it comes to Islamic banks' regulatory frameworks. Studies should be deepened when adapting the Basel III guidelines to Islamic banks. Islamic regulatory organizations are invited to create their own structures of regulatory ratios by taking into account the heterogeneity of Islamic banks in terms of size, liquidity, and stability.

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Tables

Table 3.I. Overview of the main literature on banking regulation and bank risk

Authors (year)	Period under study	Countries	Methodology	Main empirical evidence
Panel A: capital and risk				
VanHoose (2007)	---	---	Literature review	Mixed results regarding the relationship between capital and risk which promote further investigation.
Peltzman (1970)	1963–1965	United States	A theoretical model developed by Peltzman (1965) and regression analysis	Uncertainty about the effectiveness of bank portfolio of regulation and especially capital risk relationship.
Rime (2001)	1989–1995	Switzerland	Simultaneous equations	No significant relationship between capital and risk of Swiss commercial banks.
Mayne (1972)	1961–1968	United States	Ordinary Least Square regressions	A more standardized formula for capital requirements may lead to more bank compliance from banks regarding any increase of capital.
Barrios and Blanco (2004)	1985 – 1991	Spain	Disequilibrium estimation and partial adjustment equations	The pressure of market power is the key determinant of capital requirements.
Kahane (1977)	---	---	Portfolio model	Imposing constraints on both sides of bank balance sheet is the only way to construct a feasible capital measure that diminishes the probability of bank default.
a. Positive association between capital and risk				
Koehn and Santomero (1980)	---	---	Quadratic programming of Merton	Capital requirements have an opposite effect to the one intended by regulators.
Avery and Berger (1991)	1982–1989	United States	Regression analysis	Capital requirements increase bank capital ratio. Yet, bank business risk remains at an increasing pattern.
Kim and Santomero (1988)	---	---	Mean-Variance approach	Restrictions on bank assets may shift the position of bank optimal portfolio choice.
Blum (1999)	---	---	Dynamic framework	Increasing capital guidelines tomorrow will end up in increasing banks' risk today.
Pettway (1976)	197 –1974	United States	Regression analysis	Capital requirements decrease operational efficiency of the banking system.
Shrieves and Dahl (1992)	1983–1987	United States	Simultaneous equations	Positive relationship between capital and risk.
Iannotta et al. (2007)	1999 – 2004	European countries	Regression analysis	Equity to assets ratio is positively associated with bank loan loss provision ratio.
b. Negative association between capital and risk				
Rochet (1992)	---	---	Mean-Variance approach	Capital is a poor solution that leads to extreme assets allocation when examining the association between risk and solvency ratio in inefficient markets.
Demirgüç-Kunt et al. (2013)	2005 – 2009	OECD countries	Regression analysis	Capital requirements have a positive influence on banks stock returns especially in the crisis period.
Ediz et al. (1998)	1989–1995	United Kingdom	Panel regression with random effect	Minimum capital requirements ameliorate the soundness of British commercial banks
Furlong and Keely (1989)	---	---	State preference model	Taking into account the option value of deposit insurance, higher capital requirements are negatively associated with bank risk appetite.
Keely and Furlong (1990)	---	---	Mean-Variance approach	Neglecting the option value of deposit insurance misconduct the result of the relationship between capital and risk. Capital requirements reduce bank risk appetite.
Aggarwal and Jacques (1998)	1990–1993	United States	Simultaneous equations	Regulatory capital requirements reduce bank risk portfolio.
Brewer and Lee (1986)	1987–1984	United States	Multi-index market panel data model	Bank risk increases if bank loans and funds increase and decreases when capital to assets ratio increases.
Karels et al. (1989)	1977–1984	United States	CAPM and correlation	Negative relationship between systemic risk and capital adequacy ratio.

Chapter 3 – Basel III and Stability of Islamic banks: Does one solution fit all? – Tables

Authors (year)	Period under study	Countries	Methodology	Main empirical evidence
Jacques and Nigro (1997)	1990 – 1991	United States	Three stage least squares (3SLS)	Capital ratio and bank risk are negatively associated.
Altnubas et al. (2007)	1992–2000	European banks	Seemingly Unrelated regression approach (SUR)	Inefficient European banks have higher capital position and less risk.
Jahankhani and Lynge (1980)	1972–1976	United states	Regression analysis	Equity to assets ratio is negatively associated with bank risk.
Lee and Hsieh (2013)	1994–2008	Asian banks	Dynamic panel data approach	Negative relationship between bank capital and risk.
Panel B: Liquidity and risk				
Vazquez and Federico (2012)	2001–2009	U.S and European banks	Probit regressions	Negative and significant relation between Z-Score, NSFR, equity to assets ratio and probability of bank failure
Acharya and Mora (2014)	1994 – 2009	United states	Regressions with fixed effect	Liquidity shortage is the main reason behind the failing banks in 2007 –2008 financial crisis.
Horváth et al. (2012)	2000 – 2010	Czech republic	Granger causality test and GMM estimators	Existence of trade-off between stability with higher capital requirements and stability with higher liquidity creation.
Berger and Bouwman (2012)	1993 – 2003	United states	Panel data regressions	Capital ameliorates banks' soundness. However, it reduces liquidity creation for small banks compared to large banks.
Imbierowicz and Rauch (2014)	1998 – 2010	United States	Three stage least square regressions	Banks need to create a joint management for credit risk and liquidity risk.
Panel C: leverage and risk				
Papanikolaou and Wolff (2010)	2002 – 2010	United States	Panel data regressions	Accumulating leverage is positively associated with bank total risk.
Männasso and Mayes (2009)	1995 – 2004	Eastern Europe countries	Survival analysis	Higher leverage increases bank failure risk.
Blundell-Wignall and Roulet (2012)	2004 – 2011	U.S and EU countries	Multivariate regressions	Simple and un-weighted leverage ratios are negatively associated with bank stability.
Blum (2008)	---	---	Theoretical model	Need to implement a non-risk based leverage ratio to alleviate inefficiencies of Basel II risk based capital guidelines.
Panel D: Islamic banking literature				
Abedifar et al. (2013)	1999 – 2009	24 OIC countries	Panel data with random effect regressions	Higher equity to assets ratio is positively associated with credit risk of Islamic banks compared to conventional banks.
Hamza and Saadaoui (2013)	2005 – 2009	17 countries	Generalized method of moments	Excessive reliance on PSIA is negatively associated with Islamic banks' capital ratio.
Čihák and Hesse (2010)	1993–2004	Countries with dual banking system	Ordinary Least Squares (OLS) regressions	Small Islamic Banks tend to be financially stronger than small commercial banks while large commercial banks tend to be financially stronger than large Islamic banks.
Rajhi (2013)	2000–2008	MENA and Southeast Asian countries	Least trimmed squares (LTS) and quantile regressions	Credit risk and income diversity are the most common factor of insolvency for Islamic banks.
Beck et al. (2013)	1995 – 2009	22 countries	Panel data with fixed effect regressions	Islamic banks with higher equity to assets have higher stock returns in the crisis period.
Ali (2012)	2000 – 2009	18 countries	Descriptive statistics	Liquidity has a negative trend reflecting a changing pattern in Islamic banks' business model.
Panel D: Islamic banking literature				
Pappas et al. (2012)	1995 – 2010	20 Middle East and far Eastern countries	Survival models	Higher leverage increases failure risk of conventional banks compared to Islamic banks. Liquidity is negatively associated with failure risk for both Islamic and conventional banks.
Srairi (2008)	1999 – 2006	GCC countries	Regressions with fixed effect	Liquidity and leverage are positively associated with the profitability of Islamic banks but the results are not conclusive for conventional banks.
Toumi et al. (2011)	2004 – 2008	18 countries	Logistic regressions and discriminant analysis	Banks with lower leverage ratios are more likely to be Islamic ones.

(continued)

Table 3.II. General descriptive statistics for commercial and Islamic banks

Variables	# of obs.	Mean	STD	P10	Q1	Median	Q3	P90	Islamic banks	Conv. banks	T-test (p – value)	Wilc. (p – value)
Panel A: Stability and adjusted ROAA												
LnZS	3934	3.009	1.022	1.736	2.502	3.096	3.676	4.415	2.775	3.066	0.000***	0.000***
AROAA	3977	2.714	3.249	-0.278	0.559	2.105	4.008	6.488	1.772	2.945	0.000***	0.000***
Panel B: Regulatory variables												
<i>a. Capital</i>												
TCRP (%)	2879	22.13	18.97	11.38	13.55	16.78	22.60	36	29.95	20.14	0.000***	0.000***
TIRP (%)	2332	19.30	17.56	8.7	11.01	14.35	20.01	32.39	27.83	16.82	0.000***	0.000***
TECSTF (%)	4265	31.87	67.89	6.54	9.274	14.295	23.991	55.504	62.92	24.82	0.000***	0.000***
TETLIP (%)	4393	27.83	61.95	5.801	8.658	12.938	20.931	45.157	59.57	20.43	0.000***	0.000***
<i>b. Liquidity</i>												
LATDBP	2961	38.22	34.514	11.3	18.948	29.32	46.279	70.864	45.56	37.52	0.067*	0.057*
LATAP	4449	31.18	21.45	9.341	15.915	25.07	41.33	63.661	27.84	31.99	0.000***	0.000***
<i>c. Leverage</i>												
TLTAP	4473	83.172	17.189	66.416	82.461	88.644	92.095	94.555	73.302	85.562	0.000***	0.000***
TETAP	4473	16.96	17.01	5.445	7.93	11.488	17.568	33.617	26.83	14.57	0.000***	0.000***
Panel C: Control variables												
LnTA	4473	14.41	2.04	11.937	13.028	14.39	15.748	17.089	13.85	14.58	0.000***	0.000***
FATAP	4323	1.99	3.31	0.147	0.481	1.12	2.245	4.450	3.45	1.63	0.000***	0.000***
NLTEAP	4320	55.62	24.81	18.803	38.457	58.91	74.984	85.478	56.70	55.37	0.226	0.001***
CIRP	4300	60.57	47.58	27.765	38.980	51.60	68.667	90.501	71.96	57.99	0.000***	0.053*
OVERTAP	4410	2.61	1.84	0.861	1.291	2.12	3.434	5.271	3.36	2.43	0.000***	0.000***
ROAAP	4441	1.20	3.53	-0.276	0.472	1.15	1.998	3.274	1.418	1.112	0.5046	0.6390

***, **, * indicate significance at the 1%, 5% and 10% level, respectively.

Table 3.II presents descriptive statistics on the stability and adjusted profits of commercial and Islamic banks (panel A), a series of regulatory variables (panel B), and various bank level variables (panel C). Our sample contains 4893 bank-year observations from 2006 to 2012. Table II provides the total banking sector mean (Mean), the standard deviation (STD), the 10th percentile (P10), the lowest quantile (Q1), the banking sector median, the highest quantile (Q3), the Islamic banks mean and the conventional banks mean. The dependent variables are: the natural logarithm of the distance from default (LnZS) and the adjusted return on average assets (AROAA). The independent variables are: TCRP and represents capital regulatory also called capital adequacy ratio. This ratio is generally calculated by dividing a bank's tier1 and tier2 by its risk weighted assets; the tier 1 capital ratio represents Basel II's tier1 regulatory ratio (T1RP). This ratio is generally calculated by dividing a bank's tier1 capital ratio by its risk weighted assets; TECSTF is the ratio of bank equity to customer and short term funding; TETLIP is the percentage of bank equity to liabilities; LATDBP is computed by dividing liquid assets by its total deposits and borrowing; LATAP or liquidity ratio is the ratio of liquid assets to assets. It represents the amount of liquid assets available and therefore the liquidity position of a banking institution; TLTAP also called the debt ratio is the proportion of a bank's debt (liabilities) to its assets; TETAP is the equity to assets ratio and a traditional measure of leverage; Size is the logarithm of total assets (LnTA); FATAP is the ratio of fixed assets divided by total assets; NLTEAP is the ratio of net loans over total earning assets; CIRP is the cost to income ratio; OVERTAP is the overhead to asset ratio; ROAAP is the return on average assets ratio. We perform a series of T-tests the null hypothesis that the means derived for our Islamic and conventional bank sample are equal (specifically, we use Satterhwaite tests because they allow subsamples variances to be different). Wilc represents a Wilcoxon rank test which tests the null hypothesis that the two samples are derived from different distributions and where normality is not assumed.

Table 3.III. Sample features and macroeconomic indicators across countries

Country	All sample		Macroeconomic indicators			Demographics and concentration			
	Conventional	Islamic	GDPPC	GDPG (%)	INF (%)	RELP (%)	LEGA L	IBSP (%)	TBTI
Algeria	11	0	8.378	2.614	4.845	99	1	0	1.687
Bahrain	14	9	9.901	4.897	2.277	81.2	1	22.376	0.781
Bangladesh	20	6	6.371	6.286	8.253	89.5	1	18.060	0.342
Brunei	1	1	10.429	1.116	1.012	67	1	.	0
Egypt	24	2	7.750	4.985	10.783	90	1	4.716	0.412
Gambia	8	1	6.273	3.597	4.412	90	1	0	0.778
Indonesia	50	4	7.806	5.918	6.982	86.1	0	1.668	0.263
Iran	0	12	8.612	3.545	18.043	98	2	100	1.5
Iraq	11	5	8.316	6.1105	4.0414	97	1	33.656	1.529
Jordan	11	3	8.257	5.222	5.726	92	1	4.548	1
Kuwait	8	8	10.690	2.789	4.969	85	1	33.287	1.235
Lebanon	48	1	8.937	5.325	5.097	59.7	0	0.219	0.372
Malaysia	23	17	9.0589	4.6349	2.4361	60.4	1	11.835	0.437
Mauritania	8	2	6.930	5.627	5.703	100	1	12.174	2.1
Maldives	1	1	8.668	8.033	8.284	99.41	1	.	0
Oman	6	1	9.911	5.297	5.053	75	1	0.116	3.429
Pakistan	15	9	6.910	3.422	12.139	96.4	1	3.722	0.579
Palestine	2	2	7.222	4.914	3.964	75	1	26.657	0
Philippines	25	1	7.576	5.035	4.639	5	1	0.01	0.714
Qatar	7	4	11.239	14.605	5.305	77.5	1	18.454	1.727
Saudi Arabia	9	4	9.850	6.136	5.052	100	2	19.489	2.154
Singapore	22	1	10.606	5.695	3.259	14.3	0	0.109	0.913
Sudan	12	10	7.131	2.557	16.211	99.9	1	45.132	0.583
Syria	13	2	7.910	2.657	11.207	90	1	4.535	1.333
Tunisia	17	1	8.308	3.423	4.269	98	1	1.527	1.611
Turkey	33	4	9.167	3.938	8.556	99.8	0	3.803	0.757
UAE	20	8	10.637	3.033	5.240	96	1	18.050	0.833
UK	90	2	10.589	0.449	3.003	2.7	0	0.017	0.187
Yemen	5	4	7.092	1.626	12.570	99.9	1	54.647	2.889
Total	514	125	29	29	29	29	29	10.295	65.960

Table 3.IV. Studying Islamic banks and commercial banks stability

<i>Panel A: comparing for Islamic and conventional banks stability, adjusted profits, capitalization, and return on average assets</i>												
Model #	LnZS			AROA			TETAP			ROAAP		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantiles	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	-0.2786***	-0.2816***	-0.1869***	-0.8809***	-0.8224***	-1.5185***	0.7557***	2.9453***	10.0555***	0.2184*	0.6699***	0.8494***
	(0.0534)	(0.0502)	(0.0608)	(0.1016)	(0.1008)	(0.1667)	(0.2718)	(0.4968)	(1.3165)	(0.1133)	(0.0543)	(0.0946)
Intercept	2.7796***	3.1315***	3.6875***	1.5431***	2.5714***	3.9010***	7.1300***	10.1450***	10.9322***	1.1720***	1.2506***	2.2691***
	(0.1705)	(0.1506)	(0.2092)	(0.2931)	(0.3243)	(0.4929)	(1.0432)	(1.0327)	(1.9407)	(0.2642)	(0.1795)	(0.2764)
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	3400	3400	3400	3437	3437	3437	3514	3514	3514	3501	3501	3501
<i>Panel B: comparing for Islamic and conventional banks stability, adjusted profits, capitalization, and return on average assets (controlling for bank and country characteristics)</i>												
Model #	LnZS			AROA			TETAP			ROAAP		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantiles	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	-0.3015***	-0.2676***	-0.2288***	-0.6862***	-0.7457***	-1.4470***	0.7388**	0.7833**	2.6195***	0.6804***	0.6782***	0.7320***
	(0.0640)	(0.0455)	(0.0627)	(0.1011)	(0.1246)	(0.1748)	(0.2311)	(0.3342)	(0.6671)	(0.0910)	(0.0610)	(0.0906)
LnTA	-0.0308***	-0.0233*	-0.0473***	0.0537**	0.0898***	0.1657***	-1.2628***	-1.6779***	-2.5883***	0.6804***	0.0060	-0.0634***
	(0.0112)	(0.0122)	(0.0115)	(0.0210)	(0.0272)	(0.0417)	(0.0585)	(0.0658)	(0.0840)	(0.0910)	(0.0107)	(0.0117)
FATAP	0.0338***	0.0295***	0.0157***	0.0488***	0.0758***	0.0743***	0.6411***	0.8776***	1.0794***	-0.0675**	0.0200	0.0524**
	(0.0104)	(0.0049)	(0.0046)	(0.0168)	(0.0178)	(0.0170)	(0.0929)	(0.1111)	(0.0807)	(0.0310)	(0.0347)	(0.0278)
NLTEAP	-0.0002	-0.0004	-0.0004	0.0013	0.0020	0.0001	-0.0061	-0.0185***	-0.0601***	0.0055***	0.0014	0.0020*
	(0.0008)	(0.0009)	(0.0009)	(0.0017)	(0.0022)	(0.0034)	(0.0040)	(0.0054)	(0.0103)	(0.0012)	(0.0010)	(0.0012)
CIRP	-0.0036***	-0.0032***	-0.0025***				-0.0337***	-0.0359***	-0.163**			
	(0.0009)	(0.0006)	(0.0007)				(0.0042)	(0.0053)	(0.0080)			
OVERTAP				-0.0969***	-0.1395***	-0.1174***				-0.4700***	-0.2180***	-0.0726***
				(0.0278)	(0.0276)	(0.0410)				(0.0409)	(0.0301)	(0.0270)
GDPPC	0.1118	0.0476	0.0086	1.3608***	1.2483***	1.3553**	1.1274**	0.7734	1.2624	0.9748***	0.8401***	0.8596***
	(0.1527)	(0.1412)	(0.1616)	(0.3305)	(0.3617)	(0.5387)	(0.5596)	(0.8813)	(1.4117)	(0.1991)	(0.1696)	(0.2202)
GDPG	0.0073	0.0064	0.0078	0.0185	0.0208	0.0066	-0.0008	0.0507	0.0801*	0.0133*	0.0179***	0.0099
	(0.0069)	(0.0057)	(0.0056)	(0.0127)	(0.0161)	(0.0255)	(0.0211)	(0.0363)	(0.0438)	(0.0080)	(0.0066)	(0.0082)
INF	0.0111*	0.0069	0.0020	0.0279**	0.0346**	0.0180	0.0236	0.0078	-0.0137	0.0048	0.0170***	0.0304***
	(0.0064)	(0.0050)	(0.0053)	(0.0139)	(0.0137)	(0.0301)	(0.0214)	(0.0374)	(0.0605)	(0.0086)	(0.0095)	(0.0110)
Intercept	2.3350**	3.0890***	4.3938***	-9.1863***	-7.8692***	-7.9290**	16.1682***	25.8697***	39.1674***	-6.0369***	-4.5954***	-3.4158**
	(1.0700)	(1.0043)	(1.1520)	(2.3847)	(2.5813)	(3.8228)	(3.9189)	(6.3775)	(10.4413)	(1.5068)	(1.2260)	(1.5832)
CFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	3031	3031	3031	3109	3109	3109	3235	3235	3235	3293	3293	3293

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively. See Table DI in appendix

D for variable definitions.

Table 3.IV compares the stability of conventional commercial banks and Islamic banks using conditional quantile regression. The dependent variables are the logarithm of Z-score (LnZS), the adjusted return on average assets (AROAA), and the components of Z-score (i.e. the return on average assets (ROAAP) and the total equity to assets ratio (TETAP). We present the 25th, 50th and 75th quantile of our dependent variables. This table also includes an array of control variables such as bank size (LnTA), fixed assets to assets (FATAP), cost to income (CIRP), overheads to assets (OVERTAP), logarithm of GDP per capita (GDPPC), GDP growth (GDPG), and inflation (INF). CFE and YFE are countries and years fixed effect dummy variables. IBDV is the Islamic bank dummy variable. We apply conditional quantile regressions with bootstrapping to estimate standard errors and confidence intervals for the parameter betas.

Table 3.V. Controlling for religion

Model # Quantiles	LnZS			AROA			LnZS			AROA		
	(1) 0.25	(2) 0.50	(3) 0.75	(4) 0.25	(5) 0.50	(6) 0.75	(7) 0.25	(8) 0.50	(9) 0.75	(10) 0.25	(11) 0.50	(12) 0.75
IBDV	-0.4963*** (0.1360)	-0.3810*** (0.1096)	-0.4897*** (0.0857)	-2.5309*** (0.3752)	-2.7333*** (0.3909)	-4.1971*** (0.4848)	-0.3689*** (0.0589)	-0.3063*** (0.0479)	-0.3525*** (0.0608)	-0.9879*** (0.1607)	-1.1309*** (0.1998)	-1.7456*** (0.2838)
LEGAL	1.4642*** (0.3578)	0.4765 (0.4118)	0.2136 (0.3885)									
LEGAL×IBDV	0.2148* (0.1213)	0.2517** (0.1088)	0.3515*** (0.1020)									
RELP				0.0207** (0.0090)	0.0088 (0.0110)	0.0019 (0.0179)						
RELP×IBDV				0.0211*** (0.0045)	0.0238*** (0.0046)	0.0331*** (0.0056)						
TBTI							0.0170* (0.0087)	0.194* (0.010)	0.0213*** (0.0074)			
TBTI×IBDV							0.0832*** (0.0293)	0.0827*** (0.0218)	0.1257*** (0.0289)			
IBS										-0.0256 (0.0168)	-0.0399** (0.0177)	-0.0472 (0.0320)
IBS×IBDV										0.0133* (0.0072)	0.0167** (0.0074)	0.0478 (0.0109)
LnTA	-0.0141 (0.0104)	-0.0066 (0.0126)	-0.0266** (0.0104)	0.0509** (0.0240)	0.1201*** (0.0317)	0.1315*** (0.0439)	-0.0322** (0.0137)	-0.0288* (0.0159)	-0.0584*** (0.0122)	0.0839*** (0.0196)	0.1242*** (0.0295)	0.1957*** (0.0409)
FATAP	0.0180* (0.0098)	0.0214*** (0.0059)	0.0131*** (0.0036)	0.0349* (0.0197)	0.0357** (0.0178)	0.0280* (0.0151)	0.0130 (0.0092)	0.0211*** (0.0061)	0.0132*** (0.0042)	0.0326* (0.0178)	0.0368** (0.0178)	0.0563*** (0.0162)
NLTEAP	-0.0005 (0.0009)	-0.0006 (0.0007)	-0.0004 (0.0009)	-0.0003 (0.0018)	-0.0001 (0.0023)	-0.0061* (0.0035)	0.0000 (0.0010)	0.0001 (0.0008)	-0.0006 (0.0008)	0.0008 (0.0018)	0.0016 (0.0022)	0.0004 (0.0034)
GDPPC	0.2535*** (0.0956)	0.1209 (0.1058)	0.1099 (0.1024)	0.4162* (0.0138)	0.1635 (0.2875)	0.0380 (0.4482)	0.2923* (0.1498)	0.0742 (0.1497)	-0.0113 (0.1554)	1.3586*** (0.3356)	1.2539*** (0.3805)	1.5742*** (0.5481)
GDPG	0.0089 (0.0062)	0.0034 (0.0051)	0.0068 (0.0047)	0.0234* (0.0138)	0.0381** (0.0158)	0.0210 (0.0240)	0.0098 (0.0063)	0.0058 (0.0054)	0.0069 (0.0052)	0.0243* (0.0143)	0.0197 (0.0164)	0.0164 (0.0255)
INF	0.0057 (0.0053)	0.0061 (0.0044)	0.0016 (0.0035)	0.0402*** (0.0136)	0.0623*** (0.0122)	0.0602** (0.0256)	0.0120** (0.0060)	0.0056 (0.0044)	0.0028 (0.0042)	0.0430*** (0.0143)	0.0457*** (0.0123)	0.0284 (0.0232)
Intercept	-0.4125 (0.9914)	1.6849 (1.1162)	2.8667*** (1.0649)	-5.3878** (2.5511)	-2.7732 (3.0914)	0.1327 (4.7372)	0.8693 (1.0378)	2.7924*** (1.0584)	4.0287*** (1.0555)	-8.6947*** (2.5205)	-6.6745** (2.8402)	-7.7537* (4.2489)
CFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YFE	No	No	No	No	No	No	No	No	No	No	No	No
Obs.	3089	3089	3089	3136	3136	3136	3107	3107	3107	3118	3118	3118

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively. See Table DI in appendix D for variable definitions.

Table 3.V compares the stability and the adjusted profits of conventional and Islamic banks using conditional quantile regressions. It investigates the impact of several religiosity factors on the stability of Islamic banks compared to conventional banks. The dependent variables are the logarithm of Z-score ($\ln ZS$) and the adjusted return on average assets ($AROA$). Table 3.V also presents the 25th, 50th and 75th quantile of our dependent variables. $IBDV$ is the Islamic bank dummy variable. $LEGAL$, $RELP$, $TBTI$, and IBS represent the legal system of each country, the percentage of the Muslim population in each country, a measure of too big to be ignored, and the share of a country's total banking assets held by Islamic banks, respectively. In addition, we include the interaction terms of $IBDV$ and the four variables mentioned above. This table also includes an array of control variables such as bank size ($\ln TA$), fixed assets to assets ($FATAP$), cost to income ($CIRP$), overheads to assets ($OVERTAP$), logarithm of GDP per capita ($GDPPC$), GDP growth ($GDPG$), and the inflation rate (INF). CFE and YFE are countries and years fixed effect dummy variables. $IBDV$ is the Islamic bank dummy variable. We apply conditional quantile regression with bootstrapping to estimate standard errors and confidence intervals for the parameter betas.

Table 3.VI. Banking regulation and Stability: Islamic vs. conventional banks

Panel A: Capital requirements												
Model #	Z-score (LnZS)						AROA					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantiles	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	-1.0710***	-1.5101***	-2.6923***	-1.0272***	-1.2223***	-2.6345***	-0.8042***	-0.9544***	-1.7767***	-0.8162***	-0.9078***	-1.6310***
	(0.2598)	(0.2277)	(0.3195)	(0.2187)	(0.1860)	(0.2620)	(0.1231)	(0.1420)	(0.2019)	(0.1208)	(0.1319)	(0.2083)
T1RP	-0.0083	-0.0156**	-0.0328***									
	(0.0080)	(0.0071)	(0.0101)									
T1RP×IBDV	0.0073	0.0135	0.0283**									
	(0.0095)	(0.0086)	(0.0125)									
TCRP				-0.0051	-0.0082*	-0.0223***						
				(0.0061)	(0.0046)	(0.0069)						
TCRP×IBDV				0.0065	0.0056	0.0209***						
				(0.0075)	(0.0056)	(0.0077)						
TECSTF							-0.0027**	-0.0047***	-0.0081***			
							(0.0463)	(0.0011)	(0.0018)			
TECSTF×IBDV							0.0014	0.0039**	0.0090***			
							(0.0016)	(0.0009)	(0.0026)			
TETLIP										-0.0035**	-0.0057***	-0.0068***
										(0.0017)	(0.0018)	(0.0024)
TETLIP ×IBDV										0.0031*	0.0051**	0.0068**
										(0.0018)	(0.0020)	(0.0028)
Intercept	-2.9392	-4.5111	-0.6299	-6.9901**	-9.4856***	-2.6330	-9.8301***	-7.9167***	-7.7127**	-9.7937***	-7.7182***	-8.7189**
	(3.9901)	(4.1192)	(5.3982)	(3.3342)	(3.5277)	(4.7629)	(2.3724)	(2.5426)	(3.8283)	(2.4042)	(2.5810)	(4.1080)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1781	1781	1781	2166	2166	2166	3062	3062	3062	3123	3123	3123

Panel B: Liquidity requirements												
Model #	Z-score (LnZS)						AROA					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantiles	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	-0.2423**	-0.1734**	-0.3440***	-0.3698***	-0.3253***	-0.3543***	-0.8583***	-1.1085***	-2.0643***	-0.9477***	-0.9985***	-0.8105***
	(0.1113)	(0.0720)	(0.1118)	(0.0965)	(0.0850)	(0.1306)	(0.1619)	(0.1975)	(0.0081)	(0.0021)	(0.2681)	(0.2267)
LATDBP	0.0031**	0.0032***	0.0029***									
	(0.0013)	(0.0008)	(0.0009)									
LATDBP×IBDV	0.0005	-0.0017	-0.0011									
	(0.0017)	(0.0012)	(0.0025)									
LATAP				0.0024***	0.0023**	0.0015						
				(0.0011)	(0.0010)	(0.0012)						
LATAP×IBDV				0.0017	0.0020	0.0029						
				(0.0027)	(0.0027)	(0.0041)						
TETAP							-0.0061	-0.0174***	-0.0312***			
							(0.0048)	(0.0061)	(0.0081)			
TETAP×IBDV							0.0064	0.0163**	0.0346***			
							(0.0052)	(0.0067)	(0.0108)			
TLTAP										0.0035	0.0114*	0.0293***
										(0.0042)	(0.0059)	(0.0080)
TLTAP×IBDV										-0.0040	-0.0115*	-0.0326***
										(0.0047)	(0.0066)	(0.0098)
Intercept	2.5360	3.6611***	3.4276**	0.0727	2.0490**	3.4517***	-9.8459***	-8.2074***	-7.5774*	-10.5897***	-9.2496***	-10.8877***
	(1.7741)	(1.1520)	(1.4250)	(1.0655)	(1.0124)	(1.1247)	(2.6869)	(2.9882)	(4.0595)	(2.3451)	(2.6911)	(3.8487)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2146	2146	2146	3174	3174	3174	3136	3136	3136	3136	3136	3136

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively. See Table DI in appendix D for variable definitions.

Table 3.VI documents the regulatory determinants of stability and adjusted profits by comparing Islamic and conventional banks using conditional quantile regressions. It emphasizes the differences and the similarities between conventional and Islamic banks by investigating the influence of capital, liquidity and leverage on the stability of both banking system. The dependent variables are the logarithm of Z-score ($\ln ZS$) and the adjusted return on average assets (AR OAA). We present the 25th, 50th and 75th quantile of our dependent variables. It displays four measures of capital, two measures of liquidity and two measures of leverage. The capital ratios are: the tier 1 regulatory ratio (T1RP), the capital adequacy ratio or total capital ratio (TCRP), the equity to customers and short term funding (TECSTF) and bank equity to liabilities (TETLIP). The liquidity indicators are: liquid assets to total deposits and borrowing (LATDBP) and liquid assets to assets (LATAP). Leverage is measured by the equity to assets ratio (TETAP) and liabilities to assets ratio (TLTAP). BC and CC represent bank and country level characteristics. CFE and YFE represent country and year fixed effect dummy variables. The variables in bold represents the interaction between IBDV and the regulatory variables presented above. We use conditional quantile regressions with bootstrapping to estimate standards errors and confidence intervals for the parameter betas.

Table 3.VII. Banking regulation and stability: Islamic vs. conventional banks (classification by size)

Panel A: Capital requirements													
AROAA													
large banks						Small banks							
Model #	(1)	(2)	(3)	(4)	(5)	(6)	Model #	(7)	(8)	(9)	(10)	(11)	(12)
Quantiles	0.25	0.50	0.75	0.25	0.50	0.75	Quantiles	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	-0.9345**	-1.0877**	-3.3432***	-0.8589**	-1.3203***	-2.4161***	IBDV	-0.7231***	-1.0836***	-2.4590***	-0.5022**	-0.5530**	-0.5102
	(0.4134)	(0.5378)	(0.6449)	(0.4172)	(0.3326)	(0.6250)		(0.1966)	(0.2387)	(0.2972)	(0.2035)	(0.2471)	(0.3121)
T1RP	-0.0035	0.0144	-0.0279	-0.0038	-0.0044	-0.0176	TECSTF	0.0018	0.0004	-0.0096*	-0.0032**	-0.0047***	-0.0062***
	(0.0186)	(0.0234)	(0.0338)	(0.0083)	(0.0064)	(0.0115)		(0.0025)	(0.0037)	(0.0047)	(0.0014)	(0.0012)	(0.0018)
T1RP	-0.0000	-0.0197	0.0354	0.0062	0.0068	0.0540 **	TECSTF	-0.0068	-0.0078	0.0024	0.0010	0.0042**	0.0052**
×IBDV	(0.0236)	(0.0294)	(0.0380)	(0.0113)	(0.0081)	(0.0146)	×IBDV	0.0046	(0.0069)	(0.0098)	(0.0016)	(0.0018)	(0.0026)
Intercept	-4.3613	-2.7448	-5.0292	-1.8468	-7.1253	-10.4761	Intercept	-6.7428*	-10.1496**	-11.3774*	-11.7005***	-6.5409**	0.6405
	(4.6480)	(4.9146)	(7.2633)	(9.0445)	(8.7628)	(13.0759)		(3.7230)	(4.2914)	(5.6361)	(4.0098)	(4.3065)	
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1151	1151	1151	630	630	630	Obs.	1621	1621	1621	1441	1441	1441
IBDV	-0.4922	-0.9263*	-3.5671***	-0.7565**	-1.3376***	-2.8524***	IBDV	-0.6287***	-1.2211***	-3.1407***	-0.6402***	-0.5393***	-0.7046
	(0.4782)	(0.5000)	(0.8097)	(0.3352)	(0.2795)	(0.4621)		(0.2199)	(0.2622)	(0.3565)	(0.1900)	(0.1896)	(0.3471)
TCRP	0.0186	0.0117	-0.0325	-0.0062	-0.0073	-0.0190***	TETLIP	0.0152	0.0031	-0.0503***	-0.0046**	-0.0058***	-0.0084***
	(0.0177)	(0.0223)	(0.0343)	(0.0060)	(0.0054)	(0.0070)		(0.0092)	(0.0110)	(0.0161)	(0.0019)	(0.0020)	(0.0024)
TCRP	-0.0212	-0.0174	0.0498	-0.0012	0.0034	0.0389***	TETLIP	-0.0157	0.0005	0.0054	0.0041*	0.0057**	0.0075**
×IBDV	(0.0229)	(0.0274)	(0.0394)	(0.0082)	(0.0065)	(0.0086)	×IBDV	(0.0098)	(0.0116)	(0.0166)	(0.0021)	(0.0022)	(0.0030)
Intercept	-8.5159**	-7.1822	-8.3734	-6.6859	-11.0138*	-7.0813	Intercept	-5.7767	-8.7969**	-11.4485**	-8.9808**	-6.0288	0.6252**
	(4.0568)	(4.9896)	(7.4773)	(7.0682)	(6.6402)	(10.6579)		(3.8161)	(3.7195)	(5.1311)	(4.3030)	(3.9910)	(6.5104)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1301	1301	1301	865	865	865	Obs.	1647	1647	1647	1476	1476	1476
Panel B: Liquidity & Leverage requirements													
Z-score index (for liquidity) and AROAA (for leverage)													
large banks						Small banks							
Model #	(1)	(2)	(3)	(4)	(5)	(6)	Model #	(7)	(8)	(9)	(10)	(11)	(12)
Quantiles	0.25	0.50	0.75	0.25	0.50	0.75	Quantiles	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	-0.5171***	-0.7668***	-0.8403***	0.0300	0.0388	0.0630	IBDV	-0.6267***	-0.4975***	-0.4622***	0.0774	-0.0185	0.1501
	(0.5171)	(0.1417)	(0.1382)	(0.1702)	(0.1348)	(0.1168)		(0.1370)	(0.1111)	(0.1307)	(0.1488)	(0.1295)	(0.1355)
LATDBP	0.0048**	0.0029	0.0036**	0.0019	0.0041***	0.0035***	LATAP	0.0027	0.0028	0.0029	0.0018	0.0015	0.0032
	(0.0022)	(0.0021)	(0.0017)	(0.0015)	(0.0009)	(0.0008)		(0.0023)	(0.0020)	(0.0018)	(0.0015)	(0.0014)	(0.0012)
LATDBP	0.0033	0.0099**	0.0086**	-0.0009	-0.0043***	-0.0053***	LATAP	0.0090*	0.0069*	-0.0040	-0.0083**	-0.0058*	-0.0044
×IBDV	(0.0038)	(0.0039)	(0.0044)	(0.0022)	(0.011)	(0.0013)	×IBDV	(0.0051)	(0.0038)	(0.0049)	(0.0041)	(0.0021)	(0.0033)
Intercept	1.9866	2.7688	0.5406	0.1375	5.7670**	6.6901	Intercept	1.5375	2.3416	1.8199	-1.5425	3.5460*	3.8614**
	(1.9666)	(1.7044)	(1.3130)	(4.2018)	(2.3933)	(4.1291)		(1.5588)	(1.5534)	(1.2670)	(2.2107)	(1.8164)	(1.6684)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1381	1381	1381	765	765	765	Obs.	1633	1633	1633	1541	1541	1541
IBDV	-0.5697**	-1.2645***	-3.3168***	-0.6454***	-0.6638**	-0.8794*	IBDV	-4.4914***	-2.7673***	0.4279	-0.9467***	-0.6148*	-0.8533**
	(0.2814)	(0.3321)	(0.4279)	(0.2005)	(0.2841)	(0.0744)		(0.7579)	(0.7180)	(0.5961)	(0.2989)	(0.3185)	(0.3684)
TETAP	0.0213*	0.0123	-0.0563**	-0.0076	-0.0137*	-0.0251***	TLTAP	-0.0213	-0.0123	0.0563**	0.0061	0.0107	0.0242***
	(0.0125)	(0.174)	(0.0231)	(0.0056)	(0.0073)	(0.0089)		(0.0140)	(0.0149)	(0.0222)	(0.0042)	(0.0071)	(0.0130)
TETAP	-0.0187	0.0047	0.0791	0.0073	0.0129*	0.0200***	TLTAP	0.0187	-0.0047	-0.0791	-0.0067	-0.0465***	-0.0267***
×IBDV	(0.0173)	(0.0197)	(0.0639)	(0.0064)	(0.0071)	(0.0109)	×IBDV	(0.0180)	(0.0169)	(0.0752)	(0.0058)	(0.0088)	(0.0082)
Intercept	-7.1257*	-8.2292**	-12.2049**	-11.9805***	-7.1489*	0.3863	Intercept	-4.9961	-7.0019*	-17.8323***	-13.9058***	-8.4431**	-2.2608
	(3.7982)	(3.8885)	(5.7544)	(3.7149)	(3.9536)	(6.4137)		(3.6590)	(3.9395)	(5.7927)	(3.6514)	(3.9924)	(6.3983)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1647s	1647s	1647s	1489	1489	1489	Obs.	1647	1647	1647	1489	1489	1489

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively. See Table DI in appendix D for variable definitions.

Table 3.VII documents the regulatory determinants of stability and adjusted profitability by comparing Islamic and conventional banks according to their size using conditional quantile regressions. The dependent variables are the logarithm of Z-score (LnZS) and the adjusted return on average assets (AROAA). We present the 25th, 50th and 75th quantile of our dependent variables. It also displays four measures of capital, two measures of liquidity and two measures of leverage. The capital ratios are: the tier 1 regulatory ratio (T1RP), the capital adequacy ratio or total capital ratio (TCRP), the equity to customers and short term funding (TECSTF) and bank equity to liabilities (TETLIP). The liquidity indicators are: liquid assets to total deposits and borrowing (LATDBP) and liquid assets to assets (LATAP). Leverage is measured by the equity to assets ratio (TETAP) and liabilities to assets ratio (ILTAP). BC and CC represent bank level and country level characteristics. CFE and YFE represent country and year fixed effect dummy variables. The variables in bold represents the interaction between IBDV and the regulatory variables presented above. We use conditional quantile regression with bootstrapping to estimate standards errors and confidence intervals for the parameter betas.

Table 3.VIII. Banking regulation and stability: Islamic vs. conventional banks (classification by liquidity)

Panel A: Capital requirements													
AROAA													
High liquid			Low liquid			High liquid			Low liquid				
Model #	(1)	(2)	(3)	(4)	(5)	(6)	Model #	(7)	(8)	(9)	(10)	(11)	(12)
Quantiles	0.25	0.50	0.75	0.25	0.50	0.75	Quantiles	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	-1.4012***	-1.5774***	-3.0919***	-0.4214	-1.2867***	-2.3984***	IBDV	-0.7192***	-0.8827***	-1.3852***	-0.6902***	-1.2421***	-1.9369***
	(0.3249)	(0.3216)	(0.4728)	(0.3393)	(0.3642)	(0.5646)		(0.1789)	(0.1790)	(0.2846)	(0.1843)	(0.2333)	(0.3453)
T1RP	-0.0093	-0.0213***	-0.0237**	0.0048	-0.0181	-0.0362	TECSTF	-0.0035**	-0.0032**	-0.0051**	-0.0017	-0.0048**	-0.0097***
	(0.0088)	(0.0073)	(0.0108)	(0.0110)	(0.0121)	(0.0230)		(0.0018)	(0.0014)	(0.0022)	(0.0015)	(0.0020)	(0.0030)
T1RP	0.0069	0.0217**	0.0324*	-0.0093	0.0102	0.0182	TECSTF	0.0016	0.0030*	0.0143***	0.0002	0.0047	0.0088
×IBDV	(0.0099)	(0.0104)	(0.0171)	(0.0128)	(0.0147)	(0.0255)	×IBDV	(0.0019)	(0.0018)	(0.0037)	(0.0027)	(0.0034)	(0.0043)
Intercept	-7.0964	-5.2073	-1.8012	-2.5584	-8.0908	0.9808	Intercept	-10.699***	-8.0452**	-8.3141*	-6.4231*	-6.0472	-2.4463***
	(4.8966)	(4.5028)	(7.7133)	(5.6242)	(6.6074)	(9.3751)		(3.4648)	(3.8647)	(4.8430)	(3.6730)	(4.4577)	(7.5719)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	722	722	722	1059	1059	1059	Obs.	1497	1497	1497	1565	1565	1565
IBDV	-1.0960***	-1.2312***	-2.8877***	-0.6703**	-1.2958***	-2.3485***	IBDV	-0.7023***	-0.8805***	-1.3932***	-0.6523***	-1.1271***	-1.8914***
	(0.3044)	(0.3385)	(0.4161)	(0.3157)	(0.3489)	(0.4621)		(0.1818)	(0.1798)	(0.2936)	(0.1886)	(0.2434)	(0.3880)
TCRP	-0.0104	-0.0107	-0.0200**	0.0017	-0.0022	-0.0279*	TETLIP	-0.0029	-0.0050***	-0.0069***	0.0003	-0.0002	-0.0092
	(0.0073)	(0.0074)	(0.0093)	(0.0073)	(0.0095)	(0.0149)		(0.0023)	(0.0019)	(0.0025)	(0.0045)	(0.0059)	(0.0087)
TCRP	0.0063	0.0073	0.0296*	0.0009	0.0043	0.0145	TETLIP	0.0035*	0.0041**	0.0229**	0.0009	0.0040	0.0118
×IBDV	(0.0089)	(0.0091)	(0.0117)	(0.0101)	(0.0123)	(0.0185)	×IBDV	(0.0022)	(0.0020)	(0.0031)	(0.0049)	(0.0064)	(0.0089)
Intercept	-13.3384***	-11.8515**	-2.28947	-3.0736	-7.2046	-2.6707	Intercept	-10.978***	-7.2806**	-8.1368	-8.0901*	-8.4309*	-4.3754
	(4.2783)	(4.9730)	(7.1574)	(5.8993)	(6.6849)	(9.0007)		(3.4919)	(3.5086)	(5.0395)	(4.7100)	(4.5085)	(6.9517)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	933	933	933	1233	1233	1233	Obs.	1515	1515	1515	1608	1608	1608
Panel B: Leverage requirements													
AROAA													
High liquid			Low liquid			High liquid			Low liquid				
Model #	(1)	(2)	(3)	(4)	(5)	(6)	Model #	(7)	(8)	(9)	(10)	(11)	(12)
Quantiles	0.25	0.50	0.75	0.25	0.50	0.75	Quantiles	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	-0.8688***	-1.0020***	-1.9325***	-0.5847***	-0.8469***	-2.0165***	IBDV	-0.6706**	-0.4552**	-0.6061*	-2.0916***	-2.7290***	-1.5985***
	(0.2230)	(0.2618)	(0.4119)	(0.2248)	(0.2422)	(0.4812)		(0.2944)	(0.3335)	(0.3967)	(0.4691)	(0.5056)	(0.5842)
TETAP	-0.0104*	-0.0218***	-0.0370***	0.0087	0.0107	-0.0194	TLTAP	0.0105	0.0218***	0.0370***	-0.0017	-0.0123	0.0092
	(0.0063)	(0.0063)	(0.0090)	(0.0088)	(0.0107)	(0.0190)		(0.0068)	(0.0067)	(0.0094)	(0.0085)	(0.0097)	(0.0204)
TETAP	0.0099	0.0136**	0.0327**	-0.0056	-0.0073	0.0296	TLTAP	-0.0104	-0.0196**	-0.0327**	-0.0009	0.0089	-0.0127
×IBDV	(0.0056)	(0.0066)	(0.0137)	(0.0093)	(0.0118)	(0.0228)	×IBDV	(0.0073)	(0.0085)	(0.0138)	(0.0087)	(0.0111)	(0.0224)
Intercept	-10.5943***	-6.2974	-5.4710	-7.5156*	-9.9365***	-2.0794	Intercept	-11.5282***	-8.4758**	-9.1682	-7.2277*	-8.7224*	-3.1843
	(3.5536)	(0.1011)	(5.8974)	(4.0363)	(4.5656)	(7.1530)		(3.0958)	(3.5736)	(5.7988)	(4.3243)	(4.7433)	(7.0212)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1517	1517	1517	1619	1619	1619	Obs.	1517	1517	1517	1619	1619	1619

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively. See Table DI in appendix D for variable definitions.

Table 3.VIII document the regulatory determinants of stability and adjusted profits by comparing Islamic and conventional banks according to their liquidity position using conditional quantile regressions. We consider two subgroups of banks: highly liquid banks versus low liquidity banks. The dependent variables are the logarithm of Z-score ($\ln ZS$) and the adjusted return on average assets (AROAA). We present the 25th, 50th and 75th quantile of our dependent variables. It also displays four measures of capital and two measures of leverage. The capital ratios are: the tier 1 regulatory ratio (T1RP), the capital adequacy ratio or total capital ratio (TCRP), equity to customers and short term funding (TECSTF) and bank equity to liabilities (TETLIP). Leverage is measured by the equity to assets ratio (TETAP) and liabilities to assets ratio (TLTAP). BC and CC represent bank level and country level characteristics. CFE and YFE represent country and year fixed effect dummy variables. The variables in bold represents the interaction between IBDV and the regulatory variables presented above. We use conditional quantile regressions with bootstrapping to estimate standards errors and confidence intervals for the parameter betas.

Table 3.IX. Banking regulation behavior during the global financial crisis: Islamic vs. conventional banks

Model # Quantiles	AROA									LnZS		
	(1) 0.25	(2) 0.50	(3) 0.75	(4) 0.25	(5) 0.50	(6) 0.75	(7) 0.25	(8) 0.50	(9) 0.75	(10) 0.25	(11) 0.50	(12) 0.75
IBDV	-1.0094*** (0.1740)	-1.3462*** (0.1711)	-2.3102*** (0.2483)	-0.7451*** (0.1154)	-0.8142*** (0.1246)	-1.4739*** (0.1953)	-0.1756*** (0.1315)	-0.7831*** (0.1459)	-1.4768*** (0.2312)	-0.2706*** (0.0641)	-0.2535*** (0.0518)	-0.2697*** (0.0706)
T1RP	-0.0019 (0.0073)	-0.0026 (0.0061)	-0.0118 (0.0076)									
T1RP×GLOBAL	-0.0082 (0.0113)	-0.0115 (0.0082)	-0.0100 (0.0137)									
T1RP×GLOBAL ×IBDV	0.0090 (0.0086)	0.0096 (0.0061)	0.0171 (0.0117)									
TETLP				-0.0005 (0.0011)	-0.0011 (0.0013)	-0.0007 (0.0012)						
TETLIP×GLOBAL				-0.0013 (0.0027)	-0.0043* (0.0026)	-0.0059 (0.0042)						
TETLIP ×GLOBAL ×IBDV				0.0013 (0.0026)	0.0046* (0.0025)	0.0052 (0.0044)						
TLTAP							-0.0017 (0.0032)	0.0036 (0.0043)	0.0123** (0.0055)			
TLTAP ×GLOBAL							0.0059 (0.0044)	0.0005 (0.0052)	0.0023 (0.0087)			
TLTAP ×GLOBAL ×IBDV							-0.0007 (0.0021)	0.0005 (0.0022)	0.0025 (0.0041)			
LATAP										0.0024** (0.0012)	0.0028** (0.0011)	0.0015 (0.0012)
LATAP×GLOBAL										0.0005 (0.0020)	0.0007 (0.0016)	0.0003 (0.0018)
LATAP ×GLOBAL ×IBDV										-0.0042 (0.0035)	-0.0034 (0.0024)	-0.0001 (0.0030)
Intercept	-4.0137 (3.7266)	-5.3473 (4.6288)	-3.6309*** (5.6525)	-9.1206 (2.5603)	-8.4691*** (2.8898)	-9.8830** (4.2179)	-8.9206*** (2.4801)	-8.9736*** (2.7486)	-10.8429*** (4.1996)	0.3073 (1.1416)	2.3233** (1.0362)	3.2480*** (1.0445)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1781	1781	1781	3123	3123	3123	3174	3174	3174	3136	3136	3136

Robust standard errors are reported in parentheses. ***, **, * indicate significance at 1%, 5% and 10%, respectively. See Table DI in appendix D for variable definitions.

Table 3.IX documents difference and similarities between Islamic and conventional banks during the 2008 – 2009 financial crisis using conditional quantile regressions. Specifically, it investigates the impact of capital, liquidity and leverage on bank stability and adjusted profits during the subprime crisis. We present the 25th, 50th and 75th quantile of our dependent variables. We display two measures of capital, one measures of leverage and one measures of liquidity. The capital ratios are: the tier 1 regulatory ratio (T1RP) and the equity to liabilities (TETLIP). Leverage is measured by total liabilities to assets (TLTAP) while liquidity is measured by liquid assets to assets (LATAP). GLOBAL is a dummy that control for crisis period and equals 1 in 2008 and 2009, and 0 otherwise. CFE and YFE represent country and year fixed effect dummy variables. The variables in bold represents the interaction between IBDV, the crisis dummy, and the regulatory variables presented above.

Appendix D

Table D.I. Variable definitions and data sources

Variable	Definition	Sources
Dependent variables		
LnZS	Measure of bank insolvency calculated as the natural logarithm of $((ROAAP + TETAP)/SDROAA)$, where ROAAP is the return on average assets, TETAP represents equity to assets ratio, and SDROAA stands for standard deviation of return on average assets.	Authors' calculation based on Bankscope
AROOA	Measure of risk adjusted return on average assets. It is calculated as the return on average assets divided by the standard deviation of ROAAP	Authors' calculation
Independent variables		
<i>Regulatory variables</i>		
1. Capital requirements		
TCRP	This ratio is the capital adequacy ratio. It is the sum of bank tier 1 plus tier 2 as a percentage of risk weighted assets. According to Basel II rules, banks must maintain a minimum of 8% of capital adequacy ratio.	Bankscope and banks' annual reports
TIRP	Similar to capital adequacy ratio, tier 1 ratio. This measure of capital adequacy measures tier 1 capital divided by risk weighted assets computed under the Basel rules. Banks must maintain a minimum of tier 1 capital of at least 4%.	Bankscope and banks' annual reports
TECSTF	This is another ratio of bank capitalisation. It measures the amount of bank equity relative to bank deposits and short term funding.	Bankscope
TETLIP	This ratio is the equity funding of a bank balance sheet as a percentage of its liabilities. It is consider as another way to look into bank capital adequacy.	Bankscope
2. Liquidity requirements		
LATAP	The ratio of liquid assets to total assets refer to assets that are easily convertible to cash at any time without any constraints	Bankscope
LATDBP	The ratio of liquid assets to total deposits and borrowing. Similar to liquid assets to deposit and short term funding ratio, this ratio look also at the amount of liquid assets available not only for depositors but also for borrowers.	Bankscope
3. Leverage requirements		
TLTAP	The ratio of total liabilities to total assets measures the share of bank debt relative to bank assets. This ratio is also called debt ratio and considered a measure of bank risk	Bankscope
TETAP	This is the bank equity to assets ratio. It is the traditional measure of bank capital (leverage).	Bankscope
<i>Control variables</i>		
1. Bank control variables		
LnTA	The natural logarithm of total assets	Bankscope
FATAP	This is the ratio of bank fixed assets to total assets times 100	Bankscope
NLTEAP	It represents the share of bank net loans in total earning assets times 100	Bankscope
ROAAP	The profitability ratio is a measure of bank profitability at the operational level	Bankscope
CIRP	It is the share of bank costs to bank income before provisions times 100	Bankscope
OVERTAP	The percentage of bank overheads to total assets	Authors' calculation based on Bankscope
2. Country control variables		
GDPPC	The natural logarithm of GDP per capita	World development indicator (WDI)
GDPG	Growth rate of GDP	World development indicator (WDI)

Variable	Definition	Sources
INF	The consumer price index	World development indicator (WDI)
IBSP	Market share of Islamic banks in a country per year	Authors' calculation based on Bankscope
TBTI	$\sum_1^n (TBTF A_{year=1} + TBTF A_{Y=2} \dots + TBTF A_{Y=n})$. Each bank takes the value of 1 in each year if the bank's share in a country's total assets exceeds 10%. TBTI is the sum of these values over the sample period. Therefore, it varies between 0 and 6.	Authors' calculation based on Bankscope
RELP	The percentage of Muslim population of each country	Pew research center and the CIA world fact book
LEGAL	Takes the value of 0 if a country does not apply <i>Shariah</i> rules in its legal system, the value of 1 is <i>Shariah</i> law and other legal systems are considered, and the value of 2 if <i>Shariah</i> is the only accepted law	The CIA world fact book
GLOBAL	A dummy that equals 1 for 2007 and 2008 and 0 otherwise	Authors' calculation
IBDV	Equals 1 for Islamic banks, 0 otherwise	Authors' calculation

(continued)

This table documents the variables used in the study

**Chapter 4. Basel III and Efficiency of Islamic
banks: Does one solution fit all?
A comparison with conventional banks**

Abstract

This study examines the impact of the Basel III regulatory framework on the efficiency of Islamic and conventional banks using conditional quantile regressions. We find that Islamic banks are significantly more efficient than conventional banks. We also find that Basel III requirements for higher capital and liquidity are negatively associated with the efficiency of Islamic banks while the opposite is true for financial leverage. Our results are even stronger when examining small and highly liquid banks. Furthermore, we find that higher capital and liquidity positions resulted in better efficiency for conventional than Islamic banks during the subprime crisis.

1. Introduction

Since the passing of the first Basel regulatory framework, followed by Basel II and more recently Basel III, banking regulatory guidelines have consistently been directed toward imposing more stringent requirements. For instance, Basel III requires banks to hold more capital of good quality. It also introduces two liquidity ratios (i.e. the Liquidity Coverage Ratio and the Net Stable Funding Ratio) to promote a more resilient liquidity profile for the banking system. Finally, the accord requires banks to maintain a simple non risk-based leverage ratio as a backstop and complement to risk-based capital ratios. Basel III will be introduced between 2013 and 2019 following several preparatory phases (Basel Committee on Banking and Supervision (BCBS, 2011))¹⁰⁷. The purpose of this paper is to anticipate how this new accord will impact the efficiency of Islamic banks compared to conventional banks.

New banking guidelines are almost always introduced in response to catastrophic financial events (Banker, Chang and Lee, 2010). For instance, Basel III was proposed following the failure of Lehmann Brothers and many other financial institutions that were acquired while facing potential bankruptcy or being subject to a government takeover¹⁰⁸ as a result of a series of shocks during and after the 2007 – 2008 financial crisis. What is interesting is that even though financial reforms have become very complex and constraining (Haldane, 2012), financial crises have

¹⁰⁷ For instance, minimum capital requirements and capital conservation buffers should be at 8.625% in 2016 and 10.5% by 2019. Liquidity measures are much more complicated to introduce. Therefore, they will be implemented after longer periods of observation. For example, the liquidity coverage ratio will be fully active in 2019 after an annual raise of 10%, starting from a reduced level that equals 60% of minimum requirements in 2015 (BCBS, 2013) while the net stable funding ratio will be introduced in 2018 (BCBS, 2014). As for the leverage ratio, the disclosure requirements for banks start at the beginning of 2015 (BCBS, 2011).

¹⁰⁸ For example: American International Group, Fannie Mae, and Freddie Mac

become more devastating and consecutive. The 2007 – 2008 crisis was at a systemic level that destabilized the entire financial system in both the developed and developing world. Thus, it is often argued that the crisis has been the worst financial crisis since the Great Depression in the late 1920s/early 1930s. Despite what happened, it is interesting that, unlike conventional banks, Islamic banks were not directly affected by the crisis. Rather, Hamdan (2009) reveals that Islamic banks were largely insulated from the impact of the subprime crisis. Furthermore, research has shown that interest-free financial institutions are becoming increasingly important competitors of conventional banks. Accordingly, Hassan and Dridi (2010) argue that Islamic banks are becoming “*too big to be ignored*” in some countries reflecting their role as promising new players in the banking industry.

To investigate the impact of banking regulations and specifically the Basel III accord on the efficiency of conventional and Islamic banks, we follow Barth et al. (2013) and use a two stage data envelopment analysis (DEA) methodology. Specifically, in a first step, we compute and compare the efficiency scores of conventional and Islamic banks following the new methodology proposed by Johnes, Izzeldin, and Pappas (2013). Then, in a second step, we regress our efficiency scores on a series of proxies for capital, liquidity, and leverage using, for the first time, conditional quantile regressions.

We use an unbalanced panel of 4,473 bank-year observations over the period 2006 to 2012. Our results suggest that Islamic banks are significantly more efficient than conventional banks when compared to their own efficiency frontier. Capital and liquidity ratios are negatively associated with the efficiency of Islamic banks while leverage has a positive impact on the efficiency of Islamic banks. The effect is opposite for conventional banks. The results are even stronger when examining small and highly liquid Islamic banks. Because Islamic banks have to comply with *Sharia'a* law, they are prohibited from using derivatives and other non-*Sharia'a* products to increase capital and liquidity. On the other hand, leverage increases the efficiency of Islamic banks because they use profit sharing investment accounts (PSIA) which make them more prudent in terms of risk taking than conventional banks. Furthermore, we find evidence that Islamic banks are more capitalized, more liquid but less leveraged than conventional banks during crisis periods. However, requiring bank to hold higher capital and liquidity appear to be more beneficial for conventional banks' efficiency than Islamic banks during the subprime crisis. Our results persist in successive quantiles of efficiency.

Our research contributes to the existing literature in several ways. First, our study is the first to empirically examine how the Basel guidelines affect the efficiency of Islamic and

conventional banks and the first to employ conditional quantile regressions in a bank efficiency context. A quantile regression approach is preferable over other approaches in that it allows for an examination of whether less efficient banks react differently to banking regulations than highly efficient ones and vice versa. In addition, it is more robust to departures from normality. Second, we empirically investigate the main reasons behind the new rules on capital, liquidity, and leverage imposed by Basel III and whether they are appropriate for the business model of Islamic banks. Third, we shed some light on the consistency of the relationship between regulation and different quantiles of efficiency for Islamic banks and conventional banks by comparing small and large banks, highly liquid and less liquid banks, and banks that operates in crisis periods.

Our paper is structured as follows. Section 2 establishes the theoretical framework used in analyzing banking regulations. Section 3 discusses our methodology, presents our variables and describes our data set. Section 4 discusses our quantitative results, including our descriptive statistics, our baseline quantile regressions, and several robustness checks. Section 5 concludes.

2. Literature review

In this section we discuss the theoretical background regarding the efficiency of the banking sector. Accordingly, we discuss the relationship between banking regulations such as Basel III and the efficiency of conventional and Islamic banks.

2.1. BANKING REGULATION, EFFICIENCY, AND TESTED HYPOTHESES

Basel III requires banks to strengthen their capital buffers by enhancing “*the quantity, the quality, the consistency and the reliability*”¹⁰⁹ of their capital adequacy ratios. Some of the prior economic literature, however, offers a different view on the association between capital and efficiency¹¹⁰. For instance, Berger and Udell (2006) develop the *agency cost* hypothesis which

¹⁰⁹ From the speech of Stefan Ingves, Governor of the Sveriges Riksbank and Chairman of the Basel Committee on Banking Supervision at the Abu Dhabi Ninth High Level Meeting for the Middle East & North Africa Region organized by the Basel Committee on Banking and Supervision (BCBS), the Financial Stability Institute, and the Arab Monetary Fund (AMF) in Abu Dhabi, United Arab Emirates.

¹¹⁰ Several empirical studies argue that studying the relationship between capital and stability must be extended to encompass the performance of banking institutions (cf., Huges and Mester, 1998; Fiordelisi, Marques-Ibanez, and Molyneux, 2011). For instance, Lee and Hsieh (2013) emphasize the role of profitability by examining the impact of capital on the profitability and risk of the Asian banking sector. Their results suggest that the capital ratios of investment banks have a positive but marginal influence on their profitability (see also Pasiouras, 2008, and Barth et al., 2013). Their findings also show that in low income countries, bank capital has a significantly positive effect on

suggests that high leverage or low capital ratios diminish agency costs and ameliorate efficiency. Under this hypothesis, higher financial leverage alleviates the agency costs of outside equity and encourages bank managers to act more closely in line with the interest of shareholders. This is due to the fact that a high degree of leverage imposes a liquidation problem which may lead to a reduction of manager bonuses and salaries and a deterioration of managers' reputation. Ultimately, this threat requires managers to attract even more debt and engage in riskier activities to satisfy shareholders' appetite for higher income as a way to compensate for their engagement in riskier activities. Furthermore, the existence of deposit insurance, governmental guarantees, and bailouts (e.g. the notion that some banks are *too big to fail*) creates additional incentives for bank managers and shareholders to take on excessive leverage, as higher profits are considered a substitute for capital requirements in protecting the bank. For this reason, regulatory authorities tend to be more flexible with highly efficient banks in terms of capital and leverage (Fiordelisi, Marques-Ibanez, and Molyneux, 2011). Although the *agency cost* hypothesis alleviates agency problems between managers and shareholders by relying on outside equity, excessive leverage behavior cannot persist without eventually putting the firm at risk of default. For instance, the subprime crisis has shown that excessive leverage not only amplifies agency conflicts between bank shareholders and debt holders but also severely damages public wealth by requiring taxpayers to bail out financial institutions. Therefore, at some point the agency cost of outside debt outweighs the agency cost of outside equity resulting in higher total agency costs. This requires regulatory intervention and a demand for banks to hold more capital to diminish the agency cost of outside debt and the risky behavior of bank managers. Some early banking studies also claim that capital ratios should be negatively associated with bank performance by arguing that higher capital requirements may alter investor demands who tend to require lower rates of return. This is due to the fact that higher capital ratios alleviate banks' risk taking and cause investors to accept lower returns on their investments (Park and Weber, 2006). In this context, Altunbas et al. (2007) report a negative relationship between efficiency and bank capital (Staub, da Silva e Souza, and Tabak, 2010) and suggest that inefficient European banks hold more capital than efficient ones. Their results are in line with those obtained by Goddard et al. (2010) who argue that "*capitalized banks are less risky, and therefore tend to generate lower returns*".

However, the *moral hazard* hypothesis stands in contrast to the agency cost hypothesis and suggests that banks are required to hold more capital to reduce the *moral hazard* between bank managers and shareholders. Fiordelisi, Marques-Ibanez, and Molyneux (2011) argue that by doing

profitability. Finally, capital buffers in the Middle East are found to be the most positively correlated with profitability.

so, agency conflicts between managers and shareholders will be reduced. Examining an unbalanced panel of 5,227 bank-year observations in 22 European Union countries, Chortareas, Girardoneb, and Ventouric (2012) find that capital requirements have a positive effect on efficiency and a negative effect on costs. Their results suggest that higher capitalization alleviates agency problems between managers and shareholders. Hence, the latter will have greater incentives to monitor management performance and ensure that the bank is efficient. Staub, da Silva e Souza, and Tabak (2010) also test the moral hazard hypothesis and find that when banks hold more capital they are more cautious in terms of their risk behavior which can be channeled into higher efficiency scores. Likewise, investigating the efficiency of 14 Korean banks during the period from 1995 to 2005, Banker, Chang, and Lee (2010) show that the capital ratio is positively correlated with aggregate efficiency, technical efficiency, and allocative efficiency. Consistent with the moral hazard hypothesis¹¹¹, they argue that higher capital adequacy ratios reduce banks' portfolio risk which can lead to safer and better credit risk management practices (Niswander and Swanson, 2000) and consequently to a better performance of the entire banking system (Hsiao et al., 2010). This argument is also supported by Sufian (2010) who highlights the important role of capital requirements in maintaining and strengthening the capacity of financial institutions in developing countries to withstand financial crises.

Barth et al. (2013) is among the studies investigating the relationship between banking regulations and efficiency. Their results suggest that banking regulation, supervision, and monitoring are important determinants of bank efficiency. For instance, capital stringency and equity to asset ratios are positively associated with bank efficiency. According to Pasiouras, Tanna, and Zopounidis (2009), capital requirements can influence the efficiency of the banking system for several reasons. First, by definition banks are financial intermediaries that transform their inputs (i.e. investment deposits and *Amana* deposits in the case of Islamic banks) into outputs (i.e. mark-up transactions and profit loss sharing transactions in the case of Islamic banks). Therefore, capital stringency may influence the quantity and quality of lending activities. Second, requiring banks to commensurate their capital ratios with the amount of risk taken may affect how managers allocate their bank's asset portfolio and may alter the level of returns they are able to generate. Finally, banks capital requirements may shift banks' decisions regarding the mix of deposit and equity employ to finance their activities. In this context, Pasiouras (2008) investigates the impact of regulation and supervision recommended by Basel II on banks'

¹¹¹ Another possible explanation for the positive relationship between capital and efficiency is provided by Carvalho and Kasman (2005) and Ariff and Can (2008) who argue that efficient banks are more profitable and thus hold more capital buffers as retained profits.

technical efficiency. Using data for 1,008 banks from 113 countries, he examines the influence of capital adequacy requirements, information disclosure requirements, restrictions on banks activities, deposit insurance schemes, the disciplinary power of the authorities, and entry requirements on banks' technical efficiency using Barth et al.'s (2004) survey data. His findings suggest that technical efficiency increases with bank size, higher capitalization ratios, and lower loan activity. His results are in line with the results of Das and Ghosh (2006) and Barth et al. (2013) and show a positive association between capital buffers and bank efficiency.

As for Islamic banks, we are only aware of one study (Alam, 2012) that examines the conflicted relationship between banking regulations, risk, and efficiency between conventional banks and Islamic banks. Using data on capital, liquidity, risk and efficiency, he argues that Islamic banks are more adaptable to regulatory requirements than their conventional peers. Moreover, he finds a negative relationship between capital buffers and risk for both bank categories and a positive relationship with bank efficiency confirming the results of Pasiouras (2008, 2009), Chortareas, Girardoneb, and Ventouric (2012), and Barth et al. (2013).

Based on the two hypotheses mentioned above, Islamic banks can benefit from applying profit loss sharing (PLS) principles to investment account holders (IAHs). This way, they can take on more leverage and generate higher profits to satisfy shareholders at the expense of IAHs who bear any potential losses. Accordingly, bank managers and shareholders may continue to attract more IAHs and take on more leverage which reduces the agency costs between both parties. This implicit agreement provides higher profits to Islamic bank shareholders while it ameliorates the reputation, salary and bonuses of Islamic banks managers. In other words, the investment accounts of Islamic bank may be used as leverage to maximize bank profits at the expense of bank IAHs and the banks' capital position. This suggests that higher leverage and thin capital ratios ameliorate Islamic bank efficiency, supporting the agency cost hypothesis of Berger and Di Patti (2006). In addition, Islamic banks can benefit from capital buffers in the form of retained profits (Carvallo and Kasman, 2005; Fiordelisi, Marques-Ibanez, and Molyneux, 2011).

However, on a practical level, Islamic banks cannot always channel losses to IAHs because eventually they will no longer invest with Islamic banks. This could generate a massive withdrawal of investors' money causing liquidity and solvency problems. One solution is that Islamic banks maintain profit smoothing reserves¹¹². By doing so, Islamic banks can channel retained earnings from these reserves to remunerate IAH accounts in case of investment losses to

¹¹² Islamic banks use two reserves: Investment Risk Reserves (IRR) and Profit Equalization Reserves (PER) to smooth profit returns of IAHs and thereby minimize withdrawal risk.

avoid any possible withdrawals, especially when competing with conventional banks. Yet, Islamic banks need to adjust their equity base in case of severe losses or when their reserves are no longer capable of providing profits to IAHs. As a result, they may decide to maintain higher capital ratios than conventional banks to avoid any possible solvency problems. This can also create a disincentive against leverage and risky behavior thereby supporting the moral hazard hypothesis. Chortareas, Girardoneb, and Ventouric (2012) argue that higher capital ratios alleviate agency problems between bank managers and shareholders and provide greater incentives to shareholders to monitor management performance and ensure that the bank is efficient.

Based on the results of these empirical studies, together with other research that focuses on the performance of the banking system using financial ratios¹¹³ (Berger, 1995; Jacques and Nigro, 1997; Demirguc-Kunt and Huizinga, 1999; Rime, 2001; Staikouras and Wood, 2003; Goddard et al. 2004; Ionnata et al., 2007; Pasiouras and Kasmidou, 2007; Kasmidou, 2008; Chortareas, Girardoneb, and Ventouric, 2012; and Lee and Hsieh, 2013), we formulate the following hypotheses:

Hypothesis 1.a: “Higher capital ratios increase the efficiency of Islamic banks compared to conventional banks”
(The moral hazard view).

Hypothesis 1.b: “Higher capital ratios decrease the efficiency of Islamic banks compared to conventional banks”
(The agency cost view).

The recent financial crisis reveals that capital standards are not sufficient to promote sound risk management (Housa, 2013). One major lesson of the subprime crisis is that liquidity plays a critical role in maintaining a resilient, healthy, and efficient banking system alongside with capital requirements. This observation led the Basel Committee on Banking and Supervision (BCBS) to introduce two separate but complementary liquidity measures, namely the *Liquidity Coverage Ratio (LCR)* and the *Net Stable Funding Ratio (NSFR)*. The purpose of these two indicators is to avoid and limit any short, medium or long-term liquidity shortages. Housa (2013) argues that these requirements are likely to have an important impact on the funding structure and profitability of banks around the globe. Despite the importance of these new regulations, we find few studies that examine the impact of liquidity on bank efficiency.

¹¹³ In particular, prior research was focused on the return on average assets (ROAA), the return on average equity (ROAE), the net interest margin (NIM), and the cost to income ratio (CIRP).

Relying on the European context, Chortareasa, Girardoneb, and Ventouric (2012) contend that liquidity is significantly positively correlated with net interest margins, technical efficiency, and lower cost to income ratios. Likewise, Altunbas et al. (2007) and Johnes, Izzeldin, and Pappas (2013) find a positive association between liquidity and conventional bank efficiency while Hassan and Dridi (2010) argue that Islamic banks should be prudent when considering the Basel liquidity requirements, as the liquidity management of these banks is still in its infancy. Therefore, such requirements may put Islamic banks at a disadvantage relative to their conventional counterparts. However, Belans and Hassiki (2012) find a positive correlation between conventional and Islamic banks' liquidity and efficiency at the 1% and 10% significance level, respectively. These findings are consistent with those by Lee and Hsieh (2013) who find a positive relationship between liquidity and profitability. Belans and Hassiki (2012) provide two explanations for their results: First, big clients as well as investors and borrowers prefer banks that have a healthy ratio of liquid assets to customer and short term funding; second, Islamic banks tend to hold more cash in preparation for any potential withdrawals.

Islamic banks face several challenges regarding their funding structure. Therefore, holding surplus liquidity may have a perverse effect on their efficiency (Olson and Zoubi, 2008; Chong and Liu, 2009). For example, Srairi (2008) finds a negative association between Islamic bank liquidity and profitability. He explains that Islamic banks are restricted to investment choices since they have to comply with *Sharia'a* law; as a result, higher liquidity decreases profitability due to the opportunity cost of not using these funds in their investment activities. Williams and Nguyen (2005) explain the mixed results for the impact of liquidity on bank efficiency. On one hand, they argue that a positive and significant relationship is expected when bank loans are used to diversify bank portfolio risk. On the other hand, a negative and significant association might exist when loans end up as non-performing loans or maturity mismatches (Vento and Ganga, 2009). Moreover, Das and Ghosh (2006) argue that holding a higher proportion of liquidity buffers may be considered a signal of poor quality of bank cash management. Finally, Alam (2012) reports mixed results when examining the impact of bank liquidity on bank efficiency. Specifically, he finds that inefficient Islamic banks are more liquid, while inefficient conventional banks are less liquid and concludes that liquidity is positively linked to Islamic banking system inefficiency. Accordingly, we examine the following hypothesis:

Hypothesis 2.a: "Higher liquidity requirements increase the efficiency of Islamic banks compared to conventional banks".

Hypothesis 2.b: “Higher liquidity requirements decrease the efficiency of Islamic banks compared to conventional banks”.

Last but not least, Basel III recommends that banks reduce the use of leverage by imposing a non-risk based leverage ratio that works as a backstop¹¹⁴ to the risk-based capital measure (Brunsden, 2014). The extant literature has intensely examined the relationship between leverage requirements¹¹⁵ and risk following the meltdown of huge banking institutions during the 2008–2009 financial crisis (Männasoo and Mayes, 2009; Papanikolaou and Wolff, 2010; Hamza and Saadaoui, 2011; Pappas, Izzeldin, and Fuertes, 2012; Vazquez and Federico, 2012; and Blundell-Wignall and Roulet, 2012). It was very clear that a risk-based capital adequacy ratio was not fulfilling its purpose because under Basel II guidelines, the assessment of bank risk¹¹⁶ was delegated to the banks themselves (Blum, 2008). Ironically, it is easy for banks to be shady when disclosing their real exposure to risk and it is unrealistic to expect banks to be honest in revealing their risk exposure. Blum (2008) demonstrates that the Basel II solution of risk disclosure “*may be illusory*” (p. 1706); hence, he calls for a combination of a risk-based capital ratio and an additional, risk-independent leverage measure. Blum’s recommendations are reflected in Basel III. As for the impact of leverage on bank efficiency and performance, Toumi, Viviani, and Belkacem (2011) refer to the “*pecking order*”¹¹⁷ hypothesis and the “*trade-off*” hypothesis to explain the conflicting results in the literature. The former states that firms have internal and external sources of financing. Accordingly, if a firm is profitable, it will rely on internal funding and avoid debt by replacing it with retained earnings. Thus, we can expect a negative association between bank profitability and leverage. The latter, however, assumes a positive correlation between bank performance and financial leverage as profitable banks prefer to hold more debt to benefit from their tax shield. This is in line with the *cost agency* hypothesis under which high leverage is expected to be positively associated with the efficiency of the banking system (Berger and Di Patti, 2006). However, excessive financial leverage also creates agency problems between bank managers and debt holders. At some level, leverage may generate a reverse effect and deteriorate bank efficiency, requiring regulatory intervention to impose more stringent capital requirements and

¹¹⁴ According to the president of the European Central Bank (ECB) Mario Draghi: “*The leverage ratio is an important backstop to the risk-based capital regime*”. Please visit <http://www.bis.org/press/p140112.htm>.

¹¹⁵ Leverage can be implemented differently between conventional banks and Islamic banks, especially because the latter use bank deposits (i.e. investment accounts) as a type of leverage. Accordingly, it is important to know that the depositors for Islamic banks are treated like investors. They do not only share profits with their banks (i.e. like interest in the conventional banking system) but also any losses that may occur.

¹¹⁶ See the Basel II Internal Rating Based Approach.

¹¹⁷ For more details, please refer to Myers and Majluf (1984).

ameliorate efficiency. For instance, Srairi (2008) and Belans and Hassiki (2012) find a positive relationship between efficiency, profitability and leverage for conventional and Islamic banks. Their results are consistent with the results of Oslon and Zoubi (2008) and Ho and Hsu (2010). Accordingly, we test the following hypothesis:

Hypothesis 3: “Higher leverage ratios increase the efficiency of Islamic banks compared to conventional banks”.

However, someone may also argue that a higher leverage position could eventually harm the efficiency of Islamic banks as it would for conventional banks. Therefore, the opposite effect may be observed.

Table 4.I, 4.II, and 4.III provide a summary of empirical studies that have examined the association between banking regulation and efficiency for both conventional and Islamic banks. In addition, an extensive literature review on bank efficiency is provided in Appendix E.

3. Data and methodology

3.1. DATA ENVELOPMENT ANALYSIS

Data Envelopment Analysis (DEA) was first introduced by Charnes, Cooper, and Rhodes (1978) as a method for performance evaluation (Gregoriou and Zhou, 2005). Denizer, Dinc, and Tarimcilar (2007) characterize DEA as “*a mathematical programming technique that measures the efficiency of a bank relative to a best-practice bank on the efficiency frontier*”. DEA was applied for the first time in a banking context by Shermen and Gold (1985). DEA research has proliferated during the two last decades; see Seiford and Thrall (1990), Berger and Humphrey (1997), and Berger (2007) who provide a review of its main developments.

The motivation for choosing DEA stems from the fact that there is an extensive amount of research on banking regulation based on regulatory surveys of the World Bank such as Barth et al. (2004, 2006, 2008) as well as on traditional financial ratios of performance (i.e. ROAA and ROAE). Our current study uses capital, liquidity, and leverage proxies derived from balance sheets combined with an efficiency frontier analysis¹¹⁸ as an advanced measure of bank performance and productivity (Sufian, 2006). Our goal is to investigate the impact of capitalization, liquidity, and leverage in light of Basel III on the conditional quantile of efficiency of conventional banks and Islamic banks following a two-stage DEA process.

¹¹⁸ Berger and Humphrey (1997) argue that frontier analyses make it easier to find and compare firms to their most efficient counterparts.

According to Berger and Humphrey (1997) and Mokhtar, Abdullah, and Al-Habshi (2007), DEA is an important measure that helps regulators and policy makers gauge the impact of regulatory guidelines on the performance and efficiency of the banking system owing to the special criterion of efficiency scores that catch a bank's individual performance compared to the performance of the entire banking industry. Furthermore, DEA is a non-parametric technique and does not require any distributional form of the error term, which makes it more flexible than traditional regression analysis (Drake, Hall, and Simper, 2006; Sufian, 2007; Mokhtar, Abdullah and Al-Habshi, 2007; and Barth et al., 2013). In addition, DEA relies on the individual assessment of every banking unit rather than considering the entire sample average, as compared with parametric ordinary regression models (Barth et al., 2013). Finally, DEA compares a single bank efficiency score to the most efficient one by creating a best efficiency frontier¹¹⁹. It can be used by choosing any type of input and output that captures managerial interest (Avkiran, 1999). In other words, DEA enables banks to identify whether they are using excessive inputs or generating fewer outputs compared to the benchmark.

In order to construct the DEA efficiency frontier of conventional banks and Islamic banks, we consider an input-oriented technique. The extant literature shows that DEA modeling can be performed by following either an input- or output-oriented approach. Although there is no general consensus that defines the choice of inputs and outputs, the banking literature has focused on employing an input-oriented¹²⁰ approach (Isik and Hassan, 2003; Denizer, Dinc, and Tarimcilar, 2007; Das and Ghoshb, 2009; Hsiao et al., 2010; Banker, Chang, and Lee, 2010; Chortareas, Girardoneb, and Ventouric, 2012; and Barth et al., 2013) rather than an output-oriented¹²¹ approach (Abdul-Majid, Saal, and Battisti, 2010; and Qureshi and Shaikh, 2012) when calculating efficiency scores. Indeed, using an input-oriented approach appears to be logical since financial institutions such as banks are cost minimizing institutions, where outputs are normally determined by external demand and factors, which banking institutions cannot control

¹¹⁹ We follow Johnes, Izzedin, and Pappas (2009, 2013). The distinctive feature about these studies is that they redefine efficiency by distinguishing between two main subcategories: First, gross efficiency (i.e. a common frontier for both bank categories) which includes both the quality of bank management and the efficiency arising from the bank type. Second, net efficiency (i.e. a specific frontier for each bank category) which represents the difference between gross efficiency and type efficiency (see Johnes, Izzeldin, and Pappas, 2013). In practical terms, this means that conventional banks and Islamic banks should be compared to their own efficiency frontiers.

¹²⁰ The input-oriented approach aims to reduce the amount of banking inputs while keeping the amount of banking outputs constant.

¹²¹ The output-oriented approach aims to maximize a bank's level of outputs without increasing the quantity of inputs.

(Kumbhakar and Lozano-Vivas, 2005; Sufian, 2006; Chortareasa, Girardoneb, and Ventouric, 2012). In addition, we use an input-oriented DEA with Variable Returns to Scale¹²² (VRS) as proposed by Banker, Charnes, and Cooper (1984)¹²³ rather than the traditional Constant Return to Scale¹²⁴ (CRS) approach employed by Charnes, Cooper, and Rhodes (1978). CRS efficiency provides a measure of Overall Technical Efficiency¹²⁵ (OTE) while VRS efficiency measures Pure Technical Efficiency¹²⁶ (PTE). In addition, a CRS model should only be used in a context where all banking institutions work at an optimal scale (Rozman, Wahab, and Zainol, 2014). Clearly this is not the case because operating at an optimal scale requires efficient markets with no moral hazard behavior or information asymmetries.

The efficiency scores of conventional and Islamic banks are calculated relative to a common best-practice as well as a specific frontier that is estimated separately for each bank type and every single year of the covered period (Chortareasa, Girardoneb, and Ventouric, 2012; Johnes, Izzedin, and Pappas, 2013). *Ceteris paribus*, Sufian (2006) argues that polling data separately for each year is important in estimating efficiency scores for two reasons: First, in contrast to regressions, DEA efficiency scores reflect yearly observations for each bank and assume that each bank optimizes its own productivity; second, because the banking environment is very dynamic, a bank might be efficient in the first year but inefficient in the following year. Hence, a yearly best practice frontier might reveal significant changes over time. In addition, similar concerns may arise on a country level. We do not pool our data for each country because the rules under which Islamic banks¹²⁷ (i.e. *Sharia'a* principles) and conventional banks work are the same regardless of location.

¹²² Commonly known as the BCC model. It refers to Banker, Charnes, and Cooper (1988).

¹²³ The authors argue that *“the CRS technique is efficient when all units (i.e banks) are operating at an optimal level but due to constraints on finance and imperfect competition, units may not be working at an optimal level”*. In addition, Coelli (1996) argues that using the CRS specification does not separate between Pure Technical Efficiency (PTE) and Scale Efficiency (SE). Moreover, the VRS model allows for Increasing (IRS), Decreasing (DRS) and Constant Returns to Scale (CRS).

¹²⁴ Commonly known as the CCR model. It refers to Charnes, Cooper, and Rhodes (1978).

¹²⁵ The CCR model of efficiency computes efficiency scores by including scale efficiencies (SE). Accordingly, this type of efficiency is known as overall technical efficiency (OTE).

¹²⁶ The VRS model of efficiency, in contrast to CCR, identifies pure technical efficiency (PTE) scores by separating the scale efficiency effects.

¹²⁷ Also refer to Berger (2007) who argues that there are three possible approaches which can be used when calculating a common frontier: (1) comparing bank efficiency to a best practice common frontier, (2) comparing similar banks to their own country specific frontier and, (3) comparing different bank categories to their own country specific DEA frontier. Although Berger (2007) recommends the use of the third category, we cannot compute

As we follow an input-oriented DEA approach with VRS, we measure the efficiency for each bank using the following linear programming:

$$\theta^* = \min \theta \tag{1}$$

Subject to

$$\sum_{j=1}^n \lambda_j x_{ij} \leq \theta x_{i0} \quad i = 1, 2, 3, \dots, m;$$

$$\sum_{j=1}^n \lambda_j y_{rj} \geq y_{r0} \quad r = 1, 2, 3, \dots, s;$$

$$\sum_{j=1}^n \lambda_j = 1$$

$$\lambda_j \geq 0 \quad j = 1, 2, 3, \dots, n.$$

Where θ is the efficiency score of the bank under evaluation, and x_{i0} and y_{r0} are the i th input and the r th output for this bank. Both $\sum \lambda_j x_{ij}$ and $\sum \lambda_j y_{rj}$ are the convex combinations of the possible values of the inputs and the outputs for each of the n banks under study. λ_j is the sum of assigned weights for inputs and outputs ($\sum \lambda_j = 1$ under the VRS assumption) while $j = 1, \dots, n$ corresponds to each of the n banks under evaluation. The objective is to reduce the number of inputs and keep the same level of outputs. Therefore, if $\theta^* = 1$, the observed input levels cannot be reduced, which indicates that the bank is efficient. If $\theta^* < 1$, the bank is considered inefficient because the same level of observed outputs can be achieved using lower amount of inputs.

3.2. CONDITIONAL QUANTILE REGRESSIONS¹²⁸

We use quantile regressions to test whether our measures of banking regulation and supervision have a homogenous effect on banks' technical efficiency. Estimating a whole set of

efficiency according to every country's best practice frontier because we have a small sample of Islamic banks. Also, we cannot compare efficiency scores of different countries because they are calculated and measured against different efficiency frontiers. Therefore, we only compare conventional and Islamic banks in similar countries and control for bank level and country level characteristics by following a second stage DEA technique.

¹²⁸ The quantile regressions methodology is already elaborated in chapter 3, section 3.2.

quantile functions provides a richer description of the heterogeneous relation between bank regulation and bank efficiency. Quantile regression results are robust to outliers and distributions with heavy tails. In addition, quantile regressions help avoid the restrictive assumption that the error terms are identically distributed at all points of the conditional distribution. The baseline quantile regression is given by:

$$Q(EFF_{ijt}|REG_{ijt}) = f(BR, BC \& CC) \quad (2)$$

where EFF_{ijt} is a measure of the pure technical efficiency of bank i in country j in year t . This variable is calculated by pooling data annually. Efficiency scores are estimated relative to a common frontier that includes conventional and Islamic banks (EFF1 and EFF2). This comparison gives an advantage to conventional banks as they are far more developed than Islamic banks. Therefore, we follow another approach by estimating our efficiency scores relative to each bank category's own efficiency frontier (EFF3 and EFF4) to ensure the robustness of our results (Johnes, Izzedin, and Pappas, 2009 and 2013). In other words, Islamic (conventional) banks are compared to their own benchmark (i.e. the most efficient Islamic (conventional) banks in a year). We also compute a basic efficiency score model in which we do not control for the risk in bank inputs in the first step (EFF1 and EFF3) and re-calculate our scores by introducing loan loss provisions to control for banking risk (EFF2 and EFF4). This strengthens the results regarding our dependent variable.

The exogenous variable vectors include four groups: (i) a list of regulatory variables (BR), (ii) bank level variables (BC), (iii) country level variables including macroeconomic factors (CC), and (iv) interaction, cross section, and time-series fixed effect variables. All variables are defined in Table EI in Appendix E.

3.3. REGULATORY DETERMINANTS OF BANK EFFICIENCY

As noted above, the vector BR represents banking regulatory requirements. The main difference between our study and the prior literature on banking regulation is that we use bank-level regulatory variables instead of aggregate, country, and time-invariant measures of regulation. In other words, we use variables that change across countries and years. For instance, Pasiouras (2008), Chortareas, Girardoneb, and Ventouric (2012), and Barth et al. (2013) use time invariant regulatory variables, which represent a critical limitation. Therefore, we collect bank level historical data that covers 29 countries during the period 2006 – 2012. Our dataset incorporates eight regulatory ratios to proxy for the impact of the new Basel III guidelines on the efficiency of banks. We refer to the Bankscope total capital ratio (regulatory capital ratio, TCRP) to examine

the impact of capital requirements on the efficiency of conventional and Islamic banks. We also use the tier1 capital ratio (T1RP) which is calculated in a similar fashion as the total capital ratio. An important difference between the traditional capital ratios and both the total capital and tier1 ratios is that Basel regulatory guidelines closely relate the level of bank capital to the underlying risk a bank faces. However, the assessment of their risk is done by banks themselves which creates incentives for them to hide their real exposure to risk and disclose untruthful information (Blum, 2008) about their capital adequacy position, as became clear during the subprime mortgage crisis. In addition to the two capital risk based measures mentioned above, we use the ratio of equity to liabilities (TETLIP) which provides another way of looking at bank capital adequacy and the ratio of equity to customers and short term funding (TECSTF) which measures the amount of equity available to cover for any potential mismatch of short term funding, as traditional non-risk based measures of capitalization.

As for liquidity, we use three ratios. The first one is the maturity match ratio (LADSTFP) provided by Bankscope to proxy the liquidity risk related to any potential mismatch between the assets and liabilities on a bank's balance sheet (Rajhi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013). The ratio is computed by dividing a bank's liquid assets by its deposits and short term funding. This ratio measures the risk that arises from different maturity profiles of liabilities and assets in financial institutions. A higher value means that a bank is more liquid. The second ratio is the ratio of liquid assets to assets (LATAP). One important feature of this ratio is that it provides a quick picture of the proportion of liquidity available to pay for short-term obligations. The third and final measure is the ratio of liquid assets to total deposits and short-term borrowing (LATDBP). Similar to LADSTFP, this ratio provides us with a general view of a bank's liquidity position by adding the amount of liquid assets available for borrowing in addition to deposits.

As for leverage, we employ the commonly used equity to assets ratio (TETAP) (Vazquez and Federico, 2012; Abedifar, Molyneux, and Tarazi, 2013). A leveraged bank can be considered at risk of bankruptcy because at some level, it will not be able to repay its debt, which can lead to difficulties in getting new funding for long term engagements. The last financial crisis has shown that excessive leverage jeopardizes bank health and consequently deteriorates the bank's financial position. Vazquez and Federico (2012) consider the TETAP ratio as being in line with the Basel III leverage framework.

BC is the vector of bank portfolio characteristics. We control for bank size using the natural logarithm of total assets (LnTA). Bigger banking institutions tend to be more efficient

(Pasiouras, 2008; Chortareasa, Girardoneb, and Ventouric, 2012; Beck, Demirgüç-Kunt, and Merrouche, 2013; Barth et al., 2013). We also use the ratio of fixed assets to assets (FATAP) and the ratio of net loans to total earning assets (NLTEAP) to control for the bank's financing activities (Beck, Demirgüç-Kunt, and Merrouche, 2013; Abedifar, Molyneux, and Tarazi, 2013). In order to investigate whether costs and profitability are positively or negatively associated with bank efficiency, we employ several measures of cost and profitability. Specifically, we use the cost to income ratio (CIRP), the net interest margin (NIMP), and overhead to assets (OVERTAP) to measure bank costs (Barth et al., 2004; Demirgüç-Kunt et al., 2004; Pasiouras, 2008; Čihák and Hesse, 2010; Chortareasa, Girardoneb, and Ventouric, 2012; Bourkhis and Nabi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013). We argue that higher costs are negatively associated with bank efficiency. Finally, we use a measure of bank profitability, namely the return on average assets (ROAAP) (Beck, Demirgüç-Kunt, and Merrouche, 2013; Abedifar, Molyneux, and Tarazi, 2013).

CC is a vector of country control variables used to control for macroeconomic conditions. We use the logarithm of GDP per capita (GDPPC) and GDP growth (GDPG) to measure economic development. For instance, a higher value of GDP growth reflects higher financial stability (Beck, Demirgüç-Kunt, and Merrouche, 2010; Anginer, Demirgüç-Kunt, and Zhu, 2014; Vasquez, and Federico, 2012). We also use the inflation rate (INF). Kasman and Yilirim (2006) propose that higher inflation may create incentives for banks to compete through excessive branch networks. Lee and Hsieh (2013) argue that with higher inflation rates banks tend to charge customers more, resulting in higher interest rates and bank profits. However, such behavior might be followed by less demand for loans and more expensive loan reimbursement leading to higher default rates (Koopman, 2009). Boyd, Levine, and Smith (2001) consider inflation as a signal for an undeveloped market and banking system (Chortareasa, Girardoneb, and Ventouric, 2012). Moreover, the CC vector controls for a country's degree of religion (DR). Following Abedifar, Molyneux, and Tarazi (2013), we use two indicators of religion: the share of a country's Muslim population (RELP) and a country's legal system (LEGAL) (i.e. a variable that captures to what extent a country applies *Sharia'a* law). Finally, we use the market share of total assets that Islamic banks hold relative to the total assets held by all banks in the banking system (IBS) as an indicator of Islamic bank concentration (Čihák and Hesse, 2010). In addition, we include country-year dummy variables to control for time and country heterogeneity. All explanatory variables are winsorized at the 1 and 99 percent level to mitigate the effect of outliers. Definitions and data sources for all variables are provided in Table EI in Appendix E.

3.4. DATA AND DEA INPUT – OUTPUT DEFINITION

The data used in this study is derived from five main sources. First, bank level financial characteristics for an unbalanced sample of 4473 bank-year observations (a total of 639 banks with 514 conventional banks and 125 Islamic banks) for 29 countries¹²⁹ over the period 2006 to 2012 are obtained from the Bankscope database of Bureau Van Djik. Second, bank level financial characteristics of 3,543 listed bank-year observations for 24 countries for 1995 to 2012 are obtained from the Osiris database of Bureau Van Djik.¹³⁰ Third, the 2012 World Development Indicator (WDI) database is used to control for macroeconomic conditions and financial development. Fourth, the Pew Research Center and the Word Fact Book are used to retrieve information about the Muslim population and legal system in each country. Fifth, we manually collect information on the total capital ratio and the tier1 capital ratio from the annual reports and financial statements of 125 Islamic banks for which the information is not entirely available in the Bankscope database.

The choice of inputs vs. outputs is still under debate in the efficiency literature¹³¹. We employ a combination of inputs and outputs as done by previous studies. The inputs are: deposits and short term funding (Isik and Hassan, 2003; Pasiouras, 2008; Johnes, Izzeldin and Pappas, 2009; Dasa and Ghoshb, 2009; Hsiao et al. 2010; Belans and Hassiki, 2012; Chortareasa, Girardoneb, and Ventouric, 2012; Barth et al., 2013; Johnes, Izzeldin, and Pappas, 2013; Rosman, Wahab, and Zainol, 2014), fixed assets (Drake and Hall, 2003; Dasa and Ghoshb, 2009; Johnes, Izzeldin, and Pappas, 2009; Sufian, 2010; Pappas, Izzeldin, and Fuertes, 2013; Rosman, Wahab, and Zainol, 2014), overhead as a proxy for general and administrative expenses and loan loss provisions as a proxy of risk (Drake and Hall, 2003; Sufian, 2007; Barth et al., 2013). The efficiency literature is divided around the incorporation of loan loss provisions versus equity to control for a bank's risk exposure. On one hand, researchers such as Johnes, Izzeldin, and Pappas (2009, 2013) propose to use equity as an indicator of risk taking. They argue that data on

¹²⁹ Specifically, our sample covers the following countries: Algeria, Bahrain, Bangladesh, Brunei, Egypt, Gambia, Indonesia, Iran, Iraq, Jordan, Kuwait, Lebanon, Malaysia, Mauritania, the Maldives, Oman, Pakistan, the Palestinian Territories, the Philippines, Qatar, Saudi Arabia, Singapore, Syria, Sudan, Tunisia, Turkey, UAE, UK and Yemen.

¹³⁰ Bankscope contains listed, unlisted and delisted banks while Osiris contains only publicly listed banks. We collect the data from Osiris because standard Bankscope licenses only provide access to data for 7 years while Osiris provides the data for 17 years but only for listed banks. The main objective of recollecting data from Osiris is to compute a TREND dummy to test whether capitalization and leverage have a downward or upward trend. We also employ the Osiris data to test for local crises – see the robustness tests in section 4.3.2.

¹³¹ Descriptive statistics for banks' inputs and outputs are available in Table EII in Appendix E.

loan loss provisions is more difficult to collect and may reduce the sample size because of data unavailability. On the other hand, Beck, Demirgüç-Kunt, and Merrouche (2013) point out that risk can be incorporated by including loan loss provisions in efficiency analyses. The outputs are: total loans (Canhoto and Dermine, 2003; Sathye, 2003; Ariff and Can, 2008; Johnes, Izzeldin, and Pappas, 2009; Hsiao et al., 2010; Staub et al., 2010; Pappas, Izzeldin, and Fuertes, 2013; Chortareasa, Girardoneb, and Ventouric, 2012; Barth et al., 2013), other earning assets (Isik and Hassan, 2003; Pasiouras, 2008; Johnes, Izzeldin, and Pappas, 2009; Abdul-Majid et al. 2010; Pappas, Izzeldin, and Fuertes, 2013; Barth et al., 2013; Chortareasa, Girardoneb, and Ventouric, 2012), and other operating income. Barth et al. (2013) argue that an important reason behind the inclusion of other operating income is to avoid any penalization of banks that largely rely on non-traditional activities in their investment portfolio.

4. Empirical results

4.1. DESCRIPTIVE STATISTICS¹³²

Table 4.IV, Panel A, shows that the sample¹³³ averages for EFF1, EFF2, EFF3, and EFF4 are 45.68%, 52.60%, 53.79% and 60.18%, respectively¹³⁴. EFF1 and EFF2 imply that, on average, Islamic banks are technically more efficient than conventional banks. The EFF1 average is 48.75% for the former and 45.01% for the latter. Similarly, the EFF2 average is 53.95% for Islamic and 52.35% for conventional banks. Our t-tests and Wilcoxon rank tests show that Islamic banks are marginally more efficient than conventional banks in terms of EFF1, while there is no significant difference in terms of EFF2.

Moreover, both tests for EFF3 show that Islamic banks are significantly more efficient than their conventional counterparts at the 1% significance level. Similar results are reported for

¹³² Some descriptive statistics in this section are similar to those in chapter 3

¹³³ We also compare efficiency scores by regions and countries' income level. See Table EIII in Appendix E.

¹³⁴ One reason for the low efficiency score is the inclusion of the United Kingdom in our sample. Some researchers argue that the United Kingdom should be excluded when comparing Islamic and conventional banks because UK banks are structurally very different from those in our remaining sample countries. Some studies such as Beck, Demirgüç-Kunt, and Merrouche (2013) include the UK when studying Islamic banks while others such as Abedifar, Molyneux, and Tarazi (2013) exclude the UK. Although the UK banking system is very different from the rest of our sample countries, we believe that the inclusion of the UK in our sample implies that Islamic banks exist and work in this country regardless of the environment and the macroeconomic structure of the system. Accordingly, excluding the UK might bias our results.

EFF4. Islamic banks become more efficient when compared to their own efficiency frontier (e.g. 76.54% and 70.54% instead of 53.95% and 48.75%). Similar patterns are reported for conventional commercial banks (e.g. 57.13% and 50.11% instead of 52.35% and 45.01%). By comparing each bank category to its own efficiency frontier, we show that the specificities of Islamic banks have a positive impact on their efficiency scores.

We conclude that: first, marginal differences exist when comparing Islamic banks and conventional banks to a common frontier; second, Islamic banks are significantly more efficient than conventional banks when compared to their own efficiency frontier; third, controlling for bank risk by including loan loss provisions in bank inputs ameliorates the efficiency scores for both bank categories.

Third, Table 4.IV, Panel B, describes the set of regulatory variables. The descriptive statistics indicate that Islamic banks are more capitalized than conventional banks. The total capital ratio (TCRP) sample average is 22.13% with an average of 20.14% for commercial banks and 29.95% for Islamic banks. Similarly, the tier1 ratio (T1RP) has an average of 16.82% for commercial banks and 27.83% for Islamic banks. On average, Islamic banks have significantly higher TCRP and T1RP than commercial banks. Furthermore, non-risk based capital measures show that the equity to liabilities ratio has an average of 20.43% for commercial banks and 59.57% for Islamic banks. Likewise, the ratio of equity to deposits and short term funding has an average of 24.82% for commercial banks and 62.92% for Islamic banks.

As for liquidity ratios, we find that the average liquid assets to deposits and short term funding ratio (LADSTF) is 76.12% for Islamic banks and 49.20% for commercial banks. In addition, the average liquid assets to assets ratio (LATAP) is 27.84% for Islamic banks and 31.99% for commercial banks. Further, we find that the average liquid assets to total deposits and borrowing (LATDBP) is 45.56% for Islamic banks and 37.52% for conventional banks. Our t-tests and Wilcoxon tests show a significant difference for the three liquidity ratios.

The equity to assets ratio varies strongly with an average of 26.83% for Islamic banks and 14.57% for conventional banks. Our results suggest that Islamic banks do engage in leverage activities but at a significantly lower level (higher capital) than conventional banks.

Finally, Table 4.IV, Panel C, provides information on our bank level and country level control variables. The logarithm of total assets (LnTA) shows that conventional banks are bigger than Islamic banks with a mean of 14.58 for the former and 13.85 for the latter (Čihák and Hesse, 2010; Molyneux, and Tarazi, 2013; Bourkhis and Nabi, 2013). We include the ratio of

fixed assets to assets (FATAP) to control for the opportunity costs that “*arise from having non-earning assets on the balance sheet*” (Beck, Demirgüç-Kunt, and Merrouche, 2013). We find that Islamic banks hold more fixed assets than conventional banks. The net loans to total earning assets ratio (NLTEAP) shows that Islamic banks engage more in traditional financing activities than commercial banks. The NLTEAP ratio has an average of 56.70% for Islamic banks and 55.37% for conventional banks. The higher results for Islamic banks reflect the constraints imposed by *Sharia*'s law regarding their investments in other earning assets (Abedifar, Molyneux, and Tarazi, 2013).

We also consider several measures of bank cost and profitability. Islamic banks have a higher cost to income (CIRP) than conventional banks (Čihák and Hesse, 2010; Abedifar, Molyneux, and Tarazi, 2013; Beck, Demirgüç-Kunt, and Merrouche, 2013). However, the results of our Wilcoxon test suggest that conventional banks are marginally more cost efficient than Islamic banks. Other measures of bank cost are the net interest margin (NIMP) and the overhead to assets ratio (OVERTAP). Similar to CIRP, conventional banks are significantly more cost efficient than Islamic banks. As for profitability, we use return on average assets (ROAAP) with an average of 1.42% for Islamic banks and 1.11% for conventional banks. The results for ROAAP show insignificant differences between the profitability of Islamic and conventional banks.

Our country level results are provided in Table EIV in the Appendix. During our sample period, the mean GDP growth for our sample countries is around 4.12% while the mean inflation rate (INF) is 6.20%. The mean Muslim population (RELP) is 65.91% and the average market share of Islamic banks (IBSP) is 9.77% of the total assets of the entire banking sector¹³⁵.

4.2. MAIN RESULTS

4.2.1. Studying efficiency: Comparing Islamic and conventional banks

As shown in the previous section, our univariate tests suggest that there are significant differences in the efficiency of conventional commercial and Islamic banks when comparing them to their own frontier (i.e. EFF3 and EFF4) instead of a common efficiency frontier (i.e. EFF1 and EFF2). Those results also suggested significant differences regarding regulatory measures and other determinants of bank efficiency. In this section, we compare the efficiency of

¹³⁵ Islamic banks in countries like Iran have a market share of 100% as the full banking system is Islamic.

commercial and Islamic banks by employing quantile regressions. In a first step, we employ a basic quantile regression model:

$$Q(EFF_{ijt}|REG_{ijt}) = \alpha + \varphi \times IBDV + \delta \times \sum_{j=1}^N Country_j + \mu \times \sum_{t=1}^T Time_t + \varepsilon \quad (3)$$

Controlling for country-year fixed effects, we use an Islamic bank dummy variable (IBDV) that takes a value of one for Islamic banks and zero for conventional banks to capture any differences between the two bank types. Table 4.V shows that Islamic banks are significantly less efficient than conventional banks when comparing both systems to a common frontier (Panel A, models 1, 4 and 5). For instance, Islamic banks are less efficient than conventional banks at the lower quantile of the efficiency distribution (Panel A, model 1) but are more efficient than conventional banks at the upper quantile of the efficiency distribution (Panel A, model 3). These findings suggest that the results are not uniform across quantiles. This first comparison, however, is somewhat unrealistic given that Islamic banks do not share the same objectives and rules under which conventional banks operate. Therefore, we report efficiency scores by comparing each bank category to its own efficiency frontier (EFF3 and EFF4). Accordingly, our quantile regressions now show that Islamic banks are significantly more efficient than conventional banks (Johnes, Izzeldin, and Pappas, 2009, 2013; Saeed and Izzeldin, 2014). Our results persist across quantiles from models (7) to (12).

In a second step, we control for bank level and country level characteristics. To do this, we include bank size (LnTA), fixed assets to assets (FATAP), three measures of cost (i.e. CIRP, NIMP and OVERTAP), and one measure of profitability (ROAAP). As for country-level controls, we use GDPPC, GDPG, and INF. Accordingly, we employ the following quantile regression model:

$$Q(EFF_{ijt}|REG_{ijt}) = \alpha + \varphi \times IBDV + \beta \times BC_{ijt} + \gamma \times CC_{jt} + \delta \sum_{j=1}^N Country_j + \mu \sum_{t=1}^T Time_t + \varepsilon \quad (4)$$

Table 4.V, Panel B, confirms the results reported in Table 4.V, Panel A EFF3 and EFF4 show that Islamic banks are more efficient than conventional banks when comparing each bank category to its own efficiency frontier (Table 4.V, Panel B, models 7 to 12). The bank level control variables show that bigger banks have higher efficiency scores. Barth et al. (2013) argue that the positive impact of bank size on efficiency is due to economies of scale (see also Viverita and Skully, 2007; Srairi, 2008; Belans and Hassiki, 2012). However, Beck, Demirgüç-Kunt, and

Merrouche (2013) find that bigger banks have lower returns on assets. We also find that higher fixed assets have a negative impact on bank efficiency. Therefore, a higher share of non-earning assets on bank balance sheets deteriorates efficiency scores because of the opportunity cost that arises from investing in fixed assets instead of loans, derivatives and other types of securities. The three measures of bank cost clearly show that higher cost deteriorates bank efficiency at successive quantiles and for almost all models. Chortareas, Girardone, and Ventouric (2012) explain the relationship between efficiency, cost of intermediation (i.e. net interest margin), and cost effectiveness (i.e. cost to income). For instance, a higher NIMP is a signal of poor and inefficient intermediation. Likewise, the inability to control operating expenses (measured by cost to income and overhead to assets) has a negative influence on bank efficiency (Belans and Hassiki, 2012). As for profitability, we find that ROAAP has a positive impact on bank efficiency (Panel B, models 1 to 3). The literature, however, is inconclusive regarding the relationship between profitability and efficiency. Pasiouras (2008) finds no significant relationship between return on equity and bank efficiency while Belans and Hassiki (2012) report a negative association between return on equity and the efficiency of conventional banks. Johnes, Izzeldin, and Pappas (2009) argue that profitability ratios should be considered as a supplement rather than as an alternative to efficiency scores as they measure performance from different angles. As for macroeconomic conditions, we find that GDP growth is positively associated with bank efficiency in almost all models while GDP per capita is also positively associated with the upper quantile of the efficiency distribution in models (6) and (12) suggesting that economic growth ameliorates banks' efficiency. Our results are consistent with the findings of Johnes, Izzeldin, and Pappas (2013) and Barth et al. (2013). Finally, we find some evidence that inflation has a positive impact on bank efficiency which marginally supports the argument of Lee and Hsieh (2013) who find that when inflation rates are high, banks tend to charge customers more, resulting in higher interest rates and bank profits.

In a third step¹³⁶, we examine the relationship between efficiency and three measures that control for the degree of religion (DR). Following Abedifar, Molyneux, and Tarazi (2013), we consider the share of the Muslim population in each country (RELP) and an index of its legal system (LEGAL). The third measure is a measure of Islamic banks' share of assets (IBS) for each

¹³⁶ From this point forward, we use EFF3 and EFF4 as sole measures of efficiency. The reason behind excluding EFF1 and EFF2 is that EFF3 and EFF4 provide a better discrimination between the efficiency of Islamic and conventional banks than EFF1 and EFF2. Also, it seems inappropriate to use efficiency scores of banks based on a common frontier as it may penalize Islamic or conventional banks by assuming that the two bank categories are equal.

year and country (Čihák and Hesse, 2010). To do this, we use the following quantile regression equation:

$$Q(EFF_{ijt}|REG_{ijt}) = \alpha + \varphi \times IBDV + \varphi^* \times IBDV \times DR_{jt} + \beta \times BC_{ijt} + \gamma \times CC_{jt} + \delta \times \sum_{j=1}^N Country_j + \mu \times \sum_{t=1}^T Time_t + \varepsilon \quad (5)$$

The interaction term φ^* is introduced to investigate whether religion, a country's legal system and the Islamic bank share in a given country ameliorate or deteriorate the efficiency of Islamic banks compared to conventional banks. After controlling for each of the three variables, Table 4.VI shows that IBDV remains positive and significant in all models. Abedifar, Molyneux, and Tarazi (2013) argue that Islamic banks may be more stable than conventional banks due to the religion of their clients. Their results show that religion impedes the credit risk of Islamic banks. The quantile regression results in Table 4.VI show that religion is positively associated with the efficiency of Islamic banks at the upper quantile of the efficiency distribution (model 3). This shows the superiority of high efficiency Islamic banks in attracting religious customers through their reputation, the low charge for offering Islamic services and the competitive products compared to low efficiency banks. We also find similar results regarding the interaction between legal system and the efficiency of Islamic banks at the median and the upper quantile of the conditional distribution of efficiency (models 5 and 6). We find that the more a country adopts *Sharia'a* law, the higher the efficiency of Islamic banks relative to conventional banks in that country. This is logical since applying *Sharia'a* law facilitates the work of Islamic banks. In addition, when examining the interaction between the market share of Islamic banks and efficiency, the results show that the presence of Islamic banks ameliorates the efficiency of the entire banking system. The results persist in all models (models 7, 8, 9) but only remain significant at the lower quantile of the efficiency distribution when an Islamic bank dummy is introduced (model 7). The result is negative at the upper quantile (model 9). This means that the positive results of the banking system are driven by Islamic banks at the lower quantile of the efficiency distribution. The higher market share of Islamic banks benefits Islamic banks with lower efficiency but damages Islamic banks with high efficiency. Such results would suggest that higher market share means higher market power and therefore a more dominant market position. According to the "*quit life hypothesis*" this makes banks less interested in Research and Development, and cost minimization, which reduces their efficiency as Turk-Ariss (2010a) claims. Hesse and Cihak (2010) find that a higher presence of Islamic banks in a banking system has a negative impact on their stability compared to conventional banks. Our finding is the first

to show a negative influence between the market share of Islamic banks and their efficiency scores. The finding persists when replacing EFF3 with EFF4 (Table 4.VI, Panel B) except for model (9) where the results become insignificant. Therefore, our findings provide evidence that it is crucial to study the influence of religion¹³⁷, legal system, and Islamic banks' share on the banking system across quantiles and between Islamic and conventional banks.

4.2.2. Studying efficiency and banking regulation: Comparing Islamic and conventional banks

In this section, we examine the impact of bank capital, liquidity, and leverage requirements on the efficiency of the banking sector with a focus on Islamic banking institutions. To do this, we use the following equation:

$$Q(\text{EFF}_{ijt}|\text{REG}_{ijt}) = \alpha + \varphi \times \text{IBDV} + \vartheta \times \text{REG}_{ijt} + \vartheta^* \times \text{REG}_{ijt} \times \text{IBDV} + \beta \times \text{BC}_{ijt} \\ + \gamma \times \text{CC}_{jt} + \delta \times \sum_{j=1}^N \text{Country}_j + \mu \times \sum_{t=1}^T \text{Time}_t + \varepsilon \quad (6)$$

In contrast to the existing literature, this is the first study that uses quantile regressions to compare the possible impact of regulation on various levels of efficiency quantiles of the banking system. Quantile regressions allow for a comparison of any heterogeneous effects (if they exist) of regulatory requirements on the efficiency of the Islamic banking system compared to the conventional banking system. ϑ^* illustrates the interaction between IBDV and three vectors of regulatory measures. The first vector represents capital requirements. It includes TCRP, T1RP, TETLIP and TECSTF. Table 4.VII, Panel A, presents our results. The second vector represents liquidity requirements. It contains LADSTFP, LATAP and LATDBP. Table 4.VII, Panel B, documents our results. It also shows the impact of leverage requirements where TETAP is used to control for financial leverage.

First, we examine the relationship between capital requirements and the efficiency of Islamic banks compared to commercial banks. Overall, our results show that Islamic banks are more efficient than conventional banks in almost all models. The interaction terms between IBDV and the two measures of capital to risk weighted assets show no significant difference between Islamic banks and conventional banks (Panel A, models 1 to 6). Yet, non-risk based capital measures (i.e. TETLIP and TECSTF) show that higher capital requirements are associated

¹³⁷ However, results of RELP dependent on banks' efficiency level.

with a lower efficiency for Islamic banks when compared to conventional banks. For example, a one unit increase in TETLIP and TECSTF decreases the efficiency of Islamic banks compared to conventional banks by 0.4773% and 0.1651% at the 75th percentile of the conditional distribution of efficiency, respectively (Panel A, models 7 to 12). It appears that capitalization has a negative impact on the efficiency of Islamic banks compared to conventional banks which stands in contrast to *hypothesis 1.a* and support the agency cost hypothesis which suggest that higher capital ratios negatively affect the efficiency of Islamic banks compared to conventional banks.

If we turn back to the *agency cost* hypothesis, banks tend to have higher financial leverage and thin capital ratios when depositors' money is guaranteed by a deposit insurance scheme. In the case of Islamic banks, depositors themselves are responsible when losses occur. As a result, managers' incentives towards risk taking and the exploitation of flat deposit insurance schemes (Demirgüç-Kunt and Santomero, 2001; Demirgüç-Kunt and Kane, 2002; Altunbas et al., 2007; Lee and Hsieh, 2013) may not exist for Islamic banks. Yet, the fact that Islamic banks do not have deposit insurance could make them even riskier as managers will engage more in leverage activities because depositors/investors are fully responsible if losses occur. According to the *agency cost* hypothesis, agency conflicts arise between debt holders and conventional bank shareholders when leverage surpasses a critical level. However, Islamic bank debt holders are mainly investment account holders who agree to bear losses. Theoretically speaking, investment account holders should bear losses because under *Sharia'a* rules, banks and investors work under a profit and loss sharing concept. Therefore, in this case and in contrast to the *agency cost* hypothesis, regulators should not intervene and require Islamic banks to raise more capital because raising capital is mainly a protection buffer against depositors' losses which is inadequate for the business model of Islamic banks. At a practical level, bearing losses by investment account holders of Islamic banks is not realistic because in case of a loss, investment account holders may withdraw their deposits and other investors will no longer invest their money with Islamic banks. Further, investors will likely shift their investments to conventional banks. Under these circumstances, Islamic banks become more vulnerable to withdrawal risk and thereby liquidity risk, especially in a competitive environment. In the end, banks in both categories share the same market. To avoid this, Islamic banks use a smoothing mechanism by channeling past profit reserves to investment account holders to reduce current losses. However, if losses are high, the equity base of Islamic banks will diminish forcing them to raise additional capital. Therefore, an excessive use of leverage by Islamic banks may reduce their equity base forcing them at some level to raise more capital at the expense of leverage and profits which may negatively influence their efficiency. This is one reason why Islamic banks hold more capital

buffers than conventional banks. Being excessively capitalized damages the efficiency of Islamic banks compared to their conventional peers. All in all, Islamic regulatory organizations such as IFSB¹³⁸ and AAOIFI¹³⁹ need to think about the reasons and theories behind implementing a capital risk ratio before adopting Basel III capital requirements for Islamic financial institutions.

In the banking literature, there is an arguing debate about whether there is a positive or negative relationship between capital requirements and efficiency. Regulators, such as the Basel Committee for Banking and Supervision (BCBS) argue for a positive association between efficiency and capital guidelines. However, the recent financial crisis showed that even though there was a lot of capital, at least by regulatory standards, banks were unable to absorb their losses¹⁴⁰. Accordingly, Blum (2008) argues that the Basel II solution of risk disclosure “*may be illusory*” (p. 1706). A difficult question that should be answered is that: given that banks’ activities, as well as the regulatory, macroeconomic and political environment, differ from one country to another, should the risk based capital requirements of banks around the world be similar to each other?

This question is very important because understanding whether investment banks should be treated like commercial banks or like Islamic banks, helps us determine the sensitivity of imposing unified global regulatory standards (e.g. the Basel III framework) for all banks including Islamic ones. Haldane (2012) criticizes the complexity of the new risk-based capital requirements recommended by Basel III. The author expresses concerns about the opacity of the risk weighted assets concept. He argues that the million-dimension of the new capital adequacy framework provides limitless scope for arbitrage. His findings show that the simple equity to assets ratio performs better than the tier1 capital ratio when studying the association between capital and risk. This poses another important question and that is: If regulators already failed to make Basel I and Basel II’s capital requirements foolproof, why should they perform better in this third time? This might be a reason why we find no significant difference in the impact of TCRP and T1RP on the efficiency of Islamic banks compared to conventional banks (panel A specifications 1 to 6). Maybe the IFSB and AAOIFI should learn from the mistakes of BCBS when adapting Basel rules to Islamic banks.

¹³⁸ The Islamic Financial Services Board (IFSB) was created in 2002 for the purpose of harmonizing regulatory and supervisory frameworks to ensure the soundness and stability of the Islamic financial industry. IFSB is similar to the Basel Committee for Banking and Supervision of conventional banks.

¹³⁹ The Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) was created 1990 in order to prepare accounting, auditing, governance, ethics and *Sharia’a* standards for Islamic financial institutions.

¹⁴⁰ According to the Economist, Lehman brothers had a tier1 capital ratio of 11% before its collapse.

Second, the interaction terms between IBDV and our liquidity measures provide evidence that higher liquidity decreases the efficiency of Islamic banks compared to conventional banks. This supports *Hypothesis 2.b* where liquidity impedes Islamic banks efficiency compared to conventional banks. For instance, a one-unit change of LADSTFP decreases Islamic banks' technical efficiency by 0.0563% compared to conventional commercial banks at the 25th percentile of the efficiency distribution and by 0.0813% at the upper tail of the conditional distribution of efficiency (Table 4.VII, Panel B, models 1 to 3). However, the results show only a single difference between both systems for LATAP and LATDBP at the upper tail of the efficiency distribution (Table 4.VII, Panel B, models 6 and 9). This means that the negative impact is even stronger with high efficiency Islamic banks. We are not surprised by the negative impact of liquidity on Islamic banks. Academics and practitioners have long argued that the nature of *Sharia'a* law imposes a great constraint on the liquidity risk management of Islamic banks (Ali, 2012). For instance, in a financial survey¹⁴¹ that was conducted to study the most pressing issues in the Islamic financial industry, Abdullah (2010) reports several challenges regarding the liquidity management of Islamic banks: First, a different interpretation of *Sharia'a* principles; second, poor cash management and lack of a powerful Islamic interbank money market; third, limitations regarding short term financing instruments and finally, a disparity of standard and accounting procedures and instruments. Hence, a higher maturity match by Islamic banks is related to their managerial choices (Pellegrina, 2008; Olson and Zoubi, 2008, Pappas, Izzeldin, and Fuertes, 2010). In this context, Pappas, Izzeldin, and Fuertes (2013) explain that large liquidity buffers are vital for Islamic banks for two reasons. First, Islamic banks suffer from limited access to liquidity due to *Sharia'a* constraints. Second, hedging instruments to mitigate liquidity risk such as the sale of debt are not allowed (Ali, 2012). Thus, the Islamic Financial Services Board (IFSB) should be prudent when implementing the Basel III liquidity framework. It is important to consider the specificities of the balance sheet structure of Islamic banks and the Islamic *Sharia'a* compliant principles (the profit loss sharing paradigm, weights assigned to assets and liabilities) as well as the constraints regarding short term liquidity instruments. Under these circumstances, the deficiency of liquidity management infrastructure by Islamic banks may be the reason behind the negative impact of liquidity on the efficiency of Islamic banks compared to their conventional counterparts. The latter are also exposed to liquidity risk, as became clear in the 2008 – 2009 financial crisis. Yet, conventional banks are far more developed in managing liquidity and maturity transformation activities. It is true that there are no *Sharia'a* constraints for conventional banks; however, by imposing two liquidity requirements on conventional banks,

¹⁴¹ For more information see Abdullah (2010).

Basel III is making an effort to reduce the usage of some toxic instruments that are used to sell debt and multiply leverage, by requiring banks to hold sufficiently high quality liquid resources over a horizon of 30 days. It also requires banks to hold a minimum amount of liquid and stable sources of funding relative to their asset position for a one year period. This arrangement aims to promote short term and long term stability and efficiency in the banking system. However, the results show that Basel III liquidity requirements may penalize the efficiency of Islamic banks compared to conventional banks.

Finally, the interaction term between IBDV and TETAP shows that higher leverage (lower equity to assets) is associated with higher efficiency for Islamic banks at the median and the upper quantile of the conditional distribution of efficiency supporting *Hypothesis 3*. A one unit change in leverage shows no significant difference between Islamic banks and conventional banks at the 25th percentile of the conditional distribution of efficiency while it increases the efficiency of Islamic banks by 0.5499% and 0.7633% at the 50th and 75th percentile of the conditional distribution of efficiency, respectively (Table 4.IX, Panel B, models 11 and 12). Therefore, highly leveraged Islamic banks tend to be more efficient than their conventional peers. Srairi (2008) argue that Islamic banks take on more risk than conventional banks because they tend to benefit from depositors' money (i.e. investment accounts). In the absence of a deposit insurance scheme, they channel these funds to invest in risky activities. This means that Islamic banks somehow use these deposits or investment accounts as leverage to maximize their profits. Yet, one major difference to conventional banks is that the incurred risk is also shared with depositors or investment account holders. If we refer to the *agency cost* hypothesis, higher leverage ameliorates bank efficiency (Berger and Di Patti, 2006; Belans and Hassiki, 2012). It appears that managers and shareholders of Islamic banks tend to attract more debt to generate more profits thereby supporting the *trade-off* hypothesis and the *agency cost* hypothesis. This could also explain why lower capitalisation is associated with higher efficiency for Islamic banks. Nevertheless, this behavior by Islamic banks may create future problems. Again, the *agency cost* hypothesis warns that at some point, the agency cost of outside debt may outweigh the agency cost of outside equity¹⁴². As a result, a further increase in the leverage of Islamic banks may negatively influence their efficiency and may require them to raise capital to face this excessive leverage behavior. This can

¹⁴² Berger and Di Patti (2006) argue that excessive leverage behavior generates "*lax risk management*" supported by incentives to exploit deposit insurance schemes. As a result, bank default risk becomes more important. Under those circumstances, a banking institution will pay higher interest expenses to compensate debt holders for this shift in risk and the expected losses. As a rule of thumb, the agency cost of outside debt becomes more important than the agency cost of outside equity.

also explain the behavior of commercial banks whose efficiency is negatively affected by financial leverage and positively affected by capital requirements.

4.3. ROBUSTNESS CHECKS

4.3.1. The role of bank size

To provide some additional insight, we split our sample of Islamic and conventional banks according to their total assets. Beck, Demirgüç-Kunt, and Merrouche (2013) split their sample into three sub-samples and define large banks as those above the 75th percentile, medium banks as those between the 25th and 75th percentile, and small banks as those below the 25th percentile. Abedifar, Molyneux, and Tarazi (2013) consider banks with less than one billion US\$ in total assets as small. Due to the limited number of observations in our sample of Islamic banks, we split the sample between small and large banks according to the median¹⁴³ of the logarithm of total assets in each bank category. Similar to Equation (11), we include bank¹⁴⁴ and country level characteristics in addition to country-year fixed effects. Employing conditional quantile regressions, Table 4.VIII shows that capital ratios are positively but marginally associated with the lower quantile of the conditional distribution of efficiency of large Islamic banks. Therefore, in contrast to our findings in Table 4.VII, Panel A, capital requirements show consistent positive signs with our four measures of capital, even with our two measures of capital to risk weighted assets (Table 4.VIII, Panel A, model 1). Nevertheless, our results do not provide any significant difference between large Islamic banks and large conventional banks at the 50th and 75th percentile of the conditional distribution of efficiency (Table 4.VIII, Panel A, models 2 and 3). Risk-based capital measures appear to have a marginal positive impact on large and low efficiency Islamic banks. Furthermore, consistent with our results in Table 4.VII, Panel A, capital measures are negatively associated with the upper tail of the efficiency distribution of small Islamic banks (Table 4.VIII, Panel A, model 6). The results are also persistent in successive quantiles of TETLIP and TECSTF (Table 4.VIII, Panel A, models 4 to 6). However, the results suggest that this solution may only work for highly efficient small Islamic banks when T1RP and TCRP are employed. These results suggest that capital requirements impose a constraint on small Islamic banks rather than large Islamic banks. Small Islamic banks may be more subject to *Sharia'a*

¹⁴³ Based on the median value of each bank category, Islamic banks are classified as small banks when $\text{LnTA} \leq 14.0650$ and large when $\text{LnTA} > 14.0650$. Likewise, conventional commercial banks are considered small when $\text{LnTA} \leq 14.4783$ and large when $\text{LnTA} > 14.4783$.

¹⁴⁴ We split Islamic and conventional banks according to their asset size, thus we no longer control for LnTA in Table 4.IX.

constraints and thus incur higher cost inefficiency because, in contrast to large banks, they do not benefit from economies of scale and diversification as claimed by Abedifar, Molyneux, and Tarazi (2013). As a result, requiring small Islamic banks to hold more capital buffers deteriorates their efficiency because of the opportunity cost of not using their funds in investment activities. It appears that the negative effect of capital requirements on Islamic banks in Table 4.VII is driven by small Islamic banks compared to large Islamic banks (see Table 4.VIII). All in all, there is little evidence that large Islamic banks support the *moral hazard* hypothesis where higher capital requirements are positively associated with the efficiency of Islamic banks. Yet, there is clear evidence that small Islamic banks support the *cost agency* hypothesis where higher capital requirements are negatively associated with the efficiency of small Islamic banks. Again, depending on the efficiency level, we note that our results show no significant difference between Islamic banks and conventional banks especially when risk-based capital ratios are employed.

As for liquidity, our results also show that small Islamic banks are behind the negative relationship between liquidity and Islamic bank efficiency. Table 4.VIII suggests that LADSTFP is negatively associated with the efficiency of small Islamic banks in all models (Panel B, models 10 to 12). As for other liquidity measures, the negative sign only persists at the upper quantile of the efficiency distribution (Panel B, model 12). Further, we find no evidence for a significant difference in the association between liquidity requirements and efficiency of large Islamic compared to large conventional banks¹⁴⁵. Accordingly, for small Islamic banks we find support for *Hypothesis 2.b* (i.e. higher liquidity impedes the efficiency of small Islamic banks compared to small conventional banks). Small Islamic banks may prefer to hold surplus liquidity to avoid any sudden withdrawal and also because the Islamic banking industry suffers from *Sharia'a* constraints regarding any conventional short term financing or hedging instruments. It also seems that small but highly efficient Islamic banks are behind the negative association with liquidity (Panel B, model 12). As a result, the opportunity cost that arises from holding liquidity instead of engaging in investment projects may explain the reason behind the negative relationship between higher liquidity and the efficiency of small Islamic banks – especially highly efficient small Islamic banks – compared to conventional banks.

As for leverage, we find that higher leverage (low capital) is negatively associated with the 25th percentile of the conditional efficiency distribution of large Islamic banks (Panel B, model 7) while higher leverage has a positive impact on the median and the upper quantiles of the

¹⁴⁵ We only find one positive but marginally significant association between liquidity and the upper quantile of efficiency of large banks compared to conventional banks (Panel B, model 9).

efficiency of small Islamic banks. Our results confirm our initial findings that Islamic banks rely on leverage to maximise their profits, thus supporting *Hypothesis 3*. Table 4.VIII also shows that this behavior is driven by small and highly efficient Islamic banks rather than large Islamic banks. The leverage ratio is positively associated with the efficiency of small Islamic banks while capital ratios have a negative impact on the efficiency of small Islamic banks.

4.3.2. The role of liquidity

Table 4.IX shows some divergent patterns between liquid and non-liquidity banks¹⁴⁶. In successive quantiles, three out of four capital variables have a significant negative impact on the efficiency of highly liquid Islamic banks. TCRP, TECSTF, and TETLIP have a negative and persistent influence on the efficiency of highly liquid Islamic banks (Panel A, models 1 to 3 and 7 to 9). Nevertheless, our results marginally persist for the upper quantile of the efficiency distribution when we examine banks with low liquidity (Panel A, models 6 and 12). A possible explanation is that imposing higher capital requirements on Islamic banks that are already liquid may severely harm their funding and investment activities. Horváth, Seidler, and Weill (2013) examine the causality relationship between bank capital and liquidity creation. The authors' results show that combining both of Basel III capital and liquidity requirements might cause problems for banking institutions. Their findings reflect a trade-off between higher capital ratios and liquidity creation. In other words, the Basel solution of inquiring banks to hold stronger capital buffers might harm banks' liquidity creation and vice versa. These results find also support in the work of Berger et al. (2014) who find that capital is negatively associated with bank liquidity creation in the short term. Accordingly, we show that imposing more stringent capital requirements on highly liquid Islamic banks – which are already more capitalised than their conventional peers – might be the reason behind the deterioration of their efficiency. It appears that small (see Table 4.VIII) and highly liquid Islamic banks are the reason behind the negative relationship between capital and Islamic bank efficiency. As for leverage, similar to our results in Tables 4.VII and 4.VIII, high leverage (low capital) is positively correlated with the efficiency of highly liquid Islamic banks compared to highly liquid conventional banks. This reflects the fact that highly liquid Islamic banks should be encouraged to be less prudent when dealing with leverage for two reasons: First, holding higher liquidity buffers instead of having investments in

¹⁴⁶ Based on the median value of each bank category, Islamic banks are classified as having low liquid when $LADSTFP \leq 33.955$ and as being highly liquid when $LADSTFP > 33.955$. Likewise, conventional commercial banks are considered as having low liquidity when $LADSTFP \leq 33.756$ and as being highly liquid when $LADSTFP > 33.756$.

profitable projects is negatively associated with their efficiency; Second, higher liquidity is considered a signal of a weak liquidity management. Our results persist at the 25th, 50th, and the 75th quantile of the efficiency distribution (Panel B, models 1 to 3). Meanwhile, we find no significant difference between Islamic and conventional banks with low liquidity except in the upper tail of the conditional distribution of efficiency (Panel B, models 6 and 12). This shows that the opposite relationship between high efficiency and higher capital requirements continues even for low liquidity Islamic banks. It appears that highly liquid, small and less capitalized Islamic banks tend to take on more leverage than low liquidity, large, and more capitalized Islamic banks. It is clear that leverage and capital are inversely correlated and that higher capital ratios might harm the efficiency of highly liquid Islamic banks. We also show that the positive sign on the leverage ratio in Table 4.VII and Table 4.VIII is driven by highly liquid Islamic banks compared to highly liquid conventional banks.

4.3.3. Lagging independent variables and including equity as an alternative risk factor

As an additional sensitivity test, we lag our independent variables by one year and examine whether our main findings persist. Table 4.X, Panel A, shows very similar results to the ones reported in Table 4.VII. Non-risk capital ratios negatively affect the efficiency of Islamic banks compared to conventional banks (models 7 to 12) while risk based capital ratios show no significant difference between the efficiency of Islamic and conventional banks. As for liquidity, Panel B shows that higher liquidity deteriorates the efficiency of Islamic banks. In addition, we find a negative and significant effect of LATDBP on the median quantiles of the efficiency distribution (models 8) compared to the liquidity results in Table 4.VII (model 8). Finally, leverage (lower capital) shows a consistently positive relationship with the efficiency of Islamic banks compared to conventional banks (models 10 to 12).

In a second step, we replace EFF4 by EFF3. By doing so, we exclude loan loss provisions from our bank inputs and therefore no longer controls for this risk measure. Similar to Equation (12), we include bank and country level characteristics in addition to country-year fixed effects. Applying conditional quantile regression, Table XI shows that the results become even more persistent. For instance, TCRP is now negatively associated with the upper quantile of efficiency for Islamic banks compared to conventional banks (Panel A, model 6). In addition, LATAP now shows a negative influence on Islamic bank efficiency at successive quantiles (models 4 to 6) which confirms our previous results and provides additional support for *Hypothesis 2.b* where higher liquidity is negatively associated with the successive quantiles of Islamic banks efficiency.

In a third and final step, we replace loan loss provisions with total equity as another measure to control for bank risk (Johnes, Izzeldin, and Pappas, 2009, 2013). The results in Table 4.XII are consistent with those in prior tables. Capital and liquidity negatively affect the efficiency of Islamic banks compared to conventional banks (T1RP also shows a significant negative impact on the median and the upper quantile of the conditional distribution of efficiency of Islamic banks) while leverage (low capital) shows a positive influence on Islamic bank efficiency.

4.3.4. Regulation and the financial crisis: Islamic banks vs. conventional banks

As our sample period includes the 2008–2009 financial crisis¹⁴⁷, we decided to re-estimate our model by investigating the relationship between regulation and efficiency after excluding the years 2008 and 2009. Our results are provided in Table 4.XIII.

We find no significant difference between the results obtained for the entire period and for the same period when excluding the 2008–2009 crisis period. If anything, the results become even more persistent. In a second step, we examine whether Islamic and conventional banks differ in terms of capital, liquidity, and leverage behavior during stress situations. To do this, we enlarge our banking sample to cover the period from 1995 to 2012 using the Osiris database. Because Osiris only contains listed banks, our unbalanced sample is reduced to 3,170 bank-year observations in 24 countries. Table EV in Appendix E includes descriptive statistics for our new dataset and shows that most of our variables do not vary much from our initial sample. Unlike in our previous analysis, this test examines whether bank capital, liquidity, and leverage ratios vary during stress situations. Following Beck, Demirgüç-Kunt, and Merrouche (2013), we differentiate between the global financial crisis¹⁴⁸ and local¹⁴⁹ banking crises. In our new sample, we find that Indonesia had a financial crisis between 1997 and 2001, Malaysia between 1997 and 1999, the Philippines between 1997 and 2001, Turkey in 2000 and 2011, and finally the United Kingdom¹⁵⁰

¹⁴⁷ Beck, Demirgüç-Kunt, and Merrouche (2013) place the global financial crisis between Q4–2007 and Q4–2008 while Abedifar, Molyneux, and Tarazi (2013) refer to the Bank for International Settlements' 80th annual report and label the crisis period between July 2007 and March 2009 as the crisis period. However, due to the unavailability of quarterly data, we follow the work of Abedifar, Molyneux, and Tarazi (2013) and consider 2008–2009 as the crisis period.

¹⁴⁸ We add a dummy that equals 1 for 2008 – 2009 and 0 otherwise. See Table EI in the Appendix for variable definitions and sources.

¹⁴⁹ We add a dummy that equals 1 when a local financial crisis occurred and 0 otherwise. See Table EI in the Appendix for variable definitions and sources.

¹⁵⁰ In many regards, the UK crisis surpassed aspects of the global financial crisis which prompted us to record a local crisis on top of the global crisis.

between 2007 and 2009. Using conditional quantile regressions, we replace our dependent efficiency variable by a series of regulatory variables. We use the following quantile regression model:

$$\begin{aligned} (\text{REG}_{ijt}|\text{CRISIS}_{jt}) = & \alpha + \varphi \times \text{IBDV} + \varphi^* \times \text{IBDV} \times \text{GLOBAL} + \varphi^{*'} \times \text{IBDV} \times \text{LOCAL} \\ & + \varnothing \times \text{IBDV} \times \text{TREND} + \beta \times \text{BC}_{ijt} + \delta \sum_{j=1}^N \text{Country}_j + \varepsilon \quad (7) \end{aligned}$$

where REG_{ijt} is a vector of regulatory variables. It includes capital (T1RP, TCRP, TETLIP and TECSTF), liquidity (LADSTFP, LATAP, and LATDBP) and leverage (TETAP). φ^* and $\varphi^{*'}$ represent the interactions between Islamic banks and crises periods. Thus, the introduction of both φ^* and $\varphi^{*'}$ allows us to examine additional differences or similarities between Islamic and conventional banks' capital, liquidity, and leverage behavior in stressful situations (i.e. local and global crises). Also, we add a trend dummy (TREND) that varies between 1 and 18 and interact it with IBDV to distinguish between the impact of crises on any differences between our bank categories and longer time trends (Beck, Demirgüç-Kunt, and Merrouche, 2013). The results in Table 4.XIV show that Islamic banks have higher T1RP, TCRP, TETLIP, and TECSTF. Our findings vary across quantiles, especially for the risk-based capital ratios (Panel A, models 1 to 6). However, these results only hold in the upper tail of the conditional distribution of TETLIP and TECSTF during local financial crises, while no significant difference is found during the 2008–2009 financial crisis (Panel A, models 9 and 12). We also notice a negative trend in the capitalization of Islamic banks compared to their conventional counterparts. This clearly shows that, over time, Islamic banks are becoming less capitalized. We argue that the leverage behavior of Islamic banks is behind this downward trend in capitalization. This supports the *agency cost* hypothesis which suggests that Islamic banks, over time, tend to be excessively leveraged and less capitalized compared to their conventional counterparts. Especially after the 2007–2008 financial crisis, the latter tend to be more capitalized as a response to regulatory intervention in order to alleviate agency costs and moral hazard behavior. Table 4.XIV, Panel B, shows that Islamic banks are more liquid (Panel B, models 1, 2, 4, 6, 8 and 9) and have less leverage (Panel B, model 12) compared to conventional banks during local crises (Beck, Demirgüç-Kunt, and Merrouche, 2013). Nevertheless, the interaction of TREND with IBDV confirms what we have mentioned earlier regarding the relationship between capital, leverage, and the *agency cost* hypothesis. We find a positive trend in the leverage (linked to a negative trend in the capital) of Islamic banks compared to their conventional peers during the 18 year period (Panel B, models 10 and 11).

In a third step, we examine interaction terms between capital, liquidity, and leverage with GLOBAL and with IBDV to capture any differences in bank regulation and EFF4 during the 2008–2009 crisis period (REGULATION× GLOBAL) and also between Islamic banks and conventional banks (REGULATION×IBDV×GLOBAL). Table 4.XV provides evidence of a negative relationship between capital (i.e. risk-based and non-risk based capital ratios) and efficiency for Islamic banks even during the financial crisis. This poses questions about the effectiveness of regulatory capital requirements on the efficiency of Islamic banks (the regulatory hypothesis) during stress situations. Table 4.XV also shows that liquidity is negatively correlated with the efficiency of Islamic banks compared to conventional banks while the results are in favor of leverage. It appears that higher capital and liquidity requirements have a negative impact on Islamic banks' efficiency during the crisis period. Accordingly, our findings suggest that regulations are ineffective when applied to Islamic banks in crises periods.

5. Conclusions

This study is the first study in the literature that explores the relationship between Basel guidelines and banking efficiency and to employ four types of efficiency measures to proxy for the impact of the Basel III framework on the efficiency of Islamic and conventional banks in a conditional quantile regression framework. We employ a panel of 639 conventional commercial and Islamic banks across 29 countries during the period from 2006 to 2012. We analyze and compare the impact of capital, liquidity, and leverage requirements on the efficiency of the banking sector by emphasizing the differences and the similarities between Islamic and conventional banks on different quantiles of bank efficiency. Our results suggest that: First, capital ratios negatively affect the efficiency of Islamic banks relative to conventional banks. On one hand, we find no evidence of any significant differences between Islamic and conventional banks regarding the relationship between capital ratios and efficiency when we employ risk-based capital measures. When using non-risk based capital measures, on the other hand, we find that higher capital ratios are associated with lower efficiency for Islamic banks than for their conventional counterparts. Second, liquidity ratios are negatively associated with the efficiency of Islamic banks suggesting that the rules under which they operate constitute a liquidity constraint that decreases Islamic banks' efficiency scores. Third, we find a significant positive relationship between leverage and the efficiency of Islamic banks. Our results are consistent with the *agency cost* hypothesis for Islamic banks. However, Islamic banks should be prudent when it comes to taking on excessive leverage. In the long term, this behavior might negatively impact the efficiency of these institutions. Our results persist when we do not control for loan loss

provisions. Robustness checks show that the negative association between capital, liquidity, and efficiency and the positive relation between leverage and efficiency are driven by small Islamic banks compared to large Islamic banks and conventional banks. Also, when we compare highly liquid banks to banks with low liquidity, we find that the negative correlation between capital and efficiency of Islamic banks is driven by highly liquid banks rather than less liquid Islamic banks. In addition, the positive sign of the leverage ratio is driven by highly liquid Islamic banks compared to their highly liquid conventional peers. Furthermore, when examining bank capital, liquidity, and leverage behavior in crisis periods, we find little evidence that Islamic banks are more capitalised, more liquid but less leveraged compared to their conventional counterparts. Finally, we find that higher capital and liquidity positions resulted in better efficiency for conventional than Islamic banks during the subprime crisis. However, over time, Islamic banks tend to be more leveraged, less capitalized, and less liquid compared to conventional banks.

There are several limitations to our study. First, we were not able to study the impact of other financial crisis because our sample period is relatively short. We did not include alternative market measures of financial performance because of data availability and may thus provide limited insights into the characteristics of Islamic banks. Finally, our analysis is complicated by the fact that the Bankscope database does not take particularities of Islamic banks into account when defining its variables.

Future work should determine an appropriate regulatory framework for Islamic banks. Islamic regulatory organizations are invited to use Islamic financial principles and concepts to create their own structure of ratios rather than imitating the Basel framework. Higher capital and liquidity ratios impede small Islamic banks' efficiency scores compared to conventional banks. Therefore, Basel III might disadvantage Islamic banks' in term of their efficiency position when compared to commercial banks

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Tables

Table 4.I. Overview of the literature on banking regulations and bank efficiency

Authors (year)	Period under study	Countries	Methodology	Main empirical results
<i>Two Stage DEA Approach</i>				
Barth et al. (2013)	1999 – 2007	72 countries	DEA and regressions	Banking regulations are an important determinant of bank efficiency
Chortareas et al. (2012)	2000 – 2008	22 EU countries	DEA, truncated, Tobit and GLM regressions	Bank size, capital, liquidity and banking sector stability are positively associated with the efficiency and the net interest margin of the EU banking sector
Banker et al. (2010)	1995 – 2005	Korea	DEA, OLS regressions	Banking reforms are an important determinant of Korean bank efficiency. The capital adequacy ratio and the non-performing loans ratio are positively and negatively associated with bank efficiency, respectively.
Hsiao et al. (2010)	2000 – 2005	Taiwan	DEA, panel regressions, Tobit regressions and Malmquist productivity index	Non-performing loans have a negative impact on bank efficiency while the capital adequacy ratio has a positive impact on bank efficiency.
Pasiouras (2008)	2003	95 countries	DEA and Tobit regressions	Technical efficiency increases with size, higher capitalization, lower loan activity, and lower GDP. No conclusive evidence for a positive correlation between inflation, ROE, and Pure Technical Efficiency (PTE).
Alam (2012)	2006 – 2010	11 Countries of the OIC (Organization of Islamic Cooperation)	DEA and seemingly unrelated regressions	Islamic banks are more prone to the adaptation of Basel III guidelines especially when they relate to capital and liquidity requirements.
<i>Financial Ratios</i>				
Lee and Hsieh (2013)	1994 – 2008	42 Asian countries	Two step dynamic panel data regressions	Highly capitalized investment banks, banks in low-income countries and banks in Middle Eastern countries have higher profitability.
Goddard et al. (2010)	1992 – 2007	8 European Union countries	Dynamic panel models	Capital and the loans to assets ratio are positively associated with profitability while the cost to income ratio is negatively correlated with profitability.
Srairi (2008)	1999 – 2006	6 GCC countries	Fixed effects regressions	Liquidity and leverage are positively associated with the profitability of Islamic banks but not with the profitability of conventional banks.

Table 4.II. Overview of the literature on the determinants of conventional bank efficiency

Authors (year)	Period under study	Countries	Methodology	Main empirical results
Staub, da Silva e Souza, and Tabak (2010)	2000 – 2007	Brazil	DEA, dynamic panel data, autoregressive and Tobit regressions	Market share, size, non-performing loans and capitalization are an important determinant of Brazilian bank efficiency.
Sufian (2010)		China	DEA, panel data and Tobit regressions	Bank size and capitalization are positively related to bank efficiency, while market share and the proportion of non-performing loans are negatively associated with bank efficiency.
Das and Ghosh (2009)	1992 – 2004	India	DEA and Tobit regressions	Bank size, the loans to assets ratio, the ratio of capital to risk weighted-assets, and liquidity are positively associated with efficiency.
Ariff and Can (2008)	1995 – 2004	China	DEA and Tobit regressions	Liquid and medium sized banks have a higher efficiency while credit risk and the cost to income ratio are negatively related to bank efficiency.
Denizer, Dinc and Tarimcilar (2007)	1970 – 1994	Turkey	DEA and OLS regressions	Macro-economic factors like GDP growth are an important determinant of bank efficiency.
Sathye (2003)	1997 – 1998	India	DEA	More work is needed to achieve what was declared by the government of India which is making Indian banks more competitive at the international level.
Canhoto and Dermine (2003)	1990 – 1995	Portugal	DEA and Malmquist productivity index	Due to deregulations, Portuguese banks are now more efficient.
Miller and Noulas (1996)	1984 – 1990	USA	DEA and OLS regressions	Bank size and profitability are important determinants of bank efficiency but not of market power.
Isik and Hassan (2003)	1981 – 1990	Turkey	DEA and Malmquist productivity index	Deregulation had a positive impact on the efficiency of Turkish banks.

Table 4.III. Overview of the literature on conventional and Islamic bank efficiency

Authors (year)	Period under study	Countries	Methodology	Main empirical results
Johnes, Izzedin, and Pappas (2013)	2004 – 2009	19 predominantly Muslim countries	Meta Frontier DEA and random effects regressions	No significant differences between Islamic and conventional banks when compared to a common efficiency frontier. Islamic banks become less efficient than conventional banks when computing the efficiency frontier independently for each bank type.
Belans and Hassiki (2012)	2006 – 2009	14 countries in the MENA (Middle East and North Africa) region	DEA and OLS regressions	Islamic banks do not differ significantly from their conventional peers. Liquidity is positively correlated with the efficiency of Islamic and conventional banks. There is a positive relationship between leverage and efficiency but it only applies for conventional banks.
Said (2012)	2006 – 2009	Middle East countries and Non-Middle East countries	DEA and t-tests	The impact of the financial crisis on bank efficiency depends on the size and type of a bank.
Johnes, Izzedin, and Pappas (2009)	2004 – 2007	6 GCC (Gulf Cooperation Council) countries	Financial Ratio Analysis (FRA), DEA, and Malmquist productivity index	Islamic banks have higher cost to income and higher ROA than their conventional peers. The latter are also found to be more gross efficient and more type efficient when compared to Islamic banks.
Sufian, and Zulkhibri (2008)	2001 – 2006	MENA and Asian countries	DEA	Islamic banks are marginally efficient in MENA countries and in South East Asia. Nevertheless, MENA Islamic banks are more efficient than their South East Asian peers.
Abdul-Majid, Saal, and Battisti (2010)	1996 – 2002	10 countries	Output Distance Functions	<i>Sharia'a</i> constraints threaten the efficiency of Islamic banks. The authors consider it a systemic inefficiency.
Mokhtar, Abdullah and AlHabshi (2007)	1997 – 2003	Malaysia	DEA and GLS regressions	Conventional banks are more efficient than full-fledged Islamic banks and the latter are more efficient than Islamic windows. Bank size, age and capital have a positive impact on the technical and cost efficiency of banks.
Sufian (2007)	2001 – 2005	Malaysia	DEA, Spearman and Pearson correlation	The pure technical efficiency of Malaysian Islamic banks is more sensitive to risk than scale efficiency. Foreign banks are more efficient than domestic Malaysian banks.
Sufian (2006)	2001 – 2004	Malaysia	DEA	Domestic Islamic banks are more scale efficient than their foreign Islamic counterparts (i.e. scale inefficiency dominates pure technical efficiency).
El Moussawi and Obeid (2010)	2005 – 2008	GCC countries	DEA and OLS regressions	Technical and allocative inefficiencies increase the cost of Islamic banks.
Viverita, Brown and Skully (2007)	1998 – 2002	13 countries in Asia, Africa and the Middle East	DEA and Malmquist productivity index	Asian Islamic banks are more efficient than their Middle Eastern and Asian counterparts.
Kamaruddin, Safa, and Mohd (2008)	1998 – 2004	Malaysia	DEA	Islamic banks in Malaysia are more cost efficient than profit efficient.

Table 4.IV. General descriptive statistics for conventional and Islamic banks

Variables	Entire sample				Conventional banks				Islamic banks				t-test (p-value)	Wilc-test (p-value)
	N	Mean	Median	STD	N	Mean	Median	STD	N	Mean	Median	STD		
Panel A: Efficiency scores														
EFF1 (%)	4123	45.68	39.36	24.68	3380	45.01	39.24	23.74	743	48.75	39.66	28.39	0.00***	0.09*
EFF2 (%)	3677	52.60	46.83	24.99	3094	52.35	46.76	24.48	583	53.95	47.09	27.53	0.15	0.71
EFF3 (%)	4123	53.79	47.17	25.91	3380	50.11	44.64	23.81	743	70.54	73.35	28.37	0.00***	0.00***
EFF4 (%)	3677	60.18	55.36	24.99	3094	57.13	52.48	23.55	583	76.36	86.15	26.17	0.00***	0.00***
EFF-TE (%)	4123	63.28	59.30	24.28	3380	58.47	54.40	22.54	743	85.11	96.41	19.45	0.00***	0.00***
Panel B: Regulatory variables														
<i>a. Capital</i>														
TCRP (%)	2879	22.13	16.78	18.97	2296	20.14	16.39	13.15	583	29.95	19.00	31.96	0.00***	0.00***
TIRP (%)	2332	19.30	14.35	17.56	1806	16.82	13.70	11.84	526	27.83	18.11	28.16	0.00***	0.00***
TETLIP (%)	4393	27.83	12.94	61.95	3563	20.43	12.35	31.77	830	59.57	18.04	121.47	0.00***	0.00***
TECSTF (%)	4265	31.87	14.29	67.89	3476	24.82	13.60	43.09	789	62.92	20.64	124.78	0.00***	0.00***
<i>b. Liquidity</i>														
LADSTF (%)	4349	54.27	33.80	81.61	3530	49.20	33.76	57.72	819	76.12	33.96	142.96	0.000***	0.58
LATAP (%)	4449	31.18	25.07	21.45	3580	31.99	25.87	21.66	869	27.84	22.33	20.24	0.000***	0.00***
LATDBP (%)	2961	38.22	29.32	34.51	2560	37.52	29.39	29.85	401	45.56	28.10	55.58	0.00***	0.06*
<i>c. Leverage</i>														
TETAP (%)	4473	16.96	11.49	17.01	3598	14.57	10.95	12.96	875	26.83	15.85	25.88	0.00***	0.00***
Panel C: Control variables														
<i>a. Bank level characteristics</i>														
LnTA	4473	14.41	14.39	2.04	3598	14.58	14.48	2.02	875	13.85	14.07	1.99	0.00***	0.00***
FATAP	4323	1.99	1.12	3.31	3484	1.63	1.05	1.92	839	3.45	1.72	6.19	0.00***	0.00***
NLTEAP	4320	55.62	58.91	24.81	3505	55.37	57.84	23.72	815	56.70	65.04	29.01	0.17***	0.00***
<i>b. Profitability & cost</i>														
ROAA	4441	1.20	1.15	3.53	3578	1.21	1.15	2.13	863	1.42	1.11	6.73	0.63	0.64
CIRP	4300	60.57	51.60	47.58	3506	57.99	51.57	35.12	794	71.96	51.71	81.63	0.00***	0.05*
OVERTAP	4410	2.61	2.12	1.84	3552	2.43	2.02	1.55	858	3.36	2.41	2.59	0.00***	0.00***
NIMP	4372	3.93	3.24	4.30	3542	3.75	3.17	2.74	830	4.68	3.52	8.05	0.00***	0.01**

***, **, * indicate significance at the 1%, 5% and 10% level, respectively. See Table EI in appendix E for variable definitions.

Table 4.IV presents descriptive statistics on the efficiency of commercial and Islamic banks (Panels A), a series of regulatory variables (Panel B), and various bank- and country-level variables (Panel C). Our sample contains 4,473 bank-year observations for the period 2006 – 2012. EFF1 denotes banks' efficiency scores calculated relative to a common frontier where the risk factor is excluded from the efficiency inputs; EFF2 represents efficiency scores calculated relative to a common frontier where loan loss provisions are used as a risk factor; EFF3 denotes banks' efficiency scores calculated relative to each bank's specific efficiency frontier where the risk factor is excluded from the efficiency inputs; EFF4 represents efficiency scores calculated relative to each bank's specific efficiency frontier where loan loss provisions are used as a risk factor; EFF-TE represents efficiency scores calculated relative to each bank's specific efficiency frontier where the total equity is used as a risk factor; TCRP is the total capital ratio, also called the capital adequacy ratio. This ratio is generally calculated by dividing a bank's tier1 and tier2 capital ratio by its risk weighted assets; the tier 1 capital ratio represents the Basel II tier1 regulatory ratio. This ratio is generally calculated by dividing a bank's tier1 capital ratio by its risk weighted assets; TETLIP is the equity to liabilities ratio; TECSTF is the ratio of bank equity to customer and short term funding; LADSTF (also called the maturity match ratio) is the ratio of liquid assets to deposits and short term funding. It represents the liquidity of a banking institution; LATAP or the liquidity ratio is the ratio of liquid assets to assets. It represents the amount of liquid assets available and therefore the liquidity position of a banking institution; LATDBP is similar to LADSTF and is computed by dividing a bank's liquid assets by its total deposits and borrowing; TETAP is the equity to assets leverage ratio ; Size is the logarithm of total assets; FATAP is the ratio of fixed assets divided by total assets; NLTEAP is the ratio of net loans over total earning assets; ROAAP is the return on average assets ratio; CIRP is the cost to income ratio; OVERTAP is the overhead to asset ratio; NIMP is the net interest margin ratio. We perform a series of t-tests of the null hypothesis that the means derived for our Islamic and conventional bank sample are equal (specifically, we use Satterthwaite tests because they allow subsample variances to be different). Wilc-test represents a Wilcoxon rank test which tests the null hypothesis that the two samples are derived from different distributions (where normality is not assumed).

Table 4.V. The efficiency of conventional and Islamic bank

	EFF1			EFF2			EFF3			EFF4		
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
Panel A: Comparing the efficiency of Islamic and conventional banks												
IBDV	-4.3000***	-0.9868	6.3478**	-5.8400***	-3.8032***	3.7137	10.8500***	22.4278***	28.9000***	10.4221***	22.7223***	19.6750***
	(0.8929)	(1.1119)	(2.7431)	(1.1584)	(1.0863)	(1.8821)	(1.3863)	(1.6407)	(0.7231)	(1.3683)	(1.7050)	(0.9506)
Intercept	33.6733***	37.8426***	42.1075***	42.1881***	44.5230***	49.9975***	32.2804***	35.1251***	43.0021***	41.2157***	44.1577***	56.3750***
	(2.1890)	(2.9465)	(2.7431)	(2.6160)	(2.1485)	(4.6769)	(2.6295)	(3.2453)	(4.0152)	(3.2842)	(22.7223)	(4.2115)
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4123	4123	4123	3677	3677	3677	4123	4123	4123	3677	3677	3677
Panel B: Comparing the efficiency of Islamic and conventional banks, controlling for bank and country characteristics												
IBDV	-0.1065	2.2063**	11.4812***	-2.5355***	0.3337	7.6170***	13.5643***	24.8432***	31.1304***	15.7667***	25.5575***	23.6007***
	(0.8067)	(1.0465)	(2.2092)	(0.8521)	(1.2758)	(1.7604)	(1.3149)	(1.5115)	(1.0395)	(1.4107)	(1.6626)	(1.2211)
LnTA	3.3314***	2.8912***	2.1735***	4.0207***	3.6628***	2.2246***	3.2760***	3.1598***	1.7279***	3.6221***	3.3259***	1.5803***
	(0.1819)	(0.2053)	(0.2490)	(0.2257)	(0.2244)	(0.2597)	(0.2151)	(0.2431)	(0.2363)	(0.2424)	(0.2589)	(0.2126)
FATAP	-0.3634*	-0.5190***	-0.5077***	-0.6607***	-1.0475***	-1.5687***	-0.8731***	-1.1374***	-0.8880***	-0.6817***	-1.1157***	-1.2412***
	(0.2134)	(0.1951)	(0.1812)	(0.1907)	(0.2151)	(0.3227)	(0.2580)	(0.2505)	(0.2206)	(0.2565)	(0.2907)	(0.3171)
ROAAP	1.5929***	1.6926***	2.0937***									
	(0.2084)	(0.2051)	(0.1496)									
CIRP				-0.0856***	-0.0924***	-0.0844***						
				(0.1907)	(0.0150)	(0.0078)						
NIMP							-1.0422***	-0.7404***	-0.1598			
							(0.2209)	(0.2392)	(0.1999)			
OVERTAP										-3.0512***	-2.9925***	-2.3331***
										(0.4053)	(0.3908)	(0.5006)
GDPPC	0.1669	-0.5059	2.6526	1.5405	2.5743	9.6286***	3.3337	-1.1456	3.5785	-1.7052	2.1069	6.0889*
	(1.7183)	(2.2231)	(3.8880)	(2.1396)	(2.7411)	(3.3817)	(2.2388)	(3.0844)	(2.9254)	(2.5765)	(2.9766)	(3.1449)
GDPG	0.3884***	0.4807***	0.5647***	0.5796***	0.5557***	0.7240***	0.3465***	0.5178***	0.2677	0.5779***	0.6120***	0.6137***
	(0.0851)	(0.1162)	(0.2044)	(0.0984)	(0.1335)	(0.1921)	(0.1012)	(0.1227)	(0.1638)	(0.1238)	(0.1265)	(0.1784)
INF	0.1504**	0.1065	0.0920	0.2072**	0.2835**	0.1643	0.1283	0.0129	0.2677	0.1724	0.1954	0.0324
	(0.0703)	(0.0947)	(0.1672)	(0.0984)	(0.1232)	(0.1494)	(0.0889)	(0.1057)	(0.1638)	(0.1321)	(0.1278)	(0.1218)
Intercept	-12.6029	1.0494	-9.2610	-18.4002	-15.3169	-38.7583*	-25.7808	8.4140	0.9587	10.8552	-5.5414	1.8723
	(12.0423)	(14.4948)	(25.9535)	(14.6751)	(19.0080)	(23.2606)	(15.9081)	(20.4995)	(19.2493)	(17.7843)	(19.7672)	(21.8636)
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4123	4123	4123	3651	3651	3651	4099	4099	4099	3677	3677	3677

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively. See Table EI in appendix E for variable definitions.

Table 4.V compares the efficiency scores of conventional commercial banks and Islamic banks using quantile regressions for the period 2006 – 2012. The dependent variable is pure technical efficiency. It is computed by comparing banks to a common efficiency frontier (EFF1 and EFF2) and to their own efficiency frontier (EFF3 and EFF4). The efficiency frontiers for each measure are calculated in two ways: the efficiency scores of models (1) – (3) and (7) – (9) do not include a risk factor at the input level while the efficiency scores of models (4) – (6) and (10) – (12) include the banks' loan loss provisions as a risk factor. We present the 25th, 50th, and 75th quantile of our dependent variable. Our independent variables include firm size (LnTA), fixed assets to assets (FATAP), return on average assets (ROAAP), cost to income (CIRP), net interest margin (NIM), overhead to assets (OVERTAP), GDP per capita (GDPPC), GDP growth (GDPG), and inflation (INF). CFE and YFE represent country and year fixed effect dummy variables. IBDV is a dummy variable that identifies Islamic banks. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regression with bootstrapping to estimate the standard errors and confidence intervals for the parameter betas.

Table 4.VI. Comparing the efficiency of Islamic and conventional banks, controlling for religion

Panel A: EFF3									
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	4.7025 (5.6149)	24.1181*** (8.2391)	21.0897*** (5.2761)	9.8767*** (2.9684)	19.8742*** (3.4161)	18.9966*** (2.6818)	11.2138*** (1.6755)	24.7088*** (2.4397)	36.9996*** (2.0651)
REL _P	0.0936*** (0.0323)	0.1313*** (0.0379)	0.1236 (0.0797)						
REL_P×IBDV	0.0982 (0.0661)	0.0163 (0.0933)	0.1201* (0.0613)						
LEGAL				-7.1262 (7.8604)	-15.0664* (8.7527)	-36.3445*** (10.8777)			
LEGAL×IBDV				5.0149 (3.2686)	9.4853*** (3.3504)	12.5180*** (2.3096)			
IBS							0.3030** (0.1253)	0.4205*** (0.1546)	0.4782*** (0.1378)
IBS×IBDV							0.1517** (0.0774)	0.0396 (0.0969)	-0.3195*** (0.0866)
Intercept	-35.4676** (15.2307)	-29.0325 (19.3407)	-20.0066 (22.1752)	-14.4617 (20.8714)	1.6635 (23.5462)	48.1193 (30.8991)	-35.9011** (16.1846)	-25.7770 (19.8845)	-14.8214 (21.1152)
Obs.	4120	4120	4120	4101	4101	4101	4100	4100	4100
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: EFF4									
IBDV	5.8892 (7.6274)	29.4717*** (4.6326)	6.8182** (3.2358)	14.6469*** (3.8071)	21.0211*** (2.3663)	15.1062*** (2.9582)	11.4285*** (1.8697)	21.3887*** (2.4488)	20.4527*** (2.7085)
REL _P	0.0999** (0.0389)	0.1067** (0.0444)	0.1613 (0.1096)						
REL_P×IBDV	0.1123 (0.0885)	-0.0553 (0.0506)	0.2094*** (0.0421)						
LEGAL				-5.1232 (9.4247)	-19.4637** (9.8147)	-5.0891 (12.5240)			
LEGAL×IBDV				0.3208 (4.0394)	5.2550** (2.1772)	7.2939*** (2.7487)			
IBS							0.3021** (0.1335)	0.4043*** (0.1960)	0.3745** (0.1698)
IBS×IBDV							0.1996** (0.0874)	0.1960** (0.1171)	0.1375 (0.1143)
Intercept	-33.3655* (20.2090)	-25.1595 (20.4504)	-28.0318 (24.8194)	-10.3222 (26.0510)	11.4029 (27.0734)	-7.0883 (33.1287)	-28.7518 (19.6082)	-22.9673 (21.3059)	-16.4637 (24.4820)
Obs.	3674	3674	3674	3655	3655	3655	3659	3659	3659
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. See Table EI in appendix E for variable definitions.

Table 4.VI compares the efficiency scores of conventional commercial banks and Islamic banks using quantile regressions for the period 2006 – 2012. The dependent variable is the pure technical efficiency. It is computed by comparing banks to their own efficiency frontier (EFF3 and EFF4). The efficiency frontier for each measure is calculated in two ways: the efficiency scores of models (1) – (3) and (7) – (9) do not include a risk factor at the input level while the efficiency scores of models (4) – (6) and (10) – (12) include the banks' loan loss provisions as a risk factor. We present the 25th, 50th, and 75th quantile of our dependent variable. We control for countries and years, as well as bank and country level characteristics. IBDV is our Islamic bank dummy variable. RELP, LEGAL, and IBS represent the percentage of the Muslim population in each country, the legal system of each country and the share of a country's total banking assets held by Islamic banks, respectively. CFE and YFE represent country and year fixed effect dummy variables. In addition, we include interaction terms of IBDV and the three variables mentioned above. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regression with bootstrapping to estimate the standard errors and confidence intervals for the parameter betas. In this table, we also control for bank and country level characteristics (BC & CC).

Table 4.VII. Banking regulation and efficiency: Islamic vs. conventional banks

Panel A: Capital requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	17.6388*** (2.6088)	25.2624*** (2.7053)	27.8691*** (3.4752)	0.2372 (1.8518)	0.3296 (1.9195)	7.6202** (3.2754)	17.5812*** (1.3907)	29.7209*** (1.9203)	33.4172*** (2.1825)	16.6914*** (1.4048)	26.4091*** (1.8830)	26.3177*** (2.1088)
T1RP	0.1372* (0.0685)	0.3252*** (0.0589)	0.4958*** (0.1068)									
T1RP×IBDV	-0.1066 (0.1189)	-0.1204 (0.1238)	-0.2681 (0.1646)									
TCRP				0.2080*** (0.0476)	0.3274*** (0.0429)	0.5255*** (0.0624)						
TCRP×IBDV				-0.1167 (0.0787)	-0.1317 (0.0810)	-0.1333 (0.1123)						
TETLIP							0.2278*** (0.0232)	0.3205*** (0.0527)	0.5199*** (0.0692)			
TETLIP×IBDV							-0.1632*** (0.0279)	-0.2766*** (0.0554)	-0.4773*** (0.0781)			
TECSTF										0.1876*** (0.0132)	0.2197*** (0.0216)	0.3134*** (0.0394)
TECSTF×IBDV										-0.1281*** (0.042)	-0.1260*** (0.0366)	-0.1651*** (0.0540)
Intercept	-72.2318*** (26.4180)	-69.7888*** (26.8003)	-70.0103** (33.6278)	-75.2580*** (20.6705)	-72.5969*** (22.6570)	-131.046 (25.0975)	-16.8552 (14.8556)	-28.7740 (17.5904)	-27.6653 (20.5390)	-24.4706 (16.7840)	-27.3322 (16.8557)	-33.9576* (19.1476)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2133	2133	2133	2627	2627	2627	3672	3672	3672	3612	3612	3612
Panel B: Liquidity & leverage requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	16.4324*** (1.7818)	28.0024*** (1.6106)	26.9419*** (1.5496)	17.6450*** (3.0619)	23.7115*** (2.9058)	24.5424*** (1.9523)	22.9933*** (4.7812)	32.7186*** (2.5748)	30.9240*** (2.0064)	16.6050*** (2.1318)	31.4993*** (1.8526)	35.5114*** (2.6923)
LADSTFP	0.1102*** (0.0129)	0.1433*** (0.0097)	0.1356*** (0.0169)									
LADSTFP×IBDV	-0.0563*** (0.0169)	-0.0970*** (0.0130)	-0.0813*** (0.0221)									
LATAP				0.0166 (0.0288)	0.0567** (0.0278)	0.0516 (0.0323)						
LATAP×IBDV				-0.0802 (0.1034)	0.0325 (0.0986)	-0.0843** (0.0367)						
LATDBP							0.0490* (0.0275)	0.0932*** (0.0298)	0.1171*** (0.0244)			
LATDBP×IBDV							0.0574 (0.1312)	-0.0440 (0.0471)	-0.1206*** (0.0284)			
TETAP										0.6584*** (0.0605)	0.9315*** (0.0572)	1.1450*** (0.0817)
TETAP×IBDV										-0.1602 (0.1102)	-0.5499*** (0.0699)	-0.7633*** (0.1508)
Intercept	-42.7299** (17.3482)	-27.8226 (17.9105)	-34.5321 (23.6721)	-3.6493 (17.2138)	-12.0276 (18.5522)	-12.4190 (21.8601)	-10.0904 (27.5430)	-3.5985 (24.0414)	-15.6893 (31.7974)	-19.0992 (17.4594)	-28.6373* (17.2147)	-31.1901 (20.8161)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	3669	3669	3669	3671	3671	3671	2626	2626	2626	3677	3677	3677

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. See Table AI in appendix E for variable definitions.

Table 4.VII documents the regulatory determinants of efficiency by comparing Islamic and conventional banks using conditional quantile regressions for the period 2006 – 2012. The dependent variable is pure technical efficiency. It is computed by comparing banks to their own efficiency frontier. Efficiency scores EFF4 are calculated after controlling for a risk factor (i.e. Loan Loss Provisions, LLP). We present the 25th, 50th, and 75th quantile of our dependent variable. Our independent variables include four measures of capital, three measures of liquidity, and a single measure of leverage. The capital ratios are: tier 1 regulatory ratio (T1RP), Capital adequacy ratio or total capital ratio (TCRP), equity to liabilities (TETLIP), and equity to customers and short term funding (TECSTF). The liquidity indicators are: liquid assets to deposits and short term funding (LADSTFP), liquid assets to assets (LATAP), and liquid assets to total deposits and borrowing (LATDBP). Leverage is measured by the ratio of equity to assets (TETAP). BC and CC represent bank level and country level characteristics. CFE and YFE represent country and year fixed effect dummy variables. In addition, we include interaction terms between IBDV and the regulatory variables above. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regressions with bootstrapping to estimate standards errors and confidence intervals for the parameter betas.

Table 4.VIII. Banking regulation and efficiency: Islamic vs. conventional banks (classification by size)

Panel A: Capital requirements						Panel B: Liquidity & leverage requirements							
Large banks			Small banks			Large banks			Small banks				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)		
0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75		
IBDV	3.117	22.6456***	20.5065***	10.0973***	15.9820***	31.0509***	IBDV	13.6170***	25.0919***	18.8725***	13.1940***	25.2892***	36.3669***
	(4.6169)	(4.2254)	(2.7878)	(3.7969)	(4.7710)	(5.8874)		(3.0226)	(2.0376)	(1.7482)	(2.0813)	(3.3469)	(3.6178)
T1RP	-0.2393	-0.1280	0.0614	0.1561**	0.2091**	0.4990***	LADSTFP	0.0752**	0.0648***	0.0143	0.1243***	0.1315***	0.1866***
	(0.1579)	(0.1360)	(0.1300)	(0.0648)	(0.0810)	(0.1060)		(0.0341)	(0.0197)	(0.0116)	(0.0153)	(0.0080)	(0.0252)
T1RP	0.4817*	-0.0036	-0.0547	0.0257	0.0160	-0.3479**	LADSTFP	-0.0237	-0.0435	0.0073	-0.0668***	-0.0870***	-0.1598***
×IBDV	(0.2530)	(0.1275)	(0.1640)	(0.0954)	(0.1321)	(0.1060)	×IBDV	(0.0567)	(0.0355)	(0.0286)	(0.0200)	(-0.0145)	(0.0293)
Intercept	55.9263	41.3240	2.9873	73.8993	13.6895	-36.8679	Intercept	45.7058	52.1265*	27.3696	46.9399**	38.1090	25.8080
	(35.4007)	(31.5798)	(28.6394)	(63.9766)	(68.1668)	(88.4103)		(33.5369)	(30.9311)	(25.5980)	(23.0302)	(28.0333)	(47.8717)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1435	1435	1435	697	697	697	Obs.	2039	2039	2039	1630	1630	1630
IBDV	3.8067	22.4512***	19.0205***	9.5796***	16.2621***	30.5795***	IBDV	17.7498***	20.3072***	17.5055***	12.7472***	26.2627***	41.8569***
	(5.0686)	(4.4891)	(3.2679)	(3.4923)	(4.6570)	(5.3094)		(6.1291)	(2.8924)	(1.5466)	(3.6602)	(5.1455)	(4.3611)
TCRP	-0.2174*	-0.1339	0.0231	0.1486***	0.3091***	0.5509***	LATAP	-0.0694	-0.1236**	-0.0145	0.0387	0.0702***	0.1852***
	(0.1307)	(0.1294)	(0.1126)	(0.0434)	(0.0639)	(0.0758)		(0.0455)	(0.0528)	(0.0246)	(0.0276)	(0.0271)	(0.0491)
TCRP	0.4876*	0.0565	0.0511	0.0427	-0.0127	-0.3537**	LATAP	-0.1319	0.1326	0.0803*	-0.0636	-0.1001	-0.3677***
×IBDV	(0.2495)	(0.2137)	(0.1775)	(0.0878)	(0.1165)	(0.1395)	×IBDV	(0.2335)	(0.1186)	(0.0472)	(0.1215)	(0.1330)	(0.0875)
Intercept	40.6491	53.4795	-7.5631	76.0555*	96.5200**	3.3160	Intercept	50.5375	77.7967***	47.8943*	69.1015***	49.7726*	70.8938
	(45.9117)	(32.6539)	(30.9317)	(0.0918)	(44.6033)	(60.4431)		(30.9538)	(29.3072)	(24.4466)	(23.9368)	(28.1580)	(48.3876)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1633	1633	1633	994	994	994	Obs.	2039	2039	2039	1632	1632	1632
IBDV	12.9651***	23.2704***	20.6337***	12.2053***	27.2385***	38.1246***	IBDV	14.8182**	22.3990***	19.9413***	27.7578**	45.7101***	47.1840***
	(3.0378)	(2.3994)	(2.0541)	(1.9050)	(3.2198)	(3.3090)		(7.4055)	(2.5631)	(1.9355)	(10.7798)	(0.0361)	(5.5869)
TETLIP	0.0185	0.0483	0.1578	0.2030***	0.2849***	0.4562***	LATDBP	-0.0286	-0.0423	-0.0062	0.0143	0.1209***	0.1712***
	(0.1448)	(0.1076)	(0.1001)	(0.0251)	(0.0369)	(0.0616)		(0.0446)	(0.0440)	(0.0159)	(0.0320)	(0.0361)	(0.0323)
TETLIP	0.0706*	-0.0097	-0.1270	-0.1410***	-0.2526***	-0.4534***	LATDBP	0.1461	0.0751	0.0257	-0.0825	-0.1079	-0.1984***
×IBDV	(0.1559)	(0.1166)	(0.1097)	(0.0280)	(0.0.97)	(0.0715)	×IBDV	(0.2389)	(0.0615)	(0.0395)	(0.1816)	(0.0955)	(0.0617)
Intercept	34.8842	39.2469	25.6836	52.6302**	46.8303*	61.3500	Intercept	71.8364**	65.8069**	16.4369	107.4880***	85.1527**	127.6288*
	(32.9245)	(31.0620)	(23.7160)	(23.8269)	(25.5121)	(42.6002)		(33.6190)	(30.6065)	(27.6450)	(39.8619)	(38.4727)	(68.2285)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2042	2042	2042	1630	1630	1630	Obs.	1748	1748	1748	878	878	878
IBDV	10.7994***	22.6350***	18.6411***	11.2887***	23.5187***	28.7121***	IBDV	7.6280**	19.8562***	19.6576***	11.7648***	28.3708***	41.2138***
	(3.0499)	(2.3571)	(1.9449)	(1.8114)	(3.8127)	(3.4821)		(3.3921)	(2.6543)	(1.9623)	(2.8505)	(4.2281)	(4.0451)
TECSTF	0.07777	0.1310***	0.1361*	0.1785***	0.2282***	0.2817***	TETAP	0.0021	-0.0075	0.1652	0.6145***	0.9457***	1.1985***
	(0.0755)	(0.0451)	(0.0761)	(0.0101)	(0.0232)	(0.0387)		(0.1774)	(0.1391)	(0.1141)	(0.0709)	(0.0633)	(0.0748)
TECSTF	0.1804*	0.0174	-0.0422	-0.1120***	-0.1635***	-0.1890***	TETAP	0.4851**	0.2219	-0.0607	-0.1736	-0.5880***	-0.9861***
×IBDV	(0.1063)	(0.0782)	(0.0805)	(0.0158)	(0.0430)	(0.0479)	×IBDV	(0.2247)	(0.1584)	(0.1331)	(0.1256)	(0.0957)	(0.1558)
Intercept	33.5382	33.6407	27.4175	44.9304**	51.9012**	66.9473*	Intercept	33.5250	34.0864	25.9246	77.3332***	63.6523***	74.0449*
	(31.8190)	(31.9337)	(24.9383)	(21.7924)	(26.2961)	(39.5670)		(31.2212)	(30.9954)	(23.0168)	(23.8952)	(24.6088)	(40.1530)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2009	2009	2009	1603	1603	1603	Obs.	2042	2042	2042	1635	1635	1635

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. See Table EI in appendix E for variable definitions.

Table 4.VIII documents the regulatory determinants of efficiency by comparing Islamic and conventional banks according to their size using conditional quantile regressions for the period 2006 – 2012. The dependent variable is the pure technical efficiency. It is computed by comparing banks to their own efficiency frontier. Efficiency scores EFF4 are calculated after controlling for a risk factor (i.e. Loan Loss Provisions, LLP). We present the 25th, 50th and 75th quantile of our dependent variable. Our independent variables include four measures of capital, three measures of liquidity, and a single measure of leverage. The capital ratios are: tier 1 regulatory ratio (T1RP), Capital adequacy ratio or total capital ratio (TCRP), equity to liabilities (TETLIP), and equity to customers and short term funding (TECSTF). The liquidity indicators are: liquid assets to deposits and short term funding (LADSTFP), liquid assets to assets (LATAP), and liquid assets to total deposits and borrowing (LATDBP). Leverage is measured by the equity to assets (TETAP). BC and CC represent bank level and country level characteristics. CFE and YFE represent country and year fixed effect dummy variables. In addition, we include interaction terms between IBDV and the regulatory variables above. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regressions with bootstrapping to estimate standard errors and confidence intervals for the parameter betas.

Table 4.IX. Banking regulation and efficiency: Islamic vs. conventional banks (classification by liquidity)

Panel A: Capital requirements													
Model #	High liquidity			Low liquidity			Model #	High liquidity			Low liquidity		
	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	Quantile	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	21.1821***	30.4670***	32.4337***	14.9520***	24.0866***	29.4321***	IBDV	18.2801***	31.5957***	35.5868***	16.0657***	24.8372***	30.9106***
	(4.7192)	(3.8657)	(4.0533)	(5.0791)	(3.6043)	(3.6689)		(2.0083)	(2.1590)	(2.9869)	(2.5873)	(2.7429)	(3.5557)
T1RP	0.1693**	0.2495**	0.3490***	0.1835	0.4273***	0.4812***	TETLIP	0.2093***	0.2547***	0.4703***	0.2802***	0.4725***	0.7249***
	(0.0775)	(0.0846)	(0.1110)	(0.1338)	(0.1345)	(0.1393)		(0.0285)	(0.0457)	(0.0703)	(0.0800)	(0.0835)	(0.0852)
T1RP	-0.1706	-0.1483	-0.2470*	0.0744	-0.1566	-0.4382**	TETLIP	-0.1059***	-0.2207***	-0.4518***	-0.0577	-0.1222	-0.3862*
×IBDV	(0.1374)	(0.1284)	(0.1431)	(0.1338)	(0.2093)	(0.2056)	×IBDV	(0.0349)	(0.0450)	(0.0722)	(0.1286)	(0.1295)	(0.2002)
Intercept	-43.9950	-116.792***	-42.0333	-138.453***	-73.8819**	-75.4316*	Intercept	17.9311	-28.6205	-65.8995**	-75.5996**	-17.6635	-13.0111
	(49.7785)	(40.5076)	(45.6248)	(43.4954)	(36.4332)	(45.5321)		(24.6033)	(25.0333)	(30.0220)	(30.5327)	(29.6897)	(32.7738)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	800	800	800	1332	1332	1332	Obs.	1686	1686	1686	1986	1986	1986
IBDV	23.3159***	34.4588***	40.6573***	18.8706***	24.0560***	31.9277***	IBDV	18.0404***	31.9621***	29.9885***	13.7675***	20.9034***	26.3793***
	(4.6940)	(3.4899)	(4.1446)	(5.5305)	(3.3765)	(4.0577)		(2.8358)	(2.3145)	(2.7468)	(2.1220)	(2.2975)	(2.9576)
TCRP	0.1644***	0.3504***	0.6118***	0.1842	0.3901***	0.4908***	TECSTF	0.1815***	0.2214***	0.3045***	0.1801***	0.2247***	0.4593***
	(0.0613)	(0.0658)	(0.1152)	(0.1120)	(0.1019)	(0.0935)		(0.0156)	(0.0214)	(0.0392)	(0.0457)	(0.0498)	(0.1087)
TCRP	-0.2367*	-0.2753**	-0.5079***	-0.2011	-0.1793	-0.5368**	TECSTF	-0.1633***	-0.1949***	-0.2412***	0.0699	0.0354	-0.2271*
×IBDV	(0.1319)	(0.0658)	(0.1399)	(0.3391)	(0.1694)	(0.2142)	×IBDV	(0.0301)	(0.0332)	(0.0509)	(0.0540)	(0.0633)	(0.1296)
Intercept	-15.9276	-75.9620**	-77.5765**	-92.148**	-67.7622*	-98.4324*	Intercept	0.5068	-28.2551	-60.3999*	-72.7626**	-23.7491	-17.5341
	(32.8518)	(33.0848)	(38.8191)	(40.3686)	(37.1916)	(55.2529)		(25.7658)	(23.8147)	(32.0024)	(33.4726)	(30.0043)	(38.3458)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	BC & CC	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1063	1063	1063	1564	1564	1564	Obs.	1656	1656	1656	1956	1956	1956
Panel B: Leverage requirements													
IBDV	21.0775***	40.1510***	41.9272***	13.9163***	24.3303***	30.7518***							
	(3.3620)	(2.7460)	(3.6696)	(2.7720)	(3.3375)	(3.7677)							
TETAP	0.7287***	1.0418***	1.2503***	0.4834***	0.7228***	1.0535***							
	(0.0761)	(0.0826)	(0.1044)	(0.1111)	(0.1036)	(0.1199)							
TETAP	-0.3702***	-0.8037***	-1.0041***	0.2292	-0.1082	-0.4122							
×IBDV	(0.1295)	(0.1031)	(0.1481)	(0.1596)	(0.1812)	(0.2594)							
Intercept	18.2666	-32.2362	-68.2457***	-86.7905***	-26.1333	-22.7514							
	(22.7729)	(24.3829)	(25.9142)	(33.1070)	(30.5274)	(29.3836)							
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes							
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes							
Obs.	1690	1690	1690	1987	1987	1987							

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. See Table EI in appendix E for variable definitions.

Table 4.IX documents the regulatory determinants of efficiency by comparing Islamic and conventional banks according to their liquidity using conditional quantile regressions for the period 2006 – 2012. We consider two subgroups of banks: highly liquid banks and banks with low liquidity. The dependent variable is pure technical efficiency. It is computed by comparing banks to their own efficiency frontier. Efficiency scores are calculated after controlling for a risk factor (i.e. Loan Loss Provisions, LLP). We present the 25th, 50th, and 75th quantile of our dependent variable. Our independent variables include four measures of capital, three measures of liquidity, and a single measure of leverage. The capital ratios are: tier 1 regulatory ratio (T1RP), Capital adequacy ratio or total capital ratio (TCRP), equity to liabilities (TETLIP), and equity to customers and short term funding (TECSTF). The liquidity indicators are: liquid assets to deposits and short term funding (LADSTFP), liquid assets to assets (LATAP), and liquid assets to total deposits and borrowing (LATDBP). Leverage is measured by the ratio of equity to assets (TETAP). BC and CC represent bank level and country level characteristics. CFE and YFE represent country and year fixed effect dummy variables. In addition, we include interaction terms between IBDV and the regulatory variables above. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regressions with bootstrapping to estimate standards errors and confidence intervals for the parameter betas.

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Table 4.X. Banking regulation and efficiency: Islamic vs. conventional banks (One year lag)

Panel A: Capital requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	16.7708*** (2.9203)	25.5270*** (2.4620)	25.9281*** (2.9666)	15.2869*** (2.7177)	23.4634*** (2.9601)	25.5407*** (2.9633)	17.4802*** (1.8968)	29.7219*** (1.7503)	29.1541*** (1.9253)	16.7324*** (1.8408)	26.4898*** (1.7373)	24.4789*** (2.1630)
T1RP	0.0976 (0.0690)	0.2436*** (0.0389)	0.3837*** (0.0973)									
T1RP×IBDV	-0.0269 (0.1269)	-0.0845 (0.1050)	-0.1388 (0.1324)									
TCRP				0.1147** (0.0561)	0.02501*** (0.0586)	0.3856*** (0.0846)						
TCRP×IBDV				0.0551 (0.1119)	0.0282 (0.1057)	-0.1243 (0.1223)						
TETLIP							0.2022*** (0.0367)	0.2855*** (0.0388)	0.3900*** (0.0672)			
TETLIP×IBDV							-0.1504*** (0.0389)	-0.2564*** (0.0396)	-0.3694*** (0.0696)			
TECSTF										0.1823*** (0.0281)	0.2017*** (0.0211)	0.2555*** (0.0507)
TECSTF×IBDV										-0.1211*** (0.0362)	-0.1282*** (0.0384)	-0.1492** (0.0635)
Intercept	-83.5302** (37.7229)	-67.3966** (30.4622)	-102.285** (42.3603)	-64.6535** (32.3844)	-63.0909** (26.8032)	-78.2929** (37.0875)	-27.5921 (23.6954)	-38.0322* (21.5173)	-56.0707* (30.9038)	-29.5052 (21.0497)	-37.5740* (21.1092)	-44.0742 (28.9054)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1723	1723	1723	2001	2001	2001	2744	2744	2744	2700	2700	2700
Panel B: Liquidity & leverage requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	17.8831*** (2.0121)	27.5224*** (1.9103)	24.8790*** (1.8557)	18.5509*** (3.0266)	25.3390*** (3.0663)	25.2103*** (2.1315)	27.7237*** (4.3765)	35.8720*** (2.4886)	29.9449*** (2.5280)	18.1637*** (2.5176)	32.5671*** (1.8983)	33.5578*** (2.4532)
LADSTFP	0.1127*** (0.0172)	0.1395*** (0.0146)	0.1241*** (0.0176)									
LADSTFP×IBDV	-0.0672*** (0.0245)	-0.0829*** (0.0192)	-0.0688*** (0.0227)									
LATAP				0.1240*** (0.0243)	0.1393*** (0.0301)	0.0993*** (0.0335)						
LATAP×IBDV				-0.1239 (0.0980)	-0.0081 (0.0965)	-0.1241** (0.0503)						
LATDBP							0.1124*** (0.0312)	0.1317*** (0.0302)	0.1249*** (0.0304)			
LATDBP×IBDV							-0.0722 (0.1069)	-0.0860** (0.0403)	-0.1295*** (0.0328)			
TETAP										0.5530*** (0.0799)	0.8375*** (0.0577)	0.9822*** (0.0847)
TETAP×IBDV										-0.2501* (0.1333)	-0.5752*** (0.0661)	-0.7942*** (0.1226)
Intercept	-32.2363 (24.2796)	-58.2505** (22.8502)	-59.6826* (30.5223)	-20.8884 (26.0299)	-38.4906 (25.3469)	-41.2454 (30.8475)	-41.9195 (35.5442)	-54.2432 (39.6784)	-14.1407 (45.6291)	-35.4363 (24.6719)	-43.0455** (21.3889)	-57.9154** (27.8532)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2747	2747	2747	2750	2750	2750	1953	1953	1953	2751	2751	2751

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. See Table EI in appendix E for variable definitions.

Table 4.X documents the regulatory determinants of efficiency by comparing Islamic and conventional banks using conditional quantile regressions for the period 2006 – 2012. The dependent variable is pure technical efficiency. It is computed by comparing banks to their own efficiency frontier. Efficiency scores are calculated after controlling for a risk factor (i.e. Loan Loss Provisions, LLP). We present the 25th, 50th, and 75th quantile of our dependent variable. Our independent variables include four measures of capital, three measures of liquidity, and a single measure of leverage. The capital ratios are: tier 1 regulatory ratio (T1RP), Capital adequacy ratio or total capital ratio (TCRP), equity to liabilities (TETLIP), and equity to customers and short term funding (TECSTF). The liquidity indicators are: liquid assets to deposits and short term funding (LADSTFP), liquid assets to assets (LATAP), and liquid assets to total deposits and borrowing (LATDBP). Leverage is measured by the ratio of equity to assets (TETAP). BC and CC represent bank level and country level characteristics. All independent variables are lagged by one year. CFE and YFE represent country and year fixed effect dummy variables. In addition, we include interaction terms between IBDV and the regulatory variables above. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regressions with bootstrapping to estimate standards errors and confidence intervals for the parameter betas.

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Table 4.XI. Banking regulation and efficiency without controlling for risk: Islamic vs. conventional banks

Panel A: Capital requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	16.4088*** (2.9066)	24.6137*** (2.8203)	34.9279*** (3.0884)	15.8454*** (2.9753)	23.7371*** (2.3240)	35.7322*** (2.2450)	14.0246*** (1.3999)	28.3792*** (1.7731)	37.6332*** (2.1314)	14.8479*** (1.3326)	25.8141*** (1.7181)	35.4294*** (1.7555)
T1RP	0.1312 (0.0806)	0.3080*** (0.0632)	0.4589*** (0.0985)									
T1RP×IBDV	-0.1035 (0.1303)	-0.0904 (0.1122)	-0.1893 (0.1197)									
TCRP				0.1257** (0.0530)	0.3379*** (0.0444)	0.4952*** (0.0602)						
TCRP×IBDV				-0.0960 (0.1180)	-0.0163 (0.0744)	-0.2538*** (0.0683)						
TETLIP							0.1554*** (0.0333)	0.2583*** (0.0231)	0.4010*** (0.0573)			
TETLIP×IBDV							-0.0797** (0.0343)	-0.2051*** (0.0253)	-0.3301*** (0.0662)			
TECSTF										0.1873*** (0.0184)	0.2259*** (0.0137)	0.2994*** (0.0367)
TECSTF×IBDV										-0.1087*** (0.0213)	-0.1429*** (0.0198)	-0.2225*** (0.0384)
Intercept	-78.6436*** (23.4716)	-60.5680*** (23.3598)	-40.4086 (27.5196)	-62.9998*** (17.7479)	-46.9815** (21.0453)	-61.4563*** (21.8478)	-31.4005** (15.0888)	-14.8421 (18.1289)	-9.5188 (0.6548)	-33.3549** (13.4678)	-15.5543 (15.9173)	-12.6872 (19.2797)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2204	2204	2204	2730	2730	2730	4412	4412	4412	4045	4045	4045
Panel B: Liquidity & leverage requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	14.9060*** (1.5047)	27.8820*** (1.7720)	37.1955*** (1.5592)	22.2284*** (2.7119)	34.5175*** (3.2009)	36.9894*** (1.9449)	27.1997*** (3.9863)	38.9858*** (2.6806)	42.9402*** (1.9791)	12.3452*** (1.9755)	29.1239*** (2.1024)	40.6180*** (2.0753)
LADSTFP	0.1069*** (0.0126)	0.1409*** (0.0119)	0.1634*** (0.0169)									
LADSTFP×IBDV	-0.0471*** (0.0172)	-0.0824*** (0.0124)	-0.1290*** (0.0206)									
LATAP				0.0411* (0.0233)	0.0974*** (0.0305)	0.1591*** (0.0304)						
LATAP×IBDV				-0.2652*** (0.0812)	-0.3434*** (0.1135)	-0.2029*** (0.0596)						
LATDBP							0.0462* (0.0264)	0.1013*** (0.0288)	0.1542*** (0.0305)			
LATDBP×IBDV							-0.0671 (0.0962)	-0.0608 (0.0639)	-0.1614*** (0.0337)			
TETAP										0.4454*** (0.0619)	0.8031*** (0.0612)	0.9804*** (0.0781)
TETAP×IBDV										0.0305 (0.1039)	-0.3731*** (0.0717)	-0.6556*** (0.1044)
Intercept	-45.7421*** (14.4115)	-30.5882* (18.0763)	-35.1523* (19.0615)	-32.3960** (14.9954)	-0.5892 (17.6978)	-15.9236 (18.6583)	-38.6645* (21.2499)	-5.3155 (22.0034)	-17.5145 (29.1233)	-30.1193* (15.3664)	-28.4562* (16.4223)	-27.6235 (17.9831)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4111	4111	4111	4117	4117	4117	2833	2833	2833	4123	4123	4123

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. See Table EI in appendix E for variable definitions.

Table 4.XI documents the regulatory determinants of efficiency by comparing Islamic and conventional banks using conditional quantile regressions for the period 2006 – 2012. The dependent variable is pure technical efficiency (EFF3). It is computed by comparing banks to their own efficiency frontier. Efficiency scores EFF3 are calculated without controlling for risk factor. We present the 25th, 50th, and 75th quantile of our dependent variable. Our independent variables include four measures of capital, three measures of liquidity, and a single measure of leverage. The capital ratios are: tier 1 regulatory ratio (T1RP), Capital adequacy ratio or total capital ratio (TCRP), equity to liabilities (TETLIP), and equity to customers and short term funding (TECSTF). The liquidity indicators are: liquid assets to deposits and short term funding (LADSTFP), liquid assets to assets (LATAP), and liquid assets to total deposits and borrowing (LATDBP). Leverage is measured by the ratio of equity to assets (TETAP). BC and CC represent bank level and country level characteristics. CFE and YFE represent country and year fixed effect dummy variables. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regressions with bootstrapping to estimate standards errors and confidence intervals for the parameter betas. In addition, we include interaction terms between IBDV and the regulatory variables above. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regressions with bootstrapping to estimate standards errors and confidence intervals for the parameter betas.

Chapter 4 – Basel III and Efficiency of Islamic banks: Does one solution fit all?– Tables

Table 4.XII. Banking regulation and efficiency after using total equity to control for risk: Islamic vs. conventional banks

Panel A: Capital requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	36.9522***	41.0592***	38.5850***	36.4066***	38.5736***	38.1434***	31.6113***	37.3569***	34.7257***	32.2047***	37.4493***	34.0877***
	(3.1485)	(2.6797)	(1.8905)	(3.3684)	(2.3407)	(1.5803)	(1.5995)	(1.1041)	(1.1738)	(1.5945)	(1.1477)	(1.1652)
T1RP	-0.1303	0.0651	0.2913***									
	(0.0837)	(0.0682)	(0.0849)									
T1RP×IBDV	-0.1559	-0.1941*	-0.2638***									
	(0.1390)	(0.1161)	(0.0895)									
TCRP				-0.0487	0.140***	0.3573***						
				(0.0712)	(0.0503)	(0.0562)						
TCRP×IBDV				-0.1499	-0.1115	-0.2448***						
				(0.1362)	(0.0995)	(0.0629)						
TETLIP							0.0308	0.1422***	0.1838***			
							(0.0367)	(0.0231)	(0.0344)			
TETLIP×IBDV							-0.0191	-0.1276***	-0.1740***			
							(0.0398)	(0.0230)	(0.0362)			
TECSTF										0.1230***	0.1454***	0.1730***
										(0.0227)	(0.0094)	(0.0188)
TECSTF×IBDV										-0.0899***	-0.120***	-0.1316***
										(0.0266)	(0.0148)	(0.0242)
Intercept	-41.7518	4.0671	6.1224	-14.6643	24.8141	17.6159	10.2176	52.5822***	30.7288*	5.4041	51.8798***	38.7738**
	(28.1619)	(22.3098)	(24.8850)	(23.0746)	(17.8621)	(20.4768)	(15.9589)	(14.1428)	(16.4732)	(17.1189)	(14.3059)	(16.0524)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2204	2204	2204	2730	2730	2730	4412	4412	4412	4045	4045	4045
Panel B: Liquidity & leverage requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	32.6714***	38.9504***	35.5369***	40.2756***	40.7623***	33.5919***	42.3354***	43.0136***	38.7414***	32.5434***	38.8797***	36.4758***
	(1.4707)	(1.1074)	(0.9581)	(2.3140)	(1.8376)	(1.2253)	(3.3493)	(1.8828)	(1.4062)	(2.5739)	(1.3542)	(1.0288)
LADSTFP	0.0901***	0.1152***	0.1147***									
	(0.0124)	(0.0071)	(0.0103)									
LADSTFP×IBDV	-0.0568***	-0.0927***	-0.0976***									
	(0.0141)	(0.0085)	(0.0124)									
LATAP				0.0195	0.0451*	0.0621***						
				(0.0256)	(0.0238)	(0.0224)						
LATAP×IBDV				-0.3247***	-0.1888***	-0.1057***						
				(0.0744)	(0.0639)	(0.0321)						
LATDBP							0.0007	0.0587***	0.0881***			
							(0.0228)	(0.0210)	(0.0245)			
LATDBP×IBDV							-0.1041	-0.0667	-0.1275***			
							(0.0961)	(0.0436)	(0.0240)			
TETAP										0.0088	0.3118***	0.4267***
										(0.0723)	(0.0475)	(0.0544)
TETAP×IBDV										-0.0878	-0.2402***	-0.3614***
										(0.1376)	(0.0618)	(0.0490)
Intercept	-2.5082	37.3460**	39.3282**	9.9014	53.8555***	35.1521**	-22.2348	58.5362***	30.5260	14.1633	57.8380***	33.3862**
	(14.0960)	(16.1035)	(15.9484)	(16.5269)	(16.3110)	(16.3325)	(24.7859)	(20.1133)	(24.5751)	(14.1993)	(13.6518)	(16.5362)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4111	4111	4111	4117	4117	4117	2833	2833	2833	4123	4123	4123

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. See Table EI in appendix E for variable definitions.

Table 4.XII documents the regulatory determinants of efficiency by comparing Islamic and conventional banks using conditional quantile regressions for the period 2006 – 2012. The dependent variable is pure technical efficiency (EFF-TE). It is computed by comparing banks to their own efficiency frontier. Efficiency scores are calculated after controlling for a risk factor (i.e. Total Equity, TE). We present the 25th, 50th, and 75th quantile of our dependent variable. Our independent variables include four measures of capital, three measures of liquidity, and a single measure of leverage. The capital ratios are: tier 1 regulatory ratio (T1RP), Capital adequacy ratio or total capital ratio (TCRP), equity to liabilities (TETLIP), and equity to customers and short term funding (TECSTF). The liquidity indicators are: liquid assets to deposits and short term funding (LADSTFP), liquid assets to assets (LATAP), and liquid assets to total deposits and borrowing (LATDBP). Leverage is measured by the ratio of equity to assets (TETAP). BC and CC represent bank level and country level characteristics. CFE and YFE represent country and year fixed effect dummy variables. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regressions with bootstrapping to estimate standards errors and confidence intervals for the parameter betas. In addition, we include interaction terms between IBDV and the regulatory variables above. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regressions with bootstrapping to estimate standards errors and confidence intervals for the parameter betas.

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Table 4.XIII. Banking regulation and efficiency: Islamic vs. conventional banks, excluding the crisis period

Panel A: Capital requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	16.2630*** (3.1957)	22.5007*** (3.8468)	31.4199*** (3.3939)	15.4693*** (3.3982)	20.4371*** (2.8679)	33.4167*** (2.7082)	20.2295*** (2.1156)	30.2740*** (1.9931)	34.9942*** (2.3737)	17.2315*** (1.7250)	28.4186*** (1.9379)	33.2615*** (2.1065)
T1RP	-0.0081 (0.0737)	0.2804*** (3.8468)	0.3511*** (0.0971)									
T1RP×IBDV	0.0223 (0.1260)	0.0509 (0.1504)	-0.1412 (0.1417)									
TCRP				0.0322 (0.0605)	0.2358*** (0.0638)	0.4658*** (0.0847)						
TCRP×IBDV				0.0386 (0.1409)	0.0875 (0.0860)	-0.2242** (0.1096)						
TETLIP							0.2196*** (0.0281)	0.2449*** (0.0384)	0.4921*** (0.0651)			
TETLIP×IBDV							-0.1642*** (0.0381)	-0.2154*** (0.0391)	-0.4782*** (0.0776)			
TECSTF										0.1608*** (0.0252)	0.2134*** (0.0198)	0.2759*** (0.0409)
TECSTF×IBDV										-0.1053*** (0.0294)	-0.1288*** (0.0302)	-0.1258*** (0.0496)
Intercept	-5.2327 (22.7596)	-57.6925** (23.2230)	-63.5273*** (22.7635)	12.4317 (17.3445)	-42.9725*** (13.6158)	-56.2266*** (13.6131)	-16.1379 (13.5834)	-30.5856** (12.2631)	-8.2150 (11.9356)	14.7179 (12.6654)	-9.9590 (10.5022)	-21.7764 (13.5205)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1554	1554	1554	1995	1995	1995	2714	2714	2714	2990	2990	2990
Panel B: Liquidity & Leverage requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	16.3329*** (2.0083)	30.9830*** (2.3177)	34.1223*** (1.5764)	25.5468*** (2.8220)	33.8830*** (3.6245)	34.0004*** (2.0833)	31.9053*** (5.2716)	35.7603*** (33.3665)	38.9291*** (2.1977)	14.3406*** (2.5204)	29.6876*** (2.5288)	37.3377*** (2.5353)
LADSTFP	0.0936*** (0.0143)	0.1312*** (0.0129)	0.1488*** (0.0135)									
LADSTFP×IBDV	-0.0330 (0.0204)	-0.0811*** (0.0146)	-0.1033*** (0.0184)									
LATAP				0.0094 (0.0247)	0.0392 (0.0314)	0.1242*** (0.0412)						
LATAP×IBDV				-0.3031*** (0.0804)	-0.1888 (0.1347)	-0.1429** (0.0683)						
LATDBP							0.0505 (0.0344)	0.0628** (0.0286)	0.1080*** (0.0297)			
LATDBP×IBDV							-0.1126 (0.1360)	-0.0264 (0.0766)	-0.1427*** (0.0298)			
TETAP										0.3933*** (0.0695)	0.7482*** (0.0687)	0.8586*** (0.0952)
TETAP×IBDV										0.0487 (0.1192)	-0.3085*** (0.0864)	-0.5130*** (0.1334)
Intercept	8.8888 (13.1016)	-30.8574*** (11.3569)	-38.5711*** (13.5160)	27.8966** (11.2471)	-4.8382 (11.6574)	-23.1333 (15.0873)	30.4452 (19.6890)	-11.2984 (20.3232)	-52.8201** (26.1160)	17.4448 (11.6394)	-6.9643 (11.5060)	-32.1740*** (11.3664)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	3032	3032	3032	3037	3037	3037	2104	2104	2104	3042	3042	3042

Robust standard errors are reported in parentheses. ***, **, * indicate significance at 1%, 5%, and 10%, respectively. See Table EI in appendix E for variable definitions.

Table 4.XIII documents the regulatory determinants of efficiency by comparing Islamic and conventional banks using conditional quantile regressions for the period between 2006 and 2012 but excluding the 2008–2009 financial crisis. The dependent variable is the pure technical efficiency (EFF4). It is computed by comparing banks to their own efficiency frontier. Efficiency scores are calculated after controlling for a risk factor (i.e. LLP). Table XIII also presents the 25th, 50th, and 75th quantile of our dependent variable. It displays 4 measures of capital, 3 measures of liquidity, and a single measure of leverage. Capital ratios are: tier 1 capital regulatory ratio (T1RP), Capital adequacy ratio or total capital ratio (TCRP), equity to liabilities (TETLIP), and equity to customers and short term funding (TECSTF). Liquidity indicators are: liquid assets to deposits and short term funding (LADSTFP), liquid assets to assets (LATAP), liquid assets to total deposits and borrowing (LATDBP). Leverage is measured by the ratio of equity to assets (TETAP). BC and CC represent bank level and country level characteristics. CFE represents countries fixed effect dummy variables. In addition, we include interaction terms between IBDV and the regulatory variables above. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regressions with bootstrapping to estimate standards errors and confidence intervals for the parameter beta.

Table 4.XIV. Banking regulations during global and local crisis

Panel A: Capital requirements												
Model #	TIRP			TCRP			TETLIP			TECSTF		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	1.8845***	2.1280	0.6776	2.3127***	3.2280***	1.8507	2.1039***	6.3033***	7.3300**	2.5267***	6.7139***	18.3936***
	(0.6576)	(1.2981)	(1.9707)	(0.6967)	(0.8565)	(2.0220)	(0.7264)	(1.2406)	(3.3723)	(0.9195)	(1.5026)	(5.1554)
GLOBAL*IBDV	-0.5454	-1.0970	-2.5871	-0.6593	-0.5461	-1.9921	0.6765	1.0299	0.3287	1.0291	1.0313	-0.9560
	(0.8005)	(0.5216)	(3.2856)	(1.1207)	(1.0663)	(2.5682)	(1.2918)	(2.2964)	(5.2991)	(1.2420)	(2.6806)	(7.1834)
LOCAL*IBDV	17.8915	14.2228	13.4594	15.7566	14.4375	17.9188	2.4090	18.8255	403.606***	0.7856	9.8937	601.7476***
	(11.8742)	(16.9014)	(29.3651)	(12.5739)	(21.0723)	(35.0047)	(15.9211)	(66.5483)	(125.8547)	(14.8396)	(66.7182)	(204.0745)
TREND*IBDV	-0.1900	0.3437	-1.3997**	-0.2137*	-0.2853	0.4337	-0.3202***	-0.6663***	-0.2118	-0.3541***	-0.7399***	-1.2765*
	(0.1428)	(0.3648)	(0.6229)	(0.1162)	(0.1817)	(0.4082)	(0.0668)	(0.1262)	(0.5096)	(0.0902)	(0.1437)	(-1.2765)
LnTA	-0.1893*	-0.6422***	-1.4286***	-0.1430*	-0.5867***	-1.4483***	-0.6430***	-0.9712***	-1.7916***	-0.5129***	-0.9516***	-1.6967***
	(0.1076)	(0.1191)	(0.1606)	(0.0813)	(0.0932)	(0.1743)	(0.0706)	(0.1047)	(0.1572)	(0.0713)	(0.1133)	(0.2119)
FATAP	-0.1535	0.2363	0.4301	0.1992***	0.5726***	1.0207***	0.5206***	0.9451***	1.5683***	0.8163***	1.3067***	2.3728***
	(0.1429)	(0.1619)	(0.2685)	(0.0668)	(0.0945)	(0.2745)	(0.0932)	(0.1428)	(0.1825)	(0.1690)	(0.2067)	(0.3652)
Intercept	11.1577***	21.4764***	41.3616***	14.9411***	27.2883***	47.9336***	15.1907***	22.8523***	39.6399***	14.3184***	23.6315***	40.4904***
	(2.6267)	(3.4800)	(4.8343)	(1.8268)	(2.4878)	(6.1544)	(1.5151)	(2.6347)	(6.9787)	(1.5501)	(2.7139)	(11.2013)
CFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YFE	No	No	No	No	No	No	No	No	No	No	No	No
Obs.	1527	1527	1527	2079	2079	2079	3130	3130	3130	3310	3310	3310

Panel B: Liquidity & leverage requirements												
Model #	LATAP			LADSTFP			LATDBP			TETAP		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	-2.7299	-1.0538	-5.0918***	-0.3963	1.8350	-1.9216	-2.3549	-2.2128	-5.6598**	1.8102***	4.8952***	4.4201**
	(1.6749)	(1.4584)	(1.3911)	(2.1868)	(2.1005)	(3.2335)	(2.7398)	(2.7589)	(2.4385)	(0.5767)	(0.8304)	(1.9362)
GLOBAL*IBDV	-2.7818	-0.6485	0.5378	-1.5621	-0.9892	-0.7770	-2.5545	-1.9183	-1.6082	0.6285	0.6696	0.7245
	(1.7728)	(2.2627)	(1.8629)	(2.8280)	(4.7987)	(6.6635)	(3.2037)	(5.3836)	(3.4632)	(1.0366)	(1.2755)	(2.4184)
LOCAL*IBDV	56.5035***	41.6997**	-1.1171	68.1440**	70.7605	442.0929**	134.9852	330.167***	304.913***	2.0013	8.3886	46.6223*
	(14.8141)	(17.4671)	(18.1266)	(28.0292)	(126.4820)	(187.9188)	(101.6394)	(97.2424)	(70.7030)	(10.6817)	(25.7596)	(26.7437)
TREND*IBDV	-0.4563**	-0.4842***	0.1314	-0.6509***	-0.7473**	0.0122	-0.3474	-0.5547**	-0.0990	-0.2709***	-0.5225***	-0.0935
	(0.2061)	(0.1801)	(0.1813)	(0.2509)	(0.3099)	(0.2928)	(0.2493)	(0.2815)	(0.2875)	(0.0550)	(0.0933)	(0.2721)
LnTA	0.0677	-0.6792***	-1.9281***	-0.0846	-1.1623***	-3.2438***	-0.0804	-1.0268***	-2.6780***	-0.5701***	-0.8229***	-1.4632***
	(0.1481)	(0.1353)	(0.1934)	(0.1646)	(0.2682)	(0.2820)	(0.1765)	(0.1963)	(0.2478)	(0.0598)	(0.0603)	(0.0931)
FATAP	-0.1174	-0.2244***	-0.2015***	-0.2250	0.0220	-0.0007	-0.0079	-0.0740	-0.2082	0.3311***	0.6613***	0.8246***
	(0.0873)	(0.0714)	(0.1082)	(0.1657)	(0.1717)	(0.2133)	(0.0874)	(0.0992)	(0.2036)	(0.0676)	(0.1081)	(0.1514)
Intercept	14.7473***	43.3957***	105.5905***	21.7106***	56.6886***	147.3182***	12.2572**	40.8378***	90.4806***	13.8980***	20.0500***	48.5675***
	(3.7988)	(5.0589)	(5.6021)	(5.5552)	(9.1620)	(11.3484)	(5.5685)	(5.8527)	(6.8086)	(1.1999)	(1.4713)	(6.3106)
CFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YFE	No	No	No	No	No	No	No	No	No	No	No	No
Obs.	3129	3129	3129	3123	3123	3123	2436	2436	2436	3138	3138	3138

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. See Table EI in appendix E for variable definitions.

Table 4.XIV documents the regulatory determinants of banking regulation by comparing Islamic and conventional banks using conditional quantile regressions. The dependent variables include our capital, liquidity, and leverage ratios. The capital ratios are: tier 1 regulatory ratio (T1RP), the capital adequacy ratio or total capital ratio (TCRP), equity to liabilities (ETLIP), and equity to customers and short term funding (TECSTF). The liquidity indicators are: liquid assets to assets (LATAP), liquid assets to deposits and short term funding (LADSTFP), and liquid assets to total deposits and borrowing (LATDBP). Leverage is measured by the ratio of equity to assets (ETAP). CFE and YFE represent country and year fixed effect dummy variables. Trend (TREND) is a time dummy that represents the time fixed effect of the dependent variables. We also control for bank characteristics using the fixed assets to assets ratio (FATAP) and the logarithm of total assets (LnTA). In addition, we include interaction terms between IBDV and the regulatory variables above. We use conditional quantile regression with bootstrapping to estimate standard errors and confidence intervals for the parameter betas.

Table 4.XV. Banking regulation and efficiency during financial crises: Islamic vs. conventional banks

Panel A: Capital requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	16.7027***	23.6983***	24.400***	15.9290***	23.7423***	25.7106***	16.3797***	23.8958***	24.2469***	14.8463***	23.8995***	22.4379***
	(1.7124)	(1.8289)	(2.1466)	(1.5172)	(1.7104)	(1.8519)	(1.7921)	(1.9468)	(2.2788)	(1.3700)	(1.4692)	(1.4725)
T1RP	0.0747	0.2907***	0.3337***									
	(0.0629)	(0.0618)	(0.1100)									
T1RP×GLOBAL	0.1910	0.0579	0.3350*									
	(0.1276)	(0.1359)	(0.1889)									
T1RP×IBDV× GLOBAL	-0.2138*	-0.2789*	-0.4094***									
	(0.1113)	(0.1498)	(0.1553)									
TCRP				0.1180**	0.3029***	0.4647***						
				(0.0537)	(0.0522)	(0.0994)						
TCRP×IBDV				0.1395	0.0268	0.1089						
				(0.0946)	(0.1065)	(0.1377)						
TCRP×IBDV× GLOBAL				-0.1765*	-0.2023	-0.3496***						
				(0.0962)	(0.1262)	(0.1252)						
TETLIP							0.0657***	0.0621	0.2121			
							(0.0223)	(0.0741)	(0.1494)			
TETLIP× GLOBAL							0.1584	0.2750**	0.1499			
							(0.1038)	(0.1185)	(0.1676)			
TETLIP×IBDV× GLOBAL							-0.2492	-0.4306***	-0.3454**			
							(0.1625)	(0.1578)	(0.1383)			
TECSTF										0.1362***	0.1896***	0.2487***
										(0.0150)	(0.0183)	(0.0311)
TECSTF× GLOBAL										0.0511**	0.0125	0.0502
										(0.0205)	(0.0538)	(0.0884)
TECSTF×IBDV× GLOBAL										-0.1213***	-0.1303*	-0.1277
										(0.0392)	(0.0731)	(0.0879)
Intercept	-69.8277***	-70.4695***	-54.8870*	-27.5903	-40.0121**	-62.0285***	-58.0770**	-47.4313**	-33.5801	-16.7281	-24.3990	-21.2814
	(27.0485)	(24.7001)	(29.4786)	(21.1032)	(18.7119)	(24.6880)	(26.2571)	(22.6518)	(29.8690)	(16.7569)	(17.1204)	(19.1376)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2132	2132	2132	2627	2627	2627	2129	2129	2129	3612	3612	3612

Table 4.XV. Banking regulation and efficiency during financial crises: Islamic vs. conventional banks – Continued.

Panel B: Liquidity & leverage requirements												
Model #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quantile	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75	0.25	0.50	0.75
IBDV	14.6983***	24.9011***	23.9928***	15.6353***	25.0836***	23.4624***	23.5788***	31.3190***	28.2508***	15.7731***	25.2583***	26.0098***
	(1.4623)	(1.5733)	(1.2221)	(1.6777)	(1.8989)	(1.3734)	(2.7095)	(1.9136)	(1.9314)	(1.4994)	(1.2992)	(1.4421)
LADSTFP	0.0899***	0.1099***	0.1127***									
	(0.0105)	(0.0144)	(0.0120)									
LADSTFP× GLOBAL	0.0410**	0.0418	0.0340									
	(0.0199)	(0.0262)	(0.0296)									
LADSTFP×IBDV× GLOBAL	-0.0688***	-0.1019***	-0.1107***									
	(0.0235)	(0.0361)	(0.0337)									
LATAP				-0.0382	0.0493	0.0318						
				(0.0278)	(0.0328)	(0.0314)						
LATAP× GLOBAL				0.1394***	0.0525	0.0530						
				(0.0455)	(0.0552)	(0.0681)						
LATAP×IBDV× GLOBAL				-0.1183	0.0062	-0.1545***						
				(0.0936)	(0.0864)	(0.0598)						
LATDBP							0.0289	0.0736***	0.0931***			
							(0.0270)	(0.0274)	(0.0300)			
LATDBP× GLOBAL							0.0744	0.0658	0.0105			
							(0.0479)	(0.0441)	(0.0458)			
LATDBP×IBDV× GLOBAL							0.0058	-0.0834	-0.1037*			
							(0.0941)	(0.0606)	(0.0584)			
TETAP										0.5412***	0.6821***	0.9470***
										(0.0449)	(0.0639)	(0.0929)
TETAP× GLOBAL										0.2711*	0.4033***	0.2356**
										(0.1432)	(0.01137)	(0.1165)
TETAP×IBDV× GLOBAL										-0.3779***	-0.6239***	-0.5320***
										(0.1381)	(0.1179)	(0.1297)
Intercept	-32.7987*	-30.6004	-32.0554	-1.9942	-23.7791	-6.8704	-3.4924	1.4265	1.0703	-10.1308	-18.1770	-22.2726
	(16.8829)	(18.9902)	(21.2766)	(16.4177)	(19.5584)	(22.3871)	(26.9793)	(24.5789)	(31.7161)	(16.6194)	(1.2992)	(20.7719)
BC & CC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CFE & YFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	3669	3669	3669	3671	3671	3671	2626	2626	2626	3677	3677	3677

Robust standard errors are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. See Table EI in appendix E for variable definitions

Table 4.XV documents the regulatory determinants of efficiency by comparing Islamic and conventional banks using conditional quantile regressions for the period 2006 – 2012. The dependent variable is pure technical efficiency. It is computed by comparing banks to their own efficiency frontier. Efficiency scores are calculated after controlling for a risk factor (i.e. Loan Loss Provisions, LLP). We present the 25th, 50th, and 75th quantile of our dependent variable. Our independent variables include four measures of capital, three measures of liquidity, and a single measure of leverage. The capital ratios are: tier 1 regulatory ratio (T1RP), Capital adequacy ratio or total capital ratio (TCRP), equity to liabilities (TETLIP), and equity to customers and short term funding (TECSTF). The liquidity indicators are: liquid assets to deposits and short term funding (LADSTFP), liquid assets to assets (LATAP), and liquid assets to total deposits and borrowing (LATDBP). Leverage is measured by the equity to assets (TETAP). BC and CC represent bank level and country level characteristics. All independent variables are lagged by one year. CFE and YFE represent country and year fixed effect dummy variables. In addition, we include interaction terms between IBDV and the regulatory variables above. We apply Data Envelopment Analysis (DEA) to calculate efficiency scores and conditional quantile regressions with bootstrapping to estimate standards errors and confidence intervals for the parameter betas.

Appendix E

Literature review of efficiency

CONVENTIONAL BANK EFFICIENCY

Over the last two decades, there was a growing and diversified literature of the efficiency of financial institutions. For instance, Berger and Humphrey (1997) survey 130 papers that use various methods of efficiency frontier in 21 countries. By covering research on financial institutions, one of the broad categories of interest of the frontier analysis literature is a debate on the importance of financial reforms. They subdivide the financial reforms literature into four main components: (1) deregulation, (2) risk and financial institutions failure, (3) concentration and market structure, and (4) the effects of mergers and acquisitions. Furthermore, they find that the impact of financial reforms on financial institutions efficiency is contradictory. Nevertheless, it seems that research agrees that risk, bad loans, low capital ratio, cash flow problems, and weak management are negatively associated with financial institutions efficiency. In addition, Berger (2007) evaluates the consolidation activity of the banking sector and suggests that foreign banks are less efficient in developed countries when compared to domestically owned banks and that situation is reversed in developing countries where foreign owned banks are more efficient than domestically owned peers. Assessing the efficiency in more than 100 papers, he reveals three strategic policies when comparing efficiency: First, banks from different countries are compared to the same efficiency frontier. Second, banks from every single country are compared to their own country specific efficiency frontier. Finally, comparing different bank categories efficiency against their own country specific frontier. All in all, he concludes that comparing bank efficiency scores – in studies like comparing foreign owned banks versus domestically owned banks – should be performed using the third category where same nation banks are compared to their own nation common frontier.

Next, we discuss the results of a chosen number of papers that mainly examine the impact of financial reforms on the efficiency of conventional banks. To begin with, Hsiao et al. (2010) find that lower non-performing loans and higher capital adequacy are positively associated with operating efficiency when investigating the relationship between financial restructuring and the operational efficiency of 37 Taiwanese banks for the period between 2000 and 2005. They also find that banks' operating efficiency did not improve much during the period between pre- and post-reform. However, the coefficient of the reform is significantly different between the two transition periods. Studying the Indian banking sector, Das and Ghosh (2009) investigate the

relationship between profit efficiency and banking deregulation during the period of 1992 – 2004 and find that domestic Indian banks were more cost efficient and profit inefficient. A second stage Tobit regression on the efficiency measure suggested that big listed banks with higher capital ratios, bigger loan portfolio and good management skills are more efficient and likely to generate more returns. In addition, Indian state-owned banks are found to be more resilient in competing with private and foreign peers.

Further, Denizer, Dinc and Tarimcilar (2007) evaluate the banking efficiency in the pre- and post- financial liberalization period in the Turkish context. Using annual reports for 53 banks and 25 years period, they find that liberalization does not provide any efficiency gain, Turkish banks inefficiently benefit of their resources and that state-owned banks are not very different from privately-owned banks. They also explain that a stable macro-economic environment may have an important impact of the Turkish banking sector efficiency. Next, Canhoto and Dermine (2003) quantify the impact of deregulation on the efficiency of the Portugal banking system. Following two approaches related to the DEA efficiency, they are able to study the relative efficiency of new domestic banks to older banks by assuming a common frontier for all the period of the study as a first step then, by computing the DEA scores relative to each annual time series separately, as a second step. Further, they use the Malmquist productivity index and find new domestic banks are more efficient than the older banks in the period of deregulation. Last but not least, Isik and Hassan (2003) consider the efficiency of 458 observations of Turkish banks for the period of 1981 – 1990. Employing three inputs (i.e. labor, capital, and loans) and 4 outputs (i.e. short-term loans, long-term loans, risk-adjusted off-balance sheet items, and other earning assets), they conclude that Turkish banks efficiency has improved due to the deregulation. Nevertheless, Turkish domestic banks have experienced scale inefficiency because of the diseconomies of scale that manifests in excessive production. Finally, the exclusion of off-balance sheet parameters significantly decreases the average efficiency and productivity scores of the banking sector.

Additionally, we examine another set of paper that jointly employed DEA when evaluating bank efficiency, risk, market share, and some of bank specific characteristics. For instance, Sufian (2010) exhibits the relationship between risk and efficiency of Chinese banks. Employing three inputs (i.e. total deposits, fixed assets and loan loss provision) and two outputs (i.e. total loans and investments), he decomposes efficiency into technical efficiency, pure technical efficiency and scale efficiency. He discovers that scale inefficiency outperform pure technical inefficiency.

As for the second stage analysis, he find that technically efficient Chinese banks are more capitalized, bigger, have a smaller market share and a lower non-performing loans ratio.

Staub, da Silva e Souza and Tabak (2010) investigate cost, allocative and technical efficiency of domestic and foreign Brazilian banks for the period between 2000 and 2007. Their findings show that Brazilian state-owned banks are more cost efficient than the rest of bank categories. They also find that non-performing loans and capital are negatively and significantly associated with allocative efficiency at 10% level while market share was positively correlated with cost, technical and allocative efficiency at 5% level. Next, Ariff and Can (2008) use two stage DEA technique to evaluate bank cost and profit efficiency for a sample of 28 Chinese banks for the 1995 to 2004 period. Employing three inputs (i.e. total loanable funds, number of employees, and physical capital) and two outputs (i.e. total loans and investments), they report that Chinese medium size banks are the most efficient. Moreover, liquidity is positively associated with Chinese bank efficiency while the capital ratio is negatively correlated with bank efficiency though the relationship was not significant. Then, basing on the dataset that covers 27 public sector commercial banks, 34 private sector commercial banks and 42 foreign banks for 1997 and 1998, Sathye (2003) examines the productive efficiency of Indian banks. The results suggest that Indian public sector banks have a higher mean efficiency scores than Indian private sector and foreign banks. He also finds that most banks on the efficiency frontier are foreign owned. Finally, Miller and Noulas (1996) examine the technical efficiency of 201 large banks with assets that exceed \$1 billion dollars in 1984. Employing 4 inputs (i.e. transactions deposits, non-transactions deposits, total interest expenses and total non-interest expenses) and 6 outputs (i.e. commercial and industrial loans, consumer loans, real estate loans, investments, total interest income, and total non-interest income), they show that large and more profitable banks have higher pure technical efficiency and that market power is inversely associated with technical efficiency.

A third strain of literature refers to studies that have applied DEA to the question of efficiency of Islamic banks compared to their conventional counterparts. In this section below, we provide the relevant literature.

COMPARING CONVENTIONAL AND ISLAMIC BANKS EFFICIENCY

Recently, there have been studies comparing the efficiency of conventional banks to that of Islamic banks. Johnes, Izzedin and Pappas (2013) argue that a small fragment of literature comparing the efficiency of Islamic banks either with that of other Islamic banks or that of conventional counterparts.

For conventional bank and Islamic bank comparison, Johnes, Izzedin and Pappas (2009) evaluate the efficiency of Islamic and conventional banks using Financial Ratios Analysis (FRA) and Data Envelopment Analysis (DEA). The former technique incorporates financial ratios and suggests that that cost to income ratio and net interest expenses to average assets ratio are higher for Islamic banks compared to conventional one. It also shows that return on average assets, return on average equity, other operating income to other assets, net interest margin are higher for Islamic compared to conventional peers. The latter technique (i.e. DEA) employs a risk factor (i.e. equity) in the inputs along with an array of other inputs and outputs parameters to assess for differences in risk behavior of the two systems and its relationship with banks' level of efficiency. The result reports a significantly higher efficiency for conventional banks when compared to a common frontier while Islamic banks are more efficient when comparing each bank category to its own efficiency frontier.

Further, investigating if the rules under which Islamic banks operates affect their own efficiency, Johnes, Izzedin and Pappas (2013) analyze and compare the efficiency of Islamic banks to their conventional counterparts. They carry a Meta frontier DEA by separating and calculating Islamic banks efficiency scores and frontier apart of conventional banks efficiency scores and frontier. Employing a cross sectional and time series study on 210 conventional banks and 45 Islamic banks in 19 countries and 6 years period, they find no differences in term of gross efficiency and type efficiency between Islamic and conventional banks. They also show that net efficiency of Islamic banks is significantly higher than for conventional bank. They conclude that *Sharia'a* rules impact negatively the efficiency of Islamic banks and that managers' make up for this lack of performance. Thus, the expansion of demand on Islamic financial product is associated with the improvement of managerial efficiency rather than *Sharia'a* compliant principles. In the same context, Abdul-Majid, Saal and Battisti (2010) study the efficiency of Islamic banks and conventional banks by highlighting the importance of banks' operational characteristics' which mainly include banks' level, country and environmental specific characteristics, and their impact on the relative outputs of banks. Their results show that Islamic banks have lower outputs for given inputs which can be interpreted as a "*systemic inefficiency attributable to Sharia'a compliance*" constraints.

In 2012, Belans and Hassiki contribute to the Islamic efficiency literature by investigating the impact of the 2007 – 2008 financial crisis on the efficiency of conventional banks and Islamic banks. They show that: first, conventional banks are slightly more efficient than Islamic banks and second, small and large conventional banks are more efficient than small and large Islamic

banks. The results also show that liquidity buffers have a positive impact on banks' efficiency scores of both systems. Meanwhile, leverage and risk increase the efficiency of conventional banks, suggesting that, in contrast to their Islamic peers, efficient conventional banks incur more risk and are more leveraged.

Further, Mokhtar, Abdullah and AlHabshi (2007) examine the efficiency of full-fledged Islamic banks, Islamic banks windows and conventional banks of the Malaysian banking sector. They employ DEA as a first stage to compute technical and cost efficiency of the three categories of banks. Their results show conventional banks are more efficient than fully-fledged Islamic banks followed by Islamic windows. Furthermore, Islamic windows of foreign banks are found to be more efficient than the Islamic windows of the domestic banks. They also apply generalized least square regression (GLS) to examine the determinant of banks efficiency and conclude that bank size, capitalization and age are positively associated with banking sector technical and cost efficiency, whilst banking cost decreases banking sector technical and cost efficiency. They suggest Islamic banks have a large room of improvement but at the same time are constrained to improve due to the infancy of the industry. In addition to that, Said (2012) assess the impact of the 2007 – 2008 financial crisis on the efficiency of large and small commercial banks and Islamic banks. His results suggest that large commercial banks and Islamic banks are less vulnerable to the financial crisis than small commercial banks.

Besides the traditional comparison between conventional and Islamic banks, literature has also provided some empirical studies that compare the efficiency scores of Islamic banks among themselves. For Instance, Sufian, Mohamed and Zulkhibri (2008) compare the efficiency of Islamic banks in MENA and South East Asia regions and show that Islamic banks in MENA region were more efficient than Islamic banks in South East Asia. However, Islamic banks in both regions are found to be distant from being technically efficient since pure technical efficiency was marginally efficient compared to scale efficiency. In contrast, Viverita, Brownand and Skully (2007) conclude that Asian Islamic banks and especially Indonesia's Islamic banks are more efficient compared to Middle Eastern and African partners. Yet, they suggest policymakers use UAE's Islamic banks as an example for the efficient application of inputs and outputs and Indonesian banks for their successful technology.

Moreover, Kamaruddin, Safa and Mohd (2008) find that Islamic banks in Malaysia are more costly efficient than profit efficient and this is due to the good management and economies of scale while Sufian (2007) emphasizes the importance of risk in evaluating the efficiency of Malaysian Islamic banks. He proposes two efficiency models. The first model does not include a

risk factor as input while the second model introduces loan loss provision as an input risk parameter. By decomposing the Technical Efficiency (TE) into Pure Technical Efficiency (PTE) and Scale Efficiency (SE), the model 1 results show that Malaysian Islamic banks are “*operating at the wrong scale of operations*”. Furthermore, foreign Malaysian Islamic banks are found to be more efficient than domestic Malaysian Islamic banks due to their managerial competency in controlling costs. Similarly, model 2 results suggest that the inclusion of a risk parameter as inputs ameliorates Islamic banks’ technical efficiency by increasing their own pure technical efficiency. These results indicate that Islamic banks’ pure technical efficiency is more sensitive to the inclusion of risk parameter than Islamic banks’ scale efficiency (Drake and hall, 2003). However, in another study that also examines the Malaysian banking system, Sufian (2006) find that foreign Malaysian Islamic banks are scale inefficient compared to domestic Malaysian Islamic banks. The results also show that domestic Malaysian Islamic banks are more technically efficient than foreign Malaysian Islamic banks due to the poor management of operations cost. Finally, El Moussawi and Obeid (2010) examine the efficiency of Islamic banks in the GCC region. By decomposing productive efficiency into technical efficiency, allocative efficiency and cost efficiency, they suggest that technical inefficiency and allocative inefficiency have increased bank cost by 14% and 29%, respectively. Nevertheless, by examining the determinant of banks’ efficiency, they show a negative relationship between capital and productive efficiency.

Table E.I. Variables definitions and data sources

Variable	Definition	Data Sources
Efficiency model		
<i>Outputs of banks</i>		
TL	Loans and total other lending (US\$ thousands)	Bankscope
OEA	Total other earning assets (US\$ thousands)	Bankscope
OOI	Other operating income (US\$ thousands)	Bankscope
<i>Inputs of banks</i>		
DSTF	The sum of deposits and short term funding (US\$ thousands)	Bankscope
FA	Fixed assets (US\$ thousands)	Bankscope
OVERH	Overhead (US\$ thousands)	Bankscope
RISK	Loan loss provisions (US\$ thousands)	Bankscope
Dependent variables		
EFF1	Bank pure technical efficiency, ranging between 0 and 100. EFF1 is calculated by comparing Islamic and conventional banks to a common frontier. EFF1 does not include loan loss provisions to control for risk	Authors' calculation
EFF2	Bank pure technical efficiency, ranging between 0 and 100. EFF2 is calculated by comparing Islamic and conventional banks to a common frontier. EFF2 includes loan loss provisions to control for risk	Authors' calculation
EFF3	Bank pure technical efficiency, ranging between 0 and 100. EFF3 is calculated by comparing each bank category (i.e. Islamic and conventional banks) to its own efficiency frontier. EFF3 does not include loan loss provisions to control for risk	Authors' calculation
EFF4	Bank pure technical efficiency, ranging between 0 and 100. EFF4 is calculated by comparing each bank category (i.e. Islamic and conventional banks) to its own efficiency frontier. EFF3 includes loan loss provisions to control for risk	Authors' calculation
EFF-TE	Bank pure technical efficiency, ranging between 0 and 100. EFF-TE is calculated by comparing each bank category (i.e. Islamic and conventional banks) to its own efficiency frontier. EFF-TE includes total equity to control for risk.	Authors' calculation
Independent variables		
<i>Regulatory variables</i>		
4. Capital requirements		
TCRP	This ratio is the capital adequacy ratio. It is the sum of bank tier 1 plus tier 2 capital as a percentage of risk weighted assets. This includes subordinated debt, hybrid capital, loan loss reserves and valuation reserves as a percentage of risk weighted assets and off balance sheet risks. This ratio must be maintained at a level of at least 8% under Basel II rules.	Bankscope and banks' annual reports
TIRP	Similar to the capital adequacy ratio. This measure of capital adequacy measures tier 1 capital divided by risk weighted assets computed under the Basel rules. Banks must maintain a minimum tier 1 capital of at least 4%.	Bankscope and banks' annual reports
TETLIP	The traditional equity to liabilities ratio times 100. This ratio is a non-risk capital adequacy measure. It reports the amount of equity available compared to the bank's debt position.	Bankscope
TECSTF	Another ratio of bank capitalisation. It measures the amount of bank equity relative to bank deposits and short term funding.	Bankscope
5. Liquidity requirements		
LADSTFP	The ratio of liquid assets to deposits and short term funding. It measures and assesses the sensitivity to bank runs; therefore, it promotes financial soundness but it can be also interpreted as excess of liquidity coverage.	Bankscope
LATAP	The ratio of liquid assets to total assets. The ratio measures assets that are easily convertible to cash at any time and without any constraints.	Bankscope
LATDBP	The ratio of liquid assets to total deposits and borrowing. Similar to the liquid assets to deposit and short term funding ratio, this ratio considers the amount of liquid assets available not only for depositors but also for borrowers.	Bankscope
6. Leverage requirements		
TETAP	The traditional leverage ratio measured as the equity to assets times 100.	Bankscope
Control variables		
<i>Bank control variables</i>		
LnTA	The natural logarithm of total assets	Bankscope
FATAP	The ratio of bank fixed assets to total assets times 100	Bankscope

Variable	Definition	Data Sources
NLTEAP	The share of bank net loans in total earning assets times 100	Bankscope
ROAAP	The profitability ratio is a measure of bank profitability at the operational level. It reports the amount of a bank's net income divided by average total assets times 100.	Bankscope
CIRP	The share of bank costs to bank income before provisions times 100	Bankscope
OVERTAP	The percentage of bank overhead to total assets	
NIMP	Bank interest income minus bank interest expenses as a percentage of earning assets	Bankscope
<i>Country control variables</i>		
IBSP	Market share of Islamic banks in a country per year	Authors' calculation based on Bankscope
GDPPC	The natural logarithm of GDP per capita	World Development Indicators (WDI)
GDPG	Growth rate of GDP	World Development Indicators (WDI)
INF	Inflation rate, based on changes in the consumer price index	World Development Indicators (WDI)
RELP	The percentage of the Muslim population in each country	PEW Research Center and the CIA World Fact Book
LEGAL	Dummy that takes on a value of 0 if a country does not apply <i>Sharia'a</i> rules in its legal system, a value of 1 if <i>Sharia'a</i> law and other legal systems are considered, and a value of 2 if <i>Sharia'a</i> is the only accepted law	The CIA World Fact Book
GLOBAL	A dummy variable that equals 1 for 2007 and 2008 and 0 otherwise	Authors' calculation
LOCAL	A dummy variable that equals 1 if a local financial crisis occurred and 0 otherwise	Laeven and Valencia (2012)
TREND	A time fixed effect parameter that varies between 1 and 18 to control for linear trends in regulation.	Authors' calculation
IBDV	Dummy variable, equals 1 for Islamic banks, 0 otherwise	Authors' calculation

(continued)

Table E.II. Summary statistics for DEA inputs and outputs

Variable	# of obs.	Mean	Median	STD	Islamic banks	Conv. banks
<i>Outputs of banks</i>						
Total loans	4320	11767	872	65743	3099	13783
Other earning assets	4426	11491	570	91321	1153	13973
Other operating income	4391	265	23	1583	108	302
<i>Inputs of banks</i>						
Deposits and short term funding	4366	15509	1474	80911	3957	18205
Fixed assets	4323	185	20	1063	139	197
Overheads	4410	342	36	1904	118	397
Loan loss provision	3785	141	7	990	38	161

This table presents DEA inputs and outputs in US\$ millions for a sample of 4473 bank-year observations for 2006–2012 in 29 countries.

Table E.III. Evidence on the behavior of bank efficiency, comparing Islamic banks and conventional bank efficiency between regions and income classification.

Variables	N	Mean	STD	P10	Q1	Median	Q3	P90	Islamic banks	Conv. banks	t-test (p-value)	Wilc-test (p-value)
Panel A: Efficiency scores by regions												
<i>Middle East and North Africa (MENA)</i>												
EFF1 (%)	1003	40.49	19.96	20.71	26.89	35.67	47.81	68.22	50.4	38.05	0.00***	0.00***
EFF2 (%)	872	46.29	19.95	25.99	32.45	41.41	54.73	73.86	55.35	44.65	0.00***	0.00***
EFF3 (%)	1003	48.83	23.21	24.89	32.54	42.09	60.24	89.96	72.9	42.91	0.00***	0.00***
EFF4 (%)	872	53.95	21.8	30.5	38.47	47.79	64.79	100	78.423	49.55	0.00***	0.00***
<i>Gulf Cooperation Council (GCC)</i>												
EFF1 (%)	634	52.89	22.89	25.71	35.41	50.4	65.13	91.13	54.27	52.15	0.32	0.66
EFF2 (%)	587	61.52	22.19	34.05	44.78	58.68	77.67	100	61.86	61.36	0.892	0.57
EFF3 (%)	634	66.5	24.12	34.46	47.87	63.73	89.52	100	83.24	57.54	0.00***	0.00***
EFF4 (%)	587	73.28	21.46	46.42	57.48	57.48	100	100	88.46	66.29	0.00***	0.00***
<i>European Union (EU)</i>												
EFF1 (%)	884	40.04	27.38	24.73	33.85	49.61	76.54	100	48.22	56.54	0.04**	0.02**
EFF2 (%)	747	46.96	26.33	30.91	41.26	58.7	94.25	100	54.87	64.01	0.01***	0.03**
EFF3 (%)	884	61.52	26.43	29.36	41.22	56.83	89.54	100	69.4	61.09	0.03***	0.04**
EFF4 (%)	747	68.2	24.96	36.16	48.26	65.76	100	100	78.64	67.54	0.00***	0.01***
<i>East Asia & Pacific (SEA)</i>												
EFF1 (%)	1412	40.04	24.11	16.42	22.32	33.38	49.76	79.18	43.21	39.5	0.09*	0.73
EFF2 (%)	1347	46.96	25.38	20.36	28.1	39.48	58.79	100	45.61	47.18	0.48	0.03**
EFF3 (%)	1412	47.25	25.12	19.76	28.52	40.99	60.8	96.3	60.42	44.98	0.00***	0.00***
EFF4 (%)	1347	54	24.91	26.21	36.15	47.25	68.29	100	63.7	52.49	0.00***	0.00***
<i>Sub-Saharan Africa countries (SUB)</i>												
EFF1 (%)	190	42.47	22.27	21.1	26.36	35.63	53.03	79.19	43.43	41.91	0.65	0.56
EFF2 (%)	124	50.55	22.66	26.14	33.47	45.29	65.70	84.67	49.62	50.97	0.75	0.99
EFF3 (%)	190	50.25	24	25.2	32.05	42.63	67.12	92.03	54.54	47.75	0.06*	0.08*
EFF4 (%)	124	60.81	25.18	30.35	38.41	57.02	81.66	100	68.55	57.39	0.03**	0.04**
Panel B: Efficiency scores by countries' income level												
<i>Low Income Countries (LI)</i>												
EFF1 (%)	196	40.57	17.36	21.96	28.94	38.44	48.08	59.14	38.63	40.88	0.528	0.57
EFF2 (%)	188	46.63	18	27.34	34.11	43.87	54	67.68	42.89	47.17	0.27	0.11
EFF3 (%)	196	48.34	18.41	27.1	34.72	46.15	56.87	71.63	55.757	47.152	0.07*	0.04**
EFF4 (%)	188	54.89	18.15	33.9	41.03	52.5	63.73	79.71	61.183	53.972	0.07*	0.04**
<i>Lower Middle Income (LMI)</i>												
EFF1 (%)	1323	35.32	20.31	16.27	21.53	30.53	55.44	100	39.63	34.51	0.01***	0.23
EFF2 (%)	1169	40.89	20.62	20.28	26.99	35.91	65.02	100	42.02	40.72	0.51	0.5
EFF3 (%)	1323	42.16	22.41	19.09	26.61	37.39	68.17	100	54.58	39.84	0.00***	0.00***
EFF4 (%)	1169	48.25	22.23	24.93	33.86	42.53	77.03	100	62.31	46.21	0.00***	0.00***
<i>Upper Middle Income Countries (UMI)</i>												
EFF1 (%)	1186	44.79	23.03	21.08	28	39.12	55.44	81.95	52.08	42.78	0.00***	0.00***
EFF2 (%)	1169	52.30	23.9	26.44	34.16	47.27	65.02	99.98	56.14	51.45	0.03**	0.12
EFF3 (%)	1186	53.79	24.98	25.63	34.26	47.15	68.17	100	74.28	48.15	0.00***	0.00***
EFF4 (%)	1092	60.02	23.77	31.57	41.79	54.82	77.03	100	76.88	56.28	0.00***	0.00***
<i>High Income Countries (HI)</i>												
EFF1 (%)	1418	56.81	25.95	26.02	36.16	52.1	74.94	100	54.04	57.4	0.09*	0.01**
EFF2 (%)	1228	64.93	24.91	33.43	44.63	61.42	89.76	100	61.45	65.66	0.03**	0.01**
EFF3 (%)	1418	65.40	25.5	32.41	44.67	62.5	93.64	100	81.59	61.92	0.00***	0.00***
EFF4 (%)	1228	72.50	23.59	39.76	54.94	72.41	100	100	87.35	69.38	0.00***	0.00***

***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table EIII compares bank efficiency between regions and Income classifications. EFF1 represents banks' efficiency scores calculated relative to a common frontier where the risk factor is excluded from the efficiency inputs; EFF2 represents efficiency scores calculated relative to a common frontier where loan loss provisions are included as a risk factor in bank inputs; EFF3 measures banks' efficiency scores calculated relative to banks' specific efficiency frontier where the risk factor is excluded from the efficiency inputs; EFF4 represents efficiency scores calculated relative to banks' specific efficiency frontier where loan loss provision are included as a risk factor in bank inputs. Panel A uses a regional classification of countries. Accordingly, our sample is divided into five geographical regions. These regions are: (i) Middle East and North Africa (MENA), (ii) European Union (EU), (iii) East Asia & Pacific, (iv) Sub-Saharan Africa. However, we decompose MENA region into two sub-regions: The MENA and the Gulf Cooperation Council (GCC) because we believe that the six countries of the GCC are economically and institutionally different from the rest of the MENA countries. Panel B reorganises the data set according to the level of income provided by the World Bank. Our calculations are based on GNI per capita data in October 2013 and are calculated following the World Bank's Atlas method. Thus, our sample includes five income groups. These groups are: (i) Low income, (ii) lower middle income, (iii) higher middle income and (iv) high income countries. We perform a series of t-tests to test the null hypothesis that the means derived for Islamic banks and conventional banks are equal (we use a Satterthwaite test because it allows for variances to be different). Wilc-test represents a Wilcoxon rank test which tests the null hypothesis that the two samples are derived from different distributions (where normality is not assumed).

Table E.IV. Sample features and macroeconomic indicators across countries.

Country	All sample		Macroeconomic indicators			Demographics and concentration		
	Conventional	Islamic	GDPPC	GDPG (%)	INF (%)	RELP (%)	LEGAL	IBSP (%)
Algeria	11	0	8.325	3.091	4.343	99	1	0
Bahrain	14	9	9.862	5.327	2.323	81.2	1	21.572
Bangladesh	20	6	6.368	6.283	8.244	89.5	1	18.075
Brunei	1	1	10.370	0.954	1.064	67	1	.
Egypt	24	2	7.671	4.919	10.025	90	1	4.673
Gambia	8	1	6.270	3.526	4.417	90	1	0
Indonesia	50	4	7.703	5.883	7.528	95.765	0	1.518
Iran	0	12	8.525	3.680	17.467	98.937	2	100
Iraq	11	5	8.198	4.789	13.794	97.684	1	33.656
Jordan	11	3	8.194	5.586	5.447	92	1	4.471
Kuwait	8	8	10.662	3.766	4.865	85	1	33.554
Lebanon	48	1	8.885	4.633	4.166	59.7	0	0.200
Malaysia	23	17	8.949	4.862	2.662	60.4	1	10.247
Mauritania	8	2	6.930	5.627	5.703	98.571	1	12.174
Maldives	1	1	8.668	8.033	8.284	99.41	1	.
Oman	6	1	9.820	5.058	4.468	75	1	0.094
Pakistan	15	9	6.898	3.561	12.033	96.4	1	3.665
Palestine	2	2	7.207	5.085	3.902	75.187	1	26.657
Philippines	25	1	7.501	4.995	4.930	5	1	0.009
Qatar	7	4	11.193	13.730	5.744	77.5	1	17.886
Saudi Arabia	9	4	9.800	6.294	4.436	100	2	19.210
Singapore	22	1	10.551	5.972	2.790	14.3	0	0.109
Sudan	12	10	7.089	2.886	15.698	99.9	1	44.073
Syria	13	2	7.847	3.074	10.740	90	1	4.001
Tunisia	17	1	8.281	3.494	4.001	98	1	1.495
Turkey	33	4	9.162	4.022	8.586	99.8	0	3.769
UAE	20	8	10.643	3.261	5.359	96	1	17.806
UK	90	2	10.582	0.922	2.842	2.7	0	0.015
Yemen	5	4	7.042	2.169	12.466	99.9	1	50.407
Total	514	125	29	29	29	29	29	9.771

This table documents the number of banks, the macroeconomic indicators, some demographics and concentration variables across 29 countries, over the 2006 – 2012 periods. GDPPC is the logarithm of the annual percentage growth rate of the GDP per capita in a given country; GDPG is the annual GDP growth rate in a given country; INF represents inflation based on the consumer price index in a given country; RELP is the percentage of the Muslim population in a given country; LEGAL is an indicator of a country's legal system. LEGAL equals 0 if the country does not use *Sharia'a* law in its legal system, 1 for countries that consider *Sharia'a* with other legal systems, and 2 if the legal system is only *Sharia'a* compliant; IBSP is the share of total banking assets held by Islamic banks in a given country.

Table E.V. Descriptive statistics – regulatory quantile regression sample.

	# of obs.	Mean	STD	P10	P90
TCRP (%)	2114	18.31	14.16	10.58	27.62
T1RP (%)	1558	16.06	12.02	8.63	24
TETLIP (%)	3155	19.23	48.75	5.6	26.24
TECSTF (%)	3132	21.06	48.84	6.22	30.72
LADSTF (%)	3146	39.31	53.64	12.05	66.15
LATAP (%)	3159	26.92	16.88	9.43	50.98
LATDBP (%)	2446	32.45	25.53	11.33	59.32
TETAP (%)	3170	12.86	13.16	5.27	21.05

General Conclusion

This thesis represents the first empirical work to examine the contrasting relationships between the banking regulation, stability, and efficiency of Islamic banks compared to conventional banks. The conventional banking literature provides no conclusive results about the association between regulatory frameworks and banking system stability and efficiency. In fact, the results in the literature are contradictory. In this thesis, we try to position Islamic banks by investigating whether banking regulations improve or impede their stability and efficiency compared to the literature's benchmark.

In terms of capitalization, and according to the regulatory hypothesis, higher capital requirements increase the stability and the efficiency of the banking system. However, the moral hazard and the cost agency hypothesis argue that the opposite might be true. In other words, the moral hazard hypothesis points to higher capital requirements having a destabilizing effect on banking system stability because banks will take more risk to compensate for capital constraints. Furthermore, the cost agency hypothesis posits that bank managers will engage in more leverage to satisfy shareholders' demands for higher income as a way to compensate for their engagement in riskier activities. These hypotheses could be applied to Islamic banks. However, the fact that depositors or investment account holders in Islamic banks are considered to be investors who participate in profit and loss might have a positive or a negative effect on Islamic bank stability and efficiency. This also depends on the profit smoothing mechanisms used by Islamic banks.

Beside capital requirements, the Basel III framework calls for regulatory authorities to extend regulatory guidelines to examine bank liquidity requirements. Indeed, Basel III requires

banks to hold and maintain higher liquidity buffers that are explicitly computed using a short-term liquidity measure (the Liquidity Coverage Ratio, LCR) and a long-term liquidity measure (the Net Stable Funding Ratio, NSFR). The literature is also not conclusive about the impact of higher liquidity on banking system stability and efficiency. As for Islamic banks, the challenges will be more important. Islamic banks have a weak liquidity infrastructure due to *Sharia'a* constraints; therefore liquidity requirements might penalize this newborn sector in terms of its stability and efficiency, in comparison to its conventional counterparts.

Finally, Basel III constrains bank leverage by imposing an explicit non-risk-based measure that creates a blockage against leverage. The literature shows that by constraining the leverage ratio, banks will be less profitable. As for Islamic banks, several theoretical and empirical works have shown that Islamic banks have an advantage in their use of leverage compared to conventional banks. *Sharia'a* law requires each bank transaction to be asset backed. In addition, if severe losses occur, depositors in Islamic banks will be impacted as they will participate in the losses. This can trigger a massive withdrawal and make institutions insolvent, even if Islamic banks distribute profits from special reserves, this policy cannot be maintained in cases of severe losses where these banks will be required to adjust their equity base. Therefore, Islamic banks are more prudent when using leverage than conventional banks and this could have a positive impact on their stability and efficiency.

Research question

In reviewing the literature that concerns the three main challenges required by Basel III, this PhD dissertation investigates the impact of capital, liquidity, and leverage requirements on the stability and the efficiency of Islamic and conventional banks. This novel work is the first attempt to empirically assess whether Islamic banks should be regulated in the same way as conventional banks. No empirical studies in the literature have examined the relationship between the regulation, stability, and efficiency of both bank types. Accordingly, this work tries to fill this gap in the literature and answers the following research question:

Do banking regulations have the same impact on Islamic banks' stability and efficiency as they do on conventional banks?

This research question reflects three sub-questions that we use to examine differences and similarities between both bank types:

1. **What are the strengths and the weaknesses of Islamic banks' financial characteristics compared to conventional banks?**
2. **Do banking regulations – in the light of Basel III – improve or impede Islamic banks' stability compared to conventional banks?**
3. **Do banking regulations – in the light of Basel III – improve or impede Islamic banks' efficiency compared to conventional banks?**

To do this, we proceeded by using several methodological and empirical investigations. This is reflected in four chapters that explore and compare Islamic and conventional banks' financial characteristics and regulatory requirements.

Research focus and findings

This first chapter is an introductory chapter. It explores Islamic banks' history and growth, but focuses on the specificities of Islamic banks. Accordingly, Chapter 1 exhibits and compares Islamic banks' theoretical business models, as required by *Sharia'a* law. Using detailed financial data from 115 Islamic banks for the period between 2000 and 2011, we show that, on their asset side, Islamic banks tend to use mark-up financing techniques instead of profit and loss sharing techniques. According to some Islamic law scholars, this commercialized business model casts doubt on the specific practices of Islamic banks. However, this does not mean that non-profit and loss sharing techniques are not *Sharia'a* compliant. The use of these tools is also permissible because mark-up financing techniques are asset backed and funds are not invested in prohibited projects. The only concern is that dealing with commercial products (e.g., *Murabaha*) does not reflect the essence of Islamic banking, which is the profit and loss sharing principle. Accordingly, Islamic banking practices show divergence from their main theoretical principles. Such divergence poses several questions about whether they should be regulated in the same way as conventional banks. Finally, Chapter 1 compares Basel I and Basel II guidelines between both bank types with a special focus on Basel III capital, liquidity, and leverage requirements. We demonstrate that IFSB and AAOIFI have responded to BCBS regulatory guidelines by focusing on Islamic banks' capital requirements. If anything, we show that the Basel III regulatory framework does not fit Islamic banks as well as it does their conventional counterparts, especially

for liquidity requirements. As a result, some issues (e.g., additional capital buffers, liquidity requirements, and the explicit leverage ratio) should be examined further before requiring Islamic banks to fully acknowledge Basel III.

The second chapter of this dissertation is the first empirical study to perform principal component analysis (PCA) to explore and compare the financial characteristics of conventional and Islamic banks. In contrast to the existing literature, this study uses an array of 20 financial ratios to derive four components to examine the financial strength of both bank types. We use PCA because literature shows contradictory results when comparing Islamic and conventional banks stability, risk profitability, capital, and liquidity. Our intuition is to create a new but powerful dataset by building on the initial financial measures to avoid the contradictory results of the literature and to examine whether both banking types have same or different patterns. The PCA shows that capital requirements, stability, liquidity and profitability are the most informative components in explaining the financial differences between Islamic and conventional banks. We further employ logit, probit, OLS, and quantile regressions to compare Islamic and conventional banks' financial strength. Our results show that Islamic banks are more capitalized, more liquid, and more profitable, but less stable than their conventional counterparts. The findings in terms of capitalization and liquidity are driven by small Islamic banks in our sample of 28 countries. Finally, we provide evidence that Islamic banks were more resilient than conventional banks in terms of capital, liquidity, and profitability during the subprime crisis. Our findings persist when US banks are excluded and when banks are compared in countries where the two banking systems co-exist.

The third chapter of this dissertation aims to empirically determine the regulatory relationship based on Basel III between Islamic and conventional banks. The literature has shown that there is interest in comparing the stability, risk, capital, and profitability of Islamic and conventional banks. However, no empirical works have investigated the impact of banking regulations on the stability of the Islamic banking system. Accordingly, with the benefit of Basel III recommendations, we ask whether banking regulations have a positive impact on the stability of Islamic banks compared to conventional banks. We particularly focus on the impact of capital, liquidity, and leverage ratios on the stability and adjusted profits of Islamic and conventional banks using conditional quantile regression models. We use quantile regressions to allow for heterogeneous responses to regulations (i.e., capital, liquidity, leverage) by conditioning on bank stability and adjusted profits. The total studied sample consists of 4473 bank-year observations (with 875 bank-year observations for Islamic banks) on banks located in 29 countries over the

period from 2006 to 2012. We find that Islamic banks are less stable than conventional banks. We also show that across stability quantiles, higher capital, and lower leverage have a more positive impact on Islamic bank stability than on conventional bank stability, while there is no significant difference between Islamic and conventional banks concerning liquidity. In the robustness tests, we show that non-risk-based capital ratios improve the adjusted profits of small and highly liquid Islamic banks. Higher liquidity is positively associated with the stability of large Islamic banks and negatively correlated with the stability of small Islamic banks. . Finally, we find no significant difference between Islamic and conventional bank stability and regulations during the subprime crisis.

The last chapter examines the impact of banking regulations on the efficiency of Islamic and conventional banks in light of Basel III. We employ an unbalanced sample of 4473 bank-year observations in 29 countries over the period from 2006 to 2012 to investigate whether the Basel III regulatory framework is suitable for both Islamic and conventional banks. We derive efficiency scores for our sample of banks using Data Envelopment Analysis (DEA) and investigate the impact of the regulation on different levels of efficiency using, for the first time, a conditional quantile regression methodology. Our findings suggest that Islamic banks are significantly more efficient than conventional banks when compared to their own efficiency frontier. However, the Basel III requirements for higher capital and liquidity are negatively associated with the efficiency of Islamic banks, while the opposite is true for financial leverage. Our results are driven by small and highly liquid Islamic banks compared to conventional banks. Our study also sheds light on the capital, liquidity, and leverage position of Islamic and conventional banks during the 2007/2008 financial crisis. We find that higher capital and liquidity positions resulted in greater efficiency for conventional than Islamic banks during the subprime crisis. Finally, we find that Islamic banks' capital ratios tend to show a negative trend, while their leverage ratios tend to show a positive trend, which reflects a change in the policy of Islamic banks regarding their capitalized position.

Research contributions

In this part of the conclusion, I will briefly explain thesis' main empirical and operational contributions.

Empirical contributions

One of the most important empirical contributions is that we utilize for the first time Principal Component Analysis (PCA) to create a new set of variables to compare Islamic and conventional banks' financial strength. Despite the importance of such technique, PCA was rarely used in the conventional banking literature. Therefore, we take advantage of such gap in the empirical literature and use PCA to investigate similarities and differences between Islamic and conventional banks' financial characteristics.

A second important contribution is that we develop the work of Abedifar, Molyneux and Tarazi (2013), Barth et al., (2013), and Beck, Demirgüç-Kunt, and Merrouche (2013) and implement conditional quantile regressions instead of OLS regression. One important feature of quantile regression is that it allows for heterogeneous solutions of regulations by conditioning on bank stability and efficiency. In other words, Islamic and conventional banks with lower stability and lower efficiency may have different responses to regulation than highly stable and efficient banks. Conditional quantile regressions also allow for a richer description of such differences. Moreover they are more robust in term of outliers and distributions with heavily tails.

A third empirical contribution is related to performance and efficiency literature. Although most banking literature uses accounting ratios to examine bank performance (e.g. ROA, ROE, cost to income ratio, etc.) in this thesis we use a non-parametric approach called Data Envelopment Analysis (DEA). As we elaborated in chapter four, this technique creates an efficiency frontier that allows banks to identify whether they are using excessive inputs or generating fewer outputs compared to the benchmark. Considering several inputs and outputs, DEA is more adequate and helps us to have a complete picture of bank performance compared to traditional ratios analysis.

Fourth and final empirical contribution of this research is that we combine multi-dimensional approaches such as DEA and PCA with several regression techniques such as OLS, Logit, and Probit methods, and Quantile regressions which strengthen our results and provide us with richer descriptions of the relationship between our regulatory variables and bank stability, and efficiency.

Operational contributions

The research results have important implications for regulators and policymakers of Islamic banks. As Basel III requires conventional banks to strengthen their capital and liquidity requirements, Islamic regulatory organizations such as the Islamic Financial Services Board (IFSB) and the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) are also invited to adapt Basel III recommendations to Islamic banks. IFSB is still working on the new liquidity guidelines that are expected to be published in the beginning of 2015. According to Standard and Poor's (2014), the new IFSB capital and liquidity guidelines will help Islamic banking industry to be more resilient. Our thesis results show that higher non-risk based capital measures and lower leverage improve the adjusted profits of Islamic banks. In addition, we find that risk based capital measures rarely show a significant difference between Islamic and conventional banks' adjusted returns. Nevertheless, holding higher liquidity buffers have an opposite effect. Depending on bank size, we find that higher liquidity is negatively associated with the stability of small Islamic banks while the opposite is true for large Islamic banks. Furthermore, there is evidence that the impact of banking regulations may differ between Islamic and conventional banks depending on bank stability level (i.e. highly stable vs. low stability banks). Therefore, different factors should be taken into account before publishing this new revised accord on Banking regulation and supervision for Islamic banks.

In addition, it is interesting to ask whether Basel III guidelines have a positive impact on Islamic banks' efficiency as well. Our findings show some kind of trade-off between stability and efficiency. Although our results show positive association between Basel III recommendations and Islamic banks' stability compared to conventional banks, the findings are quite opposite when studying the efficiency of Islamic banks. It appears that Basel III recommendations for higher capital and liquidity ratios may penalize the efficiency of small and highly liquid Islamic banks compared to conventional banks. In addition, we find no significant difference between large Islamic banks and large conventional banks regarding the regulatory solutions. This poses important questions on the consequences of adapting and applying Basel III framework for Islamic banks especially small and highly liquid ones.

Recommendations

As conventional banks are expected to apply Basel III, several questions are yet remained to be answered regarding Islamic banks. Our research shows evidence that higher capital requirements have a positive influence on Islamic banks' adjusted profits. The findings

corroborate those of Standard and Poor's (2014). The author of this report – Mohamed Damak – explains that raising additional capital requirements through the introduction of the Capital Conservation Buffer (CCB) and the Counter-cyclical Buffer (CB) will make the industry more resilient especially because Islamic banks are more exposed to real economy (e.g. real estate sector) due to *Sharia'a* rules. Yet, IFSB and AAOIFI need to be careful and take into consideration the fact that higher capital requirements may create a trade-off between stability and efficiency. In chapter three we show that higher capital requirements improve the adjusted profits of small and highly liquid Islamic banks while in chapter four we find that capital requirements have opposite relationship with efficiency. This requires a careful examination and more reasonable policy especially for small and highly liquid Islamic banks.

Standard and Poor's (2014) report also encourages Islamic banks to adapt Basel III in term of liquidity requirements. Mohamed Damak argues that Basel III will create an opportunity for Islamic banks to develop high quality liquidity instruments that serve against liquidity shortage and weak interbank money market. Our results show that holding higher liquidity buffers decrease stability and efficiency of small Islamic banks. These banks will be penalized only if IFSB, AAOIFI and Central Banks are able to find or develop new liquidity instruments. For instance, the report refers to Malaysia that succeeded to issue high quality short term *Sukuks* which provided Malaysian's Islamic banks with enough liquidity management tools. However, we must also note that Islamic scholars disagree on whether these *Sukuks* are *Sharia'a* compliant or not.

Finally, we find that leverage has an opposite effect on Islamic banks' stability and efficiency compared to conventional banks. Specifically, we find that higher leverage has a positive impact on the efficiency of small and highly liquid Islamic banks while the opposite is true for adjusted profits. Basel III creates an explicit leverage ratio that creates blockage against excessive bank leverage behavior. In our second chapter, we find that Islamic banks are more capitalized than conventional banks which mean that they are also less leveraged. Therefore, we believe that their leverage behavior will be lower than those of conventional counterparts due to *Sharia'a* constraints. Yet, these banks should be more cautious because chapter four shows that leverage has a positive trend while chapter three shows that leverage deteriorates small and highly liquid Islamic banks' adjusted profits. These findings provide evidence that even Islamic banks can have future problems regarding their leverage position. We recommend them to rely less on investment accounts to finance the expenditure of their balance sheet, minimize the reliance on PER and IRR reserves and to be less exposed to real estate sector.

Research limitations and future research agenda

Finally, it is important to note the research limitations and some future research directions.

Research Limitations

One major obstacle to our work is access to data. Banks' financial information and, more precisely, Islamic banks' financial ratios are mainly compiled from the Bankscope database. However, standard Bankscope licenses offer seven years of historical data, which is not enough to conduct a comprehensive study. Second, the Bankscope database does not include some of the regulatory variables. For instance, we referred to each Islamic bank's website to collect and confirm the data for total capital ratio (TCRP) and tier 1 capital ratio (T1RP). In addition, Bankscope does not offer an explanation of how they compute some regulatory ratios for Islamic banks.

Another major limitation is that the number of Islamic banks is relatively small compared to conventional counterparts which may create problems when using regression analysis.

For instance, because our sample of Islamic banks is very small, we did not use two separates regression models and compare whether betas' coefficients are significantly different; rather we followed the work of Abedifar, Molyneux and Tarazi, (2013) and Beck, Demirgüç-Kunt, and Merrouche (2013) and use one regression model that combines both bank types and includes an Islamic bank dummy that takes the value of zero for conventional banks and one for Islamic banks to captures differences and similarities between banks.

Third, besides the fact that quantile regressions are very important to study the impact of banking regulations on the stability and efficiency of Islamic banks, applying such methodology made interpretation of results very complex and hard to follow. In addition, adding conventional banks for comparative purposes makes the results much more difficult to interpret.

Fourth, we tried to have contact with several Islamic banks such as the Kuwait Finance House as well as the Islamic Financial Services Board (IFSB) and the Islamic Development Bank (IDB) to secure a 6 month to one year training program. However, because of bureaucracy and administrative process we perceive that it would be better to postpone this crucial target to after thesis' defense.

Finally, there are a limited number of studies that are interested in studying Islamic banks. In our work, we faced difficulties in interpreting the observed results especially because

theoretical and empirical works are very limited and rarely show interest in investigating the association between Islamic banks' regulations, stability, and efficiency.

Future research avenues

As for the future research agenda, the plan is to continue the work on Islamic banking regulations. However, it is important to study other bank types such as investment, cooperative, and savings banks.

Working with Professor Philippe Madiès, Professor Ollivier Taramasco, Professor Thomas Walker (from Concordia University), and Professor Kuntara Pukthuanthong (of the University of Missouri), the plan is to expand our research to cover not only different bank types but also several financial hubs. To do this, it is proposed to firstly purchase the Bankscope database to collect all the necessary data. Then, the future research project will examine how the Basel III regulatory guidelines will affect the funding structure of the banking system, bank lending, and ultimately global economic development. This project will accordingly include three main areas of interest:

First, our research will continue its focus on socially responsible banking institutions such as Islamic banks. However, we will target the liquidity challenges that face Islamic banks. We will use matching samples from different countries and compare the liquidity ratios of Islamic and conventional banks. We will also study the impact of liquidity requirements on the stability and efficiency of Islamic banks using panel data and other proxies for stability and efficiency than those used in this dissertation.

Second, we will ask whether Basel III banking regulation is a good determinant of conventional banking sector stability and efficiency, which could ensure global economic stability and growth. In this context, the future research plan intends to covers two regulatory subjects (i.e., Basel III's capital and liquidity requirements). Accordingly, we will study the impact of capital (using PCA of several ratios of capital requirements) and liquidity guidelines (by computing the Vazquez and Federico's proxy of NSFR) on the systemic risk proxied by the conditional value-at-risk (Covar), the logistic transformation of R-squared, and the marginal expected shortfall (MES) as proposed by Anginer and Demirgüç-Kunt (2014). The target is to compare different responses of commercial, savings, cooperative, and investment banks worldwide.

Finally, it is important to focus on the relationship between banking regulation and the stability and efficiency of *too big to fail* US, European, and Japanese banks. Our particular interest in *too to fail* banks is related to the fact that these banks are now becoming *too big to save* banks. For instance, based on a recent report in *The Guardian*¹⁵¹ (2011), Barclays' gross balance sheet is 100% of UK GDP, which raises the question of whether the government could save the bank in the event of default. Accordingly, it is important to examine whether the new banking regulatory framework as requested by Basel III will have a positive influence on the stability and efficiency of *too big to fail* banks.

¹⁵¹ Available at: <http://www.theguardian.com/business/2011/mar/29/barclays-dilemma-viewpoint/>

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Résumé:

Cette thèse de doctorat est une première tentative d'examiner si les réglementations bancaires ont le même impact sur la stabilité et l'efficacité des banques islamiques que sur celles des banques conventionnelles. Suite aux nouvelles recommandations de Bâle III, nous étudions l'impact des exigences minimales en matière de fonds propres, de liquidité et de levier financier sur la stabilité et l'efficacité des banques islamiques comparativement aux banques conventionnelles. Une première étude exploratoire utilise l'analyse en composantes principales (ACP), les méthodes Logit et Probit et les régressions MCO pour montrer que les banques islamiques disposent d'un capital plus élevé, qu'elles sont plus liquides, plus profitables, mais moins stables que leurs homologues conventionnelles. Une deuxième étude empirique examine la stabilité des banques islamiques et utilise la régression quantile pour montrer que les banques islamiques sont moins stables que les banques classiques. L'étude prouve également que des exigences de fonds propres renforcées améliorent la stabilité des banques islamiques les plus petites et les plus liquides, tandis que le levier financier est négativement associé à la stabilité de ce type de banques. Des contraintes de liquidité plus fortes renforcent la stabilité des grandes banques islamiques alors que l'effet est inverse pour les petites banques. Enfin, nous examinons l'efficacité des banques islamiques en utilisant la méthode d'enveloppement des données (DEA). Nous constatons que les banques islamiques sont plus efficaces que les banques conventionnelles. Nous trouvons aussi que des exigences de capital et de liquidité accrues pénalisent l'efficacité des petites banques islamiques très liquides, alors que l'inverse est vrai pour le levier financier. Ces résultats montrent notamment qu'en matière de réglementation du capital pour les petites banques islamiques très liquides, un choix est à opérer entre une efficacité accrue ou une stabilité renforcée.

Mots-clés: Bâle III, banques islamiques, stabilité, efficacité, régression quantile, ACP.

Abstract:

This PhD dissertation is the first attempt to examine whether banking regulations have the same impact on the stability and the efficiency of Islamic than for conventional banks. We benefit of Basel III recommendations to investigate the impact of bank capital, liquidity and leverage requirements on the stability and the efficiency of Islamic banks compared to conventional banks. A first exploratory study uses Principal Component Analysis, Logit and Probit methods, and OLS regressions and shows that Islamic banks have higher capital, liquidity, and profitability, but that they are less stable than their conventional counterparts. A second empirical study examines the stability of Islamic banks using conditional quantile regressions and proves that Islamic banks are less stable than conventional banks. It also shows that higher capital and lower leverage improve the adjusted profits of small and highly liquid Islamic banks. Liquidity is positively associated with the stability of large Islamic banks while an opposite effect is detected when small Islamic banks are examined. Finally, we study the efficiency of Islamic banks using Data Envelopment Analysis (DEA) and find that Islamic banks are more efficient than conventional banks. We also find that higher capital and liquidity requirements penalize the efficiency of small and highly liquid Islamic banks, while the opposite is true for financial leverage. These results show that concerning capital requirements for small and highly liquid Islamic banks, a possible trade-off could be found between stability and efficiency.

Keywords: Basel III, Islamic banks, stability, efficiency, quantile regression, PCA.