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Risk and Performance of Derivatives Users: Evidence from Banks in Emerging and Recently Developed Countries

Mohamed Rochdi Keffala

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TITRE :

RISK AND PERFORMANCE OF DERIVATIVE USERS: EVIDENCE FROM BANKS
IN EMERGING AND RECENTLY DEVELOPED COUNTRIES

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RESUME en français

Cette thèse utilise des données trimestrielles et annuelles sur les cours boursiers étalant sur la période 2003-2009, ainsi que des données comptables annuelles couvrant la période 2003-2010 issues des banques de pays émergents et récemment développés. Elle a pour objectif principal d'étudier empiriquement l'effet de l'utilisation des instruments de dérivés (*forwards, swaps, options et futures*) sur à la fois le risque et la performance bancaires. Les majeurs résultats dévoilent qu'à l'exception des options les autres instruments de dérivés diminuent le risque bancaire. Ainsi, il n'y a pas une preuve qui atteste de l'implication des instruments de dérivés dans la faillite et la détresse des banques. Aussi, les résultats montrent qu'en général l'utilisation des instruments de dérivés réduit la performance bancaire. D'où, la théorie qui défend que l'utilisation des instruments de dérivés est bénéfique pour les banques devrait être révisée. Enfin, les résultats de l'analyse comparative révèlent que l'effet de l'utilisation des dérivés sur le risque et la performance est presque le même que ce soit dans le cas de banques de pays émergents ou récemment développés. En définitive, l'actuelle controverse concernant la responsabilité des instruments de dérivés dans le déclenchement des récentes crises financières devrait être corrigée.

TITRE en anglais

Risk and Performance of Derivatives Users: Evidence from Banks in Emerging and Recently Developed Countries

RESUME en anglais

This thesis uses quarterly and annual data on capital market prices covering the period 2003-2009 additionally to annual accounting data during the period 2003-2010 of banks in both emerging and recently developed countries. The purpose of the thesis is to investigate empirically the effect of using derivative instruments (forwards, swaps, options and futures) on bank risk and performance. Main results reveal that in except to options the other derivative types decrease bank risk. Thus, there is no proof that derivatives can be the cause of bank failure or distress. In addition, results show that using derivatives in the whole diminish bank performance. Indeed, adjudication that derivatives are beneficial is not allowed. Finally, comparing results expose that the effect of derivatives on bank risk and performance is almost the same either in banks from emerging or recently developed countries. Ultimately, the ongoing debate on implication of derivatives in the recent financial crises should be revised.

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INTRODUCTION

The recent financial liberalization policies have changed the business environment of the banking industry considerably and thereby increasing the risk they faced. Banks were directly affected because they were direct targets of the liberalization process. This phenomena stressed by globalization have paved the way to banks especially from emerging markets to enter to new profitable markets such as those of derivatives.

Derivatives are financial agreements generally in the form of forwards, swaps, options and futures, whose worth is based on the value of other fundamental financial assets such as stocks, bonds, mortgages, commodities, and foreign exchange.

Banks are motivated to use these innovations in order to protect against risk and uncertainty of the financial market, and also to generate revenue beyond that available from traditional bank operations.

Indeed, such benefits of derivative instruments explain the widespread use and the rapid growth of derivative transactions in the recent decades.

During this last decade, there is a constant increase of futures trading value in [Korea Exchange](#). Futures value has jumped from 766,843.64 in 2000 to 9739285.19 million USD in 2011.

In [Turkish Derivatives Exchange](#) futures trading value has grown regularly during the last seven years going from 1,727.08 in 2005 to 248,000.85 million USD in 2011.

During the last five years, the volume of futures (SET 50 Index Futures) in [The Stock Exchange of Thailand](#) has augmented from 198,737 in 2006 to 4316,437 in 2011.

The number of daily contracts option traded in [Russian Stock Exchange](#) have jumped from 2,260 on 31st of December 2004 to 145,993 contracts on 30th of June 2011.

During the period between 1996 and 2011 there is an increase in the volume of option contracts traded in [Tel-Aviv Stock Exchange](#). TA-25 Options and Dollar Options have increased in volume respectively from 23,537 and 2,299 in 1996 to 357,251 and 43,055 in 2011.

Options contract volume traded on the [Hong Kong Exchange](#) has augmented continuously from 295,217 in 1993 to 89,751,477 in 2011.

In another hand, during last decades many financial crises have happened (Mexican crisis 1994, Southeast-Asian crisis 1997, Russian crisis 1998, American subprime crisis 2007-2008) causing failure of banks (Lehman Brothers; Merrill Lynch) and big losses in many banks around the world (Northern Rock, Goldman Sachs, HSBC, Fortis, Société Générale, ...). More specifically, emerging countries are the most affected by the recent financial crisis because of the fragility of their financial system and the higher likelihood of their banks to fail comparing to advanced countries.

At that time, the rapid development and prevalence of derivative markets is happened together with this global instability of financial systems.

This statement has fuelled the ongoing debate about the implication of derivatives in the recent financial crises. Checking this argument is among the purposes of this work.

Regarding literature on derivatives, much has been written on the pricing of financial derivatives (Jarrow and Turnbull, 1995; Duffee, 1996; Pierides, 1997; Houweling and Vorst, 2005), but not that much has been done on the economic reasons, costs, benefits and impact of their use. This is quite surprising given the economic importance of these instruments: the world's aggregate position in derivatives has experienced a significant increase, and its growth does not seem to have stopped yet. It is therefore crucial to analyze and understand the use of derivatives in the economy. This work intends to fill this gap by analyzing the impact of derivative instruments use on bank risk and performance.

Literature on relationship between derivatives and risk is not large. Some papers such as Hirtle (1996) studies the correlation between derivatives use and bank risk. Overall, literature results (Chaudhry et al., 2000; Reichert and Shyu, 2003) show that swaps reduce bank risk, however options increase bank risk, and finally futures and forwards have no effect on bank risk.

On the other hand, little number of papers like Said (2011) examines the association between derivatives use and bank performance. Literature results show on the whole an increase of bank performance by derivatives use.

Nonetheless, the review of literature show that the majority of papers studying the effect of derivatives use on bank risk (Hirtle, 1996; Instefjord, 2005) and bank performance (Brewer et al., 2001; Rivas et al., 2006) have not identified types of derivatives (e.g. forwards, options, swaps, futures).

Hence, the current work tries to complete the literature by focusing on instruments of derivatives one by one.

On the other hand, despite the few number of works that examines the effect of derivatives use on bank risk and performance, most of them focuses only on advanced countries (Chaudhry et al., 2000; Reichert and Shyu, 2003; Said 2011). Nevertheless, few papers choose sample from emerging countries (Rivas et al. 2006; Yong et al. 2009).

Thus the thesis tries to fill this gap in the literature by focusing especially on banks from emerging countries.

It should be note also that during few years ago, countries such as Cyprus, Israel, and Taiwan were considered as emerging countries but nowadays they are labeled as developed countries by [United Nations Office](#). However, regarding their actual economic power and standard of living such countries cannot be defined as advanced countries like U.S.A., Western European countries or Japan but still close to emerging countries specifications.

Indeed, it is useful to introduce banks from such countries to especially resolve the problem of the lack of data on banks from emerging countries and then enlarge more the overall sample and also make benchmarking between the two groups of banks.

In the rest of this work these countries are labeled “recently developed countries” in order to distinguish between them and the advanced countries (North American countries; Eastern European countries; Japan).

Hence, this thesis includes also banks from recently developed countries in the sample study which is another contribution compared to the literature.

The thesis is composed of two large parts. The first part studies the relationship between derivatives and bank risk. The second part investigates the relationship between derivatives and bank performance.

The two parts in this thesis try to answer some fundamental questions:

Are banks at risk by using derivative instruments?

Are banks increasing their performance by using derivatives?

Are there differences in derivatives usage effect on risk and/or performance between banks in emerging countries and those in recently developed countries?

Can derivatives be considered as responsible of the last financial crisis?

The two essays contained in this work intend to give answers to these basic questions from different perspectives.

The present work contributes to the literature in several ways – most notably regarding the lack of papers studying empirically the effect of derivatives use on bank risk and performance, this thesis attends to fill this lack in the literature.

On other hand, the thesis tries to complete the literature by studying separately the effect of each derivative type on bank risk and performance.

Lastly, in opposite to the most of the previous studies focusing only on banks from advanced countries and particularly from U.S.A., the current work will be the pioneer to combine and compare banks from both emerging and recently developed countries.

The purpose of the thesis is to explore on the one hand the relationship between derivative instruments use and bank risk defined by both stock market and accounting measures, and on the other hand to investigate the relationship between derivative instruments use and bank performance defined by stock return and accounting measures.

The major goals of the current work is to check whether banks are at risk or not by using derivative instruments, and to verify whether banks increase or decrease their performance by using such innovations.

Therefore, reaching these goals allows checking the argument about implication of derivatives in the last financial crises.

In the first part, two chapters are defined. The first chapter analyzes the impact of the use of derivatives on capital market risk measures which are: total return risk, systematic risk and unsystematic risk. In this chapter we have not separated between banks issuing from emerging countries and those from recently developed countries

because the overall sample is not so large. The final results indicate that despite of options, the other instruments decrease bank risk.

In the second chapter, the effect of derivative instruments use on accounting risk is examined. Accounting risk measures are defined by return on assets ratio, return on equity ratio, non-performing loans ratio, coverage ratio, capital adequacy ratio, efficiency ratio and net interest margin ratio. The final findings show that forwards and swaps decrease accounting risk, options increase accounting risk and futures contribute minimally to accounting risk. Finally, comparing results between the two subsamples reveal a similar effect of forwards and swaps, but also a contradictory effect of options and futures on accounting risks.

The main conclusion in the first part of the thesis shows that banks in the sample do not appear to be at risk by using derivative instruments.

The second part is composed also of two chapters. The first chapter looks into the association between derivatives usage and financial bank performance measured by stock return. The results show that the use of swaps decreases performance while forwards, options and futures have no effect on performance.

In the second chapter the relationship between derivative instruments use and accounting bank performance is investigated. In the whole, findings indicate that generally the four derivative instruments reduce bank performance. Comparing results provide evidence that the use of options decrease performance in the two subsamples.

Deducing results from the second part of the thesis divulge that contrary to the most of previous studies the use of derivatives decreases bank performance.

In summary, main conclusions from the thesis reveal that despite a decrease of performance, banks seem to not increase their risk by using derivatives.

The reminder of the thesis is defined by two parts and conclusion. Each part is composed of two chapters. In turn each chapter is commonly planned as follows: the first section presents a literature review and the second section exposes empirical analysis.

PART I. DERIVATIVE INSTRUMENTS USE AND BANK RISK

The rapid development and increase of derivative instruments use around the world in the two last decades, in addition to the global instability of banks following the recent financial crisis, has fuelled the ongoing debate over the question of risk in terms of derivative instruments. More specifically, the controversy focuses on the question of derivatives either reducing or exacerbating risk in banks and other financial institutions.

An overview of the literature shows that few studies have specifically analysed the effect of derivative instruments use on bank risk. Focusing on banks from developed countries both Chaudhry et al. (2000) and Reichert and Shyu (2003) find that, in general, options increase bank risk while swaps decrease bank risk, and finally forwards and futures have no significant effect on bank risk. Furthermore, samples in the literature are composed essentially of banks from developed countries and especially from U.S.A..

Thus, the purpose of this first part of the thesis is to examine whether the use of derivative instruments affects the risk of banks focusing in particular of banks from emerging countries.

In order to reach this goal two chapters are conducted. The first chapter examines the relationship between derivative instruments use and capital market risk. The second chapter analyses the association between derivative instruments use and accounting risk.

Chapter I.1. Effect of derivative instruments use on capital market risk

In this chapter the impact of derivative instruments use on capital market risk is explored.

Derivative instruments are defined by forwards, swaps, options and futures. Capital market risk measures are total return risk, systematic risk and unsystematic risk. The major goal is to check if banks in the sample are at risk by using derivative instruments.

To attend this end two sections are carried out. The first section describes an overview of literature. The second section tests empirically the association between derivative instruments and capital market risk.

Section I.1.1. Derivative activities and bank risk: Literature review

I.1.1.1. Theoretical literature review and results

Corporate literature examining the effect of derivatives use on firms risk is defined by limited number of papers.

Bali et al. (2004) find no significant effect of credit derivatives used by Canadian firms on interest rate exposure. In contrast, using large sample of non-financial firms from 47 countries Bartram et al. (2006) conclude that the use of credit derivatives decreases both the total risk and the systematic risk of firms. Similarly, the results of Chung (2002) show that the use of derivatives decreases corporate risk. Moreover, comparing to non-users of derivatives Hentschel and Kothari (2001) deduce that derivative users have less risk in US context. Furthermore, the results of Nguyen and Faff (2003) indicate that currency derivatives reduce the exchange risk of Australian firms. Though, more recently Clark and Mefteh (2010) find that the relationship between foreign currency derivatives used by French firms and foreign currency exposure is limited.

As in corporate literature, the literature concerning the effects of derivatives on bank risk is also restricted.

This literature can be regrouped in two groups. The first group of studies focuses on derivative instruments one by one.

Shanker (1996) deduce that the use of swaps, futures, and options by US banks reduce interest-rate risk.

Basing on US banks also Choi and Elyasiani (1996) find that options were positively related to both interest-rate and currency risk, and also currency swaps reduced exchange rate risk. Likewise, the results of McAnally (1996) reveal also that the use of interest rate and currency swaps by U.S. holding banks is negatively correlated with market risk.

The study undertaken by Chaudhry et al. (2000) on US commercial banks indicates that the use of options tended to increase all types of bank risk for U.S. banks. However, in contrast, the same study not only find that swaps had a negative effect on bank risk, but also, the effect of forwards on bank risk was insignificant. Furthermore, Reichert and Shyu (2003) conclude that the use of options increased the interest rate beta for all US, European and Japanese banks, while both interest rate and currency swaps generally reduced risk.

The second group of papers has not focused on derivative instruments separately but they studied derivatives in the whole.

Using 99 U.S. bank holding companies Venkatachalam (1996) find that banks, on average, are reducing their risk exposures using derivatives.

In contrast, the findings of Hirtle (1996) show that the use of interest-rate derivatives increases the interest-rate exposure of US bank holding companies.

Comparing to nonusers, Sinkey and Carter (2000) deduce that U.S. bank users of derivatives are associated with riskier capital structure.

Focusing on U.S. banks too, Carter and Sinkey (1998) find that increase in the bank's use of interest-rate derivatives corresponds to greater interest rate risk exposure.

Additionally, the results of Instefjord (2005) expose that credit derivatives increased bank risk in England. Similarly, but in Canadian context, the results of Attig and Dai (2009) indicate that banks increase their risks with trading in derivatives. Finally, Yong et al. (2009) find that the use of derivative activities increased long-

term interest rate exposure and decreased short-term interest rate exposure of Asia-Pacific banks.

I.1.1.2. Empirical literature review

Before presenting the methodology of the study a summary of conceptual framework used by the literature is exposed below.

In the paper of Hirtle (1996) the foundation of the empirical analysis is a series of annual market model regressions relating the return on a bank holding company's common stock to the return on the market and a term designed to capture changes in interest rates.

The data used in these regressions consist of weekly stock return data for 139 BHCs whose stock traded publicly at some point during the period 1986 to 1994.

The market model regressions were estimated annually between 1986 and 1994 for each BHC whose stock traded publicly for at least 30 weeks in a given year.

The main research question of the study of Instefjord (2005) was to know if the development of the market for credit derivative securities a destabilizing effect on the banking sector. He argued that the key finding is that a financial innovation in the credit derivatives market may increase bank risk, particularly those that operate in highly elastic credit market segments. He added that credit derivatives trading is, therefore, a potential threat to bank stability even if banks use these instruments solely to hedge or securitize their credit exposures. He considered a bank with a given capital stock which is employed in a risky credit market. The credit market is modelled as a risky asset whose value evolves according to the geometric Brownian motion. Finally, the credit derivatives market consists of a portfolio of credit derivative securities which satisfies the geometric Brownian motion.

In their analysis Attig and Dai (2009) investigate the impact of the use of derivatives on bank risk. To this end they estimate cross-sectional and time-series model over the period 1997-2007 to regress major Canadian bank's implied volatility of assets on bank's intent of using derivatives both for trading and hedging and on other control variables. All regressions are estimated with standard errors corrected for heteroscedasticity and with year indicator variables. The dependent variable is the extracted risk of bank assets. As for independent variables, Trading Intensity is the notional amount of derivatives used for trading purposes divided by the extracted

value of total assets; Hedge Intensity is the notional amount of derivatives used for hedging purposes scaled by total assets; other off-balance sheet items amount divided by total assets; Financial leverage; Net interest margin; Non-interest income and the ratio of market to book value.

In investigating the effect of derivative activities on banks' interest rate and exchange rate exposures Yong et al. (2009) involve a two stage regressions. The interest rate and exchange rate exposures of Asia-Pacific banks are estimated in the first stage and are then employed as the dependent variable in the second stage. Like in the study of Reichert and Shyu (2003), in the stage one of regression, the interest rate and exchange rate risk betas are estimated for each sample bank by employing the augmented market model. The second stage of regressions investigate the impact of derivative activities on banks' interest rate and exchange rate exposures, the stage two cross-sectional regression hypothesizes that long-term interest rate, short-term interest rate and exchange rate betas, estimated in the first stage are a function of both off-balance sheet derivative activities and traditional on-balance sheet banking activities. Control variables are introduced in regressions defined by liquidity, size, capital, non-interest income, interest margin, proxies of loan quality and risk and dummy variable defining dealer bank.

Choi and Elyasiani (1996) have estimated the interest rate risk and exchange rate risk betas of 59 large U.S. commercial banks for the period of January 1975 to December 1992 in a multifactor model framework. The estimation procedure uses a modified seemingly unrelated simultaneous method that adjusts for cross-equation dependencies as well as heteroscedasticity and serial correlation. Using this method, the estimation is carried out in two steps. First, the interest rate risk and exchange rate risk betas are estimated for individual banks, and second, the betas are estimated as a function of bank-specific basic and derivative exposure variables. So after estimation of betas (market risk beta and interest risk beta) in the first step, in the second step, the interest rate and exchange rate betas generated in the first stage are regressed against bank-specific on and off-balance sheet exposure variables. This two-step estimation method lets to capture, respectively, the cross-bank dependencies and the joint influences of interest rate and exchange rate exposure variables.

Reychert and Shyu (2003) have employed stock price data to measure several types of capital market risk similar to the approach employed by Chaudhry and Reichert (1999) and Hirtle (1996). They argue that the market-model approach provides a

useful way to analyze the relationship between derivatives and interest rate and exchange rate risk. A two-stage, three-factor CAPM model is developed to identify how the capital markets react to both domestic and international bank derivative activities. In the first stage, market, interest rate, and foreign currency betas are estimated using weekly stock return data over three separate annual periods from 1995 to 1997. In the second stage, cross-sectional regressions are estimated to determine how bank derivative activity affects these three distinct measures of capital market risk. Capital market betas are defined by the market beta on the market index, the interest rate beta on intermediate term government securities, and the foreign exchange beta on a foreign exchange index. Additionally to the level of derivative activity, the cross-sectional regressions include a number of key balance sheet control variables, which are net interest margin, equity, liquidity, a measure of credit risk, and the level of commercial and industrial loans. Thus, market, interest rate, and exchange rate betas are estimated as a function of both traditional on-balance sheet banking activities plus nontraditional off-balance sheet derivative positions. Weekly returns on individual bank stocks and the market index for each country are computed using the following formula $[(P_t / P_{t-1}) / P_{t-1}]$, adjusted for dividends. The interest rate index is measured by the weekly change in the 10-year government bond yield for each country in the sample. The following three models are then estimated to examine the relative importance of different derivative instruments with respect to market, interest, and exchange rate risk. Finally, they use a modified VaR approach (EVAR analysis) in order to capture important differences between various types of derivatives in three regions (U.S., Japan and Europe).

Chaudhry et al. (2000) have focused on five different measures of capital market risk by using ordinary least-squares to estimate the following three-index market model for each sample bank: Basing on past studies that argue that a multiple-index model with proxies for interest rate returns, exchange rate changes, and the market return is an appropriate framework to model commercial bank stock return sensitivity. This model yields the following capital market measures of risk for each sample bank: total return risk for bank, unsystematic risk, systematic risk, systematic interest rate risk and systematic foreign-exchange risk. After obtaining the five risk measures for each bank, they estimate three cross-sectional regression models for each risk measure. They choose bank holding company satisfying some criteria such as that the stock was traded on the NYSE or the NASDAQ continuously during the sample period,

1989-1993 and call report data had to be available for the BHC on all variables used in the study. They exclude banks that merged or failed during the sample period. The data for both accounting-based and off-balance sheet variables are obtained from annual call reports and represent year-end values averaged over the five year sample period. Finally, control variables used in their model are defined by proxies of credit risk, capital, size, loan diversification, foreign currency off-balance sheet variables and dummy variables that indicate the level of activity within each type of contingent claim and those identifying the activity of dealer banks.

To summarize the methodology used in the previous papers can be resumed in two main approaches: the two-step ordinary least squares regressions (Yong et al., 2009) and the two-stage market model (Chaudhry et al., 2000, Rey chert and Shyu, 2003).

In the first procedure i.e. the two-step regressions model the step one regression estimates the user of derivatives. The second step estimates risk variable. This approach is used in order to distinguish user and non user of derivatives. Since, the first step explains derivative user's profile. However, in the last decade the number of banks using derivatives was increasing considerably so interesting in banks using or not derivatives is not up to date. For this reason, two step regression is not retained for our study. In this current study and according to Rey chert et Shyu (2003) we use market model in order to measure overall risk, systematic risk and unsystematic risk, and panel regressions to estimate accounting risks later in the thesis. Details on empirical work are presented in the next section.

Section I.1.2. Effect of derivative instruments use on capital market risk: Empirical analysis

This section tends to examine empirically the relationship between derivative instruments use and capital market risk. Therefore, regression analysis on the association between derivative instruments use and capital market risk is tested.

In this section, we investigate the use of derivative instruments by banks in both emerging and recently developed countries in terms of capital market risk.

The rest of the section is prepared as follows. Firstly, both data and sample sets are described, as well as the model, the methodology, and the variables used. Secondly, empirical results are interpreted and analysed. Thirdly summaries and discussions are provided.

I.1.2.1. Data, sample and methodology

I.1.2.1.A. Data

Daily capital market data including stock prices for each bank were obtained from DataStream¹. Market indices for each country were obtained from their corresponding stock exchange websites².

Stock prices were used to determine the volatility of stock returns. Daily returns on individual bank stocks i , for each country were computed using the following formula:

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \quad (1)$$

Furthermore, market indices were used to determine the β of each bank i following the standard definition of market risk β :

$$\beta_{m,i} = \frac{\text{cov}(R_{i,t}, R_{m,t})}{\text{var}(R_{m,t})}. \quad (2)$$

¹ http://thomsonreuters.com/products_services/financial/financial_products/a-z/datastream/

² [Santiago Stock Exchange \(Bolsa de Santiago\);](#) [The Zagreb Stock Exchange \(Zagrebacka Burza\);](#) [Prague Stock Exchange;](#) [Cyprus Stock Exchange;](#) [Tallinn Stock Exchange;](#) [Hong Kong Exchanges;](#) [Indonesia Stock Exchange;](#) [Tel Aviv Stock Exchange \(TASE\);](#) [Bursa Malaysia;](#) [The Stock Exchange of Mauritius;](#) [Nasdaq OMX Baltic;](#) [Philippine Stock Exchange \(PSE\);](#) [Warsaw Stock Exchange;](#) [Saudi Stock Exchange \(Tadawul\);](#) [Singapore Exchange \(SGX\);](#) [Johannesburg Stock Exchange \(JSE\);](#) [Korea Exchange \(KRX\);](#) [Taiwan Stock Exchange;](#) [The Stock Exchange of Thailand;](#) [Istanbul Stock Exchange \(ISE\)](#)

Finally, and during the period study 2003-2009 annual accounting data drawn from bank websites (see Table 2) were used to calculate control variables.

I.1.2.1.B. Sample

I.1.2.1.B.a. Sample description

Compared to advanced countries in term of economic power and standard of living some countries such as Czech Republic, Estonia and South Korea are more closed to emerging countries than to advanced countries. These countries are called in this current work recently developed countries.

Entering banks from such countries in the study allows enlarging observations and therefore improving regressions.

The latest classification by [United Nations Office](#), based on the Human Development Index³ is used to distinguish between emerging and developed countries.

In the next, the Table 1 presents classification between emerging and recently developed countries.

Table 1. Countries classification

Emerging countries	Recently developed countries
Chile; Croatia; Indonesia; Malaysia; Mauritius; Latvia; Lithuania; Philippines; Saudi Arabia; South Africa; Thailand; Turkey	Czech Republic; Cyprus; Estonia; Hong Kong; Israel; Poland; Singapore; South Korea; Taiwan

The main motivations of choosing sample banks can be summarized to the following reasons:

- ✓ The fragility of the financial system of emerging countries
- ✓ Lack in the literature of studies focusing on banks from emerging countries

³ From HDI equals to 0.784 countries are classified as developed countries and less this index countries are considered as emerging countries. For more details see the web site <http://hdr.undp.org/en/>

- ✓ Including banks from countries which were considered few years ago as emerging countries allows getting more observations and improving regressions
- ✓ Recently developed countries have not the same specificities as advanced countries, rather they are closed to emerging countries
- ✓ No previous study has identified banks from recently developed countries
- ✓ No previous study has combined bank from emerging and recently developed countries

Table 2 exposes the list of banks and their countries (as well as hyperlinks to bank web sites).

Table 2. Banks and their countries

Countries and bank names	Countries and bank names
Chile	Poland
1.1 Banco de Chile	14.1 Bank BPH S.A.
Croatia	14.2 Bank Pekao S.A.
2.1 Erste & Steiermärkische Bank D.D	14.3 Bank Zachodni WBK
2.2 Privrednabanka banka Zagreb	14.4 BRE Bank
2.3 Zagrebacka Banka	14.5 Kredyt Bank S.A.
Cyprus	14.6 Nordea Bank Polska S.A.
3.1 Bank of Cyprus	Saudi Arabia
3.2 Hellenic Cyprus Bank	15.1 Arab National Bank
Czech Republic	15.2 Saudi British Bank
4.1 Komerční banka	Singapore
Estonia	16.1 DBS Bank
5.1 Swedbank	16.2 United Overseas Bank
Hong Kong	South Africa
6.1 Bank of East Asia	17.1 ABSA Bank
6.2 Chong Hing Bank	17.2 Capitec Bank
6.3 DAH SING Bank	17.3 FirstRand Ltd.
6.4 Fubon Bank	17.4 Imperial
6.5 Hang Seng Bank	17.5 Sasfin Bank
6.6 Wing Hang Bank	South Korea
Indonesia	18.1 Industrial Bank of Korea
7.1 Bank Danamon	18.2 Korea Exchange Bank
Israel	Taiwan
8.1 FIBI Bank	19.1 Hua Nan Commercial Bank
8.2 Bank Hapoalim	19.2 Mega International Commercial Bank
Malaysia	19.3 Taiwan Business Bank
9.1 CIMB Bank	Thailand
9.2 EON Bank	20.1 Bangkok bank
Latvia	20.2 Bank of Ayudhya
10.1 DNB Nord Banka	20.3 Kasikorn Bank
Lithuania	20.4 Krung Thai Bank
11.1 ŠIAULIU BANKAS	Turkey
11.2 Swedbank	21.1 Akbank
Mauritius	21.2 Anadolubank Anonim Şirketi
12.1 MCB	21.3 Garanti Bankasi
Philippines	21.4 Sekerbank
13.1 Philippine National Bank	

1.1.2.1.B.b. Sample statistics

In total, there are 52 banks in which twelve are from emerging countries and night from recently developed countries.

Sample banks are spread over five regions. European banks represent 38.461% of the sample, while Asian banks represent 40.384%. However, only two banks from Saudi Arabia and two banks from Israel represent the Persian Gulf region. Furthermore, only one bank, from Chile, represents Latin America. While six banks represent Africa, five of them are from South Africa. Thus, banks from emerging countries represent 61.538% of total sample while 38.462% of total sample characterize banks from recently developed countries. Additionally, the sample also includes eight dealer banks, which represent 15.384% of the total banks⁴.

In terms of the research sample, with the exception of Imperial Bank, each bank made use of forwards. Swaps were the second most used instruments with 49 banks. Moreover, three quarter of banks were involved in using options, while only 44.23% of banks used futures. In general, the two most commonly used instruments were forwards and swaps, which were utilized by 92.31% of all banks, as shown in Table 3 below.

Table 3. Number and percentage of banks per derivative instruments used

Instruments	Number of banks	Percentage
FWD+SWP+OPT+FUT	23	44.23%
FWD+SWP+OPT	39	75.00%
FWD+SWP+FUT	23	44.23%
FWD+OPT+FUT	23	44.23%
SWP+OPT+FUT	23	44.23%
FWD+SWP	48	92.31%
FWD+OPT	39	75.00%
FWD+FUT	23	44.23%
SWP+OPT	39	75.00%
SWP+FUT	23	44.23%
OPT+FUT	23	44.23%
FWD	51	98.08%
SWP	49	94.23%
OPT	39	75.00%
FUT	23	44.23%

⁴ [Hellenic Cyprus Bank](#), [Hang Seng Bank](#), [Bank Hapoalim](#), [EON Bank](#), [BRE Bank](#), [FirstRand Ltd.](#), [ABSA Bank](#), [Industrial Bank of Korea](#)

The four derivative instruments, forwards, swaps, options, and futures, represent 190.36% of assets, covering the period from 2003 to 2009, with an average bank size of approximately \$10 billion. During the study period, swaps were the most represented instruments, with a notional value equal to USD \$10,836,706 trillion which corresponds to 106.36% of the total assets, while futures represent only 6.37% of total assets.

Moreover, in terms of yearly use, the highest notional value is occurred in 2005 when swaps represent 131.00% of assets. In contrast, the lowest percentage is occurred in 2008 when futures represent only 3.86% of total assets. More details concerning derivative instruments statistics are summarized in the Table 4

Table 4. Description of derivative notional amounts* per year

Year	FWD	%FWD	SWP	%SWP	OPT	%OPT	FUT	%FUT	FWD+SWP +OPT+FUT	%(FWD+OPT +SWP+FUT)	Total assets
2003	409,397	39.67	482,793	46.79	119,096	11.54	116,967	11.33	1,128,253	109.35	1,031,771
2004	499,209	44.79	1,230,617	110.43	133,088	11.94	105,147	9.43	1,968,062	176.60	1,114,360
2005	525,800	42.16	1,633,515	131.00	183,158	14.68	82,888	6.64	2,425,364	194.50	1,246,953
2006	633,066	43.98	1,665,128	115.70	274,342	19.06	117,222	8.14	2,689,759	186.89	1,439,155
2007	1,081,489	66.86	1,992,877	123.21	348,547	21.55	79,838	4.93	3,502,753	216.56	1,617,385
2008	1,557,473	85.16	2,052,719	112.23	382,281	20.90	70,708	3.86	4,063,182	222.16	1,828,878
2009	1,518,484	79.58	1,779,054	93.23	245,780	12.88	76,632	4.01	3,619,951	189.71	1,908,072
Total	6,222,836	61.07	10,836,706	106.35	1,686,294	16.55	649,404	6.37	19,395,241	190.35	10,188,821

* Amounts are in USD millions.

From Table 4 statistics show that the amount of derivative instruments represents 190.35% of total assets covering the period of the study from 2003 to 2009, and with an average bank size of approximately \$10 billion. During the study period swaps are the most represented instruments with notional amount equals to 10,836,706 USD, with a percentage equals to 106.35% of total assets, followed by forwards with percentage equals to 61.07% of total assets options with a percentage equals to 16.55% of total assets, while futures represent only 6.37% of total assets. Statistics per year indicates that the highest notional amount of instruments traded is swaps defined by 123.21% of total assets in 2007. In contrast, the lowest percentage is referred to futures in 2008 by 3.86% of total assets.

I.1.2.1.C. Methodology

I.1.2.1.C.a. Variables description

The market model is adopted from the Capital Asset Pricing Model (CAPM):

$$R_{it} = \alpha_{mi} + \beta_{mi} R_{mt} + \varepsilon_{it}, \quad (3)$$

where R_{it} is the holding period return for the i^{th} bank's stock in a given month t , R_{mt} is the holding period return on a weighted portfolio of common stocks, approximated by a stock market index, and ε_{it} is the usual error term. This model is estimated for each bank sample i to provide the three different measures of capital market risk. This model yields the following capital market measures of risk for each bank sample i :

- standard deviation of R_{it} , σ_{Ri} , measures the total return risk for bank i ;
- parameter β_{mi} , measures the systematic risk for bank i ;
- standard deviation of ε_{it} , $\sigma_{\varepsilon i}$, measures the unsystematic risk for bank i .

Differences in the systematic risk measures across banks reflect differences in the sensitivity of bank stocks to the market return. Differences in total return and unsystematic risk, in turn, reflect aggregate and diversifiable risk. These capital market risk measures are used as dependent variables.

Next, in the table below the dependent variables employed in this study along with their definitions and use in previous studies are presented.

Table 5. Description of dependent variables

Labels	Description	Proxy for	References
RRISK (σ_{Ri})	The annualized standard deviation of the banks' daily stock returns.	Total return risk	Chaudhry et al. (2000), Agusman et al. (2008), Nguyen and Faff (2003)
BETA (β_{mi})	The beta of the banks' stock returns.	Systematic risk	Chaudhry et al. (2000), Agusman et al. (2008)
SDERROR ($\sigma_{\varepsilon i}$)	The annualized standard deviation of residual errors from the market model.	Non-systematic risk	Chaudhry et al. (2000), Agusman et al. (2008)

These dependent variables are regressed on derivative instruments and control variables.

Control variables are defined by net interest margin, size of the bank, and dummy variables reflecting dealer bank and country. Regarding the heterogeneity of the sample, which is similar to the study of Agusman et al. (2008), country dummy variables are included to control for the differences in the banking structure and regulatory environments, as well as the different economic and political characteristics that may affect the relation between derivatives and capital market measures of risk. Table 6 presents the independent variables employed along with their definitions and use in previous studies.

Table 6. Description of independent variables

Labels	Description	Proxy for	Predicted sign	References
<i>Derivative instruments</i>				
FWD	Notional value of forwards divided by total assets	Forwards	NS ⁵	Chaudhry et al. (2000)
SWP	Notional value of swaps divided by total assets	Swaps	-	Chaudhry et al. (2000); Reichert and Shyu (2003)
OPT	Notional value of options divided by total assets	Options	+	Chaudhry et al. (2000); Reichert and Shyu (2003)
FUT	Notional value of futures divided by total assets	Futures	NS	Chaudhry et al. (2000)
<i>Control variables</i>				
CAP	the ratio of book-value-equity-to-total-assets	Capital	-	Chaudhry et al. (2000); Reichert and Shyu (2003)
LIQ	the ratio of liquid-assets-to-total-assets	Liquidity	-	Chaudhry et al. (2000); Reichert and Shyu (2003)
LOAN	the ratio of gross-loans-to-total-assets	Risky assets	-	Chaudhry et al. (2000)
CR	the ratio of loan-loss-reserves-to-gross-loans	Credit risk	NS	Chaudhry et al. (2000); Reichert and Shyu (2003)
NIM	The difference between total interest income and total interest expense expressed, as a percentage of total assets.	Net interest margin	+	Chaudhry et al. (2000); Reichert and Shyu (2003)
SIZE	Natural log of total assets	Bank size	+	Chaudhry et al. (2000) ; Reichert and Shyu (2003)
<i>Dummies</i>				
DEAL	1 if bank is a member of the International Swaps and Derivative Association (ISDA), 0 otherwise	Dealer	+	Chaudhry et al. (2000);
COUNTRY	Dummy variable equals 1 when bank is issued from, 0 otherwise	Country variable	?	Agusman et al. (2008)

⁵ NS means not significant

The independent variables in this study can be divided in three groups. The first group are the four derivative instruments, FWD, SWP, OPT and FUT, which define respectively Forwards, Swaps, Options, and Futures. The second group are control variables, defined by CAP, LIQ, LOAN, CR, NIM and SIZE, which define capital, liquidity, gross loan, loan loss reserve, net interest margin, and bank size, respectively. The last group is defined by dummy variables, expressed by DEAL and COUNTRY, which designate the country variable of each bank. The country dummy variable is introduced in order to identify the specificity of each country. The dichotomous variable (DEAL) takes a value one for dealer banks and zero otherwise. DEAL is introduced - as in the study of Chaudhry et al. (2000) - in order to differentiate between the risk exposure of dealer banks and non-dealers.

1.1.2.1.C.b. Testing hypotheses and expected results

According to the results of literature (Shanker, 1996, Choi and Elyasiani, 1996, McAnally, 1996, Chaudhry et al., 2000, and Reichert and Shyu, 2003) the use of swaps affects negatively bank risk. Thus, a negative effect of swaps on capital market risk is expected as first hypothesis.

Exept to the findings of Shanker (1996) the rest of papers found that options increase bank risk. Therefore, a positive effect of options on capital market risk is hypothesized.

The results of Chaudhry et al. (2000) show that the use of futures and forwards does not affect significantly bank risk. Hence, we hypothesize that the effect of futures and forwards on capital market risk is insignificant.

Concerning control variables and according to Chaudhry et al. (2000) and Reichert and Shyu (2003), a negative effect of capital, liquidity and risky assets proxies on capital market risk is predicted.

Moreover, based on Chaudhry et al. (2000) and Reichert and Shyu (2003) a positive effect of bank size and net interest margin on capital market risk on is hypothesized. Furthermore, the results of Chaudhry et al. (2000) show that dealer banks are at risk so we forecast a positive effect of the dummy DEAL on capital market risk. While in the studies of Chaudhry et al. (2000) and Reichert and Shyu (2003) found no consistent effect of the proxy of credit risk on bank risk. Therefore, the sign of the correlation between the proxy of credit risk and capital market risk is unknown.

Finally, since no previous paper has used country variable so the effect of countries on capital market risk is unexpected.

1.1.2.1.C.c. Empirical model

Panel regression models were conducted for each risk measure as follows:

$$\begin{aligned} \text{Risk measure}_{i,t} = & \gamma_0 + \gamma_1 \text{FWD}_{i,t} + \gamma_2 \text{SWP}_{i,t} + \gamma_3 \text{OPT}_{i,t} + \gamma_4 \text{FUT}_{i,t} + \gamma_5 \text{CAP}_{i,t} + \\ & \gamma_6 \text{LIQ}_{i,t} + \gamma_7 \text{LOAN}_{i,t} + \gamma_8 \text{CR}_{i,t} + \gamma_9 \text{NIM}_{i,t} + \gamma_{10} \text{SIZE}_{i,t} + \gamma_{11} \text{DEAL}_{i,t} + \sum_{k=1}^K \gamma_{12,k} \\ & \text{COUNTRY}_{i,t,k} + u_i + e_{i,t}, \end{aligned} \quad (4)$$

Where:

Risk measure is one of σ_{Ri} , β_{mi} or σ_{ei} .

$(u_i + e_{i,t})$ is the composite error term. u_i is the random error in which heterogeneity is specifically to a cross-sectional unit-in this case, bank; and $e_{i,t}$ is the random error in which heterogeneity is specifically to a particular observation.

The aim is to test empirically the relations between capital market risk measures and derivative instruments.

The computer software STATA 10 ® was used to estimate all regressions.

1.1.2.1.C.d. Specification tests

Firstly, the stationarity of all the variables is checked using the Augmented Dickey Fuller Tests. Trying with four lags, then with trend, and finally without constant. The stationarity is also checked using Unit Root tests- Phillips-Perron test and DF-GLS test. The linearity of the model is tested for with Ramsey-Reset Test. A normal hazard of residuals is finally examined with Jacques-Bera Test. Moreover, a matrix of correlations and test for multicollinearity are conducted. The Hausman test is applied to examine the absence of correlation between the independent variables and the error terms. The null hypothesis of the Hausman test argues that there is no difference in coefficients (both the fixed effects and random effects models can be used), otherwise, only the fixed effects model, which is robust, has to be used. Finally, a Breusch and Pagan Lagrangian multiplier test is used to check the robustness of the random effect model.

I.1.2.2. Empirical results

As seen below, an empirical relationship exists between the use of derivative instruments and bank risk.

I.1.2.2.A. Descriptive statistics

Table 7 as follows describes the statistical variables used in the model.

Table 7. Descriptive statistics of variables

Variable	Mean	Std. Dev.	Min	Max
FWD	0.38	0.95	0	6.93
SWP	1.21	9.82	0	185.03
OPT	0.093	0.23	0	1.71
FUT	0.04	0.13	0	1.20
RRISK (σ_{Ri})	0.02	0.01	0	0.23
BETA (β_{mi})	4.55	10.62	1	166.20
SDERROR (σ_{ei})	2.86	10.38	0.03	137.40
CAP	0.09	0.07	0.02	0.88
LIQ	0.08	0.10	0.00	0.98
LOAN	0.58	0.14	0.03	0.93
CR	0.02	0.02	-0.02	0.19
NIM	0.03	0.07	0.00	0.77
SIZE	9.49	1.48	4.05	12.13

Descriptive statistics show unusual scores of the systematic risk and the non-systematic risk variables. Whilst for the rest of variables the mean is between 0.02 and 9.49. Standard deviation - measuring the spread of individual results around a mean of all the results – has scores from 0.01 to 9.82. Finally, min scores are between 0 and 4.05, and max scores are between 0.19 and 185.03.

I.1.2.2.B. Regression analysis

The parameter estimates from Equation 4 for each of the three risk measures are summarized in the next table. In this table, it should be noted that insignificant independent variables were removed from the models, and the regressions re-estimated to get more precise estimates.

Table 8. Estimated coefficients, years 2003--2009

	Total return risk σ_{Ri}	Systematic risk β_{mi}	Non-systematic risk $\sigma_{\epsilon i}$
Constant	0.0306*** (0.00268)	1.2110*** (0.0743)	2.7181* (1.4739)
<i>Derivative instruments</i>			
FWD	-0.0024*** (0.0006)	NS	NS
SWP	NS	-0.0042** (0.0018)	NS
OPT	0.0064* (0.0033)	NS	1.0491* (0.6320)
FUT	-0.0131** (0.0054)	NS	NS
<i>Control variables</i>			
CAP	NS	NS	NS
LIQ	NS	NS	NS
LOAN	NS	NS	NS
CR	-0.0696** (0.0312)	NS	NS
NIM	NS	NS	NS
SIZE	NS	-0.2800* (0.1622)	NS
<i>Dummies</i>			
DEAL	NS	-0.6294* (0.3243)	NS
Country	See details of the country dummies in Appendix I.		
R-squared	0.1292	0.3421	0.2619
F statistic	4.73***	94.16***	306.25***
Number of obs.	364	364	364

*, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. The variable that are not significant were removed and the model was re-estimated to get more precise results. Consequently, no parameter values are provided for these variables.

() indicate standard deviation of the estimators.

NS indicate non-significance of coefficient.

Years 2003-2009.

1.1.2.2.C. Specification tests results

The P values of the Augmented Dickey Fuller Tests for all the specifications are closed to 0. We have similar results for the Phillips-Perron test. The DF-GLS test rejects the null hypothesis of unit root at 1% significance level for all the specifications. (The results are available under request to the corresponding author). Stationarity of variables is then detected in all the cases.

In the next, the results of the Ramsey-Reset Test (for more details see Appendix V.a.) are resumed in the Table 9 as follows.

Table 9. Ramsey-Reset Test

Dependent variable	chi2(3)	Prob > chi2
Total return risk σ_{Ri}	28.97	0.0000
Systematic risk β_{mi}	3.60	0.3074
Non-systematic risk $\sigma_{\epsilon i}$	4.48	0.2142

When the risk is measured by the total return risk σ_{Ri} , the Ramsey-Reset test rejects the null hypothesis of linearity. Then the relation between the total return risk σ_{Ri} and its predicted value is examined in the Figure 1 below.

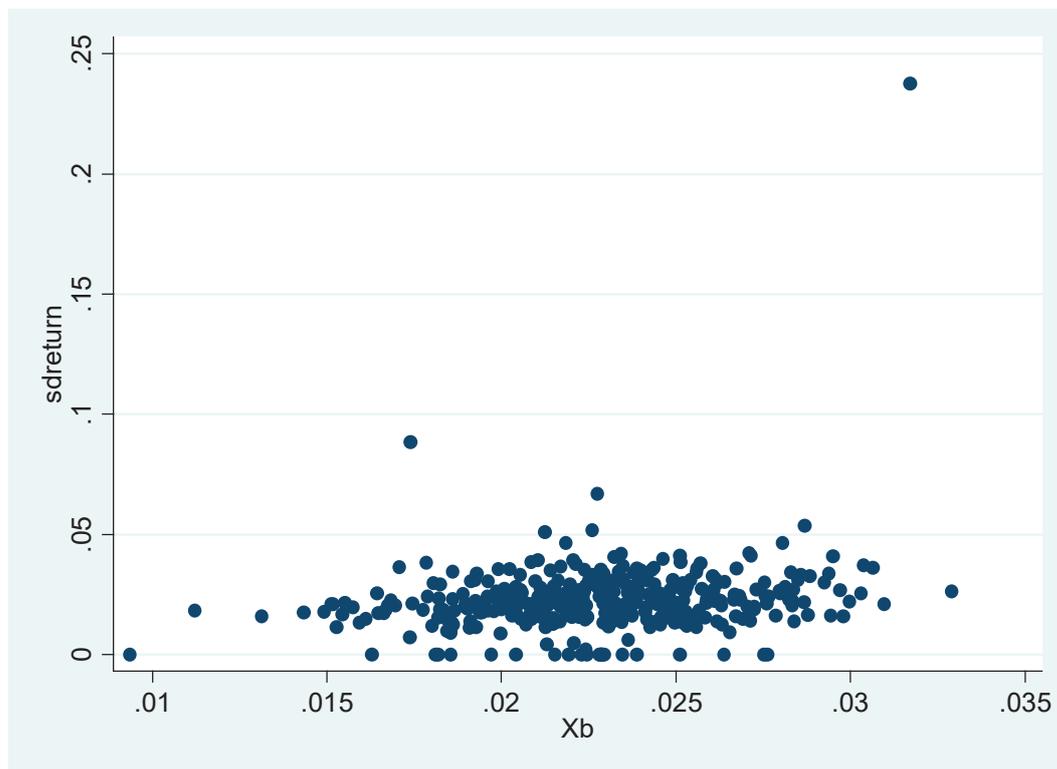


Figure 1. Total return risk against its predicted variable

From Figure 1, we can see that there is not a strong nonlinear relation between the independent variables and the dependent variable. Therefore, the linearity of the model can be confirmed.

A normal hazard of residuals is finally examined with Jacques-Bera Test in the table below.

Table 10. Normality tests

Dependent variable	Skewness		Kurtosis		Jacques-Bera
	Value	P value	Value	P value	P value
Total return risk σ_{Ri}	7.439	0.000	102.206	0.000	0.000
Systematic risk β_{mi}	11.692	0.000	180.857	0.000	0.000
Non-systematic risk $\sigma_{\epsilon i}$	12.324	0.000	162.046	0.000	0.000

All the tests reject the normality hypothesis. The probability density functions of the residuals, estimated by kernel estimator, are examined in the Figure 2 as follows.

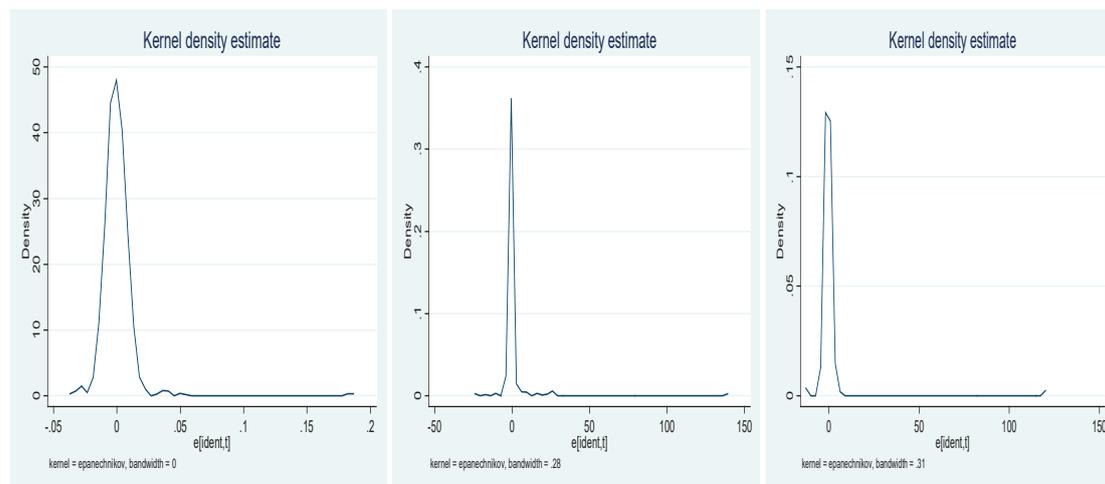


Figure 2. Probability density functions of the residuals

It should be noted that even if the error terms do not follow a normal distribution the regression estimate remains asymptotically valid. Due to the large number of observations (around 370), the non-normality of the errors terms should not affect the results.

In addition, correlations between variables of the model are presented in the following matrix:

Table 11. Matrix of correlations (total return risk is the dependent variable)

	σ_{Ri}	fwd	swp	opt	fut	loan	cap
σ_{Ri}	1.0000						
fwd	-0.0295	1.0000					
	(0.5748)						
swp	-0.0067	0.0532	1.0000				
	(0.8986)	(0.3117)					
opt	0.0081	0.2461*	0.0810	1.0000			
	(0.8773)	(0.0000)	(0.1229)				
fut	-0.0695	0.0031	0.0345	0.2081*	1.0000		
	(0.1861)	(0.9535)	(0.5116)	(0.0001)			
loan	0.1579*	0.0031	-0.0673	-0.0775	-0.0625	1.0000	
	(0.0025)	(0.9533)	(0.2001)	(0.1402)	(0.2341)		
cap	0.0181	-0.1140*	-0.0131	-0.0837	-0.0467	-0.2746*	1.0000
	(0.7311)	(0.0296)	(0.8038)	(0.1107)	(0.3739)	(0.0000)	
liq	0.0001	-0.1092*	-0.0574	0.0141	-0.0599	0.0497	0.3076*
	(0.9988)	(0.0374)	(0.2747)	(0.7882)	(0.2542)	(0.3444)	(0.0000)
nim	0.0563	-0.0577	-0.0121	-0.0509	-0.0045	-0.2232*	0.8913*
	(0.2842)	(0.2720)	(0.8184)	(0.3331)	(0.9319)	(0.0000)	(0.0000)
size	-0.0796	0.1949*	0.0609	0.1970*	0.1600*	0.0065	-0.5069*
	(0.1297)	(0.0002)	(0.2463)	(0.0002)	(0.0022)	(0.9012)	(0.0000)
cr	-0.0171	-0.0406	-0.0269	-0.0794	-0.0408	-0.3165*	0.1963*
	(0.7447)	(0.4401)	(0.6092)	(0.1307)	(0.4376)	(0.0000)	(0.0002)
	liq ta	nim ta	logta	llp loan			
liq	1.0000						
nim	0.3033*	1.0000					
	(0.0000)						
size	-0.2240*	-0.4339*	1.0000				
	(0.0000)	(0.0000)					
cr	0.0618	0.1965* -	0.1100*	1.0000			
	(0.2399)	(0.0002)	(0.0359)				

The numbers in brackets correspond to the standard error.

Table 12. Matrix of correlations (systematic risk is the dependent variable)

	β_{mi}	fwd	swp	opt	fut	loan	cap
β_{mi}	1.0000						
fwd	-0.0833	1.0000					
	(0.1126)						
swp	-0.0244	0.0532	1.0000				
	(0.6428)	(0.3117)					
opt	-0.0960	0.2461*	0.0810	1.0000			
	(0.0673)	(0.0000)	(0.1229)				
fut	0.0015	0.0031	0.0345	0.2081*	1.0000		
	(0.9778)	(0.9535)	(0.5116)	(0.0001)			
loan	-0.0442	0.0031	-0.0673	-0.0775	-0.0625	1.0000	
	(0.4004)	(0.9533)	(0.2001)	(0.1402)	(0.2341)		
cap	-0.0070	-0.1140*	-0.0131	-0.0837	-0.0467	-0.2746*	1.0000
	(0.8941)	(0.0296)	(0.8038)	(0.1107)	(0.3739)	(0.0000)	
liq	-0.0610	-0.1092*	-0.0574	0.0141	-0.0599	0.0497	0.3076*
	(0.2456)	(0.0374)	(0.2747)	(0.7882)	(0.2542)	(0.3444)	(0.0000)
nim	-0.0146	-0.0577	-0.0121	-0.0509	-0.0045	-0.2232*	0.8913*
	(0.7816)	(0.2720)	(0.8184)	(0.3331)	(0.9319)	(0.0000)	(0.0000)
size	-0.0547	0.1949*	0.0609	0.1970*	0.1600*	0.0065	-0.5069*
	(0.2976)	(0.0002)	(0.2463)	(0.0002)	(0.0022)	(0.9012)	(0.0000)
cr	0.0537	-0.0406	-0.0269	-0.0794	-0.0408	-0.3165*	0.1963*
	(0.3066)	(0.4401)	(0.6092)	(0.1307)	(0.4376)	(0.0000)	(0.0002)
	liq	nim	size	cr			
liq	1.0000						
nim	0.3033*	1.0000					
	(0.0000)						
size	-0.2240*	-0.4339*	1.0000				
	(0.0000)	(0.0000)					
cr	0.0618	0.1965* -	0.1100*	1.0000			
	(0.2399)	(0.0002)	(0.0359)				

The numbers in brackets correspond to the standard error.

Table 13. Matrix of correlations (non-systematic risk is the dependent variable)

	σ_{ϵ_i}	fwd	swp	opt	fut	loan	cap
σ_{ϵ_i}	1.0000						
fwd	-0.0102 (0.8467)	1.0000					
swp	0.0107 (0.8391)	0.0532 (0.3117)	1.0000				
opt	0.0079 (0.8810)	0.2461* (0.0000)	0.0810 (0.1229)	1.0000			
fut	-0.0331 (0.5293)	0.0031 (0.9535)	0.0345 (0.5116)	0.2081* (0.0001)	1.0000		
loan	-0.0974 (0.0635)	0.0031 (0.9533)	-0.0673 (0.2001)	-0.0775 (0.1402)	-0.0625 (0.2341)	1.0000	
cap	-0.0241 (0.6468)	-0.1140* (0.0296)	-0.0131 (0.8038)	-0.0837 (0.1107)	-0.0467 (0.3739)	-0.2746* (0.0000)	1.0000
liq	-0.0399 (0.4475)	-0.1092* (0.0374)	-0.0574 (0.2747)	0.0141 (0.7882)	-0.0599 (0.2542)	0.0497 (0.3444)	0.3076* (0.0000)
nim	-0.0418 (0.4260)	-0.0577 (0.2720)	-0.0121 (0.8184)	-0.0509 (0.3331)	-0.0045 (0.9319)	-0.2232* (0.0000)	0.8913* (0.0000)
size	0.0189 (0.7188)	0.1949* (0.0002)	0.0609 (0.2463)	0.1970* (0.0002)	0.1600* (0.0022)	0.0065 (0.9012)	-0.5069* (0.0000)
cr	-0.0047 (0.9286)	-0.0406 (0.4401)	-0.0269 (0.6092)	-0.0794 (0.1307)	-0.0408 (0.4376)	-0.3165* (0.0000)	0.1963* (0.0002)
	liq	nim	size	cr			
liq	1.0000						
nim	0.3033* (0.0000)	1.0000					
size	-0.2240* (0.0000)	-0.4339* (0.0000)	1.0000				
cr	0.0618 (0.2399)	0.1965* - (0.0002)	0.1100* (0.0359)	1.0000			

The numbers in brackets correspond to the standard error.

Furthermore, a test for multicollinearity is made. A detection-tolerance or the variance inflation factor (VIF) for multicollinearity can be defined as follows:

$$\text{Tolerance}_j = 1 - R_j^2, \text{ VIF}_j = 1/\text{Tolerance}_j$$

where R_j^2 is the coefficient of determination of a regression of explanatory variable j on all the other explanatory variables. A tolerance of less than 0.20 or 0.10 and/or a VIF of 5 or 10 and above indicates a multicollinearity problem (see O'Brien 2007). The results as follows conclude an absence of multicollinearity problem:

Table 14. Multicollinearity test

	VIF	1/VIF
size	17.29	0.057837
loan	14.77	0.067724
cap	11.05	0.090512
nim	5.97	0.167621
liq	1.89	0.529623
opt	1.35	0.740298
cr	1.31	0.764242
fwd	1.29	0.773296
fut	1.18	0.849076
swp	1.03	0.968510
Mean VIF	5.71	

Furthermore, the results as shown in the next table about Hausman tests (see Appendix VI.a. for more details) show an absence of correlation between the independent variables and the error terms which confirms the choice of random effect model.

Table 15. Hausman test

Dependent variable	chi2(10)	Prob>chi2
Total return risk σ_{Ri}	18.14	0.0526
Systematic risk β_{mi}	6.76	0.7477
Non-systematic risk $\sigma_{\epsilon i}$	6.86	0.7382

However, the total return risk σ_{Ri} is close to rejection. Consequently, we examine the parameter estimates in the case of the fixed effects model and in the case of random effects model (see the table below).

Table 16. Comparison between the fixed effects and random effects estimates - case of Total return risk σ_{Ri}

	---- Coefficients ----		Coefficient Difference	S.E. of the Coefficient Difference
	Fixed-effects	Random-effects		
fwd	-.0001664	-.0006444	.000478	.0014439
swp	-.0000346	-.0000101	-.0000245	.0000178
opt	.0028549	.0039291	-.0010742	.0035734
fut	.001243	-.0066569	.0078998	.005784
cap	-.0221073	-.0190414	-.0030659	.0186944
liq	-.029528	-.0163322	-.0131958	.0055189
loan	.0146007	.0214452	-.0068445	.0090646
cr	.0034734	.0030761	.0003973	.0035904
nim	.0632955	.0423813	.0209142	.0212707
size	.0070737	-.0001499	.0072236	.0022651

Hausman test: Ho: difference in coefficients not systematic

We can see that the Hausman test is close to rejection due to the size variable, which is only a control variable. Consequently, it does not affect the interest variable estimates.

Finally, in order to check between random effect model and simple OLS regression choice, a Breusch and Pagan Lagrangian multiplier test is conducted. The null hypothesis is $H_0: \text{“Var}(u_i)=0\text{”}$ against $H_1: \text{“Var}(u_i)>0\text{”}$. The results are presented in the table below:

Table 17. Breusch and Pagan Lagrangian multiplier test

Dep. Variable	sd(Dep. Variable)	sd($e_{i,t}$)	sd(u_i)	chi2(1) test statistic	P value
Total return risk	0.015546	0.0139762	0.0064325	19.76	0.0000 *
Systematic risk	10.62564	9.336926	5.462163	50.36	0.0000 *
Non-systematic risk	10.3801	9.64046	4.402101	18.80	0.0000 *

From these results on Breusch and Pagan Lagrangian multiplier test the null hypothesis is verified in the all models so that random effect models are the appropriate models.

1.1.2.3. Summaries and discussions

After observing the effects of the four derivative instruments on the three bank measures, it is clear that forwards, futures and swaps have a negative effect on bank risk while options have a positive effect. Moreover, the association between forwards and total return risk indicates a negative relationship at a level of significance equal to 1%.

According to the previous results of literature, this finding corroborates thesis stipulating that using forwards reduces bank risk. This can be explained by the fact that using forwards for speculation allow banks to diversify their risk and also to make profits from speculation which represents a warrant for any risk losses.

In addition, futures negatively affect the total return risk, but at a level of significance equal to 5%. In line with theory the use futures let banks to hedge their risks which explains their negative effect on risks.

However, at the same time, the relationship between options and total return risk is positively significant at a level of 10%. The fact that the coefficient of options was so low confirms the notion that the effect of options on total return risk is weak. However, the positive effect of options on unsystematic risk is stronger at the same level of significance. Also findings regarding options verify the results of literature. The use of options increases bank risk due its risky activities related to speculation.

In regard to systematic risk, the results indicate that swaps also negatively affect beta market risk at a level of significance equal to 5%. Finally, the result of our study is according with expectations stipulating that the use of swaps minimizes bank risk. This finding can be explicated by the fact that swaps are hedging tools which are useful to reduce risks of banks.

Concerning control variables, the proxy of credit risk has a negatively effect on the total return risk at a level of significance equal to 5% which rejects the unpredicted result as hypothesized before.

Another finding was that size has a negative effect on systematic risk at a level of significance equals to 10%, which contradicts the thesis stipulating that bank size increases bank risk. On the other hand, the proxies of capital, liquidity, risky assets and net interest margin seem to have no significant effect on any type of risk

measures. Consequently, it appears that the thesis stipulating that capital, liquidity and risky assets have a negative effect on bank risk is rejected.

The dummy variable that defines dealer banks is negatively significant only with systematic risk at a level of significance that is equal to 10%. Moreover, this result negates the argument that dealer banks are at risk and rejects our hypothesis. In regard to the effect of the country variable regressions, only the variables representing banks from Indonesia did not show any significant type of risk measures. As a result, Indonesian banks do not follow the criteria set forth in our hypothesis for country variables.

In summary, the results indicate that forwards have a negative effect on total return risk at 1% level of significance. Futures also negatively affect total return risk, but at a level of significance equal to 5%. In contrast, options have a positive effect on total return risk, at a 10% level of significance. Additionally, swaps have a negative effect on systematic risk, at a level of significance equal to 5%. Finally, options positively affect unsystematic risk at a 5% level of significance.

The next the table represents a summary of the regression results concerning the association between the four derivative instruments and the three capital market risks.

Table 18. Summary table of regression coefficient signs

	Forwards	Swaps	Options	Futures
Total return risk	-	NS	+	-
Systematic risk	NS	-	NS	NS
Unsystematic risk	NS	NS	+	NS

After analysis of the using pooled data from 2003 to 2009, as well as a sample composed of 52 banks from both emerging and recently developed countries, noteworthy conclusions can be drawn from the empirical results. In general, the use of options tends to increase all types of bank risk for banks of any kind. In contrast, swaps, forwards and futures negatively affect capital market risk.

Overall, and in line with theory and confirming our hypotheses swaps reduce bank risk while options increase bank risk. However, and comparing to the literature, the findings of this study show that futures and forwards decrease bank risk.

Thus, overall, and as the results show, forwards, swaps and futures may be used effectively as hedging tools, while options may be viewed in a more speculative fashion.

In sum, the evidence suggests that with exception of options, derivative instruments do not increase risk. Therefore, more control in the use of options should be made by bank managers in order to better manage its effect on risk.

Finally, as the majority of banks generally make use of forwards and swaps, it seems clear that sample banks are not at risk by using derivative instruments.

Chapter I.2. Effect of derivative instruments use on accounting risk

The literature about the effect of derivatives on bank risk is already presented in the previous chapter, for this reason this second chapter focuses to study empirically the relationship between derivative instruments and accounting risk. Hence, the following section analyses empirically the effect of derivative instruments use on accounting risk.

Section I.2.1. Effect of derivative instruments use on accounting risk: Empirical analysis

This section is organised as follows. Firstly, data and sample are described. Then the model, the methodology and the variables used in the study are specified. Lastly, summaries and discussions are presented.

I.2.1.1. Data, sample and methodology

I.2.1.1.A. Data

Accounting and quarterly data obtained from balance sheets and income statements from bank websites (see in the next the table for hyperlinks to bank websites) and covering the period study from 2003 to 2010 are used in this study.

I.2.1.1.B. Sample

Sample is composed of banks from both emerging and recently developed countries. In addition to the main motivations of this sample choice announced in the first chapter a benchmarking analysis can be carried out between banks in emerging countries and those in recently developed countries

I.2.1.1.B.a. Sample description

The following table exposes the list of banks and their countries (as well as hyperlinks to bank websites).

Table 19. Banks and their countries of overall sample

Panel A. Banks of emerging countries

Countries and bank names	Countries and bank names	Countries and bank names
Argentina	Kuwait	18.1 <u>Muskat Bank</u>
1.1 <u>Bank Hipotecario</u>	11.1 <u>Bank Bahrain Kuwait</u>	Pakistan
1.2 <u>BBVA Banco FRANCÉS S.A.</u>	11.2 <u>Burgan Bank</u>	19.1 <u>United Bank Limited</u>
Brazil	11.3 <u>Gulf Bank Kuwait</u>	Philippine
2.1 <u>Banco ITAÚ S.A.</u>	Latvia	20.1 <u>Philippine National Bank</u>
2.2 <u>Santander Banespa</u>	12.1 <u>Aizkraukles Banka Latvija</u>	Russia
	12.2 <u>AS SEB banka Latvijas Unibanka</u>	21.1 <u>Gazprombank</u>
Bulgaria	12.3 <u>Baltic International Bank</u>	21.2 <u>TransCreditBank</u>
3.1 <u>Postbank Eurobank EFG</u>	12.4 <u>DNB Nord Banka</u>	Saudi Arabia
3.2 <u>Raiffisen Bank Bulgaria</u>	12.5 <u>Latvijas Krājbanka</u>	22.1 <u>Arab National Bank</u>
3.3 <u>Unit Credit Bulgaria</u>	12.6 <u>Latvijas Biznesa Banka</u>	22.2 <u>Banque Saudi Fransi</u>
Chile	12.7 <u>Norvik Banka</u>	22.3 <u>Saudi British Bank</u>
4.1 <u>Banco de Chile</u>	12.8 <u>Parex Banka</u>	South Africa
4.2 <u>Banco Santander</u>	12.9 <u>Rietumu Banka</u>	23.1 <u>ABSA Bank</u>
4.3 <u>BCI</u>	12.10 <u>Trasta Komercbanka</u>	23.2 <u>Capitec Bank</u>
China	Lebanon	23.3 <u>FirstRand Ltd.</u>
5.1 <u>Bank of China Limited</u>	13.1 <u>Banque Audi SAL Audi Saradar</u>	23.4 <u>Imperial</u>
	13.2 <u>BLOM Bank SAL</u>	23.5 <u>Sasfin Bank</u>
Croatia	13.3 <u>Libanese Canadian Bank</u>	Thailand
6.1 <u>Erste & Steiermärkische Bank D.D</u>	Lithuania	24.1 <u>Bangkok bank</u>
6.2 <u>HPB</u>	14.1 <u>AB Citadele Bankas Parex Bankas</u>	24.2 <u>Bank of Ayudhya</u>
6.3 <u>Hypo Alpe Adria Bank D.D.</u>	14.2 <u>DNB Nord Banka</u>	24.3 <u>Kasikorn Bank</u>
6.4 <u>Jadranska Banka Sibenik</u>	14.3 <u>ŠIAULIU BANKAS</u>	24.4 <u>Krung Thai Bank</u>
6.5 <u>Privrednabanka banka Zagreb</u>	14.4 <u>Swedbank</u>	Turkey
6.6 <u>Zagrebacka Banka</u>	14.5 <u>Ukio Bankas</u>	25.1 <u>Akbank</u>
India	Malaysia	25.2 <u>Anadolubank Anonim Şirketi</u>
7.1 <u>HDFC Bank</u>	15.1 <u>CIMB Bank</u>	25.3 <u>Garanti Bankasi</u>
7.2 <u>ICICI Bank</u>	15.2 <u>EON Bank</u>	25.4 <u>Sekerbank</u>
Indonesia	15.3 <u>OCBC Bank</u>	25.5 <u>Ziraat Bankasi</u>
8.1 <u>Bank Danamon</u>	Mauritius	Vietnam
Jordan		26.1 <u>SacomBank Saigon Thuong Tin Bank</u>
9.1 <u>Capital Bank</u>	16.1 <u>MCB</u>	261.2 <u>ACB Vietnam</u>
9.2 <u>Jordan Ahli Bank</u>	Mexico	
9.3 <u>Jordan Kuwait Bank</u>	17.1 <u>HSBC Mexico</u>	
Kazakhstan		
10.1 <u>Halyk Bank</u>	Oman	

Panel B. Banks of recently developed countries

Countries and bank names	Countries and bank names	Countries and bank names
Bahrain	6.2 <u>OTP Bank</u>	11.4 <u>VUB Banka</u>
1.1 <u>Ahli United Bank B.S.C.</u>	6.3 <u>UniCredit Bank Hungary Zrt.</u>	Slovenia
1.2 <u>Arab Banking Corporation</u>	Israel	12.1 <u>Abanka Vipa d.d. Slovenska</u>
1.3 <u>Ithmaar Bank</u>	7.1 <u>BANK LEUMI</u>	12.2 <u>Factor Banka d.d.</u>
1.4 <u>United Gulf Bank</u>	7.2 <u>FIBI Bank</u>	12.3 <u>NLB</u>
Cyprus	7.3 <u>Bank Hapoalim</u>	12.4 <u>SKB banka, d. d.</u>
2.1 <u>Bank of Cyprus</u>	7.3 <u>Bank Hapoalim</u>	12.5 <u>UniCredit Slovenija d.d.</u>
2.2 <u>Hellenic Cyprus Bank</u>	Poland	South Korea
Czech Republic	8.1 <u>Bank BPH S.A.</u>	13.1 <u>Industrial Bank of Korea</u>
3.1 <u>Česká spořitelna</u>	8.2 <u>Bank Pekao S.A.</u>	13.2 <u>Korea Exchange Bank</u>
3.2 <u>CSOB</u>	8.3 <u>BRE Bank</u>	Taiwan
3.3 <u>Komerční banka</u>	8.4 <u>Bank Zachodni WBK</u>	14.1 <u>Bank Sinopac</u>
3.4 <u>Raiffensbank</u>	8.5 <u>Kredyt Bank S.A.</u>	14.2 <u>CHANG HWA COMMERCIAL BANK</u>
3.5 <u>UniCredit Bank</u>	8.6 <u>Nordea Bank Polska S.A.</u>	14.3 <u>China Trust Commercial Bank</u>
Estonia	8.7 <u>PKO Bank Polski</u>	14.4 <u>E. Sun Bank</u>
4.1 <u>SEB Bank</u>	Qatar	14.5 <u>Hua Nan Commercial Bank</u>
4.2 <u>Swedbank</u>	9.1 <u>Ahli United Qatar</u>	14.6 <u>Landbank</u>
Hong Kong	9.2 <u>Commercial Bank of Qatar</u>	14.7 <u>Mega International Commercial Bank</u>
5.1 <u>Bank of East Asia</u>	9.3 <u>Qatar National Bank</u>	14.8 <u>Taishin International Bank</u>
5.2 <u>Chong Hing Bank</u>	Singapore	14.9 <u>Taiwan Business Bank</u>
5.3 <u>DAH SING Bank</u>	10.1 <u>DBS Bank</u>	14.10 <u>Union Bank of Taiwan</u>
5.4 <u>Fubon Bank</u>	10.2 <u>OCBC Bank</u>	United Arab of Emirates
5.5 <u>Hang Seng Bank</u>	10.3 <u>United Overseas Bank</u>	15.1 <u>First Gulf Bank</u>
5.6 <u>Shanghai Commercial Bank</u>	Slovakia	15.2 <u>Machreq Bank</u>
5.7 <u>Wing Hang Bank</u>	11.1 <u>Dexia banka Slovensko a.s Výročná správa</u>	15.3 <u>National Bank of Abu Dhabi</u>
Hungary	11.2 <u>Ludova Banka Volksbank</u>	
6.1 <u>KERESKEDELMI ÉS HITELBANK ZRT.</u>	11.3 <u>Tatra banka</u>	

1.2.1.1.B.b. Sample statistics

Overall sample is defined by 137 banks from both emerging and recently developed countries. There are 74 banks from emerging countries where banks from recently developed countries are 63.

Banks in emerging countries represent 54.015% of the total banks, while banks in recently developed countries represent 45.985%. The overall sample is spread over five regions. Europe is represented by 54 banks, Asia by 69 banks of which 17 are from the Gulf States and 9 from the Middle-East. Banks from Latin America are

eight. Africa is represented by six banks of which five are from South Africa. Regarding dealer banks, the sample is defined by twelve dealer banks⁶

Regarding the use of derivatives, forwards are the most used instruments by banks in overall sample. Swaps are the second most used instruments with 128 banks. Moreover, 101 banks are involved in using options, while only 70 banks use futures. The two most used instruments are forwards and swaps with a percentage equal to 89.78% of total banks.

Concerning banks in emerging countries, the most used instrument is forwards with a percentage equal to 94.59% of total banks. With a percentage equal to 89.19% of total banks, swaps are the second most used instrument, whereas, percentages of banks using option and futures contracts are respectively 60.81% and 45.95% of total banks. The most used pair is forwards and swaps with a percentage equal to 82.43% of total banks.

As for banks in recently developed countries, all banks use forwards. Except for Arab Banking Corporation Group, all the banks are involved in swap contracts. Moreover, the percentage of banks from Panel B using options represents 90.48% of total banks, while only a percentage equal to 57.14% of banks use futures. Except for Arab Banking Corporation, all the banks in recently developed countries use forwards and swaps.

In the next more statistics on derivative instruments use are detailed in the Table 20.

⁶ Hellenic Cyprus Bank; Hang Seng Bank; Hapoalim ; EON Berhard; OCBC Malaysia; United Bank Limited; BRE Polish; PKO; OCBC Singapore ; First Rand Bank; ABSA; Industrial Bank of Korea

Table 20. Number and percentage of banks per derivative instruments used

Instruments	Number of banks			Percentage		
	Total	Emerging	Recently developed	Total	Emerging	Recently developed
FWD+SWP+OPT+FUT	64	28	36	46.71%	37.84%	57.14%
FWD+SWP+OPT	101	44	57	73.72%	59.46%	90.48%
FWD+SWP+FUT	68	32	36	49.63%	43.24%	57.14%
FWD+OPT+FUT	64	28	36	46.71%	37.84%	57.14%
SWP+OPT+FUT	64	28	36	46.71%	37.84%	57.14%
FWD+SWP	123	61	62	89.78%	82.43%	98.41%
FWD+OPT	101	45	57	73.72%	60.81%	90.48%
FWD+FUT	70	34	36	51.09%	45.95%	57.14%
SWP+OPT	97	42	57	70.80%	56.76%	90.48%
SWP+FUT	69	33	36	50.36%	44.59%	57.14%
OPT+FUT	66	30	36	48.17%	40.54%	57.14%
FWD	133	70	63	97.08%	94.59%	100%
SWP	128	66	62	93.43%	89.19%	98.41%
OPT	101	45	57	73.72%	60.81%	90.48%
FUT	70	34	36	51.09%	45.95%	57.14%

Details in derivative instruments statistics are presented in the next tables.

Table 21. Statistics on derivative notional amounts⁷ per year
Panel A. Overall sample

Year	FWD		SWP		OPT		FUT		FWD+SWP+OPT+FUT		TA	
	Amount*	%	Amount*	%	Amount*	%	Amount*	%	Amount*	%	Amount*	%
2003	430,740.20	21.85	754,883.69	38.30	273,355.94	13.87	492,725.18	25.00	1,951,705.02	99.02	1,970,911.13	
2004	528,269.18	24.72	1,607,371.07	75.22	367,659.18	17.20	596,596.66	27.91	3,099,896.1	145.06	2,136,888.88	
2005	517,281.68	20.94	1,902,523.67	77.04	453,940.52	18.38	717,703.19	29.06	3,591,449.07	145.43	2,469,425.70	
2006	642,509.40	22.17	2,096,940.67	72.35	584,769.86	20.17	755,465.76	26.06	4,079,685.70	140.77	2,898,097.65	
2007	1,050,916.16	31.14	2,576,562.61	76.34	620,333.97	18.38	443,328.21	13.13	4,691,140.96	139.00	3,374,730.20	
2008	1,551,341.39	38.03	2,938,724.00	72.05	906,817.18	22.23	434,948.49	10.66	5,831,831.07	142.98	4,078,739.26	
2009	1,435,881.97	34.40	2,595,909.33	62.27	618,153.10	14.82	437,665.32	10.50	5,087,609.73	122.05	4,168,431.02	
2010	1,851,487.45	39.70	2,814,967.71	60.32	817,277.34	17.51	485,884.01	10.41	5,969,616.52	127.92	4,666,389.20	
Total	8,015,077.09	31.10	17,312,022.70	67.18	4,643,053.99	18.02	4,364,316.85	16.93	34,334,470.7	133.25	25,766,503.80	

⁷ Amounts are in USD millions

Table 22. Statistics on derivative notional amounts⁸ per year
Panel B. Banks from emerging countries

Year	FWD		SWP		OPT		FUT		FWD+SWP+OPT+FUT		TA
	Amount*	%	Amount*	%	Amount*	%	Amount*	%	Amount*	%	Amount*
2003	119,781.38	16.25	148,469.75	20.15	92,725.392	12.58	419,768.32	56.96	780,744.84	105.94	736,970.85
2004	139,966.18	16.92	172,320.83	20.83	134,311.05	16.24	520,749.93	62.95	967,348.001	116.94	827,208.47
2005	156,204.77	15.70	301,084.53	30.27	155,252.59	15.61	661,928.99	66.54	1,274,470.89	128.13	994,691.71
2006	236,907.68	18.68	403,495.21	31.81	192,905.41	15.21	671,503.59	52.94	1,504,811.90	118.63	1,268,453.18
2007	502,842.63	32.99	639,249.42	41.94	240,374.65	15.77	398,601.36	26.15	1,781,068.06	116.84	1,524,316.95
2008	1,055,504.15	51.65	820,317.66	40.14	576,299.95	28.20	399,138.47	19.53	2,851,260.24	139.53	2,043,502.90
2009	1,082,979.94	52.45	844,593.28	40.90	343,513.39	16.64	381,799.71	18.49	2,652,886.33	128.49	2,064,725.28
2010	1,485,556.81	65.78	973,676.36	43.11	488,786.49	21.64	394,997.73	17.49	3,343,017.40	148.03	2,258,376.66
Total	4,779,743.55	40.79	4,303,207.04	36.72	2,224,168.93	18.98	3,848,488.14	32.84	15,155,607.70	129.33	11,718,246.00

⁸ Amounts are in USD millions

Table 23. Statistics on derivative notional amounts⁹ per year
Panel C. Banks from recently developed countries

Year	FWD		SWP		OPT		FUT		FWD+SWP+OPT+FUT		TA
	Amount*	%	Amount*	%	Amount*	%	Amount*	%	Amount*	%	Amount*
2003	311,206.66	24.47	610,977.79	48.05	180,840.81	14.22	73,004.08	5.74	1,176,029.33	92.50	1,271,501.81
2004	390,825.40	28.72	1,437,844.46	105.67	233,582.09	17.17	75,986.82	5.58	2,138,238.77	157.15	1,360,648.84
2005	362,151.06	23.28	1,612,498.17	103.67	299,339.92	19.24	55,894.27	3.59	2,329,883.42	149.79	1,555,386.66
2006	406,780.60	23.29	1,705,191.60	97.65	397,048.62	22.74	84,408.05	4.83	2,593,428.88	148.51	1,746,282.59
2007	556,477.74	27.82	1,973,869.67	98.68	383,719.35	19.18	44,958.15	2.24	2,959,024.91	147.92	2,000,343.87
2008	498,320.06	22.88	2,128,921.48	97.76	332,673.24	15.28	35,942.64	1.65	2,995,857.43	137.56	2,177,600.08
2009	354,556.01	15.89	1,762,346.45	78.99	276,728.22	12.40	56,030.26	2.51	2,449,660.95	109.80	2,231,064.80
2010	367,255.19	14.52	1,850,910.03	73.21	331,591.76	13.11	91,405.01	3.61	2,641,161.98	104.47	2,528,215.58
Total	3,247,572.74	21.84	13,082,559.70	87.97	2,435,524.01	16.38	517,629.285	3.48	19,283,285.70	129.67	14,871,044.20

⁹ Amounts are in USD millions

Concerning the overall sample, the amount of derivative instruments represents 133.25% of total assets covering the period of the study between 2003 and 2010, and with an average bank size of approximately \$26 billion. During the study period swaps are the most represented instruments with notional amount equal to 17,312,022.70 USD, i.e. a percentage of 67.18% of total assets, while futures represent 16.93% of total assets. Statistics per year indicate that the highest notional amount of instruments traded is swaps defined by 77.04% of assets in 2005. In contrast, the lowest percentage refers to futures in 2010 with 10.41% of total assets.

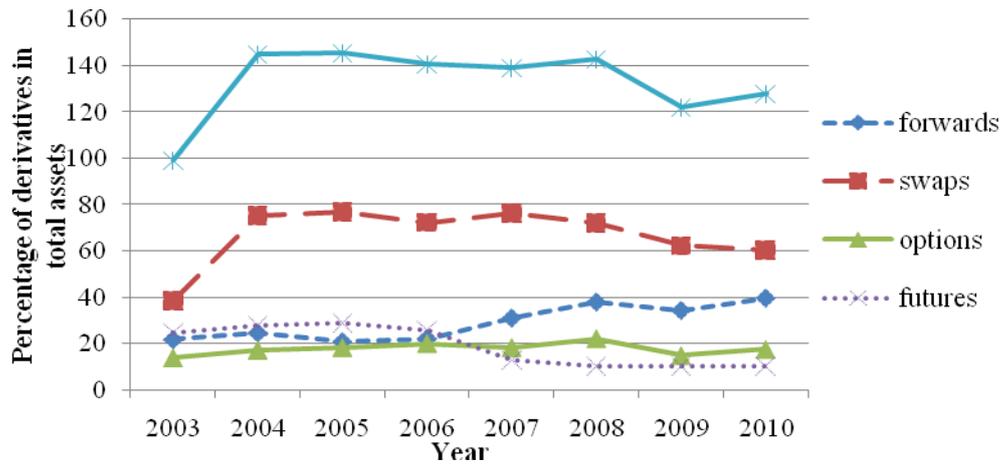
In the sample composed only of banks in emerging countries, the most representative instrument in percentage of total assets is forwards with a percentage in the sample period equal to 40.79%, whereas the percentages of swaps and futures are respectively 36.72% and 32.84%, and finally the percentage of options is the lowest with a percentage equal to 18.98%.

Regarding sample composed only of banks in recently developed countries, the percentage of swaps of total assets is the highest with a percentage during the sample period equal to 87.97%, while futures represent only a percentage of 3.48% of total assets during the sample period.

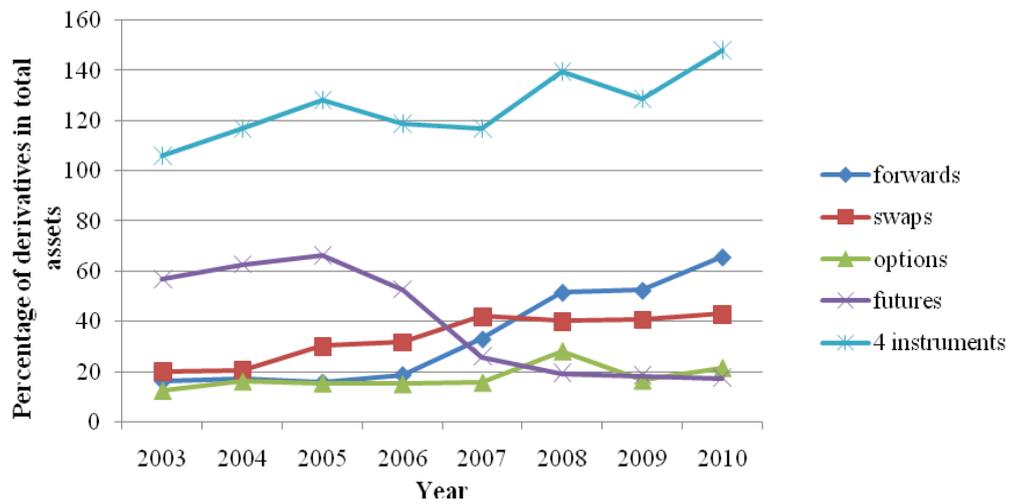
Compared to banks from recently developed countries, banks from emerging countries use more futures. Furthermore, the use of derivative instruments in banks from emerging countries seems to be more balanced compared to banks in recently developed countries. Furthermore, with the use of derivative instruments, banks from emerging countries seem to be more balanced compared to banks in recently developed countries.

As follows Figure 3 illustrates the evolution of the four derivative instruments from 2003 to 2010.

Panel A. Overall sample



Panel B. Banks from emerging countries



Panel C. Banks from recently developed countries

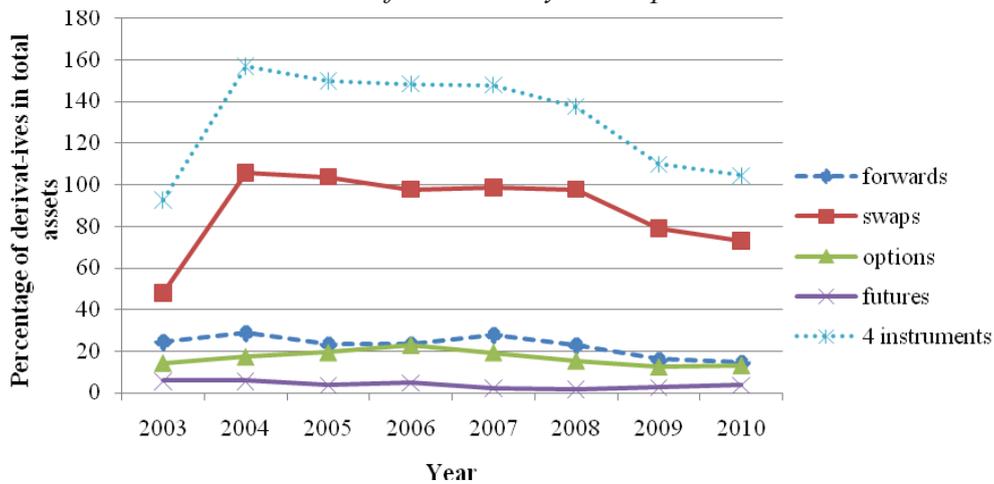


Figure 3. Evolution of derivative instruments

From Figure 3 Panel A, statistics review reveals that the percentage of swaps in total assets is the highest, followed by forwards. Conversely, the percentages of options and futures are low. From Panel B, statistics on evolution of the four instruments from emerging countries show the net decrease of futures use after the year 2005. Concerning the use of options, there is a little increase during the sample period. However, the use of swaps and especially forwards has jumped continuously. Finally, from Panel C, it can be observed that there has been a decrease in the use of derivative instruments among banks from recently developed countries especially from the year 2004. The percentage of swaps of total assets is the highest compared to the other instruments, while the percentages of futures in total assets are very low.

1.2.1.1.C. Methodology

The variables as well as the model used in the study are presented here.

1.2.1.1.C.a. Variables description

Accounting data are used to find out the volatility of return on assets, leverage risk, credit risk, and liquidity risk. Volatility of return on assets is defined by the standard deviation of return on assets calculated from quarterly income statements. Leverage risk is defined by the annual part of equity in total assets, credit risk is defined by the annual total of gross loans or loan loss reserves on total assets. Liquidity risk is defined by annual total of liquid assets on total assets.

As following the variables employed in the study along with their definitions and use in previous studies are exposed.

Table 24. Description of variables

Labels	Description	Proxy for	References
<i>Dependent variables</i>			
EQTA	the ratio of book-value-equity-to-total-assets	Leverage risk	Agusman et al. (2008)
LIQTA	the ratio of liquid-assets-to-total-assets	Liquidity risk	Agusman et al. (2008)
GLTA	the ratio of gross-loans-to-total-assets	Credit risk	Agusman et al. (2008)
LLRGL	the ratio of loan-loss-reserves-to-gross loan	Credit risk	Agusman et al. (2008)
SDROA	the standard deviation of return before taxes on assets estimated from quarterly income statements	Overall risk	Agusman et al. (2008)
<i>Independent variables: derivative instruments</i>			
FWD	Notional value of forwards divided by total assets	Forwards	Chaudhry et al. (2000)
SWP	Notional value of swaps divided by total assets	Swaps	Chaudhry et al. (2000)
OPT	Notional value of options divided by total assets	Options	Chaudhry et al. (2000)
FUT	Notional value of futures divided by total assets	Futures	Chaudhry et al. (2000)
<i>Independent variables: control variables</i>			
NIM	The difference between total interest income and total interest expense expressed, as a percentage of total assets.	Net interest margin	Chaudhry et al. (2000)
SIZE	Natural log of total assets	Bank size	Chaudhry et al. (2000) ; Reichert and Shyu (2003)
DEAL	1 if bank is a member of the International Swaps and Derivative Association (ISDA), 0 otherwise	Dealer	Chaudhry et al. (2000); Reichert and Shyu (2003)
COUNTRY	Dummy variable equals 1 when bank is issued from , 0 otherwise	Country variable	Agusman et al. (2008)

The dependent variables are regressed on derivative instruments and control variables. Control variables are defined by net interest margin, size of the bank, and dummy variables reflecting dealer bank and country belonging. Regarding the heterogeneity of the sample, like in the study by Agusman et al. (2008) country dummy variables are included to control for the differences in the banking structure and regulatory environments, and the different economic and political characteristics that may affect the relation between derivative instruments and accounting measures of risk.

The dichotomous variable DEAL takes a value one for dealer banks and zero otherwise. Accordingly to Chaudhry et al. (2000) the dummy variable DEAL is introduced in order to differentiate between the risk exposure of dealer banks and non-dealer banks.

1.2.1.1.C.b. Testing hypotheses and expected results

According to literature (Choi and Elyasiani, 1996, McAnally, 1996, Chaudhry et al., 2000, and Reichert and Shyu, 2003) swaps affect negatively bank risk, while options increase bank risk.

Therefore, hypotheses in the current study are as follows. Firstly, a negative effect of swaps on accounting risk is expected. Secondly, a positive effect of options on accounting risk is anticipated. Finally, and basing on the results of Chaudhry et al. (2000) no effect of futures and forwards use on accounting risk is stipulated.

As regards control variables, a positive effect of net interest margin and bank size on accounting risk is expected accordingly to Chaudhry et al. (2000) and Reichert and Shyu (2003).

Chaudhry et al., 2000 found that dealer banks are riskier than non-dealers so a positive effect of dealer variable on capital market risk is provided.

Finally, because no prior paper has introduced country variable in the conceptual model so the effect of countries on accounting risk is unexpected.

1.2.1.1.C.c. Empirical model

The equation (5) below presents the conceptual model:

$$\text{Risk measure}_{i,t} = \gamma_0 + \gamma_1 \text{FWD}_{i,t} + \gamma_2 \text{SWP}_{i,t} + \gamma_3 \text{OPT}_{i,t} + \gamma_4 \text{FUT}_{i,t} + \gamma_5 \text{NIMTA}_{i,t} + \gamma_6 \text{SIZE}_{i,t} + \gamma_7 \text{DEAL}_{i,t} + \sum_{k=1}^K \gamma_{8,k} \text{COUNTRY}_{i,t,k} + u_i + e_{i,t}, \quad (5)$$

Where:

Risk measure is one of EQTA; GLTA, LLRGL, LIQTA, or SDROA.

$(u_i + e_{i,t})$ is the composite error term. u_i is the random error in which heterogeneity is specifically to a cross-sectional unit-in this case, bank; and $e_{i,t}$ is the random error in which heterogeneity is specifically to a particular observation.

The model seeks to empirically test the relations between accounting risk measures and derivative instruments.

Then, we used panel data methodologies to estimate the parameter values and the computer software STATA 10 ® was used to estimate all regressions.

1.2.1.1.C.d. Specification tests

Firstly, the stationarity of all the variables is checked using the Augmented Dickey Fuller Tests. Trying with four lags, then with trend, and finally without constant. The stationarity is also checked using Unit Root tests- Phillips-Perron test and DF-GLS test. The linearity of the model is tested for with Ramsey-Reset Test. A normal hazard of residuals is finally examined with Jacques-Bera Test. Furthermore, correlations and problem of multicollinearity are checked. The Hausman test is applied to decide between fixed and random effect model. Ultimately, robustness tests of each model are conducted using a Modified Wald test for groupwise heteroskedasticity for fixed effect model and also a Breusch and Pagan Lagrangian multiplier test for random effect model.

1.2.1.2. Empirical results

As seen below, an empirical relationship exists between the use of derivative instruments and bank risk.

1.2.1.2.A. Descriptive statistics

The table below describes statistics of variables used in the model covering the overall sample and the two subsamples.

Table 25. Descriptive statistics of variables

Overall sample					
Variable	Obs	Mean	Std. Dev.	Min	Max
fwd	1096	0.23	0.71	0	11.44
swp	1096	0.43	1.13	0	19.05
opt	1096	0.09	0.26	0	3.17
fut	1096	0.08	0.86	0	16.55
eqta	1096	0.10	0.06	0.00	0.88
glta	1096	0.55	0.16	0.00	1.31
llrgl	1096	0.01	0.01	0.00	0.29
liqta	1096	0.07	0.07	0.00	1.17
sdroa	1096	0.00	0.01	0.00	0.16
nim	1096	0.03	0.04	-0.02	0.77
size	1096	9.11	1.60	3.70	12.85
Banks from emerging countries					
Variable	Obs	Mean	Std. Dev.	Min	Max
fwd	592	0.21	0.78	0.00	11.44
swp	592	0.34	1.22	0.00	19.05
opt	592	0.08	0.31	0.00	3.17
fut	592	0.14	1.17	0.00	16.55
eqta	592	0.10	0.07	0.00	0.88
glta	592	0.54	0.17	0.05	0.97
llrgl	592	0.02	0.02	0.00	0.29
liqta	592	0.09	0.08	0.00	1.17
sdroa	592	0.00	0.01	0.00	0.13
nim	592	0.03	0.05	0.00	0.77
size	592	8.63	1.72	3.70	12.85
Banks from recently developed countries					
Variable	Obs	Mean	Std. Dev.	Min	Max
fwd	504	0.25	0.61	0.00	6.00
swp	504	0.55	1.01	0.00	7.84
opt	504	0.10	0.19	0.00	1.63
fut	504	0.01	1.31	0.00	16.55
eqta	504	0.09	0.05	0.013	0.57
glta	504	0.56	0.15	0.00	1.31
llrgl	504	0.01	0.01	0.00	0.11
liqta	504	0.05	0.06	0.00	0.32
sdroa	504	0.00	0.00	0.00	0.16
nim	504	0.02	0.00	-0.02	0.04
size	504	9.68	1.22	5.66	12.34

Descriptive statistics show usual scores of all variables. For overall sample, the mean is between 0.00 and 9.11 and standard deviation has scores from 0.01 to 1.60. Finally, min scores are between 0.00 and 3.70, and max scores are between 0.16 and 19.05.

For banks from emerging countries the mean is going from 0.00 to 8.63, the standard deviation is between 0.01 and 1.72, the min is about 0.00 and 3.70, and lastly the max is between 0.13 and 19.05.

For banks from recently developed countries, the mean is between 0.00 and 9.68, the standard deviation is between 0.00 and 1.31, the min is between 0.00 and 5.66 and finally the max is comprised between 0.04 and 16.55.

1.2.1.2.B. Regression analysis

The parameter estimates from Equation 6 for each of the five risk measures are presented in the following table. In this table, it should be noted that insignificant independent variables were removed from the models, and the regressions re-estimated to get more precise estimates.

Table 26. Estimated coefficients
Panel A. For overall sample

	EQTA (Leverage risk)	GLTA (Credit risk 1)	LLRGL (Credit risk 2)	LIQTA (Liquidity risk)	SDROA (Total risk)
Constant	0.1551135*** (0.01315)	0.5482274*** (0.0377125)	0.0318569*** (0.0013297)	0.0718038*** (0.0138603)	0.0079017*** (0.0007778)
FWD	-0.005751*** (0.0019697)	NS	NS	-0.0029418* (0.0015855)	NS
SWP	NS	-0.0136368 *** (0.0032783)	-0.0015535*** (0.0002621)	NS	NS
OPT	0.0169053*** (0.0051756)	0.0190371 ** (0.0093309)	NS	NS	-0.0047164* (0.0026211)
FUT	NS	NS	NS	NS	0.0007763* (0.0004512)
NIM	0.797544*** (0.0786721)	-0.4859484 *** (0.0663234)	0.0697491*** (0.0109894)	0.3754465*** (0.0930716)	NS
SIZE	-0.0107483*** (0.0014023)	0.0147786 *** (0.0036482)	NS	-0.009032*** (0.0014829)	NS
DEAL	-0.012498*** (0.0029331)	NS	NS	-0.0247658*** (0.0051801)	NS
COUNTRIES	See details of the country dummies in Appendix II.a.				
R-squared	0.5684	0.4591	0.3270	0.4834	0.2984
F statistic	26.57***	67.47***	63.22***	46.33***	24.13***
Number of obs	1096	1096	1096	1096	736

Panel B. For emerging countries

	EQTA (Leverage risk)	GLTA (Credit risk 1)	LLRGL (Credit risk 2)	LIQTA (Liquidity risk)	SDROA (Total risk)
Constant	0.1379832*** (0.0131371)	0.3608178*** (0.0379863)	0.0305181*** (0.0014924)	0.1091668*** (0.0193169)	0.0073691*** (0.0008091)
FWD	-0.0072193** (0.0032143)	NS	NS	-0.0041709* (0.0021829)	0.0086751* (0.0049607)
SWP	NS	NS	-0.0012426*** (0.0002543)	-0.0053625*** (0.0012004)	NS
OPT	0.023765*** (0.0080161)	NS	NS	0.0273734** (0.0129902)	-0.0101757* (0.0055368)
FUT	-0.002826* (0.0016431)	NS	NS	NS	0.0015838* (0.0009134)
NIM	0.8118519*** (0.0803363)	-0.4564403*** (0.0605393)	0.0653069*** (0.0107152)	0.3721157*** (0.0948732)	NS
SIZE	-0.0081553*** (0.001383)	0.021895*** (0.0041033)	NS	-0.0093782*** (0.0017837)	NS
DEAL	-0.0288609*** (0.0065563)	NS	NS	-0.0256994*** (0.0095755)	NS
COUNTRIES	See details of the country dummies in Appendix II.b.				
R-squared	0.6129	0.5497	0.2517	0.4617	0.3687
F statistic	22.12***	112.05***	61.40***	30.56***	26.72***
Number of obs	592	592	592	592	432

Panel C. For recently developed countries

	EQTA (Leverage risk)	GLTA (Credit risk 1)	LLRGL (Credit risk 2)	LIQTA (Liquidity risk)	SDROA (Total risk)
Constant	0.2786251*** (0.0445082)	0.5699885*** (0.0113673)	0.0324165*** (0.0053214)	0.1784943*** (0.0238287)	0.0187453*** (0.0068745)
FWD	-0.0122533*** (0.0028496)	NS	NS	NS	NS
SWP	0.0052534** (0.0021781)	-0.0273719*** (0.0049557)	-0.003378*** (0.000882)	NS	NS
OPT	NS	NS	0.004761* (0.0026644)	-0.0182626* (0.0097805)	NS
FUT	0.0721828** (0.0314471)	-0.1734052*** (0.0557002)	NS	NS	0.0188567* (0.0114387)
NIM	NS	NS	0.3898091*** (0.0742684)	0.6609709** (0.2854685)	NS
SIZE	-0.0165964*** (0.0042108)	0.0232479*** (0.0048278)	-0.0013331*** (0.0004836)	-0.0093396*** (0.0020648)	-0.00132** (0.0005988)
DEAL	NS	NS	NS	-0.0264916*** (0.0061646)	NS
COUNTRIES	See details of the country dummies in Appendix II.c.				
R-squared	0.5021	0.3331	0.4755	0.4467	0.0837
F statistic	26.01***	51.81***	30.10***	21.63***	11.02 ***
Number of obs	504	504	504	504	304

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

The variable that are not significant were removed and the model was re-estimated to get more precise results. Consequently, no parameter values are provided for these variables.

() indicate standard deviation of the estimators.

NS indicate non-significance of coefficient.

Years 2003—2010.

From Panel A it is found that the use of forwards negatively affects leverage risk and liquidity risk at levels of significance respectively equal to 1% and 10%.

From these results we deduce that using forwards affects negatively bank risks of the entire sample. This finding confirms that forwards are used essentially for speculation which augments bank risks.

The association between swaps and the two credit risk measures indicates a negative relationship at a level of significance equal to 1%.

Therefore, we can interpret that using swaps is beneficial for banks since they reduce their credit risks by using swaps which confirms the hedging rule that takes swaps in minimizing bank risks.

Options positively affect leverage risk and credit risk 1 at levels of significance respectively equal to 1% and 5%, while the relationship between options and total risk is negatively and weakly significant at a level of significance equal to 10%. These results confirm that the speculation purpose of options tends to increase of bank risks. In addition, we remark that sample banks deal worse with options when they speculate.

As for futures, results indicate that the use of futures positively but weakly affects total risk at a level of significance equal to 10%. This finding explains that there is a little increase of total risk when sample banks use futures. This weakness in significance can be explicated by the little number of banks that are involved in futures activities.

Finally, as regarding the effect of derivative instruments on bank risk we find that in line with past studies only options tends to increase bank risk while the other types of derivatives tends to reduce bank risk.

Net interest margin positively affects leverage risk, credit risk 2 and liquidity risk but it has a negative effect on credit risk 1 at a level of significance equal to 1%.

Results on net interest margin show that overall net interest margin has positive effect on bank risks according to the literature results.

Size has a positive effect on leverage risk and liquidity risk but it negatively affects credit risk 1 at a level of 1%. In general, size seems to increase bank risk which verifies the thesis exposed in the literature stipulating that big banks are more risky than small banks.

The dummy variable that defines dealer banks is negatively significant with leverage risk and liquidity risk at a level of significance equal to 1%. This finding rejects expectation according to literature results. In fact, previous studies found that dealer banks are more risky than non-dealer banks because they take much risk when they deal with derivatives. Our results can be explicated by the fact that dealer banks in our sample manage better their risk from derivatives than other dealer banks.

As regards the effect of regressions of country variables, only the variable that defines banks from Indonesia is not significant with any type of risk measures.

From Panel B, results focused on emerging countries expose that forwards negatively affect leverage risk at a level of significance equal to 5% and liquidity risk at a level of significance equal to 10%, and it has a positive effect on total risk at a level of significance equal to 10%. According to literature results we can say that using derivatives reduces bank risk generally. This finding corroborates the idea that forwards are not risky instruments in spite of their use in over the counter markets.

Swaps have negative effect on credit risk 2 and liquidity risk at a level of significance equals to 1%. Similarly to forwards our results verifies the findings of previous studies that swaps minimize bank risk. Using usually as hedging tool especially against credit risks, swaps confirms that are beneficial derivatives that reduce bank risk.

Options have positive effect on leverage risk and liquidity risk at levels of significance respectively equal to 1% and 5%, and negative effect on total risk at a level of significance equal to 10%. We can deduce that in general options tend to increase bank risk as expected. There is a confirmation that options seem to be risky tool because of their speculation purpose.

And finally futures negatively affect leverage risk and positively total risk at a level of significance equal to 10%. Not contrarily to the literature we find that also that futures do not increase bank risk. In our study we can say that using futures decrease minimally bank risk. This weakness in the effect of futures on bank risk can be

explained by the little number of banks that have used this derivative type during our sample period.

As regarding control variables, net interest margin positively affect leverage risk, credit risk 2 and liquidity risk at a level of significance equal to 1%, but has a negative effect on credit risk 1 at the same level of significance. Results on net interest margin are not so concluding to say that it reduces or increases bank risk.

Size has a negative effect on leverage risk and liquidity risk but positively affects credit risk 1 all at a level of significance equal to 1%. Also for size our findings do not allow us to be relevant in the sign of the effect of size on bank risk.

The dummy variable that defines dealer bank negatively affects leverage risk and liquidity risk at a level of significance equal to 1%. Our finding shows that dealer variable has negative effect on bank risk which is contrary with literature results. We can interpret this by the fact that dealer banks in the sample manage better their risks than other dealer in literature sample.

From Panel C, results limited to recently developed countries show that forwards have a negative effect on leverage risk at a level of significance equal to 1%. This result confirms in line with theory that forwards tend to decrease bank risk.

Swaps negatively affect at a level of significance equal to 1% the two credit risk measures, but it has a positive effect on leverage risk at a level of significance equal to 5%. In general, we can say that using swaps tend to reduce bank risk. This finding corroborates the results of past studies.

While options positively affect credit risk 2 and negatively liquidity risk at a level of significance respectively equal to 10%. Findings on options are not concluding so we cannot say if options increase or decrease risk of banks from recently developed countries.

And finally, the use of futures has a positive effect on leverage risk and total risk at a level of significance equal to 10% but negatively affect credit risk 1 at a level of significance equal to 1%. Equally to options our results on futures do not allow us to interpret if futures increase or decrease bank risk.

Regarding control variables, net interest margin positively affects credit risk 2 and liquidity risk at levels of significance respectively equal to 1% and 5%. According to the theory we find that net interest margin tend to increase bank risk. Size has negative effect on leverage risk, credit risk 1 and liquidity risk but positively affects credit risk 1 all at a level of significance equal to 1%. This result about the effect of

the size on bank risk is not concluding which do not confirm or reject literature thesis. As for dummy variables, the variable that defines dealer banks is negatively significant with liquidity risk at a level of significance equal to 1%. This finding rejects expectations stipulating that dealer banks are increasing their risk.

I.2.1.2.C. Specification tests results

The P values of the Augmented Dickey Fuller Tests for all the specifications are closed to 0. We have similar results for the Phillips-Perron test. The DF-GLS test rejects the null hypothesis of unit root at 1% significance level for all the specifications. (The results are available under request to the corresponding author). Stationarity of variables is then detected in all the cases.

As follows the Table 27 summarizes the main results of the Ramsey-Reset Test (for more details see Appendix V.b.).

Table 27. Ramsey-Reset Test

Dependent variable	chi2(3)	Prob > chi2
Leverage risk EQTA	67.89	0.0000
Liquidity risk LIQTA	36.42	0.0000
Credit risk 1 GLTA	19.19	0.0002
Credit risk 2 LLRGL	0.28	0.9635
Total risk SDROA	4.93	0.1768

In the next, the Figure 4 is checked with the nonlinear relation between independent variables and error terms when the risk is measured by leverage risk, liquidity risk and credit risk 1.

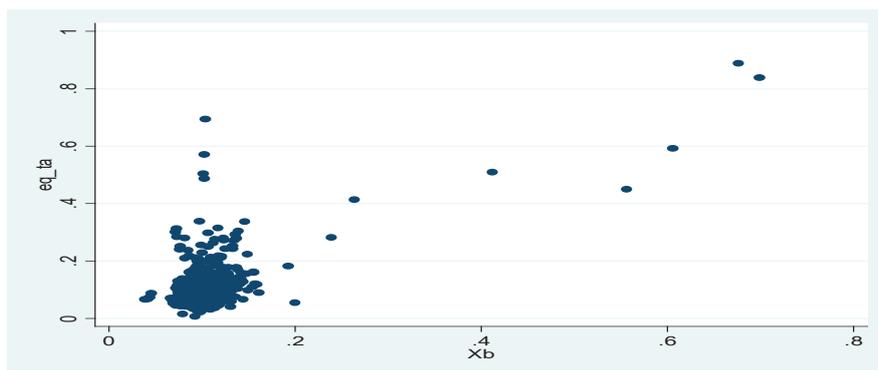


Figure4.1. Leverage risk measure function of its predicted variable

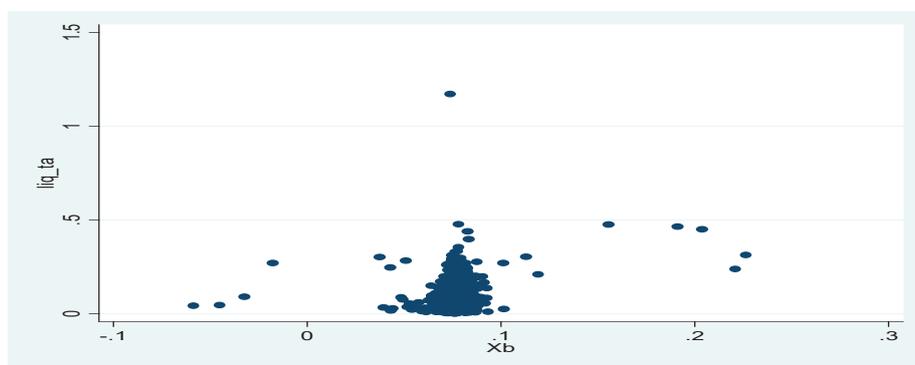


Figure4.2. Liquidity risk measure function of its predicted variable

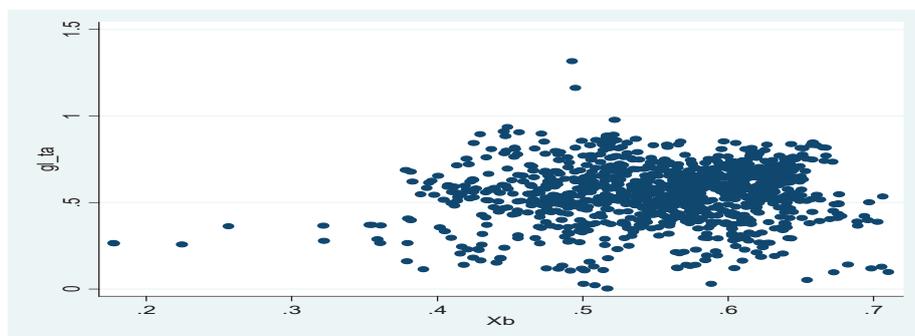


Figure4.3. Credit risk measure function of its predicted variable

Figure 4. Risk measures against their predicted variables

From Figure 4 above no strong nonlinear relation between the independent variables and the dependent variable is seen. Thus, linearity of the model is almost assured.

Correlations between variables are presented in the following matrices (5% level of significance is retained):

Table 28. Matrix of correlations (leverage risk is the dependent variable)

	eqta	fwd	swp	opt	fut	nim	size
eqta	1.0000						
fwd	-0.0795*	1.0000					
	(0.0084)						
swp	-0.0046	0.3875*	1.0000				
	(0.8781)	(0.0000)					
opt	0.0806*	0.1065*	0.1563*	1.0000			
	(0.0076)	(0.0004)	(0.0000)				
fut	0.0024	0.0003	0.0182	0.3891*	1.0000		
	(0.9377)	(0.9921)	(0.5469)	(0.0000)			
nim	0.6196*	-0.0219	0.0304	-0.0136	-0.0170	1.0000	
	(0.0000)	(0.4684)	(0.3152)	(0.6536)	(0.5746)		
size	-0.3224*	0.1056*	0.1520*	0.0872*	0.0758*	-0.1983*	1.0000
	(0.0000)	(0.0005)	(0.0000)	(0.0039)	(0.0120)	(0.0000)	

The numbers in brackets correspond to the standard error.

Table 29. Matrix of correlations (liquidity risk is the dependent variable)

	liqta	fwd	swp	opt	fut	nim	size
liqta	1.0000						
fwd	-0.0543	1.0000					
	(0.0725)						
swp	-0.1226*	0.3875*	1.0000				
	(0.0000)	(0.0000)					
opt	-0.0228	0.1065*	0.1563*	1.0000			
	(0.4517)	(0.0004)	(0.0000)				
fut	0.0371	0.0003	0.0182	0.3891*	1.0000		
	(0.2193)	(0.9921)	(0.5469)	(0.0000)			
nim	0.2497*	-0.0219	0.0304	-0.0136	-0.0170	1.0000	
	(0.0000)	(0.4684)	(0.3152)	(0.6536)	(0.5746)		
size	-0.1743*	0.1056*	0.1520*	0.0872*	0.0758*	-0.1983*	1.0000
	(0.0000)	(0.0005)	(0.0000)	(0.0039)	(0.0120)	(0.0000)	

The numbers in brackets correspond to the standard error.

Table 30. Matrix of correlations (credit risk 1 is the dependent variable)

	glta	fwd	swp	opt	fut	nim	size
glta	1.0000						
fwd	0.0820*	1.0000					
	(0.0066)						
swp	-0.0137	0.3875*	1.0000				
	(0.6495)	(0.0000)					
opt	-0.0335	0.1065*	0.1563*	1.0000			
	(0.2684)	(0.0004)	(0.0000)				
fut	-0.0310	0.0003	0.0182	0.3891*	1.0000		
	(0.3055)	(0.9921)	(0.5469)	(0.0000)			
nim	-0.0960*	-0.0219	0.0304	-0.0136	-0.0170	1.0000	
	(0.0015)	(0.4684)	(0.3152)	(0.6536)	(0.5746)		
size	0.1167*	0.1056*	0.1520*	0.0872*	0.0758*	-0.1983*	1.0000
	(0.0001)	(0.0005)	(0.0000)	(0.0039)	(0.0120)	(0.0000)	

The numbers in brackets correspond to the standard error.

Table 31. Matrix of correlations (credit risk 2 is the dependent variable)

	llrgl	fwd	swp	opt	fut	nim	size
llrgl	1.0000						
fwd	-0.0256	1.0000					
	(0.3964)						
swp	-0.0226	0.3875*	1.0000				
	(0.4550)	(0.0000)					
opt	-0.0278	0.1065*	0.1563*	1.0000			
	(0.3575)	(0.0004)	(0.0000)				
fut	-0.0279	0.0003	0.0182	0.3891*	1.0000		
	(0.3557)	(0.9921)	(0.5469)	(0.0000)			
nim	0.1800*	-0.0219	0.0304	-0.0136	-0.0170	1.0000	
	(0.0000)	(0.4684)	(0.3152)	(0.6536)	(0.5746)		
size	-0.0870*	0.1056*	0.1520*	0.0872*	0.0758*	-0.1983*	1.0000
	(0.0040)	(0.0005)	(0.0000)	(0.0039)	(0.0120)	(0.0000)	

The numbers in brackets correspond to the standard error.

Table 32. Matrix of correlations (total risk is the dependent variable)

	sdroa	fwd	swp	opt	fut	nim	size
sdroa	1.0000						
fwd	-0.0031	1.0000					
	(0.9176)						
swp	-0.0241	0.3875*	1.0000				
	(0.4250)	(0.0000)					
opt	0.0074	0.1065*	0.1563*	1.0000			
	(0.8074)	(0.0004)	(0.0000)				
fut	-0.0042	0.0003	0.0182	0.3891*	1.0000		
	(0.8897)	(0.9921)	(0.5469)	(0.0000)			
nim	0.0915*	-0.0219	0.0304	-0.0136	-0.0170	1.0000	
	(0.0024)	(0.4684)	(0.3152)	(0.6536)	(0.5746)		
size	-0.0083	0.1056*	0.1520*	0.0872*	0.0758*	-0.1983*	1.0000
	(0.7836)	(0.0005)	(0.0000)	(0.0039)	(0.0120)	(0.0000)	

The numbers in brackets correspond to the standard error.

Moreover, a test for multicollinearity is completed. A detection-tolerance or the variance inflation factor (VIF) for multicollinearity can be defined as follows:

$$\text{Tolerance}_j = 1 - R_j^2, \text{ VIF}_j = 1/\text{Tolerance}_j$$

where R_j^2 is the coefficient of determination of a regression of explanatory variable j on all the other explanatory variables. A tolerance of less than 0.20 or 0.10 and/or a VIF of 5 or 10 and above indicates a multicollinearity problem (see O'Brien 2007). As following the results confirm an absence of multicollinearity problem:

Table 33. Multicollinearity test

	VIF	1/VIF
Size	1.61	0.622517
Swp	1.39	0.719839
Nim	1.37	0.731653
Fwd	1.32	0.759111
Opt	1.28	0.778838
Fut	1.20	0.834699
Mean VIF	1.36	

The Table 34 as follows resumes main results of Hausman test (more results are in the Appendix VI.b.).

Table 34. Hausman Test

Dependent variable	chi2(6)	Prob > chi2
Leverage risk EQTA	7.54	0.2738
Liquidity risk LIQTA	29.38	0.0001
Credit risk 1 GLTA	130.76	0.0000
Credit risk 2 LLRGL	5.21	0.5171
Total risk SDROA	1.92	0.9271

As shown above for liquidity risk and credit risk 1 there is correlation between the majority of independent variables and the error terms. However, using fixed effect model dropped all the dummies, so we prefer to choose the random effect model. For the other risk measures results prove the absence of correlation between the independent variables and the error terms which confirms the choice of random effect model. .

For fixed effect model a Modified Wald test for groupwise heteroskedasticity is used. The null hypothesis is $H_0: \sigma_{\mu_i}^2 = \sigma^2$ for all i . The results are presented in the following table:

Table 35. Modified Wald test for groupwise heteroskedasticity

Dependent variable	chi2(137) test statistic	P value
Leverage risk: EQTA	1.9e+07	0.0000 *
Credit risk 1: GLTA	15277.43	0.0000 *

The results above show the null hypothesis of the presence of homoskedasticity (or constant variance) is retained. Therefore, we use the option ‘robust’ in STATA to control for heteroskedasticity.

Finally, in order to check between random effect model and simple OLS regression choice, a Breusch and Pagan Lagrangian multiplier test is conducted. The null hypothesis is $H_0: \text{“Var}(u_i)=0\text{”}$ against $H_1: \text{“Var}(u_i)>0\text{”}$. The results are presented in Table 36.

Table 36. Breusch and Pagan Lagrangian multiplier test

Dep. variable	sd(Dep. Variable)	sd($e_{i,t}$)	sd(u_i)	chi2(1) test statistic	P value
sdroa	0.01179	0.008683	0.0080738	781.38	0.0000 *
llrgl	0.0686165	0.061089	0.0295072	122.07	0.0000 *
eqta	0.0638622	0.027084	0.0396406	1690.84	0.0000 *

The results confirm that the random effect has to be used, conversely to the simple OLS regression.

From these results on Breusch and Pagan Lagrangian multiplier test the null hypothesis is verified in the all models so that random effect models are justified.

1.2.1.3. Summaries and discussions

For overall sample, finding that the coefficient of the association between derivative instruments and total risk is so low confirms that the effect of derivative instruments on total risk is weak. Results are not so significant to interpret how the use of derivatives impacts bank risk.

Concerning control variables, the result about bank size rejects the thesis stipulating that size increases bank risk. In contrast, net interest margin affect in general positively risk measures. Consequently, the hypothesis stipulating that net interest margin affects positively bank risk is confirmed. The result about dummy variable that defines dealer banks rejects the thesis stipulating that dealer banks are at risk because of its affects negatively accounting risk. Finally, Appendix II.a. shows that only the country dummy defining Indonesia is not significant with any risk types. Therefore Indonesian banks reject any relationship between country dummy and bank risk.

For emerging countries, the result about the dummy variable that defines dealer bank rejects the thesis stipulating that dealer banks are at risk.

For recently developed countries, the result about the variable that defines dealer banks rejects the thesis stipulating that dealer banks are at risk. Finally, deduced results show no strong significance in the association between derivative instruments and total risk.

To summarize, the overall results indicate that forwards have a negative effect on leverage risk and liquidity risk respectively at 1% and 10% level of significance. Swaps also negatively affect the two credit risk measures at level of significance equal to 1%. In contrast, options have a positive effect on leverage risk and credit risk 1 respectively at 1% and 5% level of significance, and have a negative but weak effect on total risk at 10% level of significance. And finally, futures positively but mildly affect total risk at a level of significance equal to 10%.

In the whole, the use of forwards and swaps contracts reduces risk, options tend to increase risk, and the use of futures contributes minimally to risk. Observing that the majority of banks mainly use forwards and swaps, we deduce that sample banks are not at risk by using derivative instruments.

The following table sums up the main regression results about the association between the four derivative instruments and the four accounting risk measures.

Table 37. Summary of regression coefficient signs
Panel A. For overall sample

	Forwards	Swaps	Options	Futures
Leverage risk	-	NS	+	NS
Credit risk 1	NS	-	+	NS
Credit risk 2	NS	-	NS	NS
Liquidity risk	-	NS	NS	NS
Total risk	NS	NS	-	+

Panel B. For emerging countries

	Forwards	Swaps	Options	Futures
Leverage risk	-	NS	+	-
Credit risk 1	NS	NS	NS	NS
Credit risk 2	NS	-	NS	NS
Liquidity risk	-	-	+	NS
Total risk	+	NS	-	+

Panel C. For recently developed countries

	Forwards	Swaps	Options	Futures
Leverage risk	-	+	NS	+
Credit risk 1	NS	-	NS	-
Credit risk 2	NS	-	+	NS
Liquidity risk	NS	NS	-	NS
Total risk	NS	NS	NS	+

Common results of the two subsamples show that the use of forwards has a negative effect on leverage risk, swaps negatively affect credit risk 2, and the use of futures has a positive and mild effect on total risk.

There is evidence that forwards and swaps are used for hedging purposes both from banks in emerging countries and those in recently developed countries. Furthermore, it appears that banks use less future contracts especially banks from recently developed countries.

Concerning control variables, net interest margin affects positively credit risk 2 and liquidity risk in the two subsamples. This result verifies literature findings and our hypothesis.

In spite of its positive effect on credit risk 1, size affects negatively leverage risk and liquidity risk in the two subsamples. Therefore, the argument stipulating that bank size increases risk is eliminated.

Finally, the dealer variable is negatively associated with liquidity risk in the two subsamples. Indeed, dealer banks in emerging as well in recently developed countries manage in the better way their accounting risks.

Differences between Panel B and Panel C are related to leverage risk and liquidity risk. For banks from recently developed countries, using futures has a positive effect on leverage risk, while it has a negative effect for banks from emerging countries. It appears that banks from emerging countries manage the risk of using futures better than banks from recently developed countries. The use of option contracts by banks from recently developed countries has a negative effect on liquidity risk while it has a positive effect with banks from emerging countries. Indeed, banks from recently developed countries deal with options in a better way.

Summarizing, forwards and swaps have the same effect on bank risk whether are used by banks in emerging or recently developed countries. However, comparing results expose that banks in emerging countries deal better with futures than banks in recently developed countries. And finally, banks in recently developed countries manager the risk of options better than banks in emerging countries.

In conclusion, this chapter examines the impact of four derivative instruments (options, swaps, forwards, and futures) on five measures of accounting risk for banks. Bank risk is measured in terms of leverage risk, liquidity risk, credit risk 1, credit risk 2 and total risk. Empirical results using pooled data for 2003-2010 collected from overall sample and two sub-samples. The overall sample is composed of banks from emerging as well as from recently developed countries.

Regarding main results collected from the overall sample and the two sub-samples, in general the use of forwards and swaps decrease bank risk while the use of options positively affects bank risk, and finally the use of futures has a mildly significant effect on bank risk.

Regarding comparing results, banks in recently developed countries manager the risk of options better than banks in emerging countries while banks in emerging countries deal better with futures than banks in recently developed countries. Whereas, forwards and swaps have the negative effect on bank risk in the subsamples.

Or the majority of banks generally make use of forwards and swaps so it seems clear that sample banks are not at risk by using derivative instruments.

Overall, it appears that forwards and swaps are used as a hedging tool while options are viewed as playing a more speculative role.

In definitive, this part of the thesis has the aim to study the effect of derivative instruments use on bank risk. Thus, two chapters have been carried out in order to attain this end. Concluding results of the two chapters show that sample banks are not at risk by using derivative instruments.

Hence, not only should the negative implications attributed to derivatives in the recent financial crisis be reviewed, but also, more importantly, the argument that derivative instruments were the principal cause of the most recent financial crisis should be revised.

PART II. DERIVATIVE INSTRUMENTS USE AND BANK PERFORMANCE

The recent financial liberalization policies have also changed the business environment of the banking industry considerably and thereby increasing the risk they faced. Banks were directly affected because they were direct targets of the liberalization process. This phenomena stressed by globalization have paved the way to banks especially from emerging markets to enter to new profitable markets such as those of derivatives.

Banks are motivated to use these innovations in order to protect against risk and uncertainty of the financial market, and also to generate revenue beyond that available from traditional bank operations.

Indeed, such benefits of derivative instruments explain the widespread use and the rapid growth of derivative transactions in the recent decades.

Benefits of derivatives usage are mentioned widely in literature. Several authors, such as Smith and Stulz (1985), Nance et al. (1993) and Fok et al. (1997) argue that there are three major benefits from using derivatives: reduced taxes under a progressive tax schedule, reduced expected cost of financial distress, and reduced agency cost problems.

However, there is a gap in the literature in studying the effect of derivative usage on bank performance. An overview of the literature shows that in our knowledge there are only two papers focusing in this topic (Said, 2011; Rivas et al. 2006).

The second part of the thesis intends to fill this gap by investigating the effect of derivative instruments use on bank performance.

To this end, this second part is planned as follows. The first chapter explores the effect of derivative instruments use on stock return performance. The second chapter studies the effect of derivative instruments use on accounting performance.

Chapter II.1. Effect of derivative instruments on stock return performance

The current chapter has the purpose to check up if by using derivatives sample banks increase or decrease their stock return performance.

To achieve this aim two sections are performed. The first section summarizes previous papers about the relationship between derivatives and bank performance. The second section is defined by an analysis testing empirically the impact of derivative instruments use on stock return risk.

Section II.1.1. Derivative activities and performance: Literature review

II.1.1.1. Theoretical literature review and results

Before presenting literature about derivatives use and performance, observation show that many papers have demonstrated the benefits of derivatives use.

Brewer et al. (2000) examine the effects of the use of interest-rate derivative products on the commercial and industrial lending activity of US commercial banks. They find that interest-rate derivatives users have greater growth in their commercial and industrial loan portfolios than non-users.

Furthermore, Gunther and Siems (2002) conclude that U.S. medium-sized commercial banks involved in derivatives are financially secure.

Moreover, the findings of Minton et al. (2009) reveal that derivatives can increase the liquidity of the organizations due these tools used to hedges financial cost, agency cost, and improve the efficiency of these organizations.

Literature investigating the relationship between derivatives use and performance can be divided in two groups.

The first group concern non-financial firms i.e. corporate literature.

Allayannis and Weston (2001) have examined the use of foreign currency derivatives (FCDs) in a sample of 720 large U.S. nonfinancial firms between 1990 and 1995 and

its potential impact on firm value. Using Tobin's Q¹⁰ as a proxy for firm value, they find a positive relation between firm value and the use of FCDs.

Moreover, the results of Bartram et al. (2006) show that the effect of derivatives use on firms' value is positive.

In his paper Ameer (2010) tests empirically the impact of Malaysian firm specific factors on the use of derivative instruments. He finds that there is a significant relationship between the use of derivatives and foreign sales, liquidity, firm growth, managerial ownership and size.

Contrarily to previous studies the findings of Fauver and Naranjo (2010) reveal a negative association between firm value defined by Tobin's Q and derivatives used in the U.S. context.

In the same way banking literature investigating the effect of derivative use on performance is limited to few papers.

In his study Said (2011) explores how the use of derivatives by US banks have impacted their performance (measured by return on assets ratio, return on equity ratio, efficiency ratio, cost of funding earning assets, and net interest margin). He found a positive correlation between accounting performance measures and usage of derivatives.

Furthermore, investigating whether the use of derivatives by banks in Latin America affect their efficiency (measured by Data Envelopment Analysis), Rivas et al. (2006) conclude that banks efficiency increases with the use of derivatives.

Brewer et al. (2000) study the relationship between lending and derivatives use over the period from the fourth quarter of 1994. They explain how the association between BHC lending and their use of interest rate derivatives can be measured by examining the relationship between the growth in BHC business loans and their involvement in interest rate derivative markets. They find that banks using derivatives increase their business lending faster than banks that do not use derivatives. Moreover, they deduce that large banks are much more likely than small banks to use derivatives. They argue that there is an agreement with the idea that there is a fixed cost associated with initially

¹⁰ Tobin's q was developed by James Tobin (Tobin 1969) as the ratio between the market value (the going price in the market) and replacement value (the price in the market for newly produced commodities) of the same physical asset. Source: Wikipedia

learning learning how to use derivatives and large banks are more willing to incur this fixed cost because they will more likely to use a larger amount of derivatives.

The findings of Brewer et al. (2001) show that U.S. interest-rate derivatives users do not increase significantly their accounting profits defined by return in asset and return on equity ratios in the 1986 to 1994 period.

Finally, and in opposite to previous studies Sinkey and Carter (2000) deduce that U.S. bank users of derivatives have lower net interest margin than non-users.

In comparison to literature, this work is focusing on banks mainly from emerging countries and examining the effect of each derivative instrument on bank performance. This contribution is presented in the next section.

II.1.1.2. Empirical literature review

Investigating the impact of U.S. interest-rate derivatives usage on accounting profits Brewer et al. (2001) have used a widely two-index market model to characterize the return generating process for bank common stocks. This model is an extension of single index market model in which capital market risk sensitivity can be represented by the equity “beta” or the measured sensitivity of the firm’s equity return with respect to the return on the market-wide portfolio of risky assets. They examine other determinant of stock return which is unanticipated changes in interest rates during the entire period is from January 1986 to December 1994.

Brewer et al. (2000) study the relationship between lending and derivatives use over the period from the fourth quarter of 1994. To this end, they employ a basic model which relates C&I lending to previous quarter capital to total assets ratio and C&I chargeoffs to total assets. They add to the base model indicators for participation in any type of interest rate derivatives. The derivative-augmented regressions indicate that banks using any type of interest rate derivative, on average experience higher growth in their C&I loan growth. The net impact of derivative usage complements the C&I lending activities of banks.

Studying how the use of derivatives by banks in Latin America affect their efficiency Rivas et al. (2006) have used two-step OLS regressions to study the effect of derivatives use on bank efficiency. In the first stage, the efficiency scores are obtained on a variable representing derivatives usage and control variables that have been documented to affect efficiency scores. In this regression, efficiency measure represents the efficiency scores of Latin American banks obtained from the DEA model of the first stage. They have introduced dummy variable measuring derivatives usage, which take the value of 1 if a bank uses derivatives, 0 otherwise. If Latin American banks are using derivatives to hedge, a positive relation between *derivatives* usage and the efficiency score of Latin American banks is expected, and if the coefficient for derivatives measure is insignificant, it indicates that derivatives usage does not affect the efficiency of Latin American banks. The second stage regress efficiency within control variables. These variables are represented by the loans portfolio of the bank, which is a proxy for asset diversification, plays an important

role in determining risk and hence, on average banks with small loan portfolios are required to maintain much higher capital levels. Therefore, they expect a positive relation between the size of the loans portfolio and the efficiency of Latin American banks. As control variable a measure of banks equity ratio adequacy is introduced in the model. They argue that lower equity ratio levels imply a higher risk-taking propensity and greater leverage, which could result in greater borrowing costs. Thus, they expected a positive relation between equity ratio and the efficiency of Latin American banks. They add to the model a proxy of the size. They are based in the theory that predicts that large well-diversified banks will be less likely to fail than small banks. Bank size serves as a proxy for a bank's ability to diversify since large banks have better diversified asset portfolios. Finally, they incorporate in the model as control variable the economic freedom index that the Heritage Foundation calculates on a yearly basis. The index represents an average of 10 individual factors that allows one to classify countries as free, mostly free, mostly unfree, or repressed.³ According to this index, Brazil and Mexico are classified as "mostly unfree" while Chile is classified as "mostly free." They suggest that Thus, economic freedom index defined as a dummy variable takes a value of 1 if the country is "mostly unfree" (Brazil and Mexico) or 0 if it is mostly free (Chile).

In his study Said (2011) looks into the effect of the use of derivatives on U.S. banks performance during the sample period from 2002 to 2009. He has employed a two stages OLS regressions approach to determine the effect of the use of derivatives on US bank performance. They measure bank performance by the ratio of return on assets, the ratio of return on equity, the efficiency ratio, cost of funding earning assets, and net interest margin. While the objective of the second stage to examine the sensitivity of performances ratios within these five banks to the use of derivatives. After calculating the performances ratios for these banks the author uses the regression model to measure the sensitivity of the performances ratios to the usage of derivatives between independent.

According to the most previous papers (Rivas et al., 2006; Said, 2011) that have used ordinary least squares (OLS) regressions model with panel estimation techniques, in this study we use also panel regression model to estimate the effect of using derivatives in bank performance. Much details of the methodology adopted in this present study is developed in the next section.

Section II.1.2. Effect of derivative instruments use on stock returns: Empirical analysis

This section analyses empirically the effect of derivative instruments use on financial performance measured by stock returns.

To reach this goal this section is organised as follows. Firstly, both data and sample sets are described as well as the methodology. Secondly, empirical results are analysed. Thirdly summaries and discussions are presented.

II.1.2.1. Data, sample and methodology

II.1.2.1.A. Data

Daily stock prices from DataStream¹¹ were used to determine daily stock returns (Brown and Warner 1984; Buyusalvarci, 2010) on individual bank using the formula as defined in the equation (1) in the first subsection of the first part. Moreover, yearly accounting data drawn from bank websites (see Table 23) are used to determine control variables. All data cover the period 2003-2009.

II.1.2.1.B. Sample

As in the first part motivations for the sample choice are the same.

II.1.2.1.B.a. Sample description

The Table 38 below presents classification of countries used in this study as defined by the latest classification by the United Nations Office (see the second subsection in the first part for more details).

Table 38. Countries classification

Emerging countries	Recently developed countries
Bulgaria, Chile; Croatia; Indonesia; Jordan, Kazakhstan, Kuwait, Malaysia; Mauritius; Oman, Latvia; Lebanon, Lithuania; Pakistan, Philippines; Russia, Saudi Arabia; South Africa; Thailand; Turkey	Bahrain, Czech Republic; Cyprus; Estonia; Hong Kong; Israel; Poland; Qatar, Singapore; Slovakia, Slovenia, South Korea; Taiwan, United Arab of Emirates

¹¹ op. cit. page No. 10

In the next, Table 39 exposes the list of banks and their countries (as well as hyperlinks to bank web sites).

Table 39. Banks and their countries

Countries and bank names	Countries and bank names
Bahrain	Pakistan
1.1 Ahli United Bank B.S.C.	20.1 United Bank Limited
1.2 United Gulf Bank	Philippines
Bulgaria	21.1 Philippine National Bank
2.1 Raiffisen Bank Bulgaria	Poland
Chile	22.1 Bank BPH S.A.
3.1 Banco de Chile	22.2 Bank Pekao S.A.
Croatia	22.3 PKO Bank Polski
4.1 Erste & Steiermärkische Bank D.D	22.4 Bank Zachodni WBK
4.2 Privrednabanka banka Zagreb	22.5 BRE Bank
4.3 Zagrebacka Banka	22.6 Kredyt Bank S.A.
Cyprus	22.7 Nordea Bank Polska S.A.
5.1 Bank of Cyprus	Qatar
5.2 Hellenic Cyprus Bank	23.1 Commercial Bank of Qatar
Czech Republic	23.2 Qatar National Bank
6.1 Komerční banka	Russia
6.2 Raiffensenbank	24.1 Gazprombank
Estonia	24.2 TransCreditBank
7.1 Swedbank	Saudi Arabia
Hong Kong	25.1 Arab National Bank
8.1 Bank of East Asia	25.2 Saudi British Bank
8.2 Chong Hing Bank	Singapore
8.3 DAH SING Bank	26.1 DBS Bank
8.4 Fubon Bank	26.2 United Overseas Bank
8.5 Hang Seng Bank	Slovakia
8.6 Wing Hang Bank	27.1 Dexia banka Slovensko a.s Výročná správa
Indonesia	27.2 Tatra banka
9.1 Bank Danamon	Slovenia
Israel	28.1 Abanka Vipa d.d. Slovenska
10.1 FIBI Bank	South Africa
10.2 Bank Hapoalim	29.1 ABSA Bank
Jordan	29.2 Capitec Bank
11.1 Capital Bank	29.3 FirstRand Ltd.
11.2 Jordan Ahli Bank	29.4 Imperial
11.3 Jordan Kuwait Bank	29.5 Sasfin Bank
Kazakhstan	South Korea
12.1 Halyk Bank	30.1 Industrial Bank of Korea
Kuwait	31.2 Korea Exchange Bank
13.1 Burgan Bank	Taiwan
13.2 Gulf Bank Kuwait	31.1 Hua Nan Commercial Bank
Latvia	31.2 Mega International Commercial Bank
14.1 DNB Nord Banka	31.3 Taiwan Business Bank
Lebanon	Thailand
15.1 BLOM Bank SAL	32.1 Bangkok bank
Lithuania	32.2 Bank of Ayudhya
16.1 SIAULIU BANKAS	32.3 Kasikorn Bank
16.2 Swedbank	32.4 Krung Thai Bank
Malaysia	Turkey
17.1 CIMB Bank	33.1 Akbank
17.2 EON Bank	33.2 Anadolubank Anonim Şirketi
Mauritius	33.3 Garanti Bankasi
18.1 MCB	33.4 Sekerbank
Oman	United Arab Emirates
19.1 Muskat Bank	34.1 National Bank of Abu Dhabi

II.1.2.1.B.b. Sample statistics

In total, the sample analysis is defined by 74 banks, in which 39 banks are from emerging and 35 banks from recently developed countries.

Banks are spread over 34 countries regrouped as emerging and recently developed. There are 20 emerging countries and 14 recently developed countries (see the Table 2 for more details).

Additionally, the sample also includes 10 dealer banks, which represent 13.51% of the total banks¹².

In terms of the research sample, with the exception of Sasfin Bank, each bank made use of forwards. Swaps were the second most used instruments with 68 banks. Moreover, less than three quarter of banks was involved in using options (71.62%), while only 47.30% of banks used futures. In general, the two most commonly used instruments were forwards and swaps, which were utilized simultaneously by 90.54% of all banks, as presented in the Table 40.

Table 40. Number and percentage of banks per derivative instruments used

Instruments	Number of banks	Percentage
FWD+SWP+OPT+FUT	33	44.59%
FWD+SWP+OPT	53	71.62%
FWD+SWP+FUT	34	45.95%
FWD+OPT+FUT	33	44.59%
SWP+OPT+FUT	33	44.59%
FWD+SWP	67	90.54%
FWD+OPT	53	71.62%
FWD+FUT	35	47.30%
SWP+OPT	53	71.62%
SWP+FUT	34	45.95%
OPT+FUT	33	44.59%
FWD	73	98.65%
SWP	68	91.89%
OPT	53	71.62%
FUT	35	47.30%

Details in derivative instruments statistics are presented in the next.

¹² [ABSA Bank](#), [Bank Hapoalim](#); [BRE Bank](#); [EON Bank](#), [FirstRand Ltd](#), [Hang Seng Bank](#), [Hellenic Cyprus Bank](#), [Industrial Bank of Korea](#), [PKO Bank Polski](#); [United Bank Limited](#)

Table 41. Description of derivative notional amounts* per year

Year	FWD	%FWD	SWP	%SWP	OPT	%OPT	FUT	%FUT	FWD+SWP +OPT+FUT	%(FWD+OPT +SWP+FUT)	Total assets
2003	321,596.057	28.01	485,789.696	42.32	150,708.985	13.12	113,856.98	9.91	1,071,951.72	9.33	1,147,832.1
2004	402,721.585	32.24	1,233,533.89	98.75	192,536.499	15.41	107,732.605	8.62	1,936,524.58	155.03	1,249,051.94
2005	424,122.799	29.86	1,663,470.47	117.13	240,992.6	16.96	72,757.4519	5.12	2,401,343.32	169.09	1,420,152.8
2006	522,915.275	31.37	1,677,291.04	100.63	377,267.903	22.63	106,546.665	6.39	2,684,020.88	161.03	1,666,774.67
2007	882,704.028	46.44	2,077,909.24	109.32	401,023.298	21.099	68,734.9652	3.61	3,430,371.53	180.48	1,900,630.75
2008	1,275,447.24	58.12	2,216,431.26	101.00	471,583.742	21.49	70,472.3218	3.21	4,033,934.57	183.83	2,194,374.26
2009	1,196,193.43	52.58	2,005,044.63	88.13	273,497.653	12.02	67,191.7023	2.95	3,541,927.42	155.69	2,274,954.45
Total	5,025,700.42	42.39	11,359,470.2	95.830013	2,107,610.68	17.78	607,292.691	5.12	1,9100,074	161.13	11,853,771

* Amounts are in USD millions.

From Table 41 statistics show that the amount of derivative instruments represents 161.13% of total assets covering the period of the study from 2003 to 2009, and with an average bank size of approximately \$12 billion. During the study period swaps are the most represented instruments with notional amount equals to 11359470.2 millions of USD, with a percentage equals to 95.83% of total assets, followed by forwards with percentage equals to 42.39% of total assets, then options with a percentage equals to 17.78% of total assets, and finally futures represent only 5.12% of total assets. Statistics per year indicates that the highest notional amount of instruments traded is swaps defined by 117.13% of total assets in 2005. In contrast, the lowest percentage is referred to futures in 2009 by 2.95% of total assets.

II.1.2.1.C. Methodology

II.1.2.1.C.a. Variables description

In the next, variables employed in this analysis with their labels, definitions, proxies, expected signs and references are described.

Table 42. Description of variables

Labels	Definition	Proxy for	Expected sign	References
Dependent variable				
SR	Stock returns	Financial performance	+	Brown and Warner (1984); Buyuksalvarci (2010)
Independent variables				
<i>Derivative instruments</i>				
FWD	Notional value of forwards divided by total assets	Forwards	+	Chaudhry et al. (2000)
SWP	Notional value of swaps divided by total assets	Swaps	+	Chaudhry et al. (2000); Reichert and Shyu (2003)
OPT	Notional value of options divided by total assets	Options	+	Chaudhry et al. (2000); Reichert and Shyu (2003)
FUT	Notional value of futures divided by total assets	Futures	+	Chaudhry et al. (2000)
<i>Control variables</i>				
CAP	the ratio of book-value-equity-to-total-assets	Capital	+	Chaudhry et al. (2000); Reichert and Shyu (2003)
LIQ	the ratio of liquid-assets-to-total-assets	Liquidity	+	Chaudhry et al. (2000); Reichert and Shyu (2003)
LOAN	the ratio of gross-loans-to-total-assets	Risky assets	-	Chaudhry et al. (2000)
CR	the ratio of loan-loss-reserves-to-gross-loans	Credit risk	-	Chaudhry et al. (2000); Reichert and Shyu (2003)
NIM	The difference between total interest income and total interest expense expressed, as a percentage of total assets.	Net interest margin	+	Chaudhry et al. (2000); Reichert and Shyu (2003)
NONIM	Non- interest income	on-balance sheet interest rate risk	+	Fraser et al. (2002)
SIZE	Natural log of total assets	Bank size	+	Chaudhry et al. (2000) ; Reichert and Shyu (2003)
<i>Dummies</i>				
DEAL	1 if bank is a member of the International Swaps and Derivative Association (ISDA), 0 otherwise	Dealer	+	Chaudhry et al. (2000);
COUNTRY	Dummy variable equals 1 when bank is issued from, 0 otherwise	Country variable	?	Agusman et al. (2008)

The dependent variable is defined by stock return as measure of financial bank performance.

The independent variables in this study can be divided in three groups. The first group are the four derivative instruments, FWD, SWP, OPT and FUT, which define respectively Forwards, Swaps, Options, and Futures. The second group are control variables, defined by CAP, LIQ, LOAN, CR, NIM, NONIM and SIZE, which define capital, liquidity, gross loan, loan loss reserve, net interest margin, non interest income and bank size, respectively. The last group is defined by dummy variables, expressed by DEAL and COUNTRY, which designate the country variable of each bank. The country dummy variable is introduced in order to identify the specificity of each country. The dichotomous variable (DEAL) takes a value one for dealer banks and zero otherwise. According to Chaudhry et al. (2000) DEAL is introduced in order to differentiate between the risk exposure of dealer banks and non-dealer banks

II.1.2.1.C.b. Testing hypotheses and expected results

Literature results (Rivas et al. 2006; Said, 2011) indicate a positive effect of derivative instruments use on bank performance. Hence, our hypothesis stipulates that the use of derivative instruments affects positively performance measure.

Following the thesis stipulating that possessing considerable liquid assets in portfolios means generally that banks are healthy, so we anticipate a positive association between the variable proxy of liquidity and bank performance.

According to Rivas et al. (2006) the variable LOAN which measures the loans portfolio of the bank plays an important role in determining risk and hence, on average banks with small loan portfolios are required to maintain much higher capital levels than banks with large portfolios, and this reduces the banks' ability to perform efficiently. Thus, we expect a positive relation between the size of the loans portfolio (LOAN) and bank performance.

Since it is considered as the proxy of credit risk (CR), we expect a negative effect of credit risk on bank performance.

Theory states that high levels of equity ratio leads to higher efficiency. Casu and Molineux (2003) argue that lower equity ratio levels imply a higher risk-taking propensity and greater leverage, which could result in greater borrowing costs. Thus, a positive relation between the variable measuring equity ratio (CAP) and bank performance is expected (Rivas et al. (2006)). Theory also predicts that large well-diversified banks will be less likely to fail than small banks (Rivas et al. (2006)). Bank size serves as a proxy for a bank's ability to diversify since large banks have better diversified asset portfolios (Shyu and Reichert, 2002; Mester, 1993). Thus, a positive relation between bank stock return and bank size (SIZE) is expected.

Net interest margin (NIM) is used in the study of Said (2011) as a performance measure, so we forecast a positive correlation between net interest margin and performance.

According to Fraser et al. (2002) the proxy of interest rate risk (NONIM) has a positive effect on bank risk, so we by analogy we presume a negative effect of non-interest income on performance.

Ultimately, the sign of the dummies on bank performance is not expected.

II.1.2.1.C.c. Empirical model

The empirical model is defined by the equation (6) below:

$$\text{Performance measure}_{i,t} = \gamma_0 + \gamma_1 \text{FWD}_{i,t} + \gamma_2 \text{SWP}_{i,t} + \gamma_3 \text{OPT}_{i,t} + \gamma_4 \text{FUT}_{i,t} + \gamma_5 \text{CAP}_{i,t} + \gamma_6 \text{LIQ}_{i,t} + \gamma_7 \text{LOAN}_{i,t} + \gamma_8 \text{CR}_{i,t} + \gamma_9 \text{NIM}_{i,t} + \gamma_{10} \text{NONIM}_{i,t} + \gamma_{11} \text{SIZE}_{i,t} + \gamma_{12} \text{DEAL}_{i,t} + \sum_{k=1}^K \gamma_{13,k} \text{COUNTRY}_{i,t,k} + u_i + e_{i,t}, \quad (6)$$

In which:

Performance measure: is determined by daily stock returns of bank i and which indicates for financial performance

$(u_i + e_{i,t})$: is the composite error term

u_i : is the random error in which heterogeneity is specifically to a cross-sectional unit-in this case, bank.

$e_{i,t}$: is the random error in which heterogeneity is specifically to a particular observation.

The aim is to test empirically the relationship between financial performance and derivative instruments.

Then, panel data methodologies are used to estimate the parameter values. The computer software STATA 10 was used to estimate all regressions.

II.1.2.1.C.d. Specification tests

Firstly, the stationarity of all the variables is checked using the Augmented Dickey Fuller Tests. Trying with four lags, then with trend, and finally without constant. The stationarity is also checked using Unit Root tests- Phillips-Perron test and DF-GLS test. The linearity of the model is tested for with Ramsey-Reset Test. A normal hazard of residuals is finally examined with Jacques-Bera Test. Additionally, correlation matrix and tests for multicollinearity problem are made. Moreover, the Hausman test is applied to examine the absence of correlation between the independent variables and the error terms and to choose between fixed and random effect models. In the end, robustness of the model is checked by a Modified Wald test for groupwise heteroskedasticity for fixed effect model.

II.1.2.2. Empirical results

II.1.2.2.A. Descriptive statistics

Table 43 as follows describes the statistical variables used in the model.

Table 43. Descriptive statistics of variables

Variable	Mean	Std. Dev.	Min	Max
FWD	0.37	0.90	0.00	7.87
SWP	0.57	1.51	0.00	19.05
OPT	0.09	0.25	0.00	1.87
FUT	0.02	0.11	0.00	1.20
SR	0.00	0.00	0.00	0.02
CAP	0.10	0.07	0.00	0.88
LIQ	0.07	0.08	0.00	1.17
LOAN	0.56	0.15	0.00	0.93
CR	0.04	0.09	0.00	1.76
NIM	0.03	0.06	-0.01	0.77
NONIM	0.01	0.02	-0.13	0.20
SIZE	9.27	1.41	4.05	12.13

Descriptive statistics illustrate typical scores of all variables. The mean is between 0.00 and 9.27 and standard deviation has scores from 0.00 to 1.51. In the end, min scores are between 0.00 and 4.05, and max scores are between 0.02 and 19.05.

II.1.2.2.B. Regression analysis

In the following table the parameter estimates from Equation (6) are exposed.

Table 44. Estimated coefficients, years 2003--2009

	Stock returns
Constant	0.008176*** (0.0013631)
FWD	NS
SWP	-0.0001086* (0.0000583)
OPT	NS
FUT	NS
CAP	-0.0083051*** (0.0027816)
LIQ	NS
LOAN	-0.0051295*** (0.0011274)
CR	NS
NIM	0.0054379* (0.0029234)
NONIM	NS
SIZE	-0.0003781*** (0.0000807)
DEAL	NS
Country	See details of the country dummies in Appendix III.
R-squared	0.1205
F statistic	5.57***
Number of obs.	518

*, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.
 The variable that are insignificant were removed and the model was re-estimated to get more precise results. Consequently, no parameter values are provided for these variables.
 () indicates standard deviation of the estimators.
 NS indicate non-significance of coefficient.
 Years 2003-2009.

From the table above, it is found that the use of swaps negatively affects stock returns at a level of significance equals to 10%, while forwards, options and futures have no significant effect on performance. This finding can be interpreted that sample banks composed of banks from both emerging and recently developed countries use badly swaps to hedge their risks. Moreover, insignificance of the effect of the most derivative instruments on bank performance can be explained by the lack of data on stock return which has minimized the sample size. Therefore, not noteworthy results are made.

As regards control variables, at a level of significance equals to 1%, the variable proxies of risky assets (LOAN), capital (CAP), and bank size (SIZE) affect negatively the performance measure. Thus, contrarily to theory stipulating that the size of banks influences positively bank performance, the size of our sample banks decrease bank performance. This finding suggests that smaller banks have better performance than large banks which is relative to our sample banks. Similarly, and in the opposite of expectations, the book equity ratio measured by the percentage of capital on total assets affects negatively performance. This finding means that our sample banks do not use in the better way their capital to enhance their performance. However, and according to expectations the proxy of risky assets influences negatively performance. In fact, higher level of the risky assets ratio means that performance is badly affected.

In contrast, net interest margin has a positive effect on stock return performance at a level of significance equals to 10%.

II.1.2.2.C. Specification tests results

The results of the Augmented Dickey Fuller Test, Phillips-Perron test, and DF-GLS test rejects the null hypothesis of unit root at 1% significance level for all the specifications which corroborates the stationarity of variables.

Due to the large number of observations (around 520), the non-normality of the errors terms should not affect the results. However, the figure 5 as follows schematizes the probability density of residuals.

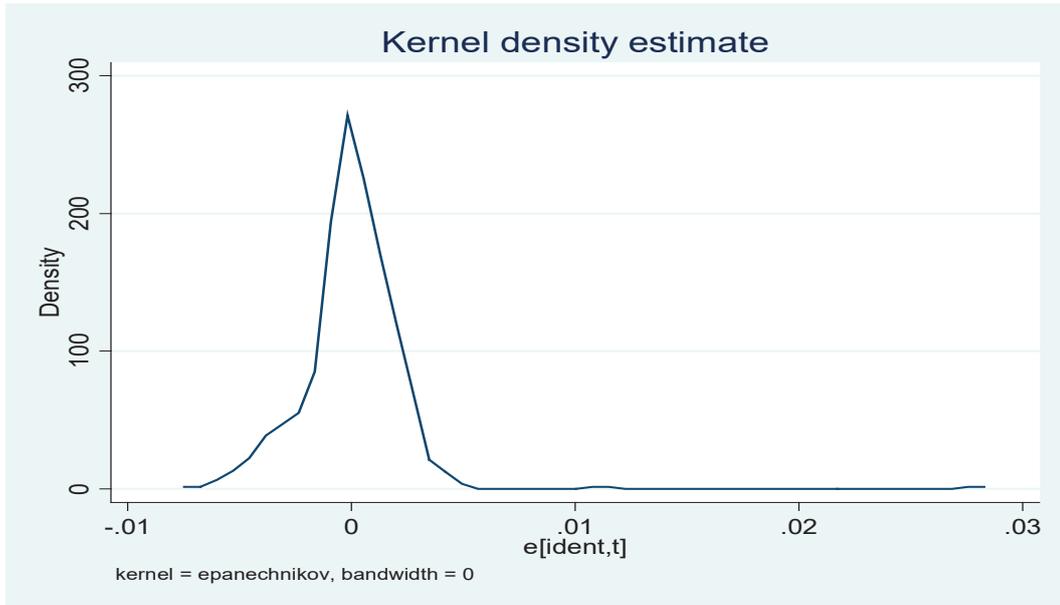


Figure 5. Probability density functions of the residuals

In the next Table 45 verifies the linearity of the model basing on Ramsey-Reset Test (see Appendix V.c. for more details).

Table 45. Ramsey-Reset Test

Dependent variable	chi2(1)	Prob > chi2
Stock returns		
SR	2.28	0.32

In the following table a matrix of correlations between variables is represented:

Table 46. Matrix of correlations

	sr	fwd	swp	opt	fut	loan	cap
sr	1.0000						
fwd	0.0318	1.0000					
	(0.4701)						
swp	-0.0207	0.3812*	1.0000				
	(0.4207)	(0.0000)	(0.0000)				
opt	-0.0355	0.2010*	0.3907*	1.0000			
	(0.4207)	(0.0000)	(0.0000)				
fut	0.0085	0.0213	0.2985*	0.1921*	1.0000		
	(0.8476)	(0.6293)	(0.0000)	(0.0000)			
loan	-0.0710	0.0685 -	0.0604	0.0418 -	0.0317	1.0000	
	(0.1065)	(0.1194)	(0.1697)	(0.3423)	(0.4722)		
cap	0.0480 -	-0.1256*	0.0274 -	0.0853 -	0.0237 -	0.2957*	1.0000
	(0.2756)	(0.0042)	(0.5334)	(0.0525)	(0.5901)	(0.0000)	
liq	-0.0072	-0.0739 -	0.1253* -	0.0487 -	0.0521 -	0.2037*	0.3009*
	(0.8699)	(0.0931)	(0.0043)	(0.2689)	(0.2366)	(0.0000)	(0.0000)
size	-0.1230*	0.0829	0.1632*	0.1637*	0.1469*	0.0823 -	0.4378
	(0.0051)	(0.0592)	(0.0002)	(0.0002)	(0.0008)	(0.0613)	(0.0000)
nonim	0.0286 -	0.0206 -	0.0171 -	0.0428 -	0.0780 -	0.1800*	0.1333*
	(0.5167)	(0.6400)	(0.6972)	(0.3313)	(0.0763)	(0.0000)	(0.0024)
cr	0.0117 -	0.0379 -	0.0336 -	0.0717 -	0.0335 -	0.2261*	0.1951*
	(0.7901)	(0.3891)	(0.4451)	(0.1033)	(0.4461)	(0.0000)	(0.0000)
	liq	size	nonim	cr			
liq	1.0000						
size	-0.2394*	1.0000					
	(0.0000)						
nonim	0.0139 -	0.1601*	1.0000				
	(0.7529)	(0.0003)					
cr	0.0410 -	0.1185*	0.0550	1.0000			
	(0.3519)	(0.0069)	(0.2112)				

The numbers in brackets correspond to the standard error.

In addition, a test for multicollinearity is done. A detection-tolerance or the variance inflation factor (VIF) for multicollinearity can be defined as follows:

$$\text{Tolerance}_j = 1 - R_j^2, \text{ VIF}_j = 1/\text{Tolerance}_j$$

where R_j^2 is the coefficient of determination of a regression of explanatory variable j on all the other explanatory variables. A tolerance of less than 0.20 or 0.10 and/or a VIF of 5 or 10 and above indicates a multicollinearity problem (see O'Brien 2007). The results are summarized in the table below:

Table 47. Multicollinearity test

Variable	VIF	1/VIF
size	15.44	0.064783
loan	13.00	0.076903
cap	3.17	0.315864
liq	1.99	0.502093
swp	1.69	0.590076
nonim	1.45	0.690491
fwd	1.42	0.702949
opt	1.40	0.712053
cr	1.31	0.763757
fut	1.21	0.823285
Mean VIF	4.21	

From these results we can deduce an absence of multicollinearity problem.

Table 48 below summarizes Hausman test results (for more details see Appendix VI.c.)

Table 48. Hausman Test

Dependent variable	chi2(1)	Prob > chi2
Stock returns SR	67.67	0.0000

From the Table 48 results reject the absence of correlation between the independent variables and the error terms. Therefore, fixed effect model is used in this analysis.

Finally, a modified Wald test for groupwise heteroskedasticity in fixed effect regression model is made:

Table 49. Modified Wald test for groupwise heteroskedasticity

Dependent variable	chi2(137) test statistic	P value
Stock returns	5488.09	0.0000 *

The results above corroborate the null hypothesis of the presence of homoskedasticity (or constant variance). Therefore, we add the option 'robust' (in STATA) in the fixed effect model regression in order to control for heteroskedasticity.

II.1.2.3. Summaries and Discussion

This analysis aims to clarify the effect of derivative instruments on stock return performance. To this end, the main question is as followed: “Do banks increase or decrease their stock return performance by using derivatives?” Thus, the major objective of the paper is to determine the impact of derivative instruments usage on performance of banks from both emerging and recently developed countries.

Findings indicate that the use of swaps decreases financial performance in terms of stock returns, while forwards, options and futures have no significant effect on performance.

As concerning control variables, the proxy of capital decreases financial performance since its negative effect on stock return, which rejects our hypothesis.

In addition, the variable used as proxy of risky assets affects negatively performance given that its negative correlation with stock returns, so that our hypothesis is also rejected.

Furthermore, bank size decreases bank performance because of its negative impact on stock return. This result contradicts the theory that bank size augments financial performance. Finally, and accordingly to expectation net interest margin increases financial performance.

For the other control variables, results show that their impact on financial performance is not comprehensible.

In summary, the main results indicate that swaps decrease financial performance, whereas the other instruments have no significant effect on financial performance.

The evidence deduced from these results is that swaps are used for speculation purpose which explains its negative impact on performance. It appears also that in term of stock return the use of derivatives by sample bank is not favourable.

Chapter II.2. Effect of derivative instruments use on accounting performance

In this chapter the impact of derivatives use on accounting performance is investigated.

Or, literature studying the relationship between derivatives and bank performance is already exposed in the first section of the first chapter, for that reason this chapter is focusing on the empirical effect of derivatives use on bank performance. Thus, in the following section empirical analysis is conducted in order to test the association between derivative instruments and accounting performance.

Section II.2.1. Effect of derivative instruments use on accounting performance: Empirical analysis

This section is planned as follows. In the first subsection, data, sample and methodology are illustrated. Empirical results are analysed in the second subsection. Finally, summaries and discussions are exposed in the third subsection.

II.2.1.1. Data, sample and methodology

II.2.1.1.A. Data

As in the second subsection of the first part yearly accounting data are used in this analysis and which were drawn from bank websites (see data used in the second subsection of the first part for more details) covering the period 2003-2010.

II.2.1.1.B. Sample

The sample analysis is composed of 137 banks from both emerging and recently developed countries (for more details see the sample used in the second subsection of the first part).

For motivations to choose sample banks see the first part of the thesis.

II.2.1.1.C. Methodology

II.2.1.1.C.a. Description of variables

Five aspects and seven measures of bank performance are used in this work as follows:

- ✓ Profitability: measured by the return on assets (ROA equals to net income to total assets) ratio and the return on equity (ROE equals to net income to equity) ratio. These two measures are considered in the literature as standards of financial performance measures.
- ✓ Efficiency: defined by the cost to income ratio calculated by costs to operating income (or calculated also by expense income to operating income)

- ✓ Asset quality: defined by either the ratio of impaired loans to gross loans (that is non-performing loans ratio or NPL ratio), and the coverage ratio (that is equal to the ratio of loan loss reserve to non-performing loans). Both of these measures describe operating performance.
- ✓ Capital adequacy: defined by the ratio of risky assets (loans) to equity.
- ✓ Net interest margin: measured by the ratio of net interest income divided by total assets.

In the next, the Table 50 explains the sign of each performance measure in case of increase or decrease. For instance, the ratio of return on assets (ROA) increases performance when it has a positive effect on performance. While a decrease of performance is caused by a positive effect of capital adequacy ratio (CAD) on performance.

Table 50. Performance measures sign

Ratios	Increase of performance	Decrease of performance
ROA	+	-
ROE	+	-
NPL ratio	-	+
Coverage ratio	+	-
Capital adequacy ratio	-	+
Efficiency ratio	+	-
NIM ratio	+	-

As follows Table 51 presents the variables employed in the study along with their labels, definitions, expected signs and their use in previous studies.

Table 51. Variables description

Labels	Definitions	Proxies	References
Dependent variables			
EFF	Cost income defined by total operating expenses divided by total operating incomes	Efficiency	Lin and Zhang (2009)
NPL	Non-performing ratio is defined by non-performing loans divided by gross loan	NPL ratio	Berger et al. (2005); Lin and Zhang (2009)
COV	Coverage ratio is defined by loan loss reserves divided by non-performing loans	Coverage ratio	Liu (2010)
ROA	Return on assets is measured by net income divided by total assets	Profitability	Bonin et al. (2004); Frei et al. (1999); Said (2011)
ROE	Return on equity is measured by net income divided by total equity	Profitability	Bonin et al. (2004); Boubakri et al. (2005); Lin and Zhang (2009); Said (2011)
CAD	The ratio of risky assets (gross loan) divided by total equity	Capital adequacy	Boubakri et al. (2005)
NIM	Net interest income divided by total assets	Net interest margin	Said (2011)
Independent variables: derivative instruments			
FWD	Notional value of forwards divided by total assets	Forwards	Chaudhry et al. (2000)
SWP	Notional value of swaps divided by total assets	Swaps	Chaudhry et al. (2000)
OPT	Notional value of options divided by total assets	Options	Chaudhry et al. (2000); Reichert and Shyu (2003)
FUT	Notional value of futures divided by total assets	Futures	Chaudhry et al. (2000)
Independent variables: control variables			
CAP	book value of equity capital divided by total assets	Leverage	Chaudhry et al. (2000); Rivas et al. (2006) ; Yong et al. (2009)
LIQ	the ratio of liquid-assets-to-total-assets	Liquidity	Chaudhry et al. (2000); Reichert and Shyu (2003); Yong et al. (2009)
LOAN	the ratio of gross-loans-to-total-assets	Risky assets	Chaudhry et al. (2000); Rivas et al. (2006) ; Yong et al. (2009)
CR	the ratio of loan-loss-reserves-to-total loans	Credit risk	Chaudhry et al. (2000); Yong et al. (2009)
SIZE	Natural log of total assets	Bank size	Chaudhry et al. (2000) ; Reichert and Shyu (2003); Rivas et al. (2006); Yong et al. (2009)
DEAL	1 if bank is a member of the International Swaps and Derivative Association (ISDA), 0 otherwise	Dealer	Chaudhry et al. (2000); Yong et al. (2009)
COUNTRY	Dummy variable equals 1 when bank is issued from , 0 otherwise	Country variable	Agusman et al. (2008)

The independent variables in this study can be divided in three groups. The first group are the four derivative instruments, FWD, SWP, OPT and FUT, which define respectively Forwards, Swaps, Options, and Futures. The second group are control variables, defined by CAP, LIQ, LOAN, CR, and SIZE, which define capital, liquidity, gross loan, loan loss reserve, net interest margin, and bank size, respectively. The last group is defined by dummy variables, expressed by DEAL and COUNTRY, which designate respectively dealer bank and the country variable of each bank. The dichotomous variable DEAL takes a value one for dealer banks and zero otherwise. Regarding the heterogeneity of the sample, like in the study by Agusman et al. (2008) country dummy variables are included to control for the differences in the banking structure and regulatory environments, and the different economic and political characteristics that may affect the relation between derivative instruments and accounting measures of performance.

II.2.1.1.C.b. Testing hypotheses and expected results

Hypotheses as well as expected results are the same as exposed in the first subsection of this second part thesis.

II.2.1.1.C.c. Empirical model

Panel regression models were conducted for each performance measure as follows in the equation (7):

$$\text{Performance measure}_{i,t} = \gamma_0 + \gamma_1 \text{FWD}_{i,t} + \gamma_2 \text{SWP}_{i,t} + \gamma_3 \text{OPT}_{i,t} + \gamma_4 \text{FUT}_{i,t} + \gamma_5 \text{CAP}_{i,t} + \gamma_6 \text{LIQ}_{i,t} + \gamma_7 \text{LOAN}_{i,t} + \gamma_8 \text{CR}_{i,t} + \gamma_9 \text{SIZE}_{i,t} + \gamma_{10} \text{DEAL}_{i,t} + \sum_{k=1}^K \gamma_{11,k} \text{COUNTRY}_{i,t,k} + u_i + e_{i,t}, \quad (7)$$

With:

Performance measure: is one of the following seven ratios: ROA, ROE, NPL, coverage, efficiency or net interest margin.

($u_i + e_{i,t}$): is the composite error term. u_i is the random error in which heterogeneity is specifically to a cross-sectional unit-in this case, bank; and $e_{i,t}$ is the random error in which heterogeneity is specifically to a particular observation.

The purpose is to empirically test the relations between accounting performance measures and derivative instruments use.

Therefore, the computer software STATA 10 ® is used to estimate all regressions.

II.2.1.1.C.d. Specification tests

Firstly, the stationarity of all the variables is checked using the Augmented Dickey Fuller Tests with four lags, then with trend, and finally without constant. Then, the stationarity is also checked using Unit Root tests- Phillips-Perron test and DF-GLS test. Moreover, the linearity of the model is tested for with Ramsey-Reset Test. In addition, a normal hazard of residuals is finally examined with Jacques-Bera Test. Correlations between variables and collinearity are checked by correlation matrix and multicollinearity test. The Hausman test is applied to examine the absence of correlation between the independent variables and the error terms which confirms the choice of random effect model. Lastly, robustness of models used is verified by Modified Wald test for groupwise heteroskedasticity test and Breusch and Pagan Lagrangian multiplier test.

II.2.1.2. Empirical results

II.2.1.2.A. Descriptive statistics

As following statistics of variables used in the model covering the overall sample and the two subsamples are presented.

Table 52. Descriptive statistics of variables

Overall sample					
Variable	Obs	Mean	Std. Dev.	Min	Max
FWD	1096	0.24	0.74	0.00	11.44
SWP	1096	0.44	1.14	0.00	19.05
OPT	1096	0.11	0.50	0.00	11.66
FUT	1096	0.09	0.89	0.00	16.55
CAP	1096	0.10	0.06	0.00	0.88
LOAN	1096	0.55	0.16	0.00	1.31
CR	1096	0.01	0.01	0.00	0.29
LIQ	1096	0.07	0.07	0.00	1.17
SIZE	1096	9.11	1.60	3.70	12.95
NIM	1096	0.03	0.04	-0.02	0.77
ROA	1096	0.01	0.01	-0.20	0.12
ROE	1096	0.12	0.21	-4.39	0.59
EFF	1096	-0.64	0.43	-5.77	0.76
CAD	1096	6.83	4.48	0.00	90.77
NPL	544	0.04	0.05	0.00	0.47
COV	544	3.20	46.60	0.01	8.84
Banks from emerging countries					
Variable	Obs	Mean	Std. Dev.	Min	Max
FWD	592	0.24	0.83	0.00	11.44
SWP	592	0.34	1.23	0.00	19.05
OPT	592	0.13	0.66	0.00	11.66
FUT	592	0.16	1.21	0.00	16.55
CAP	592	0.10	0.06	0.00	0.88
LOAN	592	0.54	0.17	0.09	0.97
CR	592	0.02	0.02	0.00	0.29
LIQ	592	0.09	0.08	0.00	1.17
SIZE	592	8.63	1.72	3.70	12.95
NIM	592	0.03	0.05	0.00	0.77
ROA	592	-0.66	0.47	-5.77	0.76
ROE	592	6.24	4.70	0.29	90.77
EFF	592	0.01	0.01	-0.20	0.11
CAD	592	0.13	0.24	-4.39	0.59
NPL	320	0.04	0.05	0.00	0.47
COV	320	4.75	60.75	0.07	8.84
Banks from recently developed countries					
Variable	Obs	Mean	Std. Dev.	Min	Max
FWD	504	0.25	0.61	0.00	6.00
SWP	504	0.55	1.01	0.00	7.84
OPT	504	0.10	0.19	0.00	1.63
FUT	504	0.01	0.08	0.00	1.20
CAP	504	0.09	0.05	0.01	0.57
LOAN	504	0.56	0.15	0.00	1.31
CR	504	0.01	0.01	0.00	0.11
LIQ	504	0.05	0.06	0.00	0.32
SIZE	504	9.68	1.22	5.66	12.34
NIM	504	0.02	0.00	-0.02	0.04
ROA	504	-0.62	0.37	-2.59	-0.11
ROE	504	7.51	4.10	0.00	30.94
EFF	504	0.01	0.01	-0.06	0.12
CAD	504	0.10	0.16	-2.45	0.58
NPL	224	0.03	0.05	0.00	0.35
COV	224	0.98	0.65	0.01	4.20

According to Table 52, except to standard deviation scores of COV variable, the rest variables present common scores. For overall sample, the mean is between 0.00 and 9.11 and standard deviation has scores from 0.01 to 46.60. Finally, min scores are between 0.00 and 5.77, and max scores are between 0.12 and 90.77.

For banks from emerging countries the mean is going from 0.01 to 60.75, the standard deviation is between 0.01 and 60.75, the min is about 0.00 and 5.77, and lastly the max is between 0.11 and 90.77.

For banks from recently developed countries, the mean is between 0.01 and 9.68, the standard deviation is between 0.00 and 4.10, the min is between 0.00 and 5.66 and finally the max is comprised between 0.04 and 30.94.

II.2.1.2.B. Regression analysis

In the next the parameter estimates from Equation (7) for each of the seven performance measures are described.

**Table 53. Estimated coefficients
Panel A. For overall sample**

	ROA	ROE	NPL	COV	CAD	EFF	NIM
Constant	0.0239441*** (0.006869)	0.3384135*** (0.037664)	0.1478271*** (0.0221495)	-1.236312*** (0.3056128)	4.887781*** (0.612808)	-1.396711*** (0.1211655)	0.0221248** (0.0107537)
FWD	NS	NS	0.005422*** (0.0018923)	-0.06015*** (0.0196646)	NS	NS	-0.0023985** (0.0009445)
SWP	-0.0010978*** (0.0003804)	NS	NS	NS	-0.0935899** (0.0377147)	-0.0174882** (0.0080742)	NS
OPT	NS	NS	-0.0308568*** (0.0080656)	NS	0.2078843* (0.1148521)	-0.040842*** (0.0116662)	-0.0077251* (0.002213)
FUT	NS	0.0039426* (0.0020723)	0.0049674*** (0.001543)	NS	NS	-0.0116284** (0.0047429)	NS
LOAN	-0.0238018*** (0.0047775)	-0.2423614*** (0.0618885)	-0.1164429*** (0.0194442)	1.413221*** (0.3935775)	11.09925*** (0.5828956)	NS	NS
CAP	0.0663521*** (0.0167742)	NS	NS	NS	-26.1029*** (4.715415)	0.5288779*** (0.127852)	0.4611862*** (0.113214)
LIQ	NS	NS	NS	2.622662*** (0.5736468)	-1.420615* (0.8379971)	NS	0.0904254* (0.0478331)
CR	NS	-7.166067*** (2.155045)	0.1526804* (0.0867876)	0.9124639* (0.5521748)	NS	NS	NS
SIZE	0.0011807** (0.0004752)	NS	-0.0055521*** (0.0013957)	0.0745078*** (0.0216683)	-0.250245*** (0.0512917)	0.0907728*** (0.0128243)	NS
DEAL	0.0057435*** (0.0015323)	NS	NS	0.2728882** (0.12157)	0.8979158*** (0.2738022)	NS	NS
COUNTRIES	See details of the country dummies in Appendix IV.a.						
R-squared	0.3110	0.1042	0.5534	0.4880	0.5151	0.3197	0.5703
F statistic	20.65***	15.29***	20.33***	17.37***	195.36***	66.61***	17.69***
Number of obs	1096	1096	544	544	1096	1096	1096

*, ** and *** respectively indicate statistical significance at the 10%, 5% and 1% levels.
The variable that are insignificant were removed and the model was re-estimated to get more precise results. Consequently, no parameter values are provided for these variables.
() indicate standard deviation of the estimators.
NS indicate non-significance of coefficient.
Years 2003—2010.

Panel B. Banks from emerging countries

	ROA	ROE	NPL	COV	CAD	EFF	NIM
Constant	0.0455808*** (0.0080397)	0.8180483*** (0.2242174)	0.0453067*** (0.0103936)	-1.815743*** (0.4464146)	2.720284*** (0.563137)	-1.305507*** (0.1411252)	0.0005738 (0.0089311)
FWD	NS	NS	NS	-0.0525389** (0.0230134)	-0.2454025** (0.1220808)	NS	NS
SWP	NS	NS	NS	NS	NS	NS	NS
OPT	-0.005198** (0.002245)	-0.0348878** (0.0167404)	0.0111851*** (0.0033979°)	-0.2717482** (0.1261782)	NS	-0.0407658*** (0.0110888)	-0.0098848*** (0.002789)
FUT	0.0010888** (0.0004662)	0.0107944*** (0.0037232)	NS	NS	NS	-0.0120581** (0.0048409)	NS
LOAN	-0.0343422*** (0.0085456)	-0.4548128*** (0.1545257)	-0.0732215*** (0.01598)	2.719787*** (0.4351267)	10.88888*** (1.015472)	-0.2648994*** (0.1003312)	-0.0193861** (0.0081639)
CAP	0.0742559*** (0.0164526)	NS	-0.0921569*** (0.0352639)	NS	-27.01694*** (5.929274)	0.5539762*** (0.1757254)	0.6341485*** (0.0901414)
LIQ	0.0362774** (0.0148672)	NS	NS	2.463702*** (0.6654761)	NS	NS	NS
CR	-0.2057944*** (0.0570443)	-2.962325** (1.235229)	0.9354284*** (0.1242061)	5.273531*** (1.444563)	14.74724* (7.899821)	-1.592629*** (0.4169518)	0.2029316*** (0.0563234)
SIZE	NS	-0.0230308** (0.0097726)	NS	0.0985315*** (0.0331751)	NS	0.1003811*** (0.0190555)	NS
DEAL	0.0089665*** (0.0032131)	0.0549488*** (0.0193464)	-0.0169819** (0.0069481)	0.3094281* (0.1826698)	NS	-0.1317581** (0.0533084)	NS
COUNTRIES	See details of the country dummies in Appendix IV.b.						
R-squared	0.3625	0.3542	0.7241	0.5202	0.4019	0.2265	0.7042
F statistic	10.60***	5.64***	27.52***	18.34***	147.45***	25.37***	8.27***
Number of obs	592	592	320	320	592	592	592

*, ** and *** respectively indicate statistical significance at the 10%, 5% and 1% levels.
 The variable that are insignificant were removed and the model was re-estimated to get more precise results. Consequently, no parameter values are provided for these variables.
 () indicate standard deviation of the estimators.
 NS indicate non-significance of coefficient.
 Years 2003—2010.

Panel C. Banks from recently developed countries

	ROA	ROE	NPL	COV	CAD	EFF	NIM
Constant	-0.0089187 (0.007684)	-0.1438615 (0.1251733)	0.2071597*** (0.0447899)	0.6833823* (0.3979716)	11.5962*** (1.636877)	-1.241727*** (0.1177772)	-0.0067288 (0.0059007)
FWD	NS	NS	-0.0533742*** (0.0106365)	-0.2411522* (0.1228402)	NS	NS	-0.0030191*** (0.0007099)
SWP	-0.0013938*** (0.0005162)	NS	0.0085061** (0.0038995)	0.5949596** (0.2890652)	-0.2059243** (0.085488)	-0.0326795*** (0.0123409)	0.0011988*** (0.0004613)
OPT	NS	NS	-0.1078375*** (0.0182856)	NS	1.657928** (0.6717204)	-0.1214119* (0.068207)	NS
FUT	NS	-0.0583062* (0.0320081)	NS	NS	NS	NS	0.0061448** (0.0030663)
LOAN	-0.019657*** (0.0058347)	-0.0962838*** (0.0345324)	-0.1100073*** (0.0296971)	NS	10.589*** (0.8073303)	NS	0.0070513* (0.0036025)
CAP	0.077812*** (0.027972)	0.5353444** (0.2310616)	0.2776484*** (0.0604546)	NS	-29.86048*** (5.055394)	0.7894079*** (0.2432088)	NS
LIQ	-0.0240487** (0.0120792)	-0.1282693* (0.0734554)	-0.1159391* (0.0670562)	NS	-5.801947*** (1.238622)	NS	0.0156799** (0.0078146)
CR	NS	NS	0.063321*** (0.0151727)	NS	NS	NS	NS
SIZE	NS	0.0231638*** (0.0087367)	-0.014387*** (0.0033371)	0.0878849** (0.0368598)	-0.7837781*** (0.1373093)	0.0704283*** (0.0115747)	0.0011503*** (0.0003895)
DEAL	0.0053448*** (0.0014623)	0.0623168*** (0.0170018)	-0.0138528* (0.007224)	NS	1.032327*** (0.2422659)	0.0857243** (0.0341649)	NS
COUNTRIES	See details of the country dummies in Appendix IV.c.						
R-squared	0.4920	0.1229	0.7534	0.3845	0.7228	0.5477	0.4207
F statistic	30.28***	8.51***	24.66***	30.75***	102.30***	83.46***	20.13***
Number of obs	504	504	224	224	504	504	504

*, ** and *** respectively indicate statistical significance at the 10%, 5% and 1% levels. The variable that are insignificant were removed and the model was re-estimated to get more precise results. Consequently, no parameter values are provided for these variables.

() indicate standard deviation of the estimators. NS indicate non-significance of coefficient. Years 2003—2010.

From Panel A, it is found that the use of forwards positively affects NPL ratio at a level of significance equals to 1% and it affects negatively coverage ratio and net interest margin at levels of significance respectively equal to 1% and 5%.

The use of swaps has negative effect on return on assets ratio and efficiency measure respectively at level of significance equal to 1% and 5% but it affects negatively also capital adequacy measure at 5% level of significance.

Options affect negatively NPL ratio at 1% level of significance but has a positive impact on capital adequacy ratio at 10% level of significance, and it has a negative effect on efficiency measure and net interest margin respectively at level of significance equal to 1 % and 10%.

Finally, the use of futures has positive impact on return on equity ratio at a level of significance equals to 10% but it affects NPL ratio positively and efficiency measure negatively respectively at level of significance equal to 1% and 5%.

Regarding control variables, the variable proxy of risky assets (LOAN) affects negatively the two financial performance measures at 1% level of significance, and has a positive effect on capital adequacy ratio at the same level of significance, while it affects negatively NPL ratio and positively coverage ratio always in the same level of significance.

Capital affects positively return on assets ratio, efficiency measure and net interest margin and has a negative effect on capital adequacy at level of significance equals to 1%.

Liquidity has positive impact on coverage ratio and net interest margin respectively at level of significance equal to 1% and 10%, and it affect negatively capital adequacy ratio at 10% level of significance.

At a level of significance equals to 1%, le variable proxy of credit risk (CR) has a negative effect on return on equity ratio but it affects positively NPL ratio and coverage ratio.

Size has a positive impact on return on assets ratio at level of significance equals to 5%, and affects positively coverage ratio and efficiency measure at 1% level of

significance, and finally it has a negative correlation with NPL ratio and capital adequacy measure at a level of significance equals to 1%.

Ultimately, the dummy variable defining dealer bank (DEAL) affects positively return on assets ratio and coverage ratio respectively at level of significance equal to 1% and 5% but it has a positive impact on capital adequacy measure at a level of significance equals to 1%.

From Panel B, results focused on emerging countries expose that the use of forwards negatively affects coverage ratio at level of significance equals to 5% but has also a negative effect on capital adequacy at the same level of significance.

The use of swaps has no significant impact on the seven performance measures.

Options affect negatively return on assets and return on equity ratios at a level of significance equals to 5%, also it has a negative impact on efficiency and net interest margin at 1% level of significance, and has a positive impact on NPL ratio and a negative impact on coverage ratio respectively at level of significance equal to 1% and 5%.

Finally, the use of futures has positive effect on return on equity and return on assets ratios respectively at levels of significance equal to 1% and 5% but it affects negatively efficiency measure at 5% level of significance.

Regarding control variables, at a level of significance equals to 1% the variable proxy of risky assets affects negatively the two financial performance measures, efficiency and net interest margin, and it has a positive impact on capital adequacy, however it affects positively coverage ratio and negatively NPL ratio.

At 1% level of significance, capital has a positive effect on ROA, efficiency and net interest margin, and also affects negatively NPL ratio and capital adequacy measure.

Liquidity affect positively coverage ratio and return on assets ratio at 1% and 5% levels of significance.

The variable proxy of credit risk is correlated negatively with return on assets and return on equity ratios at 1% and 5% levels of significance, and affects negatively efficiency measure at 1% level of significance, additionally it affects positively NPL

and capital adequacy ratios at 1% and 10% levels of significance respectively, whereas it has a positive effect on coverage ratio and net interest margin at a level of significance equals to 1%.

Size has a positive effect on efficiency and coverage ratio at 1% level of significance, while it affects negatively return on equity ratio at 5% level of significance.

Finally, the association between DEAL and the two financial performance ratios is positive at a level of significance equals to 1%, and DEAL affects positively coverage ratio and negatively NPL ratio respectively at 5% and 10% levels of significance, whereas DEAL affect negatively efficiency measure at a level of significance equals to 5%.

From Panel C, results limited to recently developed countries show that the use of forwards negatively affects net interest margin and coverage ratio at level of significance equal to 1% and 10% respectively, however the correlation between forwards and NPL ratio is negative also at level of significance equals to 1%.

The use of swaps has negative effect on efficiency and return on assets ratio at a level of significance equals to 1%, and it has positive impact on NPL ratio at 5% level of significance, while the use of swaps affects positively net interest margin and coverage ratio respectively at level of significance equal to 1% and 5% and finally it affects negatively capital adequacy at a level of significance equals to 5%.

Options affect negatively NPL ratio at a level of significance equals to 1%, but it has a positive effect on capital adequacy at 5% level of significance, and additionally it has a negative correlation with efficiency at a level of significance equals to 10%.

Finally, the use of futures has negative effect on ROE at level of significance equals to 10% while it affects positively net interest margin at a level of significance equals to 5%.

Regarding control variables, the association between the variable proxy of risky assets and the two profitability measures is negative at a level of significance equals to 1%, furthermore LOAN affects positively capital adequacy at a level of significance equals to 1%, whereas it has a positive effect on net interest margin at a level of

significance equals to 10% and finally it has a negative effect on NPL ratio at 1% level of significance.

Capital has positive effect on return on assets ratio and return on equity ratio respectively at level of significance equal to 1% and 5%, in addition it affects positively efficiency and negatively capital adequacy at a level of significance equals to 1%, however it has a positive effect on NPL ratio at a level of significance equals to 1%.

Liquidity affect negatively return on assets ratio and return on equity ratio at level of significance equal to 5% and 10% respectively, but it affects positively net interest margin at a level of significance equals to 5% and it affects negatively capital adequacy and NPL ratio respectively at level of significance equal to 1% and 10%

The correlation between the proxy of credit risk and NPL ratio is significantly positive at a level of significance equals to 1%.

Size affects positively return on equity, efficiency and net interest margin at a level of significance equals to 1%, also it has positive effect on coverage ratio positively at a level of significance equals to 5%, and finally it affects negatively NPL ratio and capital adequacy at a level of significance equals to 1%.

Finally, DEAL affects positively the two financial performance measures and efficiency respectively at level of significance equal to 1% and 5%, additionally it affects negatively NPL ratio at a level of significance equals to 10% but it has a positive effect on capital adequacy at a level of significance equals to 1%.

II.2.1.2.C. Specification tests results

The P values of the Augmented Dickey Fuller Tests for all the specifications are closed to 0. We have similar results for the Phillips-Perron test. The DF-GLS test rejects the null hypothesis of unit root at 1% significance level for all the specifications. (The results are available under request to the corresponding author). Stationarity of variables is then detected in all the cases.

The major results of the Ramsey-Reset Test (Appendix V.d. exposes more details) are presented in the Table 54 as follows.

Table 54. Ramsey-Reset Test

Dependent variable	chi2(3)	Prob > chi2
Efficiency ratio EFF	21.27	0.0001
Non-performing loan ratio NPL	279.15	0.0000
Coverage ratio COV	12.18	0.0068
Return on assets ratio ROA	211.24	0.0001
Return on equity ratio ROE	370.39	0.0001
Capital adequacy ratio CAD	380.26	0.0001
Net interest margin ratio NIM	812.52	0.0001

For the seven performance measure the Ramsey-Reset test rejects the null hypothesis of linearity. In this case, there is problem of linearity that we have to check more.

In the next, log regressions are used in order to improve linearity. The results of Ramsey-Reset test are summarized in the following table.

Table 55. Ramsey-Reset Test of Log regressions

Dependent variable	chi2(3)	Prob > chi2
Efficiency EFF	21.27	0.0383
Non-performing loan NPL	12.59	0.0056
Coverage ratio COV	21.09	0.0001
Return on assets ROA	211.24	0.0000
Return on equity ROE	370.39	0.1878
Capital adequacy CAD	380.26	0.8507
Net interest margin NIM	812.52	0.0010

According to the table above of log regressions we deduce that linearity of the most regressions is enhanced. In fact, for efficiency, return on equity and capital adequacy the Ramsey-Reset test show linearity of regressions. However, for non performing loan ratio, coverage ratio, return on assets and net interest margin ratio the Ramsey-Reset test rejects the null hypothesis of linearity despite the use of log regressions. For this reason, the relation between these dependent variables and its predicted values are checked in the Figure 6 as follows.

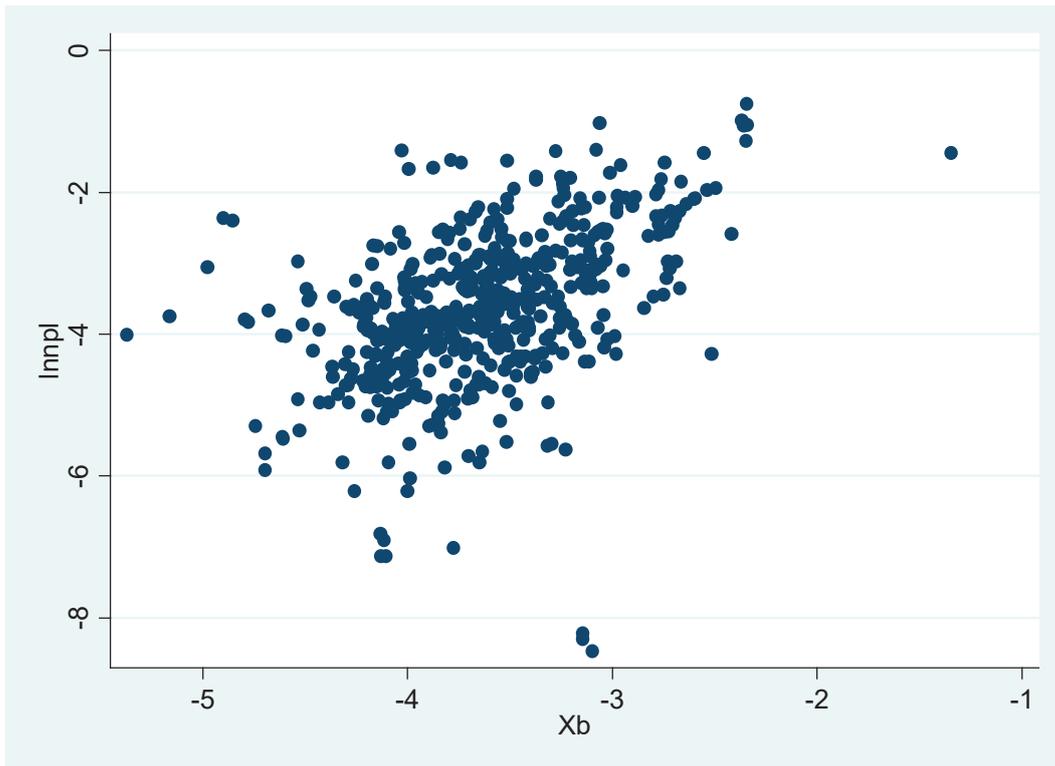


Figure 6.1. Log NPL function of its predicted variable

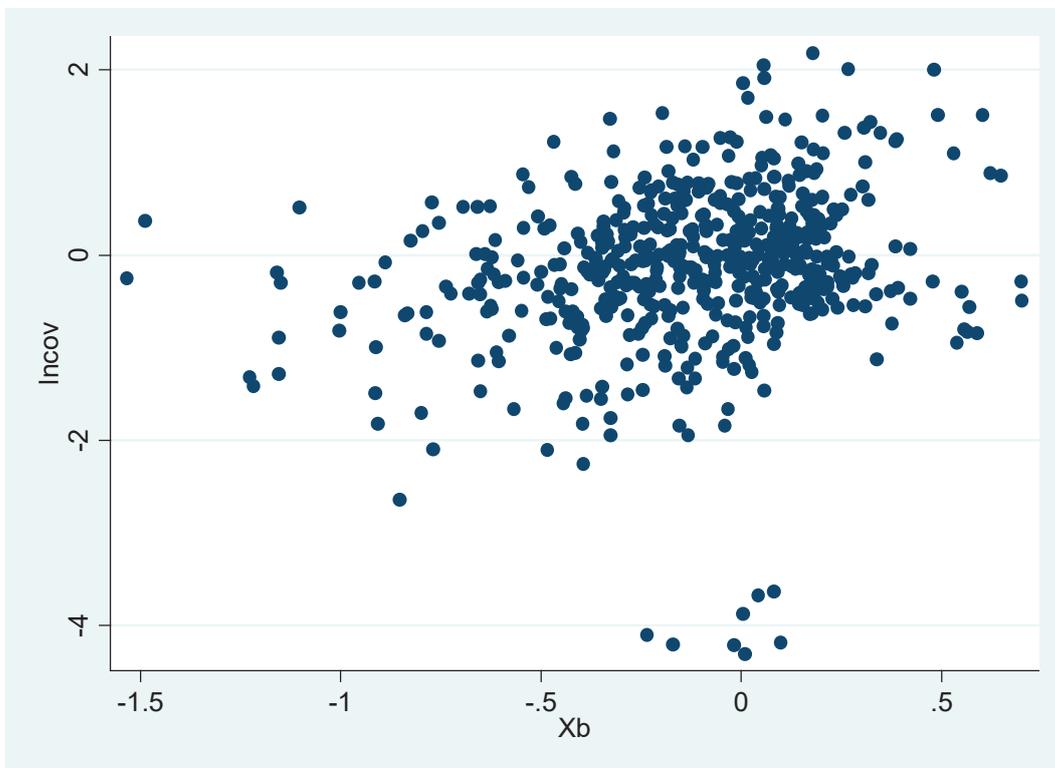


Figure 6.2. Log COV function of its predicted variable

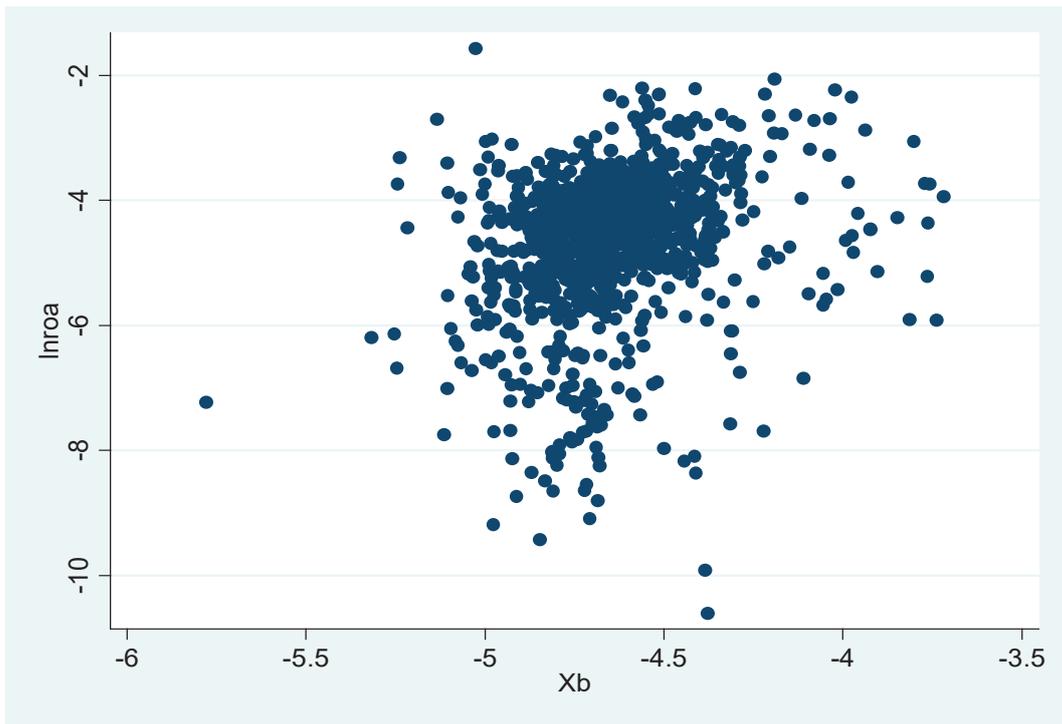


Figure 6.3. Log ROA function of its predicted variable

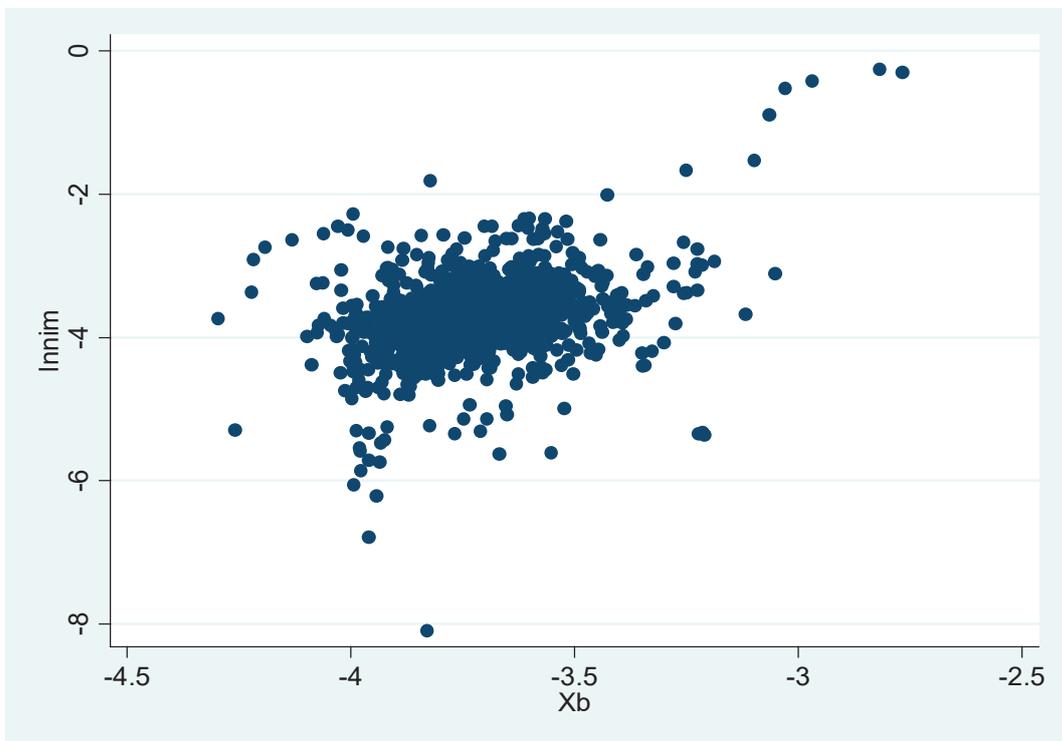


Figure 6.4. Log NIM function of its predicted variable

Figure 6. Performance measures in Log against their predicted variables

From Figure 6, we can see that there is weak nonlinear relation between the independent variables and the dependent variable for the first four pictures. There is weakness of linearity when dependent variables are measured by logarithm of non-performing loan ration (Lnloan), logarithm of coverage ratio (Lncov), logarithm of return on assets (Lnroa) and logarithm of net interest margin (Lnnim). Indeed, in the whole we can say that linearity of the model is verified.

Furthermore, matrices are presented in the next to show correlations between variables:

Table 56. Matrix of correlations (NPL ratio is the dependent variable)

	npl	fwd	swp	opt	fut	loan	cap
npl	1.0000						
fwd	-0.0192	1.0000					
	(0.6554)						
swp	-0.0945*	0.2545*	1.0000				
	(0.0276)	(0.0000)					
opt	-0.0993*	0.2795*	0.3732*	1.0000			
	(0.0205)	(0.0000)	(0.0000)				
fut	-0.0399	0.0090	0.0129	0.6962*	1.0000		
	(0.3534)	(0.8334)	(0.7634)	(0.0000)			
loan	-0.1966*	0.2265*	-0.0316	0.0108	-0.0307	1.0000	
	(0.0000)	(0.0000)	(0.4624)	(0.8015)	(0.4750)		
cap	0.1537*	-0.0678	0.0880*	-0.0045	-0.0322	-0.2079*	1.0000
	(0.0003)	(0.1142)	(0.0403)	(0.9174)	(0.4537)	(0.0000)	
liq	0.0731 -	0.0654	-0.1102*	0.0049	0.0720	-0.2523*	0.1658*
	(0.0883)	(0.1279)	(0.0101)	(0.9094)	(0.0932)	(0.0000)	(0.0001)
size	-0.2153*	0.0663	0.1409*	0.1984*	0.0841*	0.1148*	-0.3125*
	(0.0000)	(0.1224)	(0.0010)	(0.0000)	(0.0499)	(0.0074)	(0.0000)
cr	0.4346* -	0.0285	-0.0284	-0.0562	-0.0366	-0.2624*	0.0806
	(0.0000)	(0.5077)	(0.5079)	(0.1906)	(0.3948)	(0.0000)	(0.0605)
	liq	size	cr				
liq	1.0000						
size	-0.1969*	1.0000					
	(0.0000)						
cr	0.0190	-0.0871*	1.0000				
	(0.6580)	(0.0423)					

The numbers in brackets correspond to the standard error.

Table 57. Matrix of correlations (Coverage ratio is the dependent variable)

	cov	fwd	swp	opt	fut	loan	cap
Cov	1.0000						
Fwd	-0.0490	1.0000					
	0.2536						
swp	0.1469*	0.2545*	1.0000				
	0.0006	0.0000					
opt	-0.0272	0.2795*	0.3732*	1.0000			
	0.5260	0.0000	0.0000				
fut	-0.0660	0.0090	0.0129	0.6962*	1.0000		
	0.1240	0.8334	0.7634	0.0000			
loan	-0.1452*	0.2265*	-0.0316	0.0108	-0.0307	1.0000	
	0.0007	0.0000	0.4624	0.8015	0.4750		
Cap	0.0677	-0.0678	0.0880*	-0.0045	-0.0322	-0.2079*	1.0000
	0.1147	0.1142	0.0403	0.9174	0.4537	0.0000	
Liq	0.2379*	0.0654	-0.1102*	0.0049	0.0720	-0.2523*	0.1658*
	0.0000	0.1279	0.0101	0.9094	0.0932	0.0000	0.0001
Size	0.0371	0.0663	0.1409*	0.1984*	0.0841*	0.1148*	-0.3125*
	0.3874	0.1224	0.0010	0.0000	0.0499	0.0074	0.0000
Cr	0.0600	0.0285	-0.0284	-0.0562	-0.0366	-0.2624*	0.0806
	0.1623	0.5077	0.5079	0.1906	0.3948	0.0000	0.0605
	liq	size	cr				
liq							
Size	-0.1969*	1.0000					
	0.0000						
Cr	0.0190	-0.0871*	1.0000				
	0.6580	0.0423					

The numbers in brackets correspond to the standard error.

Table 58. Matrix of correlations (capital adequacy ratio is the dependent variable)

	cad	fwd	swp	opt	fut	loan	cap
cad	1.0000						
fwd	0.0828*	1.0000					
	(0.0061)						
swp	-0.0427	0.3875*	1.0000				
	(0.1573)	(0.0000)					
opt	-0.0321	0.1065*	0.1563*	1.0000			
	(0.2881)	(0.0004)	(0.0000)				
fut	-0.0165	0.0003	0.0182	0.3891*	1.0000		
	(0.5842)	(0.9921)	(0.5469)	(0.0000)			
loan	0.5486*	0.0820*	-0.0137	-0.0335	-0.0310	1.0000	
	(0.0000)	(0.0066)	(0.6495)	(0.2684)	(0.3055)		
cap	-0.4784*	-0.0795*	-0.0046	0.0806*	0.0024	-0.2249*	1.0000
	(0.0000)	(0.0084)	(0.8781)	(0.0076)	(0.9377)	(0.0000)	
liq	-0.2151*	-0.0543	-0.1226*	-0.0228	0.0371	-0.1985*	0.2328*
	(0.0000)	(0.0725)	(0.0000)	(0.4517)	(0.2193)	(0.0000)	(0.0000)
size	0.1715*	0.1056*	0.1520*	0.0872*	0.0758*	0.1167*	-0.3224*
	(0.0000)	(0.0005)	(0.0000)	(0.0039)	(0.0120)	(0.0001)	(0.0000)
cr	-0.1106*	-0.0256	-0.0226	-0.0278	-0.0279	-0.1693*	0.1658*
	(0.0002)	(0.3964)	(0.4550)	(0.3575)	(0.3557)	(0.0000)	(0.0000)
	liq	size	cr				
liq							
size	-0.1743*	1.0000					
	(0.0000)						
cr	0.0290	-0.0870*	1.0000				
	(0.3383)	(0.0040)					

The numbers in brackets correspond to the standard error.

Table 59. Matrix of correlations (ROA is the dependent variable)

	roa	fwd	swp	opt	fut	loan	cap
roa	1.0000						
fwd	-0.0412	1.0000					
	(0.1727)						
swp	-0.0048	0.3875*	1.0000				
	(0.8743)	(0.0000)					
opt	-0.0227	0.1065*	0.1563*	1.0000			
	(0.4521)	(0.0004)	(0.0000)				
fut	-0.0032	0.0003	0.0182	0.3891*	1.0000		
	(0.9154)	(0.9921)	(0.5469)	(0.0000)			
loan	-0.1964*	0.0820*	-0.0137	-0.0335	-0.0310	1.0000	
	(0.0000)	(0.0066)	(0.6495)	(0.2684)	(0.3055)		
cap	0.3042*	-0.0795*	-0.0046	0.0806*	0.0024	-0.2249*	1.0000
	(0.0000)	(0.0084)	(0.8781)	(0.0076)	(0.9377)	(0.0000)	
liq	0.1342*	-0.0543	-0.1226*	-0.0228	0.0371	-0.1985*	0.2328*
	(0.0000)	(0.0725)	(0.0000)	(0.4517)	(0.2193)	(0.0000)	(0.0000)
size	0.0374	0.1056*	0.1520*	0.0872*	0.0758*	0.1167*	-0.3224*
	(0.2166)	(0.0005)	(0.0000)	(0.0039)	(0.0120)	(0.0001)	(0.0000)
cr	-0.0760*	-0.0256	-0.0226	-0.0278	-0.0279	-0.1693*	0.1658*
	(0.0118)	(0.3964)	(0.4550)	(0.3575)	(0.3557)	(0.0000)	(0.0000)
	liq	size	cr				
liq							
size	-0.1743*	1.0000					
	(0.0000)						
cr	0.0290	-0.0870*	1.0000				
	(0.3383)	(0.0040)					

The numbers in brackets correspond to the standard error.

Table 60. Matrix of correlations (ROE is the dependent variable)

	roe	fwd	swp	opt	fut	loan	cap
roe	1.0000						
fwd	0.0353	1.0000					
	(0.2431)						
swp	0.0150	0.3875*	1.0000				
	(0.6203)	(0.0000)					
opt	-0.0072	0.1065*	0.1563*	1.0000			
	(0.8107)	(0.0004)	(0.0000)				
fut	0.0223	0.0003	0.0182	0.3891*	1.0000		
	(0.4612)	(0.9921)	(0.5469)	(0.0000)			
loan	-0.1252*	0.0820*	-0.0137	-0.0335	-0.0310	1.0000	
	(0.0000)	(0.0066)	(0.6495)	(0.2684)	(0.3055)		
cap	0.0723*	-0.0795*	-0.0046	0.0806*	0.0024	-0.2249*	1.0000
	(0.0167)	(0.0084)	(0.8781)	(0.0076)	(0.9377)	(0.0000)	
liq	0.0461	-0.0543	-0.1226*	-0.0228	0.0371	-0.1985*	0.2328*
	(0.1275)	(0.0725)	(0.0000)	(0.4517)	(0.2193)	(0.0000)	(0.0000)
size	0.0646*	0.1056*	0.1520*	0.0872*	0.0758*	0.1167*	-0.3224*
	(0.0325)	(0.0005)	(0.0000)	(0.0039)	(0.0120)	(0.0001)	(0.0000)
cr	-0.1975*	-0.0256	-0.0226	-0.0278	-0.0279	-0.1693*	0.1658*
	(0.0000)	(0.3964)	(0.4550)	(0.3575)	(0.3557)	(0.0000)	(0.0000)
	liq	size	cr				
liq							
size	-0.1743*	1.0000					
	(0.0000)						
cr	0.0290	-0.0870*	1.0000				
	(0.3383)	(0.0040)					

The numbers in brackets correspond to the standard error.

Table 61. Matrix of correlations (NIM is the dependent variable)

	Nim	fwd	swp	opt	fut	loan	cap
nim	1.0000						
fwd	-0.0219	1.0000					
	(0.4684)						
swp	0.0304	0.3875*	1.0000				
	(0.3152)	(0.0000)					
opt	-0.0136	0.1065*	0.1563*	1.0000			
	(0.6536)	(0.0004)	(0.0000)				
fut	-0.0170	0.0003	0.0182	0.3891*	1.0000		
	(0.5746)	(0.9921)	(0.5469)	(0.0000)			
loan	-0.0960*	0.0820*	-0.0137	-0.0335	-0.0310	1.0000	
	(0.0015)	(0.0066)	(0.6495)	(0.2684)	(0.3055)		
cap	0.6196*	-0.0795*	-0.0046	0.0806*	0.0024	-0.2249*	1.0000
	(0.0000)	(0.0084)	(0.8781)	(0.0076)	(0.9377)	(0.0000)	
liq	0.2497*	-0.0543	-0.1226*	-0.0228	0.0371	-0.1985*	0.2328*
	(0.0000)	(0.0725)	(0.0000)	(0.4517)	(0.2193)	(0.0000)	(0.0000)
size	-0.1983*	0.1056*	0.1520*	0.0872*	0.0758*	0.1167*	-0.3224*
	(0.0000)	(0.0005)	(0.0000)	(0.0039)	(0.0120)	(0.0001)	(0.0000)
cr	0.1800*	-0.0256	-0.0226	-0.0278	-0.0279	-0.1693*	0.1658*
	(0.0000)	(0.3964)	(0.4550)	(0.3575)	(0.3557)	(0.0000)	(0.0000)
	liq	size	cr				
liq							
size	-0.1743*	1.0000					
	(0.0000)						
cr	0.0290	-0.0870*	1.0000				
	(0.3383)	(0.0040)					

The numbers in brackets correspond to the standard error.

Furthermore, a test for multicollinearity is made. A detection-tolerance or the variance inflation factor (VIF) for multicollinearity can be defined as follows:

$$\text{Tolerance}_j = 1 - R_j^2, \text{ VIF}_j = 1/\text{Tolerance}_j$$

where R_j^2 is the coefficient of determination of a regression of explanatory variable j on all the other explanatory variables. A tolerance of less than 0.20 or 0.10 and/or a VIF of 5 or 10 and above indicates a multicollinearity problem (see O'Brien 2007).

Table 62. Multicollinearity test (for NPL and coverage ratios)

	VIF	1/VIF
size	16.52	0.060532
loan	13.67	0.073146
cap	4.75	0.210584
liq	3.33	0.300340
swp	2.42	0.413403
cr	1.90	0.526420
fwd	1.60	0.626273
opt	1.36	0.737182
fut	1.28	0.781538
Mean VIF	5.20	

Table 63. Multicollinearity test (for the other dependent variables)

	VIF	1/VIF
size	12.74	0.078519
loan	10.54	0.094916
cap	3.39	0.295330
liq	2.06	0.486105
swp	1.42	0.705047
cr	1.37	0.730518
fwd	1.33	0.749972
opt	1.30	0.768396
fut	1.20	0.829965
Mean VIF	3.93	

The results above show that there is no problem of multicollinearity.

As follows the Table 64 resumes Hausman test results.

Table 64. Hausman Test

Dependent variable	chi2(9)	Prob > chi2
EFF	12.28	0.1981
NPL	9.94	0.3553
COV	12.25	0.1996
ROA	20.77	0.0137
ROE	61.03	0.0000
CAD	10.09	0.3429
NIM	34.87	0.0001

For the results in which Hausman test show an absence of correlation between the independent variables and the error terms random effect model is retained. When performance is measured by ROE and NIM, the estimate of the random effect model is inconsistent. To avoid this problem, fixed effect model is used instead.

Moreover, tests for robustness are used for all regressions (fixed and random effect models).

For random effect models Breusch and Pagan Lagrangian multiplier test is performed. The null hypothesis stipulates that the random effect model is the appropriate model, otherwise, simple OLS regression should be conducted. The null hypothesis is H_0 : “ $\text{Var}(u_i)=0$ ” against H_1 : “ $\text{Var}(u_i)>0$ ”. The results are as follows:

Table 65. Breusch and Pagan Lagrangian multiplier test

Dep. variable	sd(Dep. Variable)	sd($e_{i,t}$)	sd(u_i)	chi2(1) test statistic	P value
Npl	0.0549582	0.0289006	0.0375704	665.74	0.0000 *
Cov	1.072926	0.723215	0.7521066	425.29	0.0000 *
Roa	0.0183679	0.0129591	0.0103871	508.74	0.0000 *
Eff	0.4335106	0.2975887	0.3090517	946.86	0.0000 *
Cad	4.482522	2.868206	1.79603	265.90	0.0000

From these results on Breusch and Pagan Lagrangian multiplier test the null hypothesis is verified in the all models so that random effect models are justified.

On the other hand, for fixed effect models a Modified Wald test for groupwise heteroskedasticity is utilised.

Table 66. Modified Wald test for groupwise heteroskedasticity

Dependent variable	chi2(137) test statistic	P value
ROE	6.7e+05	0.0000 *
NIM	8.2e+05	0.0000 *

The results above show that the null hypothesis of the presence of homoskedasticity (or constant variance) is verified. For this reason, the option ‘robust’ in STATA is used to control for heteroskedasticity and to improve the robustness of models.

II.2.1.3. Summaries and Discussion

The purpose of this work is to explain the effect of derivative instruments on bank accounting performance. Results found allow making notable conclusions.

For overall sample, the use of forwards decreases performance through its positive impact on NPL ratio and its negative effect on coverage ratio and net interest margin.

Comparing to literature results which show an increase of performance by using derivatives, and knowing that most of past studies are focusing in banks from developed countries, we can say that in our study banks from emerging and recently developed countries manage bad the use of forwards. Knowing also that forwards are exchanged in over the counter market so we can deduce that our sample banks takes more risks from over the counter market than banks from developed countries.

Also, swaps, despite its negative impact on capital adequacy ratio, generally reduce bank performance because it affects negatively profitability and efficiency.

The findings of this study contradict also literature thesis that the use of swaps enhances bank performance. This can be interpreted by the fact that our sample is composed of banks from both emerging and recently developed countries which do not have a long experience in using such instrument comparing to advanced countries. Therefore, using swaps can affect negatively their performance.

In spite of its effect on NPL ratio, the use of options seems to decrease bank performance since its negative association with efficiency and net interest margin, on the one hand, and its positive correlation with capital adequacy, on the other hand.

We know that options are used by banks essentially for speculation purpose. Finding that options use has negative impact on performance means that the sample banks does not manage options in the better way. This can be explained by the lack of opportunities due to the small derivative markets in which they deal.

Although a little positive effect on return on equity, it appears that futures tends to decrease bank performance because of its positive correlation with NPL ratio on the one hand, and its negative association with efficiency on the other hand.

Using for hedging fashion the use futures seems to be beneficial for banks. However, nothing ensures that futures increase bank performance. Thus, there is no strong relationship between hedging rule and increasing performance of futures. Therefore, despite their hedging rule futures can decrease performance.

In summarizing results regarding derivative instruments, the common thesis stipulating that derivatives enhance performance is abandoned.

As concerning control variables, findings show that the proxy of capital increases bank performance due its positive impact on return on assets and net interest margin ratios and also through its negative effect on capital adequacy. This result corroborates our hypothesis stipulating a positive correlation between capital and performance.

In addition, the variable used as proxy of liquidity affect positively performance due its positive association with coverage ratio and net interest margin, on the one hand, and its negative correlation with capital adequacy ratio on the other hand. So hypothesis concerning the increase of performance by liquidity is verified.

In addition, the proxy of credit risk has negative effect on financial performance measures and efficiency measure so it decreases bank performance and confirms our hypothesis.

Furthermore, bank size increases bank performance due its positive impact on return on assets ratio, coverage ratio and efficiency on one hand, and its negative effect on NPL ratio and capital adequacy measure. This result supports the theory that large banks have better diversified asset portfolio and economies of scales thus becoming more efficient (Rivas el. 2006, Shyu and Reichert, 2002; Mester, 1993).

For the other control variables, results show that their impact on bank performance is not comprehensible.

For emerging countries, the impact of forwards use on bank performance is ambiguous because of its negative impact on coverage ratio and capital adequacy measure.

Regarding results it appears that swaps has no significant impact on bank performance.

The use of options affects negatively financial performance measures, efficiency, net interest margin and coverage ratio and also it has a positive impact on NPL ratio that is why it seems that options decrease bank performance.

These results suggest that banks from emerging speculate badly with options so that they make losses. This can be explained by the fact that banks in emerging countries have used derivatives recently and that their derivative markets are small so banks do not have many opportunities to diversify their portfolio of speculation.

Concerning futures use, the effect of futures on bank performance is confusing due its positive impact on financial performance measures on one hand and its negative impact on efficiency measure on the other hand.

These findings can be described by the fact that too little number of banks in the sample composed only of emerging countries has used futures in the sample period. Therefore results about the impact of futures use on bank performance are not enough noteworthy.

As regards the effect of derivative instruments on bank performance, these results reject our hypotheses.

Excluding its effect on operational performance we admit that the proxy of risky assets decrease bank performance because particularly of its negative association with the two profitability measures, efficiency and net interest margin and also its positive impact on capital adequacy. In contrast, capital affects positively bank performance due its positive effect on return on assets, efficiency and net interest margin, and also since its negative correlation with NPL ratio and capital adequacy measure. This result proves theory stipulating that capital increase performance.

Likewise, due its positive effect on return on assets and coverage ratio, liquidity affects positively bank performance. So our hypothesis about positive effect of liquidity on performance is corroborated.

For the rest of control variables, it seems that their impact on bank performance is unclear.

For recently developed countries, it appears that forwards use decreases bank performance because of its negative effect on coverage ratio and net interest margin regardless of its negative impact on NPL ratio.

While, the impact of swaps use on bank performance is understandable because it has negative impact on profitability and efficiency on one hand, and it affects positively coverage ratio and net interest margin.

In spite of its negative impact on NPL ratio, it seems that options use reduces bank performance since its negative effect on efficiency measure on one hand, and its positive effect on capital adequacy measure, on the other hand.

Whereas, the impact of futures use on bank performance is not obvious because of its negative correlation with return on equity on one hand and its positive association with net interest margin on the other hand.

From these results, we deduce that thesis about positive impact of derivatives on performance is eliminated. Also from these findings we can realize that derivative instruments used for speculative fashion have negative effect on performance which indicates that banks in recently developed countries lose in your performance when they speculate by using forwards and options.

Concerning control variables, excepting its positive correlation with NPL ratio, we judge that capital augments bank performance given that its positive effect on the two profitability measures and efficiency, and also due its negative effect on capital adequacy. In contrast, the proxy of credit risk affects positively NPL ratio so it has a negative impact on bank performance. This finding supports our hypothesis about negative association between credit risk and performance.

The variable proxy of the bank size enhances performance due its positive effect on return on equity, coverage ratio, efficiency and net interest margin on one hand, and its negative impact on NPL ratio and capital adequacy measure. Since the theory about positive effect of size on performance is confirmed.

Except for its positive impact on capital adequacy, we consider that the dummy defining dealer bank increases bank performance especially due its positive association with the two profitability measures and efficiency on one hand, and its negative impact on NPL ratio on the other hand. Thus, our hypothesis stipulating a positive association between DEAL and performance is retained.

Considering the rest of control variables, we deduce that their impact on bank performance is unclear.

Summarizing results indicate that in the whole the four derivative instruments tend to decrease bank performance. Thus, theory stipulating a positive effect of derivatives usage on bank performance is rejected.

Comparing results show that the use of options by banks in emerging as well in recently developed countries decreases performance. Hence, we deduce that derivatives used by banks in emerging as well in recently developed countries have the same effect on bank performance.

The following table sums up the main regression results about the association between the four derivative instruments and the seven accounting performance measures.

Table 67. Summary table of regression coefficient signs***Panel A. For overall sample***

	Forwards	Swaps	Options	Futures
ROA	NS	-	NS	NS
ROE	NS	NS	NS	+
NPL ratio	+	NS	-	+
Coverage ratio	-	NS	NS	NS
Efficiency	NS	-	-	-
Capital adequacy ratio	NS	-	+	NS
NIM	-	NS	-	NS

Panel B. For emerging countries

	Forwards	Swaps	Options	Futures
ROA	NS	NS	-	+
ROE	NS	NS	-	+
NPL ratio	NS	NS	+	NS
Coverage ratio	-	NS	-	NS
Efficiency	NS	NS	-	-
Capital adequacy ratio	-	NS	NS	NS
NIM	NS	NS	-	NS

Panel C. For recently developed countries

	Forwards	Swaps	Options	Futures
ROA	NS	-	NS	NS
ROE	NS	NS	NS	-
NPL ratio	-	+	-	NS
Coverage ratio	-	+	NS	NS
Efficiency	NS	-	-	NS
Capital adequacy ratio	NS	-	+	NS
NIM	-	+	NS	+

Common results of the two subsamples show that the use of options has a negative effect on coverage ratio and efficiency measure. So it appears that the use of options by banks in emerging as well as in recently developed countries has the same negative impact on performance.

The use of forwards has a negative effect on NPL ratio in Panel B as well as in Panel C. Similarly, options used by banks in emerging as well as in recently developed countries affect negatively efficiency.

As regard swaps and futures, their impact on performance is not obvious in the Panel B as well as in the Panel C.

Finally, concerning control variables, capital affect positively bank performance in the two subsamples.

The impact of forwards use on bank performance is negative in the Panel C while it is ambiguous in the Panel B.

The correlation between futures and return on equity is positive for banks from emerging countries while it is negative for banks from recently developed countries.

It appears that banks from emerging countries increase their financial performance with using futures whereas banks from recently developed countries decrease their financial performance when they use futures. Indeed, banks from emerging countries deal with futures in a better way.

The association between options use and NPL ratio is positive in Panel B while it is negative in Panel C. The evidence is that, in term of operating performance, banks in recently developed countries manage better their options than banks in emerging countries.

In sum, comparing results expose that banks in recently developed countries deal with options better than those in emerging countries, and that futures are used more properly by banks in emerging countries than those in recently developed countries.

Moreover, from comparing results, we deduce that the effect of derivatives use on bank performance is almost the same in the two subsamples. Findings can be explained either that banks in recently developed countries have nearly the same specificities as well as banks in emerging countries or by the small subsamples size.

Overall findings indicate that the four derivative instruments generally reduce bank performance.

Results about banks from emerging countries reveal that the use of options by decreases their performance.

Findings concerning banks from recently developed countries expose that the use of forwards and more clearly of options diminishes their performance.

Main comparing results show that the effect of derivatives use on bank performance is almost the same in the two subsamples.

Ultimately, the major conclusion of this second part is that banks in the whole seem to decrease their performance by using derivative instruments. Indeed, deducing results reject literature findings and the argument stipulating that derivatives use increases bank performance.

CONCLUSION

The thesis has for purpose to study the effect of four derivative instruments (forwards, swaps, options and futures) use on both bank risk and performance.

The thesis has chosen a sample composed of banks from both emerging and recently considered as developed for many reasons such as: the lack of papers focusing on emerging countries context, the big differences between advanced countries and recently developed countries, the lack of data on banks from emerging countries, the absence of papers identifying banks from recently developed countries, and the absence of papers combining and comparing banks from both emerging and recently developed countries.

Using on the one hand annual and quarterly accounting data in the period 2003-2010, and on the other hand basing on annual capital market data during the period 2003-2009 regarding the combined sample banks, this thesis tries to respond to the following main research questions:

Are banks at risk by using derivative instruments?

Are banks increasing their performance by using derivatives?

Are there differences in the effect of derivatives use on risk and/or performance between banks in emerging countries and those in recently developed countries?

Can derivatives be responsible for the last financial crisis?

To provide answers two separate parts are defined in each of them reviews of literature were presented and empirical analyses were conducted.

The first part of the thesis examines the impact of derivatives use on bank risk.

Basing on literature results the main hypotheses are as follows. The first hypothesis stipulates a negative effect of swaps on bank risk. Next, a positive effect of options on risk is hypothesized. Lastly, the third hypothesis stipulates that futures and forwards do not affect significantly risk.

In order to check up the plausibility of these hypotheses, two empirical analyses defined in two chapters are performed to this end.

In the first analysis capital market risks are regressed to derivative instruments and control variables. Capital market risks are measured by total return risk, systematic risk and non-systematic risk.

The sample combines 52 banks from both emerging and recently developed countries during the sample period from 2003 to 2009.

Findings show that the use of options tends to increase all types of bank risk. In contrast, swaps, forwards and futures negatively affect capital market risk.

The second analysis is testing the effect of derivative instruments use on accounting risks. Accounting risks are defined by leverage risk, liquidity risk, credit risk and overall risk.

The total sample is defined by 137 banks and divided into two subsamples composed of bank from emerging and recently developed countries, and covering the sample period from 2003 to 2010.

The whole results reveal that in general the use of forwards and swaps decrease bank risk while the use of options positively affects bank risk, and finally the use of futures has a mildly significant effect on bank risk.

Our findings - as regarding swaps and options - are almost similar to those of the literature. Hence, there is an evidence that the use of swaps reduce bank risk while the use of options increase bank risk whether they are used by banks in developed (in the literature) or in emerging and recently developed countries (in the present study).

Deducing results from benchmarking analysis notify that forwards and swaps have negative effect on bank risk whether are used by banks in emerging or in recently developed countries. Whilst, the use of option contracts by banks from recently developed countries has a negative effect on bank risk while it has a positive effect with banks from emerging countries.

The main conclusion from the first part reveals evidence that with exception of options, derivative instruments do not increase risk.

Thus, hypotheses stipulating that swaps decrease bank risk and that options increase bank risk were supported, whereas hypothesis stipulating that forwards have no effect on bank risk was abandoned.

These findings make evidence that options are risky instrument and their use in speculation accentuates the risk of banks. Here banks should deal better with this derivative type when they use it for speculation in order to minimize its risk. On the contrary, the use of swaps reduces bank risk. This result can be explained by the fact that swaps are hedging tools so banks use swaps to cover their risks. For this reason the use of swaps is recommending for banks in order to take advantage of their covering of risks.

Ultimately, according to our sample statistics the majority of banks generally make use of forwards and swaps, therefore it seems clear that sample banks are not at risk by using derivative instruments.

The second part investigates the effect of derivative instruments use on bank performance.

According to the few papers investigating empirically this relationship the major hypothesis stipulates an increase of bank performance by derivative instruments use.

Similarly to the first part two chapters in each of them an analysis was performed in order to verify the plausibility of this hypothesis.

In the first analysis stock returns as measure of financial performance are regressed to derivative instruments and control variables.

The sample is composed of 74 banks spread over 34 countries regrouped as emerging and recently developed countries. The sample period is from 2003 to 2009.

The results divulge that the use of swaps tends to decrease financial performance. However, forwards, options and futures have no significant effect on stock returns.

The second analysis examines the impact of derivative instruments on five aspects and seven measures of accounting performance. Accounting performance is measured by financial performance or profitability (determined by return on assets ratio and return on equity ratio), operating performance or asset quality (the ratio of non-performing loans and the coverage ratio), efficiency (or cost income ratio), capital adequacy ratio, and the net interest margin ratio.

After analysis of the using pooled data from 2003 to 2010 collected from overall sample and two subsamples (composed of banks from both emerging and recently developed countries) noteworthy conclusions were drawn from the empirical results.

Overall findings indicate that the four derivative instruments generally reduce bank performance.

Results about banks from emerging countries reveal that the use of options decreases their performance.

Findings concerning banks from recently developed countries expose that the use of forwards and more clearly of options diminishes their performance.

The major conclusion is that banks in the whole seem to decrease their performance by using derivative instruments.

Indeed, deducing results of this second part reject literature findings and thesis stipulating that derivatives use enhances bank performance.

These differences between our findings and previous studies results can be because of the specificities of our sample compared to its used in the most of past studies which is composed of banks only from advanced countries. It seems clear that banks in developed or advanced countries manage better their use of derivatives in comparison to banks from both emerging and recently developed countries. It can be interpreted by the fact that banks in both emerging and recently developed are for the most part new users of derivatives so they lack experience in using these instruments. Also their derivatives markets are so small to have many opportunities to take profits of derivatives.

Finally, compared results in the two parts of the thesis find out little differences between banks in emerging countries and those in recently developed countries. These similarities between banks in the two subsamples can be explicated by the fact that specifications in emerging and recently developed countries are so close. Therefore, there are no much differences between the two groups of countries. We suggest that comparison between banks in emerging or/and recently developed countries and developed countries would be more noteworthy.

Important implications can be deduced from this work.

From the first part, it comes out that forwards, swaps and futures may be used effectively as hedging tools, while options may be viewed in a more speculative fashion. Therefore, more control in the use of options should be made by bank managers in order to better control its effect on risk.

Comparing results between banks from emerging countries and those from recently developed countries reveal that forwards and swaps have negative effect on bank risk

whether are used by banks in emerging or recently developed countries. Whilst, banks in emerging countries deal better with futures than banks in recently developed countries. And finally, banks in recently developed countries manager the risk of options better than banks in emerging countries.

From the second part and particularly from the first analysis bank managers ought to give more attention to swap contracts in order to minimize its negative effect on performance.

In the second analysis and uniformly to comparing results in the first part, it seems clear that banks in recently developed countries deal with options better than those in emerging countries, whilst futures are used more properly by banks in emerging countries than those in recently developed countries.

Main results from benchmarking analyses in the two parts show that the effect of derivatives on bank risk and performance is almost the same either in banks from emerging or recently developed countries. Therefore little differences are observed between the two ranges of banks. It can be explained by the fact that banks in recently developed countries have nearly the same specifications as well as banks in emerging countries.

In brief, deducing that by using derivatives banks decrease their performance but also their risk, indeed adjudication that derivatives are beneficial or not is not allowed.

Hence, the common opinion of many authors supporting that derivative instruments are beneficial for banks should be revised.

However, there is no proof that derivatives can be the cause of bank failure or distress. Thus, the ongoing debate that derivative instruments are implicated in the most recent financial crisis should be reviewed.

Many contributions of the thesis can be enumerated. Firstly, in contrary to most previous papers focusing only on banks from advanced countries and principally from U.S., the current work is composed of banks essentially from both emerging countries. Secondly, the thesis includes banks from countries which were considered few years ago as emerging countries which we called recently developed countries.

As a result, this study is the first paper to combine and compare banks from emerging and recently developed countries.

Thirdly, and in opposite to the majority of previous studies - the thesis has analysed instruments of derivatives independently. Indeed, it contributes to the literature by studying the effect of each derivative type on bank risk and performance.

Finally, and regarding the lack of papers studying empirically the effect of derivatives use on bank risk and performance, this thesis has aimed to fill this huge gap in the literature.

Nevertheless, the current work was limited by some constraints such as the lack of derivatives and capital market data especially of banks from emerging countries and also the lack of empirical references.

As proposals, forthcoming studies can:

- enlarge more the period and the sample study,
- get more data and focus only on emerging countries
- compare banks from emerging countries to those from developed countries,
- use other financial innovations such as securitizations,
- examine the effect of derivative instruments on others bank risk types,
- separate between bank derivative buyers and bank derivative sellers
- focus on the corporate case.

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Appendix I.

Table I. Estimated coefficients of dummy countries

	Total return risk σ_{Ri}	Systematic risk β_{mi}	Non-systematic risk σ_{ei}
<i>Dummies for emerging countries</i>			
Chile	Insignificant	11.7167*** (3.9953)	Insignificant
Croatia	--0.0116** (0.0046)	7.8814*** (2.4052)	Insignificant
Cyprus	--0.0064** (0.0025)	insignificant	2.2789*** (0.1327)
Indonesia	Insignificant	insignificant	Insignificant
Malaysia	--0.0146*** (0.0029)	insignificant	1.0233*** (0.1570)
Mauritius	Insignificant	26.3848*** (7.4031)	Insignificant
Philippines	Insignificant	34.6963* (20.7302)	Insignificant
Poland	Insignificant	insignificant	3.6181*** (0.2106)
Saudi Arabia	--0.0057** (0.0027)	-0.1744308** (0.0745211)	26.6053** (12.4175)
South Africa	Insignificant	2.1038*** (0.6925)	Insignificant
Thailand	--0.0050** (0.0019)	5.4924*** (0.2820)	Insignificant
Turkey	Insignificant	2.6150*** (0.3053)	Insignificant
<i>Dummies for recently developed countries</i>			
Czech Republic	Insignificant	5.1833*** (0.4075)	Insignificant
Estonia	--0.0206*** (0.0040)	3.0204* (1.6038)	Insignificant
Hong Kong	--0.0087*** (0.0029)	2.8161*** (0.3198)	3.9721*** (0.1229)
Israel	--0.0143*** (0.0034)	insignificant	Insignificant
Latvia	Insignificant	-0.1868** (0.0743)	2.4454*** (0.3657)
Lithuania	--0.0158*** (0.0038)	-0.2058*** (0.0742)	5.6945*** (0.4191)
Singapore	--0.01268*** (0.0024)	insignificant	9.6561*** (0.3977)
South Korea	Insignificant	7.8785*** (1.1246)	1.1904* (0.3967)
Taiwan	--0.0071** (0.0029)	insignificant	Insignificant
R-squared	0.1292	0.3421	0.2619
F statistic	4.73***	94.16***	306.25***
Number of obs.	364	364	364

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

() indicate standard deviation of the estimators.

Appendix II.a.

Table II.a. Estimated coefficients for overall sample, years 2003-2010

	Leverage risk	Credit risk 1	Credit risk 2	Liquidity risk	Total risk
Constant	0.1551135*** (0.01315)	0.5482274*** (0.0377125)	0.0318569*** (0.0013297)	0.0718038*** (0.0138603)	0.0079017*** (0.0007778)
FWD	-0.005751*** (0.0019697)	Insignificant	insignificant	-0.0029418* (0.0015855)	insignificant
SWP	insignificant	-0.0136368 *** (0.0032783)	-0.0015535*** (0.0002621)	insignificant	insignificant
OPT	0.0169053*** (0.0051756)	0.0190371 ** (0.0093309)	insignificant	insignificant	-0.0047164* (0.0026211)
FUT	insignificant	Insignificant	insignificant	insignificant	0.0007763* (0.0004512)
NIM	0.797544*** (0.0786721)	-0.4859484 *** (0.0663234)	0.0697491*** (0.0109894)	0.3754465*** (0.0930716)	insignificant
LOG	-0.0107483*** (0.0014023)	0.0147786 *** (0.0036482)	insignificant	-0.009032*** (0.0014829)	insignificant
DEAL	-0.012498*** (0.0029331)	Insignificant	insignificant	-0.0247658*** (0.0051801)	insignificant
Argentina	0.0696391*** (0.0198943)	-0.211748*** (0.0260792)	-0.0159613*** (0.0032072)	0.0806974*** (0.0140726)	insignificant
Brazil	insignificant	-0.4419428*** (0.0343203)	-0.0185841*** (0.0023226)	0.0376956*** (0.0110197)	0.0395416*** (0.0116018)
Bahrain	0.1143362*** (0.0190553)	-0.2959398*** (0.0297273)	-0.0156397*** (0.002316)	0.0520752*** (0.010192)	insignificant
Bulgaria	0.0158552* (0.008423)	-0.0581215** (0.0246933)	-0.0134186*** (0.0025407)	0.0701717*** (0.007036)	insignificant
Chile	-0.0369538*** (0.005115)	0.0402918** (0.0158307)	-0.0205024*** (0.0014238)	0.0801256*** (0.0071016)	-0.0046631*** (0.0009065)
China	insignificant	-0.0237*** (0.0052)	-0.0152271*** (0.0015248)	insignificant	-0.004334*** (0.0008724)
Croatia	0.0231912*** (0.006266)	-0.0617292*** (0.0151491)	insignificant	0.0863455*** (0.0087679)	insignificant
Cyprus	insignificant	-0.1153181*** (0.017972)	insignificant	0.0638292*** (0.0074897)	insignificant
Czech Republic	0.0096343** (0.0039073)	-0.1670715*** (0.0284205)	-0.018917*** (0.0014501)	0.0319995*** (0.0056592)	-0.0030653*** (0.0007916)
Estonia	0.04612*** (0.0071056)	Insignificant	-0.0236617*** (0.0033925)	0.0329897*** (0.006666)	-0.0062446*** (0.0008539)
Hong Kong	0.0269037*** (0.0040746)	-0.2155659*** (0.0141914)	-0.0277293*** (0.001938)	0.1415185*** (0.0141504)	insignificant
Hungary	0.0211612*** (0.0067252)	-0.0969228*** (0.0281117)	-0.0187124*** (0.002012)	0.0560294*** (0.0080973)	insignificant
India	insignificant	-0.0100*** (0.0017)	-0.0283498*** (0.0016069)	0.1295377*** (0.0257392)	-0.0038914*** (0.0010126)
Indonesia	insignificant	Insignificant	insignificant	insignificant	insignificant
Israel	0.0136935*** (0.0043082)	-0.0598289*** (0.0155154)	-0.0292938*** (0.001302)	0.1776901*** (0.0120948)	-0.0049417*** (0.0012005)
Jordan	0.0305367*** (0.0087222)	-0.1580256*** (0.0249036)	-0.0103041*** (0.0038612)	0.1539372*** (0.0157685)	insignificant
Kazakhstan	0.0229092** (0.0094437)	Insignificant	0.0269609** (0.0110825)	0.1240348*** (0.0226604)	insignificant
Kuwait	0.0343644*** (0.007373)	-0.1204964*** (0.0258362)	insignificant	0.1297191*** (0.0110037)	-0.0037954*** (0.0010189)
Latvia	insignificant	-0.1274686*** (0.0262118)	-0.0118919** (0.0046297)	0.0488524*** (0.0066151)	insignificant
Lebanon	insignificant	-0.4745122***	-0.0266508***	0.2648205***	-0.0040912***

		(0.01632)	(0.0014192)	(0.0192587)	(0.0008365)
Lithuania	insignificant	Insignificant	-0.0160086*** (0.0037154)	0.0570094*** (0.0087389)	-0.0035566*** (0.0009584)
Malaysia	0.0194871*** (0.0038898)	-0.044056** (0.0221632)	-0.012029*** (0.002166)	0.1463103*** (0.0101032)	-0.0044464*** (0.001969)
Mauritius	insignificant	Insignificant	insignificant	0.0500992*** (0.0137702)	0.0339757*** (0.0128994)
Mexico	insignificant	-0.1780016*** (0.0370564)	-0.0069785** (0.0028403)	0.1763195*** (0.0112219)	-0.0050533*** (0.0013135)
Oman	0.0396397*** (0.0092581)	Insignificant	insignificant	0.0582646*** (0.0178827)	-0.0063188*** (0.0008313)
Pakistan	insignificant	-0.1139405*** (0.0208225)	insignificant	0.1086687*** (0.0077868)	-0.0044274*** (0.0008527)
Philippine	0.0311887*** (0.0046924)	-0.3397767*** (0.018075)	0.0297366*** (0.0085547)	0.0187939*** (0.0052583)	-0.0073729*** (0.0007788)
Poland	0.0275051*** (0.005015)	-0.0530884** (0.0230845)	insignificant	0.055468*** (0.0061979)	-0.0041492*** (0.0009092)
Qatar	0.0913808*** (0.0088383)	-0.1132514*** (0.0187956)	-0.0237127*** (0.0019951)	0.0647226*** (0.0119994)	-0.0048944*** (0.0010448)
Russia	insignificant	-0.155738*** (0.0322388)	-0.0094645*** (0.0026311)	0.1858338*** (0.0669509)	insignificant
Saudi Arabia	0.0367631*** (0.0048538)	-0.0903308*** (0.0164904)	-0.0194941*** (0.001849)	0.0983635*** (0.0110218)	insignificant
Singapore	0.0647507*** (0.0048354)	-0.2144101*** (0.0242228)	-0.0156941*** (0.0015886)	0.1018443*** (0.0089836)	-0.0057701*** (0.000893)
Slovakia	insignificant	-0.1079358*** (0.0305096)	-0.0160585*** (0.0025762)	0.040571*** (0.0105824)	insignificant
Slovenia	insignificant	Insignificant	insignificant	0.0226479*** (0.0056229)	-0.0061636*** (0.0007824)
South Africa	0.0338109*** (0.0103942)	0.055458*** (0.0208534)	-0.0151158*** (0.0017633)	0.0917715*** (0.0101473)	-0.0067681*** (0.0008343)
South Korea	0.018304*** (0.0053264)	Insignificant	-0.0210231*** (0.0013769)	0.0796045*** (0.008003)	-0.0054588*** (0.000849)
Taiwan	insignificant	-0.0603936*** (0.0144349)	-0.026307*** (0.0013451)	0.0388832*** (0.0066916)	-0.0063598*** (0.0007979)
Thailand	0.0171506*** (0.0065174)	Insignificant	insignificant	0.0324971*** (0.0058077)	-0.0055125*** (0.0008851)
Turkey	0.0231517*** (0.0062829)	-0.2059404*** (0.0291501)	-0.0211061*** (0.0023688)	0.0569072*** (0.0078067)	insignificant
United Arab of Emirates	0.068559*** (0.0087933)	-0.1156283*** (0.0227667)	-0.0166024*** (0.0019611)	0.1096181*** (0.013405)	insignificant
Vietnam	insignificant	-0.1783498*** (0.0272118)	-0.0306245*** (0.0013232)	0.0605457*** (0.0085153)	insignificant
R-squared	0.5684	0.4591	0.3270	0.4834	0.2984
F statistic	26.57***	67.47***	63.22***	46.33***	24.13***
Number of obs	1096	1096	1096	1096	736

*, ** and *** indicate statistical significance respectively at the 10%, 5% and 1% levels.
() indicate standard deviation of the estimators.

Appendix II.b.

Table II.b. Estimated coefficients for emerging countries, years 2003-2010

	Leverage risk	Credit risk 1	Credit risk 2	Liquidity risk	Total risk
Constant	0.1458448*** (0.0205941)	0.7267235*** (0.0091913)	0.0308693*** (0.004071)	0.1214615*** (0.0226087)	0.0075834*** (0.0010643)
FWD	-0.0058097** (0.002277)	0.0148069* (0.0082986)	insignificant	-0.0038731* (0.002182)	0.0093869* (0.005656)
SWP	insignificant	insignificant	-0.000333** (0.0001636)	-0.0056277*** (0.0012588)	insignificant
OPT	0.0284657*** (0.0093993)	insignificant	insignificant	0.0284497** (0.0132858)	-0.0105712* (0.0057595)
FUT	-0.0039515** (0.0018213)	insignificant	insignificant	insignificant	0.0016446* (0.0009473)
NIM	0.8412569*** (0.081442)	-0.6122843*** (0.036938)	0.058843*** (0.0114226)	0.3694749*** (0.0963988)	insignificant
LOG	-0.0065504*** (0.002132)	insignificant	-0.0015232*** (0.0003767)	-0.0106004*** (0.0021096)	insignificant
DEAL	-0.0301087*** (0.00523)	insignificant	insignificant	-0.024055** (0.0095601)	insignificant
Argentina	0.0420097** (0.0205738)	-0.2721849*** (0.0269377)	insignificant	0.0463493*** (0.0146039)	insignificant
Brazil	-0.0333071** (0.0148733)	-0.4383081*** (0.0324178)	insignificant	insignificant	0.0404938*** (0.0115213)
Bulgaria	insignificant	-0.1169977*** (0.0231873)	insignificant	0.0334981*** (0.0081842)	insignificant
Chile	-0.0338413*** (0.0041785)	insignificant	-0.0040387*** (0.0012176)	0.047716*** (0.0057771)	-0.005226*** (0.0011281)
China	-0.0568718*** (0.0070524)	-0.2231001*** (0.0148039)	-0.0039581** (0.0018266)	-0.0392298*** (0.0113759)	insignificant
Croatia	insignificant	-0.1173371*** (0.0125601)	0.0115362*** (0.0017606)	0.0498437*** (0.0095347)	insignificant
India	-0.0218716*** (0.0076907)	-0.2128074*** (0.0156692)	-0.0114839*** (0.0014885)	0.0725727*** (0.0222706)	-0.0038746*** (0.0011899)
Indonesia	-0.0385695*** (0.0110908)	-0.1634618*** (0.0328114)	insignificant	insignificant	insignificant
Jordan	insignificant	-0.2224872*** (0.0221705)	insignificant	0.1162821*** (0.0163572)	insignificant
Kazakhstan	insignificant	-0.067622*** (0.0261284)	0.0417157*** (0.0114258)	0.0884896*** (0.0232055)	insignificant
Kuwait	insignificant	-0.1601715*** (0.0259459)	0.0135176** (0.0064992)	0.0950527*** (0.0107616)	-0.0040013*** (0.0011757)
Lebanon	-0.0269261*** (0.005977)	-0.5168167*** (0.0150356)	-0.0115838*** (0.0013495)	0.2295498*** (0.0188244)	-0.0041066*** (0.0010371)
Malaysia	insignificant	-0.0830847*** (0.0209789)	0.0033758* (0.0019982)	0.1133301*** (0.0095732)	-0.0044244** (0.0020908)
Mauritius	-0.0341767*** (0.0092712)	-0.0500059*** (0.0160644)	0.0116349*** (0.0024323)	insignificant	0.032228*** (0.0118463)
Mexico	-0.0435881*** (0.0072111)	-0.2097604*** (0.0365452)	0.0097614*** (0.0026413)	0.1443357*** (0.010586)	-0.0091371*** (0.0029578)
Oman	insignificant	-0.0390423* (0.0219939)	0.0149088*** (0.0033881)	insignificant	-0.0103035*** (0.0026092)
Pakistan	-0.0169509** (0.0067352)	-0.1612783*** (0.0202356)	insignificant	0.0717529*** (0.0123474)	-0.0042145*** (0.0010879)
Philippine	insignificant	-0.389828*** (0.0165432)	0.0439373*** (0.0085373)	insignificant	-0.0070982*** (0.0010541)
Russia	insignificant	-0.195738*** (0.0281596)	0.0058241** (0.0024663)	0.149996** (0.0673867)	insignificant
Saudi Arabia	insignificant	-0.1257009*** (0.0153177)	insignificant	0.0594207*** (0.008821)	insignificant
South Africa	insignificant	insignificant	insignificant	0.0559076*** (0.0114892)	-0.0064671*** (0.001103)
Thailand	-0.0188903*** (0.0070269)	insignificant	0.0188405*** (0.0027832)	insignificant	-0.0071444*** (0.0013012)
Turkey	-0.0102276* (0.0061525)	-0.2392823*** (0.0267745)	-0.0052156** (0.0022492)	0.0227069*** (0.0073626)	insignificant
Vietnam	-0.0330969*** (0.0085521)	-0.2410145*** (0.0241792)	-0.0177111*** (0.001537)	0.0233418** (0.0097746)	insignificant
R-squared	0.7270	0.7085	0.5039	0.4727	0.3881
F statistic	21.98***	86.32***	60.93***	32.70***	23.00***
Number of obs	472	472	472	472	328

Appendix II.c.

Table II.c. Estimated coefficients for recently developed countries, years 2003-2010

	Leverage risk	Credit risk 1	Credit risk 2	Liquidity risk	Total risk
Constant	0.2767355*** (0.0342121)	0.3127947*** (0.0524063)	0.0183376*** (0.001471)	0.2538888*** (0.0247863)	0.0201107*** (0.0076768)
FWD	-0.0068656*** (0.0020134)	Insignificant	-0.0025527** (0.0010374)	-0.0074443** (0.0032305)	-0.0002631 (0.0009608)
SWP	insignificant	-0.0324013*** (0.0060469)	-0.001545*** (0.0005688)	0.006968*** (0.0026689)	-0.0004746 (0.0004309)
OPT	insignificant	0.0332667* (0.0184104)	insignificant	-0.026685** (0.0111438)	0.0001535 (0.0019033)
FUT	0.0930402** (0.0418118)	-0.249701*** (0.0756926)	insignificant	insignificant	0.0219624* (0.0132388)
NIM	insignificant	1.465852* (0.8455961)	insignificant	insignificant	-0.0329643 (0.0615332)
LOG	-0.0152577*** (0.0031678)	0.0232479*** (0.0048278)	insignificant	-0.0078432*** (0.0018266)	-0.0007804 (0.0006373)
DEAL	insignificant	Insignificant	insignificant	-0.0268901*** (0.0062476)	0.0048976 (0.0039759)
Bahrain	0.0403489*** (0.015713)	-0.1512284*** (0.0237217)	insignificant	-0.135236*** (0.016234)	-0.006115*** (0.0023356)
Cyprus	-0.0682114*** (0.0061898)	Insignificant	0.0228405*** (0.0037085)	-0.1207963*** (0.013255)	-0.0011017 (0.0076884)
Czech Republic	-0.0509336*** (0.0061106)	Insignificant	insignificant	-0.1500134*** (0.0121373)	-0.006551*** (0.0014346)
Estonia	insignificant	Insignificant	-0.0087045** (0.0034316)	-0.1544008*** (0.0128418)	-0.0097184*** (0.0016575)
Hong Kong	-0.0371587*** (0.0063649)	-0.0926265*** (0.0148251)	-0.0124381*** (0.0019993)	-0.0442775*** (0.0168601)	Not included ¹³
Hungary	-0.0314823*** (0.0094302)	Insignificant	insignificant	-0.1249905*** (0.0142425)	insignificant
Israel	-0.0491568*** (0.0047783)	0.0659049*** (0.020563)	-0.0142619*** (0.0014099)	insignificant	-0.0126618*** (0.0023054)
Latvia	-0.0696819*** (0.0169747)	Insignificant	insignificant	-0.1333153*** (0.0161592)	-0.0075009*** (0.002527)
Lithuania	-0.0766756*** (0.0128779)	0.1369409*** (0.0297699)	insignificant	-0.1269228*** (0.0165069)	-0.0096696*** (0.0027955)
Poland	-0.0301544*** (0.008065)	0.0764094*** (0.0248673)	0.0206999*** (0.0041492)	-0.1316767** (0.0133753)	-0.0087672*** (0.0016446)
Qatar	0.0276522*** (0.0096615)	Insignificant	-0.0082433*** (0.0021325)	-0.1192321*** (0.0165724)	-0.0100206*** (0.0019669)
Singapore	insignificant	Insignificant	insignificant	-0.0997033*** (0.0147296)	-0.0119811*** (0.0025854)
Slovakia	-0.0650588*** (0.0101153)	Insignificant	insignificant	-0.1373247*** (0.0151835)	-0.0066661*** (0.0020996)
Slovenia	-0.0732199*** (0.0098251)	0.1472716*** (0.0316754)	0.0122808*** (0.0032203)	-0.1612694** (0.0142304)	-0.0109112*** (0.0019214)
South Korea	-0.0401928*** (0.0060355)	0.0999457*** (0.0192242)	-0.0051935*** (0.0014429)	-0.1061117*** (0.0121856)	-0.0090691*** (0.0015891)
Taiwan	-0.064525*** (0.005256)	0.0631827*** (0.0160603)	-0.0115833*** (0.0014778)	-0.1492456*** (0.0127567)	-0.0108038*** (0.0021411)
United Arab of Emirates	insignificant	Insignificant	insignificant	-0.0737245*** (0.0179006)	-0.0068432*** (0.0023236)
R-squared	0.3865	0.2949	0.2170	0.4114	0.1143
F statistic	27.05***	40.46***	58.78***	24.08***	8.98***
Number of obs	624	624	624	624	408

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

() indicate standard deviation of the estimators.

¹³ Banks from Hong Kong are excluded from the sample because of the absence of quarterly reports in their web sites

Appendix III.

Table III. Estimated coefficients of dummy countries

Countries	Stock return
Philippine	-0.0027105*** (0.0008668)
Jordan	-0.0031461*** (0.0006482)
Lebanon	-0.0045858*** (0.000905)
Slovakia	-0.0015982*** (0.0003183)
Slovenia	0.001359* (0.0007974)
Hong Kong	-0.001413*** (0.0003836)
Taiwan	-0.0006737* (0.0003939)
Bahrain	-0.0017465** (0.0007718)
R-squared	0.1205
F statistic	5.57***
Number of obs.	518

*, ** and *** indicate statistical significance respectively at the 10%, 5% and 1% levels.
() indicate standard deviation of the estimators.

Appendix IV.a.

Table IV.a. Estimated coefficients of country dummies for overall sample, years 2003--2010

	ROA	ROE	NPL ratio	Coverage ratio	Capital adequacy	Efficiency	NIM
Argentina	-0.0206634** (0.0093628)	-0.143127*** (0.0318999)	-0.0200124** (0.0078394)	1.464044*** (0.2462731)	insignificant	insignificant	-0.0538259*** (0.015671)
Brazil	-0.023272*** (0.0041881)	-0.1121968* (0.0597024)	insignificant	1.215252*** (0.2539269)	0.5035887** (0.2291536)	-0.6266149*** (0.0937464)	insignificant
Bahrain	-0.0221212*** (0.0044664)	-0.1370322*** (0.0245473)	-0.0224975*** (0.0069207)	1.565271*** (0.2097155)	1.282532*** (0.4999661)	insignificant	-0.0994961*** (0.0167994)
Bulgaria	-0.0102316*** (0.0029126)	-0.0440149*** (0.014162)	-0.0214075*** (0.0054517)	1.28607*** (0.2107007)	insignificant	insignificant	-0.0441952*** (0.0091825)
Chile	-0.0148597*** (0.0028609)	insignificant	excluded	excluded	1.652176*** (0.438381)	-0.2485272*** (0.0823831)	-0.0258236*** (0.0069242)
China	-0.0150354*** (0.0033062)	-0.077278*** (0.0160959)	insignificant	1.003711*** (0.1932631)	0.8484146* (0.4506997)	0.2545426*** (0.0443118)	-0.0298199*** (0.006296)
Croatia	-0.0164662*** (0.0027823)	-0.1031379*** (0.0194627)	0.0568997*** (0.0097406)	insignificant	insignificant	-0.4770512*** (0.1437279)	-0.0545507*** (0.0089134)
Cyprus	-0.0229871*** (0.003458)	-0.1403078*** (0.0340288)	0.0455209*** (0.0097601)	insignificant	1.744868*** (0.3687176)	-0.1068411*** (0.0251448)	-0.0311414*** (0.0066674)
Czech Republic	-0.0147415*** (0.0026013)	-0.0496895*** (0.0118161)	-0.0323269*** (0.0060532)	1.296168*** (0.1983255)	0.8679267*** (0.3161568)	-0.0722333** (0.0299911)	-0.0319181*** (0.0058607)
Estonia	-0.0124956*** (0.0039476)	insignificant	0.0229901*** (0.006704)	0.3451891** (0.1594735)	insignificant	-0.2411818*** (0.0843335)	-0.0515147*** (0.0078781)
Hong Kong	-0.0193439*** (0.0026741)	-0.0906162*** (0.0161941)	excluded	excluded	0.392591* (0.2216223)	insignificant	-0.0565154*** (0.0090129)
Hungary	-0.0104891*** (0.0027914)	-0.0419733*** (0.0127115)	excluded	excluded	insignificant	-0.1859501*** (0.071166)	-0.0423628*** (0.0073753)
India	-0.0166244*** (0.0026827)	-0.0747289*** (0.011906)	insignificant	insignificant	insignificant	-0.154522*** (0.0506811)	-0.0378685*** (0.0091398)
Indonesia	insignificant	insignificant	insignificant	2.39528*** (0.4767125)	insignificant	insignificant	insignificant
Israel	-0.0149749*** (0.0037903)	-0.1109774*** (0.0156217)	0.1127201*** (0.0239493)	-0.5741665*** (0.1042641)	2.410451*** (0.4313457)	-1.270825*** (0.0582508)	-0.0493396*** (0.0093856)
Jordan	-0.0181071*** (0.0034002)	-0.0933722*** (0.0197464)	0.0424577*** (0.0183356)	0.3293329* (0.1737023)	insignificant	0.1668611*** (0.0480141)	-0.0670414*** (0.0120897)
Kazakhstan	insignificant	insignificant	insignificant	insignificant	-0.7969741*** (0.2562305)	insignificant	-0.0466091*** (0.010865)
Kuwait	-0.0129676*** (0.0036985)	-0.0761825*** (0.027562)	-0.0106225** (0.0050393)	2.259496*** (0.7134112)	insignificant	0.2293378*** (0.0240506)	-0.0602947*** (0.0099464)
Latvia	-0.0186973*** (0.0048712)	-0.1851649*** (0.0686455)	excluded	excluded	insignificant	insignificant	-0.0473275*** (0.0075868)
Lebanon	-0.0152109*** (0.0072423)	-0.1564846*** (0.0267625)	-0.03462*** (0.0106344)	1.725298*** (0.6169907)	insignificant	insignificant	-0.0590046*** (0.0136717)
Lithuania	-0.0224109***	-0.1642046***	excluded	excluded	insignificant	insignificant	-0.0519735***

Appendix IV.b.

Table IV.b. Estimated coefficients of country dummies for emerging countries, years 2003—2010

	ROA	ROE	NPL/GL	LLR/NPL	GLEQ	Cost income	NIM
Argentina	-0.0232605*** (0.0089683)	-0.1951525*** (0.0522721)	insignificant	1.209715*** (0.2462849)	insignificant	insignificant	-0.0529807*** (0.0178186)
Brazil	-0.0151479*** (0.0038739)	insignificant	-0.0241778*** (0.0072542)	1.030686*** (0.2495805)	-1.409409*** (0.4951675)	-0.6249776*** (0.1056453)	insignificant
Bulgaria	-0.013207*** (0.0030477)	-0.1121878*** (0.0359717)	insignificant	0.8994551*** (0.2210047)	-0.9387206*** (0.3159737)	insignificant	-0.0311642*** (0.0069264)
Chile	-0.0168035*** (0.0029847)	insignificant	excluded	excluded	1.181509*** (0.4354396)	-0.2308974*** (0.0838596)	insignificant
China	-0.0171629*** (0.0029498)	-0.188104*** (0.0554924)	insignificant	0.73765*** (0.2159329)	0.9782058* (0.5365368)	0.2863695*** (0.0529303)	-0.0160771*** (0.0039663)
Croatia	-0.0153541*** (0.0024497)	-0.1075606*** (0.0229297)	0.0705845*** (0.0092848)	-0.4618061*** (0.1399326)	-1.132064*** (0.4185146)	-0.4067227*** (0.1472058)	-0.0434678*** (0.0057983)
India	-0.0239083*** (0.0043008)	-0.1778916*** (0.0586873)	insignificant	insignificant	insignificant	-0.1996486*** (0.0588013)	-0.0114904*** (0.0056707)
Indonesia	insignificant	insignificant	-0.0437722* (0.025032)	2.107211*** (0.4794485)	insignificant	insignificant	insignificant
Jordan	-0.021038*** (0.0036489)	-0.1259836*** (0.0370273)	0.0490416*** (0.011241)	insignificant	-1.341232*** (0.3235636)	0.2213064*** (0.0468403)	-0.0547834*** (0.0081255)
Kazakhstan	insignificant	insignificant	insignificant	insignificant	insignificant	0.2355987*** (0.0548257)	-0.0417513*** (0.0104915)
Kuwait	-0.0120731*** (0.0033373)	-0.0632175** (0.0248812)	-0.0285697** (0.0142795)	1.637757** (0.6459459)	insignificant	0.2786033*** (0.0314128)	-0.0463356*** (0.006446)
Latvia	-0.023098*** (0.0047679)	-0.2853936*** (0.09503)	excluded	excluded	insignificant	insignificant	-0.0345632*** (0.0052786)
Lebanon	-0.0261527*** (0.0093412)	-0.2698992*** (0.0799178)	-0.0184623*** (0.0068454)	1.771547*** (0.6022915)	-0.5732156** (0.2250465)	insignificant	-0.0326024*** (0.0056227)
Lithuania	-0.0271058*** (0.0038881)	-0.2680226*** (0.0514293)	excluded	excluded	insignificant	insignificant	-0.0331934*** (0.0046647)
Malaysia	-0.0233976*** (0.0038647)	-0.1182007*** (0.0239783)	0.0322758*** (0.0074852)	-0.4789092** (0.2264065)	insignificant	0.1478872** (0.0707664)	-0.0234622*** (0.0037209)
Mauritius	-0.0046703* (0.0028219)	insignificant	0.0195509*** (0.0062597)	insignificant	-1.3121*** (0.3844459)	0.1896014** (0.0791683)	-0.0234919*** (0.0046476)
Mexico	-0.0193362*** (0.0039451)	-0.063156* (0.0381407)	-0.0192535*** (0.0068831)	0.4595601* (0.2452243)	insignificant	-0.5883799*** (0.1905431)	insignificant
Oman	-0.0054441* (0.0031367)	insignificant	excluded	excluded	insignificant	-0.4179819*** (0.0450815)	-0.0403295*** (0.007385)
Pakistan	-0.016411*** (0.0055268)	insignificant	insignificant	insignificant	insignificant	0.2589128*** (0.0616381)	insignificant
Philippine	insignificant	insignificant	insignificant	insignificant	-3.221608**	-0.1372299*	-0.0858632***

Russia	-0.0116207** (0.0055378)	insignificant	-0.0341832*** (0.0043261)	2.982784*** (0.2596591)	(1.357828)	insignificant	(0.0819128)	(0.0122688)
Saudi Arabia	insignificant	insignificant	-0.0145534*** (0.0051531)	3.057167*** (0.9090219)	-0.9479793*** (0.1655104)	insignificant	insignificant	-0.0349462*** (0.012241)
South Africa	-0.0123963** (0.0049147)	insignificant	0.034089*** (0.0061525)	-0.6115864*** (0.1848547)	2.989516*** (0.4492365)	insignificant	insignificant	-0.0334592*** (0.0046181)
Thailand	-0.0073557*** (0.0024625)	insignificant	0.0511908*** (0.0083333)	-0.7223734*** (0.2125076)	insignificant	insignificant	insignificant	insignificant
Turkey	-0.0085662** (0.0040272)	insignificant	insignificant	0.3214152* (0.1796148)	-0.9867153*** (0.1865428)	insignificant	-0.1745671*** (0.0470341)	-0.0175907*** (0.0064059)
Vietnam	-0.0206715*** (0.0047932)	-0.1859881** (0.0878561)	insignificant	0.5705372*** (0.2033696)	insignificant	insignificant	insignificant	-0.0209122*** (0.0059893)
R-squared	0.3625	0.3542	0.7241	0.5202	0.4019	0.2265	0.7042	-0.0214236*** (0.005889)
F statistic	10.60***	5.64***	27.52***	18.34***	147.45***	25.37***	8.27***	
Number of obs	592	592	320	320	592	592	592	

* ** and *** indicate statistical significance respectively at the 10%, 5% and 1% levels.
() indicate standard deviation of the estimators.

Appendix IV.c.

Table IV.c. Estimated coefficients of country dummies for recently developed countries, years 2003--2010

	ROA	ROE	NPL/GL	LLR/NPL	GLEQ	Cost income	NIM
Bahrain	insignificant	insignificant	insignificant	insignificant	insignificant	insignificant	0.0056391*** (0.0025226)
Cyprus	insignificant	insignificant	0.0672874*** (0.0120037)	-0.8603662*** (0.0966639)	insignificant	-0.1206933*** (0.0313891)	0.0138728*** (0.0016097)
Czech Republic	0.0068324*** (0.0012812)	0.095742*** (0.0188903)	insignificant	insignificant	insignificant	insignificant	0.0175277*** (0.0017003)
Estonia	0.0073077** (0.0032965)	0.056437* (0.0294551)	0.0335009** (0.0152827)	-0.410219*** (0.1543862)	-0.5974293* (0.3175134)	-0.2052837*** (0.0873908)	0.0096566*** (0.0022216)
Hong Kong	0.0049074*** (0.0014518)	0.0679418*** (0.0190268)	excluded	excluded	insignificant	insignificant	0.0085225*** (0.0014358)
Hungary	0.011689*** (0.0018958)	0.0922227*** (0.0179005)	excluded	excluded	-0.8151779*** (0.2485406)	-0.1572365** (0.07263)	0.0210055*** (0.0022728)
Israel	0.008288*** (0.003099)	insignificant	0.1520078*** (0.0181561)	-1.4742*** (0.1158355)	1.989391*** (0.398581)	-1.213031*** (0.0598734)	insignificant
Poland	0.0061909*** (0.0021578)	insignificant	0.0661705*** (0.0096002)	-0.5473884*** (0.1207816)	insignificant	-0.1589447*** (0.0508593)	0.0197438*** (0.0017134)
Qatar	0.050668*** (0.0043773)	0.0711982*** (0.015137)	insignificant	-0.7859128*** (0.1358008)	-1.252154*** (0.427302)	0.1758114*** (0.0238952)	0.0132583*** (0.0018301)
Singapore	insignificant	insignificant	0.0329484** (0.0137001)	-0.5637404*** (0.1906585)	insignificant	insignificant	insignificant
Slovakia	0.0059074*** (0.0019071)	insignificant	excluded	excluded	insignificant	-0.2259467*** (0.0684219)	0.020198*** (0.0018544)
Slovenia	0.0067556*** (0.0018704)	insignificant	insignificant	insignificant	-1.289025*** (0.44779)	insignificant	0.0122848*** (0.0019698)
South Korea	insignificant	insignificant	0.0522858*** (0.0109388)	insignificant	2.925842*** (0.5308483)	-0.4009365*** (0.08)	0.0122162*** (0.0015228)
Taiwan	insignificant	insignificant	0.021286*** (0.0076627)	-0.8339097*** (0.0980398)	3.529491*** (0.5007153)	-0.0998717*** (0.0366493)	0.0054627*** (0.0016982)
United Arab Emirates	0.0241389*** (0.0058718)	0.104549*** (0.0234732)	excluded	excluded	-0.6675956** (0.3053736)	0.1649764*** (0.0242653)	0.0128584*** (0.0016619)
R-squared	0.4920	0.1229	0.7534	0.3845	0.7228	0.5477	0.4207
F statistic	30.28***	8.51***	24.66***	30.75***	102.30***	83.46***	20.13***
Number of obs	504	504	224	224	504	504	504

Appendix V. Ramsey-Reset Tests

Appendix V.a.

xtreg rrisk fwd swp opt fut cap liq loan cr nim size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0338

 between = 0.0738

 overall = 0.0428

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 364

Number of groups = 52

Obs per group: min = 7

 avg = 7.0

 max = 7

Wald chi2(10) = 13.72

Prob > chi2 = 0.1863

rrisk	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0006444	0.0011207	-0.57	0.565	-0.002841	0.0015522
swp	-0.0000101	0.000796	-0.13	0.899	-0.0001661	0.000146
opt	0.0039291	0.0042987	0.91	0.361	-0.0044963	0.0123545
fut	-0.0066569	0.0071132	-0.94	0.349	-0.0205986	0.0072848
cap	-0.0190414	0.0260149	-0.73	0.464	-0.0700297	0.0319469
liq	-0.0163322	0.0088679	-1.84	0.066	-0.0337129	0.0010485
loan	0.0214452	0.0075701	2.83	0.005	0.0066082	0.0362823
cr	0.0030761	0.0084964	0.36	0.717	-0.0135765	0.0197287
nim	0.0423813	0.0266367	1.59	0.112	-0.0098257	0.0945883
size	-0.0001499	0.0008782	-0.17	0.864	-0.0018711	0.0015714
constant	0.0134222	0.0105099	1.28	0.202	-0.0071769	0.0340213
sigma u	0.00643253	(fraction of variance due to u _i)				
sigma e	0.01397623					
rho	0.17480063					

predict rrisk_hat, xb

generate rrisk_hat2= rrisk_hat^2

generate rrisk_hat3= rrisk_hat^3

generate rrisk_hat4= rrisk_hat^4

xtreg rrisk fwd swp opt fut cap liq loan cr nim size rrisk_hat2 rrisk_hat3 rrisk_hat4, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0938

 between = 0.2275

 overall = 0.1291

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 364

Number of groups = 52

Obs per group: min = 7

 avg = 7.0

 max = 7

Wald chi2(10) = 43.76

Prob > chi2 = 0.0000

rrisk	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.03357	0.0447027	0.75	0.453	-0.0540458	0.1211857
swp	0.0005127	0.0007061	0.73	0.468	-0.0008712	0.0018965
opt	-0.2031002	0.2723619	-0.75	0.456	-0.7369198	0.3307194
fut	0.3485531	0.4601322	0.76	0.449	-0.5532895	1.250396
cap	1.010423	1.322856	0.76	0.445	-1.582327	3.603173
liq	0.8532553	1.130596	0.75	0.450	-1.362673	3.069184
loan	-1.108522	1.489587	-0.74	0.457	-4.028058	1.811014
cr	-.1587477	0.2140251	-0.74	0.458	-.5782292	0.2607337
nim	-2.24015	2.941831	-0.76	0.446	-8.006032	3.525733
size	0.0077293	0.0104074	0.74	0.458	-0.0126689	0.0281275
rrisk_hat2	4830.743	4677.327	1.03	0.302	-4336.65	13998.14
rrisk_hat3	-182786.4	137842	-1.33	0.185	-452951.8	87378.91
rrisk_hat4	2450930	1499705	1.63	0.102	-488437.2	5390297
constant	-0.5018921	0.5529935	-0.91	0.364	-1.585739	0.5819552
sigma u	0.00608009					

sigma_e	0.0136326	
rho	0.16591094	(fraction of variance due to u_i)

test rrisk_hat2 rrisk_hat3 rrisk_hat4

(1) rrisk_hat2 = 0

(2) rrisk_hat3 = 0

(3) rrisk_hat4 = 0

chi2(3) = 28.97

Prob > chi2 = 0.0000

xtreg beta fwd swp opt fut cap liq loan cr nim size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0026

between = 0.0525

overall = 0.0181

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 364

Number of groups = 52

Obs per group: min = 7

avg = 7.0

max = 7

Wald chi2(11) = 2.84

Prob > chi2 = 0.9849

beta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.4911395	0.8071839	-0.61	0.543	-2.073191	1.090912
swp	-0.0116554	0.0529162	-0.22	0.826	-0.1153693	0.0920584
opt	-1.522017	2.991909	-0.51	0.611	-7.386051	4.342018
fut	-0.4923387	4.949726	-0.10	0.921	-10.19362	9.208946
cap	-10.25938	17.84926	-0.57	0.565	-45.2433	24.72453
liq	-4.727091	6.061933	-0.78	0.436	-16.60826	7.15408
loan	-2.586337	5.360617	-0.48	0.629	-13.09295	7.92028
cr	-2.247955	5.713732	-0.39	0.694	-13.44666	8.950754
nim	5.489688	18.42996	0.30	0.766	-30.63237	41.61175
size	-0.5181086	0.6520933	-0.79	0.427	-1.796188	0.7599708
constant	12.6641	7.554133	1.68	0.094	2.141727	27.46993
sigma u	5.4621631	(fraction of variance due to u _i)				
sigma e	9.3369255					
rho	0.25497272					

predict beta_hat, xb

generate beta_hat2= beta_hat^2

generate beta_hat3= beta_hat^3

generate beta_hat4=beta_hat^4

xtreg beta fwd swp opt fut cap liq loan cr nim size beta_hat2 beta_hat3 beta_hat4, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0092

between = 0.0776

overall = 0.0327

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 364

Number of groups = 52

Obs per group: min = 7

avg = 7.0

max = 7

Wald chi2(10) = 6.43

Prob > chi2 = 0.9290

beta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0536383	1.539943	0.03	0.972	-2.964594	3.071871
swp	0.0108769	0.0650558	0.17	0.867	-0.1166301	0.138384
opt	0.3793321	5.161776	0.07	0.941	-9.737562	10.49623
fut	1.435272	5.194221	0.28	0.782	-8.745214	11.61576
cap	18.69553	36.19243	0.52	0.605	-52.24033	89.63139
liq	0.9413291	14.04165	0.07	0.947	-26.57979	28.46245
loan	2.970412	9.004125	0.33	0.741	-14.67735	20.61817
cr	0.0382644	8.64853	0.00	0.996	-16.91254	16.98907
nim	-8.40412	24.45057	-0.34	0.731	-56.32637	39.51813
size	0.893567	1.733488	0.52	0.606	-2.504008	4.291142
beta_hat2	-2.250282	2.218034	-1.01	0.310	6.597549	2.096985
beta_hat3	0.7284982	0.5572768	1.31	0.191	-0.3637443	1.82074
beta_hat4	-0.056613	0.0418202	-1.35	0.176	-0.1385791	0.0253531
constant	-5.892113	36.98187	-0.16	0.873	-78.37524	66.59101
sigma u	5.5115177	(fraction of variance due to u _i)				
sigma e	9.3510845					
rho	0.25782489					

test beta_hat2 beta_hat3 beta_hat4

```
(1) beta_hat2 = 0
(2) beta_hat3 = 0
(3) beta_hat4 = 0
      chi2(3) = 3.60
      Prob > chi2 = 0.3074
```

xtreg sderror fwd swp opt fut cap liq loan cr nim size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0199

 between = 0.0131

 overall = 0.0142

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 364

Number of groups = 52

Obs per group: min = 7

 avg = 7.0

 max = 7

Wald chi2(11) = 5.75

Prob > chi2 = 0.8356

sderror	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.1655996	0.7599838	-0.22	0.828	-1.65514	1.323941
swp	-0.0023634	0.0541326	-0.04	0.965	-0.1084614	0.1037346
opt	1.034661	2.918062	0.35	0.723	-4.684636	6.753958
fut	-2.353079	4.828575	-0.49	0.626	-11.81691	7.110753
cap	-9.467693	17.6678	-0.54	0.592	-44.09594	25.16055
liq	-3.965076	6.023115	-0.66	0.510	-15.77017	7.84001
loan	-10.25297	5.13613	-2.00	0.046	-20.3196	-0.1863434
cr	-1.983725	5.773876	-0.34	0.731	13.30031	9.332864
nim	-0.7886463	18.08525	-0.04	0.965	36.23508	34.65779
size	-0.3811875	0.5950369	-0.64	0.522	-1.547438	0.7850633
constant	13.93284	7.128078	1.95	0.051	-0.0379362	27.90362
sigma u	4.402101	(fraction of variance due to u _i)				
sigma e	9.6404603					
rho	0.17253398					

predict sderror_hat, xb

generate sderror_hat2= sderror_hat^2

generate sderror_hat3= sderror_hat^3

generate sderror_hat4= sderror_hat^4

xtreg sderror fwd swp opt fut cap liq loan cr nim size sderror_hat2 sderror_hat3 sderror_hat4, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0405

 between = 0.0077

 overall = 0.0209

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 364

Number of groups = 52

Obs per group: min = 7

 avg = 7.0

 max = 7

Wald chi2(10) = 10.30

Prob > chi2 = 0.6689

sderror	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.1534514	0.7917754	0.19	0.846	-1.3984	1.705303
swp	-0.0035569	0.0540685	-0.07	0.948	-0.1095293	0.1024155
opt	-1.769193	3.377134	-0.52	0.600	-8.388254	4.849869
fut	3.035055	5.75061	0.53	0.598	-8.235935	14.30604
cap	13.04109	23.42757	0.56	0.578	-32.87609	58.95827
liq	-2.838149	9.100008	-0.31	0.755	-20.67384	14.99754
loan	16.23481	17.29411	0.94	0.348	-17.66101	50.13064
cr	2.000556	6.279073	0.32	0.750	-10.3062	14.30731
nim	3.479269	18.37843	0.19	0.850	-32.54179	39.50033
size	0.555352	0.8816096	0.63	0.529	-1.172571	2.283275
sderror_hat2	0.6860212	0.4176836	1.64	0.100	-0.1326235	1.504666
sderror_hat3	0.0609724	0.1525522	0.40	0.689	-0.2380244	0.3599692
sderror_hat4	-0.0194303	0.0180476	-1.08	0.282	-0.0054803	0.0159423
constant	-19.26995	21.96828	-0.88	0.380	-62.32699	23.78708
sigma u	4.5972421	(fraction of variance due to u _i)				
sigma e	9.581471					
rho	0.18713282					

test sderror_hat2 sderror_hat3 sderror_hat4

(1) sderror_hat2 = 0
(2) sderror_hat3 = 0
(3) sderror_hat4 = 0
chi2(3) = 4.48
Prob > chi2 = 0.2142

Appendix V.b.

xtreg glta fwd swp opt fut nim size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.1313

 between = 0.0030

 overall = 0.0100

Random effects $u_i \sim$ Gaussian

corr(u_i , Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 106.83

Prob > chi2 = 0.0000

glta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0190659	0.0064842	-2.94	0.003	-0.0317747	-0.0063571
swp	0.005168	0.004485	1.15	0.249	-0.0036224	0.0139584
opt	-0.0103942	0.0182663	-0.57	0.569	-0.0461954	0.0254071
fut	-0.0017349	0.0057113	-0.30	0.761	-0.0129289	0.0094592
nim	-0.2282109	0.1083449	-2.11	0.035	-0.440563	-0.0158588
size	0.0426956	0.0047916	8.91	0.000	0.0333043	0.0520869
constant	0.1739838	0.0460699	3.78	0.000	0.0836885	0.2642792
sigma_u	0.13895608	(fraction of variance due to u_i)				
sigma_e	0.08143677					
Rho	0.74434242					

predict glta_hat, xb

generate glta_hat2= glta_hat^2

generate glta_hat3= glta_hat^3

generate glta_hat4= glta_hat^4

xtreg glta fwd swp opt fut nim size glta_hat2 glta_hat3 glta_hat4, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.1428

 between = 0.0052

 overall = 0.0154

Random effects $u_i \sim$ Gaussian

corr(u_i , Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 128.61

Prob > chi2 = 0.0000

glta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0828994	0.1462105	-0.57	0.571	-0.3694667	0.203668
swp	0.0231605	0.0398943	0.58	0.562	-0.0550308	0.1013518
opt	-0.0437124	0.0819726	-0.53	0.594	-0.2043757	0.1169509
fut	-0.0092768	0.0142049	-0.65	0.514	-0.0371178	0.0185643
nim	-0.474224	1.695718	-0.28	0.780	-3.797771	2.849323
size	0.1826538	0.3287228	0.56	0.578	-.4616311	0.8269387
glta_hat2	-2.494899	26.66757	-0.09	0.925	-54.76238	49.77258
glta_hat3	-1.10853	39.85939	-0.03	0.978	-79.23149	77.01443
glta_hat4	0.5320953	21.63131	0.02	0.980	-41.86449	42.92868
constant	-0.1659851	0.5861663	-0.28	0.777	-1.31485	0.9828798
sigma_u	0.13996243	(fraction of variance due to u_i)				
sigma_e	0.08093667					
Rho	0.74939983					

test glta_hat2 glta_hat3 glta_hat4

(1) glta_hat2 = 0

(2) glta_hat3 = 0

(3) glta_hat4 = 0

 chi2(3) = 19.19

 Prob > chi2 = 0.0002

xtreg eqta fwd swp opt fut nim size, re
 Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.2383
 between = 0.4541
 overall = 0.3914
 Random effects u_i ~ Gaussian
 corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 Wald chi2(10) = 407.50
 Prob > chi2 = 0.0000

eqta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0004265	0.0024974	-0.17	0.864	-0.0053212	0.0044683
swp	0.0000934	0.0017138	0.05	0.957	-0.0032656	0.0034524
opt	0.0071811	0.0071187	1.01	0.313	-0.0067712	0.0211335
fut	-0.0040584	0.0022004	-1.84	0.065	-0.0083711	0.0002544
nim	0.762976	0.0410469	18.59	0.000	0.6825256	0.8434264
size	-0.0061571	0.0016744	-3.68	0.000	-0.0094388	-0.0028754
constant	0.1344944	0.0159185	8.45	0.000	0.1032947	0.1656941
sigma u	0.04031467	(fraction of variance due to u _i)				
sigma e	0.03296179					
Rho	0.59934407					

predict eqta hat, xb
 generate eqta_hat2= eqta_hat^2
 generate eqta_hat3= eqta_hat^3
 generate eqta_hat4= eqta_hat^4

xtreg eqta fwd swp opt fut nim size eqta_hat2 eqta_hat3 eqta_hat4, re

Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.2873
 between = 0.4686
 overall = 0.4144
 Random effects u_i ~ Gaussian
 corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 Wald chi2(10) = 496.51
 Prob > chi2 = 0.0000

eqta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0008855	0.0024506	0.36	0.718	-0.0039175	0.0056886
swp	-0.000276	0.0016739	-0.16	0.869	-0.0035569	0.0030049
opt	-0.018683	0.0087897	-2.13	0.034	-0.0359105	-0.0014555
fut	0.0068568	0.0031735	2.16	0.031	0.0006369	0.0130767
nim	-2.824612	0.6780638	-4.17	0.000	-4.153592	-1.495631
size	0.0169923	0.0051451	3.30	0.001	.006908	0.0270765
eq hat2	26.26662	5.45233	4.82	0.000	15.58025	36.95299
eq hat3	-56.78522	11.60587	-4.89	0.000	-79.53231	-34.03813
eq hat4	40.68184	7.958975	5.11	0.000	25.08253	56.28114
constant	-0.1883441	0.0718066	-2.62	0.009	-0.3290824	-0.0476057
sigma u	0.04014202	(fraction of variance due to u _i)				
sigma e	0.03191853					
Rho	0.612652					

test eqta_hat2 eqta_hat3 eqta_hat4
 (1) eqta_hat2 = 0
 (2) eqta_hat3 = 0
 (3) eqta_hat4 = 0
 chi2(3) = 67.89
 Prob > chi2 = 0.0000

xtreg liqta fwd swp opt fut nim size, re

Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.2383
 between = 0.4541
 overall = 0.3914
 Random effects $u_i \sim \text{Gaussian}$
 corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 Wald chi2(10) = 407.50
 Prob > chi2 = 0.0000

liqta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0029925	0.0037321	-0.80	0.423	-0.0103073	0.0043222
swp	-0.0016862	0.002555	-0.66	0.509	-0.0066939	0.0033214
opt	0.00593	0.0106785	0.56	0.579	-0.0149996	0.0268595
fut	-0.0090124	0.0032896	-2.74	0.006	-0.0154598	-0.002565
nim	0.1864097	0.0610387	3.05	0.002	0.0667759	0.3060434
size	-0.00205	0.0024367	-0.84	0.400	-0.0068257	0.0027258
constant	0.0912208	0.023124	3.94	0.000	0.0458986	0.1365431
sigma u	0.05569703	(fraction of variance due to u_i)				
sigma e	0.04932614					
Rho	0.56043932					

predict liqta hat, xb
 generate liqta_hat2= liqta_hat^2
 generate liqta_hat3= liqta_hat^3
 generate liqta_hat4= liqta_hat^4

xtreg liqta fwd swp opt fut nim size liqta_hat2 liqta_hat3 liqta_hat4, re

Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.0390
 between = 0.1702
 overall = 0.1102
 Random effects $u_i \sim \text{Gaussian}$
 corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 Wald chi2(10) = 57.73
 Prob > chi2 = 0.0000

liqta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0055908	0.005266	-1.06	0.288	-0.0159119	0.0047303
swp	-0.0022692	0.003666	-0.62	0.536	-0.0094546	0.0049161
opt	0.0133122	0.0141281	0.94	0.346	-0.0143784	0.0410029
fut	0.0010647	0.0045153	0.24	0.814	-0.0077851	0.0099145
nim	0.1080688	0.4000924	0.27	0.787	-0.6760978	0.8922355
size	-0.0020167	0.0042237	-0.48	0.633	-0.0102949	0.0062616
liqta_hat2	-52.76756	14.05764	-3.75	0.000	-80.32002	-25.2151
liqta_hat3	663.3059	124.1736	5.34	0.000	419.9301	906.6818
liqta_hat4	-1934.375	368.5178	-5.25	0.000	-2656.657	-1212.094
constant	0.1693078	0.0893557	1.89	0.058	-0.005826	0.3444417
sigma u	0.05599639	(fraction of variance due to u_i)				
sigma e	0.04876765					
Rho	0.5686732					

test liqta_hat2 liqta_hat3 liqta_hat4

(1) liqta_hat2 = 0
 (2) liqta_hat3 = 0
 (3) liqta_hat4 = 0
 chi2(3) = 36.42
 Prob > chi2 = 0.0000

xtreg llrgl fwd swp opt fut nim size, re

Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.0127
 between = 0.0929
 overall = 0.0367
 Random effects u_i ~ Gaussian
 corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 Wald chi2(10) = 25.89
 Prob > chi2 = 0.0002

llrgl	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0006262	0.0038064	0.16	0.869	-0.0068343	0.0080866
swp	-0.0028107	0.0025251	-1.11	0.266	-0.0077599	0.0021385
opt	-0.0106285	0.0115963	-0.92	0.359	-0.0333569	0.0120999
fut	0.0002494	0.0034141	0.07	0.942	-0.0064421	0.0069409
nim	0.2477194	0.0582892	4.25	0.000	0.1334748	0.3619641
size	-0.0019747	0.001886	-1.05	0.295	-0.0056712	0.0017217
constant	0.0516718	0.0177285	2.91	0.004	0.0169246	0.086419
sigma u	0.02924934					
sigma e	0.06106898					
Rho	0.18659414	(fraction of variance due to u _i)				

predict llrgl_hat, xb
 generate llrgl_hat2= llrgl_hat^2
 generate llrgl_hat3= llrgl_hat^3
 generate llrgl_hat4= llrgl_hat^4

xtreg llrgl fwd swp opt fut nim size llrgl_hat2 llrgl_hat3 llrgl_hat4, re

Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.0134
 between = 0.0907
 overall = 0.0365
 Random effects u_i ~ Gaussian
 corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 Wald chi2(10) = 25.95
 Prob > chi2 = 0.0021

llrgl	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0003012	0.0039236	0.08	0.939	-0.0073889	0.0079913
swp	-0.0011833	0.0047867	-0.25	0.805	-0.0105651	0.0081985
opt	-0.0032223	0.0207705	-0.16	0.877	-0.0439318	0.0374871
fut	-0.0000892	0.0035282	-0.03	0.980	-0.0070043	0.0068259
nim	0.0354116	0.5868348	0.06	0.952	-1.114763	1.185587
Size	-0.0001709	0.0047594	-0.04	0.971	-0.0094992	0.0091575
llrgl_hat2	18.10225	40.18295	0.45	0.652	-60.65488	96.85939
llrgl_hat3	-133.1038	265.4719	-0.50	0.616	-653.4192	387.2116
llrgl_hat4	304.8077	582.4161	0.52	0.601	-836.707	1446.322
constant	0.0196216	0.0765864	0.26	0.798	-0.130485	0.1697283
sigma u	0.02958137					
sigma e	0.06104936					
Rho	0.19014379	(fraction of variance due to u _i)				

test llrgl_hat2 llrgl_hat3 llrgl_hat4

(1) llrgl_hat2 = 0
 (2) llrgl_hat3 = 0
 (3) llrgl_hat4 = 0
 chi2(3) = 0.28
 Prob > chi2 = 0.9635

xtreg sdroa fwd swp opt fut nim size, re

Random-effects GLS regression	Number of obs = 1096
Group variable: ident	Number of groups = 137
R-sq: within = 0.0014	Obs per group: min = 8
between = 0.0172	avg = 8.0
overall = 0.0090	max = 8
Random effects u _i ~ Gaussian	Wald chi2(10) = 3.14
corr(u _i , Xb) = 0 (assumed)	Prob > chi2 = 0.7910

sdroa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0002311	0.000631	0.37	0.714	-0.0010055	0.0014678
swp	-0.0003448	0.0004291	-0.80	0.422	-0.0011859	0.0004963
opt	-0.0002101	0.001825	-0.12	0.908	-0.003787	0.0033669
fut	0.0001783	0.0005571	0.32	0.749	-0.0009135	0.0012701
nim	0.0158052	0.0101818	1.55	0.121	-0.0041508	0.0357612
size	0.0000777	0.0003853	0.20	0.840	-0.0006774	0.0008328
constant	0.0043367	0.0036438	1.19	0.234	-0.002805	0.0114784
sigma u	0.00809135	(fraction of variance due to u _i)				
sigma e	0.00869488					
Rho	0.4640928					

predict sdroa_hat, xb
generate sdroa_hat2= sdroa_hat^2
generate sdroa_hat3= sdroa_hat^3
generate sdroa_hat4= sdroa_hat^4

xtreg sdroa fwd swp opt fut nim size sdroa_hat2 sdroa_hat3 sdroa_hat4, re	Number of obs = 1096
Random-effects GLS regression	Number of groups = 137
Group variable: ident	Obs per group: min = 8
R-sq: within = 0.0660	avg = 8.0
between = 0.0014	max = 8
overall = 0.0323	Wald chi2(10) = 8.30
Random effects u _i ~ Gaussian	Prob > chi2 = 0.5039
corr(u _i , Xb) = 0 (assumed)	

sdroa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0009743	0.0015031	-0.65	0.517	-0.0039203	0.0019717
swp	0.0013796	0.0019021	0.73	0.468	-0.0023484	0.0051076
opt	0.0009979	0.0022327	0.45	0.655	-0.0033781	0.0053738
fut	-0.0007934	0.001301	-0.61	0.542	-0.0033433	0.0017565
nim	-0.0285623	0.1063484	-0.27	0.788	-0.2370013	0.1798767
size	-0.0003392	0.0006068	-0.56	0.576	-0.0015285	0.0008501
liqta_hat2	1372.959	1276.094	1.08	0.282	-1128.14	3874.057
liqta_hat3	-124900.9	116335.8	-1.07	0.283	-352914.8	103113.1
liqta_hat4	3230467	3616417	0.89	0.372	-3857580	1.03e+07
constant	-.014129	.0168973	-0.84	0.403	-0.0472471	0.018989
sigma u	0.00750155	(fraction of variance due to u _i)				
sigma e	0.00870458					
Rho	0.42617364					

test sdroa_hat2 sdroa_hat3 sdroa_hat4
(1) sdroa_hat2 = 0
(2) sdroa_hat3 = 0
(3) sdroa_hat4 = 0
 chi2(3) = 4.93
 Prob > chi2 = 0.1768

Appendix V.c.

xtreg sr fwd swp opt fut cap liq loan cr nim nonim size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0775

between = 0.0195

overall = 0.0401

Random effects $u_i \sim$ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 518

Number of groups = 74

Obs per group: min = 7

avg = 7.0

max = 7

Wald chi2(10) = 21.69

Prob > chi2 = 0.0269

sr	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0000737	0.0001436	-0.51	0.607	-0.0003551	0.0002076
swp	-0.0000328	0.0000947	-0.35	0.729	-0.0002184	0.0001527
opt	-0.0001705	0.000517	-0.33	0.741	-0.0011838	0.0008427
fut	0.0006778	0.0010976	0.62	0.537	-0.0014734	0.002829
cap	-0.0082174	0.0031481	-2.61	0.009	-0.0143875	-0.0020472
liq	-0.0022986	0.0014697	-1.56	0.118	-0.0051791	0.0005819
loan	-0.0019263	0.0008757	-2.20	0.028	-0.0036425	-0.00021
cr	-0.0008533	0.0013176	-0.65	0.517	-0.0034358	0.0017291
nim	0.0105474	0.0035746	2.95	0.003	0.0035413	0.0175536
nonim	0.0064649	0.004671	1.38	0.166	-0.0026901	0.01562
size	-0.0002501	0.0000972	-2.57	0.010	-0.0004407	-0.0000595
constant	0.0046287	0.001205	3.84	0.000	0.0022669	0.0069905
sigma u	0.00025769	(fraction of variance due to u_i)				
sigma e	0.00248754					
Rho	0.01061745					

predict sr_hat, xb

generate sr_hat2= sr_hat^2

generate sr_hat3= sr_hat^3

generate sr_hat4= sr_hat^4

xtreg sr fwd swp opt fut cap liq loan cr nim nonim size sr_hat2 sr_hat3 sr_hat4, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0810

between = 0.0256

overall = 0.0444

Random effects $u_i \sim$ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 364

Number of groups = 74

Obs per group: min = 7

avg = 7.0

max = 7

Wald chi2(10) = 24.13

Prob > chi2 = 0.0299

sr	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0000566	0.000145	-0.39	0.696	-0.0003409	0.0002276
swp	-0.0000217	0.000097	-0.22	0.823	-0.0002118	0.0001684
opt	-0.0001808	0.0005188	-0.35	0.728	-0.0011976	0.0008361
fut	0.0003576	0.0011318	0.32	0.752	-0.0018607	0.0025758
cap	-0.0052777	0.0046494	-1.14	0.256	-0.0143903	0.0038349
liq	-0.0025886	0.0015004	-1.73	0.084	-0.0055294	0.0003521
loan	-0.0013461	0.0011156	-1.21	0.228	-0.0035326	0.0008404
cr	-0.0008213	0.0013262	-0.62	0.536	-0.0034206	0.001778
nim	0.0082997	0.0065994	1.26	0.209	-0.004635	0.0212343
nonim	0.0032874	0.005654	0.58	0.561	-0.0077943	0.0143691
size	-0.0001578	0.0001312	-1.20	0.229	-0.0004151	0.0000994
sr_hat2	575.9407	411.5701	1.40	0.162	-230.7218	1382.603
sr_hat3	-168764.7	114893.6	-1.47	0.142	-393952	56422.56
sr_hat4	Dropped because of collinearity					
constant	0.0030756	0.0019452	1.58	0.114	-0.0007368	0.0068881
sigma u	0.00029035	(fraction of variance due to u_i)				
sigma e	0.00248862					
rho	0.0134296					

test sr_hat2 sr_hat3

(1) sr_hat2 = 0

(2) sr_hat3 = 0

chi2(2) = 2.28
Prob > chi2 = 0.3200

Appendix V.d.

xtreg eff fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0269

 between = 0.0361

 overall = 0.0319

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 31.08

Prob > chi2 = 0.0003

eff	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0273294	0.0209917	-1.30	0.193	-0.0684725	0.0138136
swp	0.001432	0.0144689	0.10	0.921	-0.0269266	0.0297905
opt	-0.0512779	0.0240085	-2.14	0.033	-0.0983337	-0.004222
fut	-0.0036215	0.0169867	-0.21	0.831	-0.0369149	0.0296719
cap	0.2466432	0.2613055	0.94	0.345	-0.2655062	0.7587927
liq	-0.0248705	0.1786011	-0.14	0.889	-0.3749222	0.3251812
loan	-0.3891019	0.0997686	-3.90	0.000	-0.5846447	-0.1935591
cr	-0.4651	0.1549141	-3.00	0.003	-0.7687259	-0.161474
size	0.0343819	0.0144019	2.39	0.017	0.0061546	0.0626092
constant	-0.7396981	0.14413	-5.13	0.000	-1.022188	-0.4572086
sigma u	0.30905173	(fraction of variance due to u _i)				
sigma e	0.29758866					
Rho	0.51888924					

predict eff_hat, xb

generate eff_hat2= eff_hat^2

generate eff_hat3= eff_hat^3

generate eff_hat4= eff_hat^4

xtreg eff fwd swp opt fut nim size eff_hat2 eff_hat3 eff_hat4, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0459

 between = 0.0529

 overall = 0.0495

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 52.89

Prob > chi2 = 0.0000

eff	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.8954567	0.5365514	1.67	0.095	-0.1561648	1.947078
swp	-0.0462395	0.0305338	-1.51	0.130	-0.1060847	0.0136057
opt	1.635927	1.004567	1.63	0.103	-0.3329878	3.604841
fut	0.1307242	.0756798	1.73	0.084	-0.0176056	0.2790539
cap	-7.977567	4.895387	-1.63	0.103	-17.57235	1.617216
liq	0.7933261	0.5201829	1.53	0.127	-.2262137	1.812866
loan	12.68743	7.690288	1.65	0.099	-2.385259	27.76012
cr	14.5115	9.257188	1.57	0.117	-3.632251	32.65526
size	-1.123594	0.6799215	-1.65	0.098	-2.456216	.2090279
eff_hat2	-56.84485	39.50735	-1.44	0.150	-134.2778	20.58813
eff_hat3	-39.04443	33.92568	-1.15	0.250	-105.5376	27.44868
eff_hat4	-8.790334	10.47025	-0.84	0.401	-29.31166	11.73099
constant	17.20144	11.04128	1.56	0.119	-4.439084	38.84195
sigma u	0.30318932	(fraction of variance due to u _i)				
sigma e	0.29513167					
Rho	0.51346466					

test eff_hat2 eff_hat3 eff_hat4

(1) eff_hat2 = 0

(2) eff_hat3 = 0

(3) $\text{eff_hat4} = 0$
 $\text{chi2}(3) = 21.27$
 $\text{Prob} > \text{chi2} = 0.0001$

xtreg cad fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.1479

 between = 0.6476

 overall = 0.4363

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 403.97

Prob > chi2 = 0.0000

cad	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0594289	0.1822191	0.33	0.744	-0.2977141	0.4165718
swp	-0.1234026	0.1236498	-1.00	0.318	-0.3657517	0.1189466
opt	0.0709957	0.2236084	0.32	0.751	-0.3672688	0.5092601
fut	0.0308411	0.147534	0.21	0.834	-0.2583202	0.3200024
cap	-27.00417	2.216785	-12.18	0.000	-31.34899	-22.65935
liq	-2.67334	1.576606	-1.70	0.090	-5.763431	0.4167511
loan	11.27457	0.8328075	13.54	0.000	9.6423	12.90685
cr	2.444406	1.458129	1.68	0.094	-0.4134744	5.302287
size	-0.1011348	.1053276	-0.96	0.337	-0.3075731	0.1053034
constant	4.379263	1.117436	3.92	0.000	2.189129	6.569397
sigma u	1.7960301					
sigma e	2.8682063					
Rho	0.28166527	(fraction of variance due to u _i)				

predict cad_hat, xb

generate cad_hat2 = cad_hat^2

generate cad_hat3 = cad_hat^3

generate cad_hat4 = cad_hat^4

xtreg cad fwd swp opt fut nim size cad_hat2 cad_hat3 cad_hat4, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.3182

 between = 0.8286

 overall = 0.6142

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 1083.55

Prob > chi2 = 0.0000

cad	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.2428732	0.1493561	-1.63	0.104	-0.5356057	0.0498594
swp	0.1676748	0.1010205	1.66	0.097	-0.0303218	0.3656713
opt	0.2099263	0.1932111	1.09	0.277	-0.1687605	0.5886132
fut	-0.1040386	0.1203166	-0.86	0.387	-0.3398548	0.1317775
cap	-15.24792	2.637403	-5.78	0.000	-20.41713	-10.0787
liq	3.132148	1.341172	2.34	0.020	0.5035001	5.760797
loan	-8.464647	1.408541	-6.01	0.000	-11.22534	-5.703956
cr	-3.190427	1.306176	-2.44	0.015	-5.750486	-0.6303686
size	0.1406835	0.0788056	1.79	0.074	-0.0137726	0.2951396
cad_hat2	0.1259294	0.0111068	11.34	0.000	0.1041604	0.1476984
cad_hat3	0.002809	0.0004566	6.15	0.000	0.0019141	0.0037039
cad_hat4	-0.0001795	0.000048	-3.74	0.000	-0.0002735	-0.0000854
constant	4.274159	0.8864212	4.82	0.000	2.536805	6.011512
sigma u	1.1069151					
sigma e	2.5642473					
Rho	0.15707216	(fraction of variance due to u _i)				

test cad_hat2 cad_hat3 cad_hat4

(1) cad_hat2 = 0

(2) cad_hat3 = 0

(3) cad_hat4 = 0

 chi2(3) = 380.26

 Prob > chi2 = 0.0001

xtreg nim fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.3431

 between = 0.3937

 overall = 0.3811

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 585.02

Prob > chi2 = 0.0000

nim	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0008489	0.0014388	-0.59	0.555	-0.003669	0.0019711
swp	0.0010147	0.0009995	1.02	0.310	-0.0009443	0.0029737
opt	-0.002262	0.0015932	-1.42	0.156	-0.0053845	0.0008606
fut	0.000861	0.0011656	0.74	0.460	-0.0014235	0.0031455
cap	0.3994678	0.0181613	22.00	0.000	0.3638724	0.4350633
liq	0.037663	0.0121618	3.10	0.002	0.0138262	0.0614998
loan	-0.0153398	0.007022-	2.18	0.029	-0.0291027	-0.0015769
cr	0.0256189	0.0102336	2.50	0.012	0.0055615	0.0456763
size	-0.0027882	0.0011116	-2.51	0.012	-0.0049669	-0.0006094
constant	0.0196593	0.0108229	1.82	0.069	-0.0015531	0.0408718
sigma u	0.02887826	(fraction of variance due to u _i)				
sigma e	0.01935357					
Rho	0.69006519					

predict nim_hat, xb

generate nim_hat2= nim_hat^2

generate nim_hat3= nim_hat^3

generate nim_hat4= nim_hat^4

xtreg nim fwd swp opt fut size nim_hat2 nim_hat3 nim_hat4, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.6102

 between = 0.8110

 overall = 0.7113

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 1901.65

Prob > chi2 = 0.0000

nim	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0011561	0.00112	-1.03	0.302	-0.0033513	0.0010391
swp	0.0020465	0.0007701	2.66	0.008	0.0005372	0.0035559
opt	-0.0029379	0.0013877	-2.12	0.034	-0.0056577	-0.0002181
fut	0.0004374	0.0009169	0.48	0.633	-0.0013596	0.0022345
cap	0.3151183	0.0617552	5.10	0.000	0.1940805	0.4361562
liq	0.0763043	0.0106165	7.19	0.000	0.0554964	0.0971121
loan	-0.0012869	0.0054941	-0.23	0.815	-0.0120552	0.0094814
cr	0.0406092	0.0096862	4.19	0.000	0.0216246	0.0595937
size	-0.0028165	0.0007606	-3.70	0.000	-0.0043072	-0.0013257
nim_hat2	-17.12273	2.611085	-6.56	0.000	-22.24036	-12.0051
nim_hat3	123.5616	14.00936	8.82	0.000	96.10373	151.0194
nim_hat4	-193.3897	21.95463	-8.81	0.000	-236.42	-150.3594
constant	.0290685	0.0072025	4.04	0.000	0.0149518	0.0431851
sigma u	0.01121589	(fraction of variance due to u _i)				
sigma e	0.01486353					
Rho	0.36281704					

test nim_hat2 nim_hat3 nim_hat4

(1) nim_hat2 = 0

(2) nim_hat3 = 0

(3) nim_hat4 = 0

chi2(3) = 812.52

Prob > chi2 = 0.0001

xtreg roa fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0494

 between = 0.1862

 overall = 0.1174

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 78.28

Prob > chi2 = 0.0000

roa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.000142	0.0009348	-0.15	0.879	-0.0019742	0.0016901
swp	-0.0005362	0.0006322	-0.85	0.396	-0.0017753	0.0007028
opt	0.0010376	0.0027259	0.38	0.703	-0.004305	0.0063802
fut	-0.0001034	0.0008276	-0.12	0.901	-0.0017255	0.0015188
cap	0.0332772	0.0098235	3.39	0.001	0.0140235	0.0525308
liq	0.0113265	0.0075841	1.49	0.135	-0.0035382	0.0261911
loan	-0.0207916	0.0041648	-4.99	0.000	-0.0289545	-0.0126287
cr	-0.0485277	0.0068659	-7.07	0.000	-0.0619846	-0.0350708
size	0.0005534	0.0005576	0.99	0.321	-0.0005394	0.0016462
constant	0.0175034	0.0056691	3.09	0.002	0.0063921	0.0286146
sigma u	0.01055855	(fraction of variance due to u _i)				
sigma e	0.01293976					
Rho	0.39969454					

predict roa_hat, xb

generate roa_hat2= roa_hat^2

generate roa_hat3= roa_hat^3

generate roa_hat4= roa_hat^4

xtreg roa fwd swp opt fut nim size roa_hat2 roa_hat3 roa_hat4, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.2262

 between = 0.1584

 overall = 0.1893

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 300.44

Prob > chi2 = 0.0000

roa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0007005	0.0008677	-0.81	0.419	-0.0024012	0.0010001
swp	-0.0029478	0.0006319	-4.67	0.000	-0.0041862	-0.0017094
opt	0.0059935	0.0025572	2.34	0.019	0.0009815	0.0110056
fut	-0.0005634	0.0007666	-0.73	0.462	-0.0020658	0.0009391
cap	0.2366206	0.0199534	11.86	0.000	0.1975127	0.2757284
liq	0.0707126	0.0092228	7.67	0.000	0.0526363	0.0887889
loan	-0.1095909	0.0101868	-10.76	0.000	-0.1295566	-0.0896252
cr	-0.2991572	0.0212504	-14.08	0.000	-0.3408072	-0.2575073
size	0.002337	0.0005954	3.93	0.000	0.0011701	0.003504
roa_hat2	-154.2581	24.09487	-6.40	0.000	-201.4831	-107.033
roa_hat3	-1603.923	221.5769	-7.24	0.000	-2038.206	-1169.64
roa_hat4	50866.17	10538.64	4.83	0.000	30210.81	71521.53
constant	0.0679629	.0077902	8.72	0.000	0.0526943	0.0832314
sigma u	0.01072262	(fraction of variance due to u _i)				
sigma e	0.01166512					
Rho	0.45797573					

test roa_hat2 roa_hat3 roa_hat4

(1) roa_hat2 = 0

(2) roa_hat3 = 0

(3) roa_hat4 = 0

chi2(3) = 211.24

Prob > chi2 = 0.0001

xtreg roe fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0773

 between = 0.0998

 overall = 0.0809

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 92.60

Prob > chi2 = 0.0000

roe	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0102284	0.0114202	0.90	0.370	-0.0121549	0.0326116
swp	-0.0043304	0.0075499	-0.57	0.566	-0.0191279	0.0104671
opt	-0.0238614	0.0350653	-0.68	0.496	-0.0925882	0.0448653
fut	0.0076484	0.0102528	0.75	0.456	-0.0124467	0.0277434
cap	0.2176541	0.1197066	1.82	0.069	-0.0169665	0.4522748
liq	0.0657259	0.0946096	0.69	0.487	-0.1197055	0.2511572
loan	-0.2595629	0.0484583	-5.36	0.000	-0.3545393	-0.1645864
cr	-0.7982138	0.0937783	-8.51	0.000	-0.9820159	-0.6144118
size	0.0082148	0.0056561	1.45	0.146	-0.0028711	0.0193006
constant	0.1960896	0.0620715	3.16	0.002	0.0744316	0.3177476
sigma_u	0.08007405	(fraction of variance due to u _i)				
sigma_e	0.1864659					
Rho	0.15569785					

predict roe_hat, xb

generate roe_hat2= roe_hat^2

generate roe_hat3= roe_hat^3

generate roe_hat4= roe_hat^4

xtreg roe fwd swp opt fut nim size roe_hat2 roe_hat3 roe_hat4, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.3096

 between = 0. 0.3537

 overall = 0.3175

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 497.77

Prob > chi2 = 0.0000

roe	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0452945	0.0099845	4.54	0.000	0.0257252	0.0648639
swp	-0.0188859	0.0064824	-2.91	0.004	-0.0315911	-0.0061807
opt	-0.1077229	0.0304754	-3.53	0.000	-0.1674535	-0.0479923
fut	0.0380721	0.009105	4.18	0.000	0.0202265	0.0559176
cap	1.013838	0.121394	8.35	0.000	0.7759105	1.251766
liq	0.2807736	0.081935	3.43	0.001	0.1201839	0.4413632
loan	-1.132546	0.0798731	-14.18	0.000	-1.289095	-0.9759981
cr	-3.27506	0.189647	-17.27	0.000	-3.646762	-2.903359
size	0.0345325	0.0050952	6.78	0.000	0.0245461	0.044519
roe_hat2	-20.19476	1.416622	-14.26	0.000	-22.97129	-17.41823
roe_hat3	20.76731	4.298917	4.83	0.000	12.34159	29.19303
roe_hat4	37.98826	4.614513	8.23	0.000	28.94398	47.03254
constant	0.7229584	.0632968	11.42	0.000	0.5988989	0.8470178
sigma_u	0.06189224	(fraction of variance due to u _i)				
sigma_e	0.16099648					
Rho	0.1287591					

test roe_hat2 roe_hat3 roe_hat4

(1) roe_hat2 = 0

(2) roe_hat3 = 0

(3) roe_hat4 = 0

chi2(3) = 370.39

Prob > chi2 = 0.0001

xtreg npl fwd swp opt fut cap liq loan cr size, re
 Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.2210
 between = 0.1622
 overall = 0.1802
 Random effects u_i ~ Gaussian
 corr(u_i, Xb) = 0 (assumed)

Number of obs = 544
 Number of groups = 68
 Obs per group: min = 8
 avg = 8.0
 max = 8
 Wald chi2(10) = 144.57
 Prob > chi2 = 0.0003

npl	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0036337	0.0026824	1.35	0.176	-0.0016237	0.008891
swp	-0.0013395	0.0017237	-0.78	0.437	-0.0047178	0.0020388
opt	0.0043778	0.0097845	0.45	0.655	-0.0147995	0.0235551
fut	-0.000682	0.002238	0.30	0.761	-0.0050684	0.0037043
cap	-0.0835898	0.0540044	-1.55	0.122	-0.1894365	0.0222569
liq	-0.0038479	0.022946	-0.17	0.867	-0.0488213	0.0411254
loan	-0.0540318	0.0177319	-3.05	0.002	-0.0887856	-0.019278
cr	0.1490451	0.0184195	8.09	0.000	0.1129437	0.1851466
size	-0.0105992	0.0023787	-4.46	0.000	-0.0152613	-0.0059371
constant	0.1785238	0.0245252	7.28	0.000	0.1304553	0.2265924
sigma u	0.03757043	(fraction of variance due to u _i)				
sigma e	0.02890061					
Rho	0.62824829					

predict npl_hat, xb
 generate npl_hat2 = npl_hat^2
 generate npl_hat3 = npl_hat^3
 generate npl_hat4 = npl_hat^4
 xtreg npl fwd swp opt fut nim size npl_hat2 npl_hat3 npl_hat4, re
 Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.4933
 between = 0.4277
 overall = 0.4467
 Random effects u_i ~ Gaussian
 corr(u_i, Xb) = 0 (assumed)

Number of obs = 544
 Number of groups = 68
 Obs per group: min = 8
 avg = 8.0
 max = 8
 Wald chi2(10) = 499.10
 Prob > chi2 = 0.0000

npl	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0228172	0.0043818	5.21	0.000	0.0142291	0.0314053
swp	-0.0060363	0.0020762	-2.91	0.004	-0.0101055	-0.0019671
opt	0.0257529	0.0092159	2.79	0.005	0.0076901	0.0438157
fut	-0.0034418	0.0019986	-1.72	0.085	-0.0073591	0.0004755
cap	-0.4920564	0.1009775	-4.87	0.000	-0.6899687	-0.2941441
Liq	-0.0298187	0.0190093	-1.57	0.117	-0.0670763	0.0074389
loan	-0.3180505	0.058902	-5.40	0.000	-0.4334964	-0.2026046
cr	1.37754	0.1613212	8.54	0.000	1.061356	1.693724
size	-0.0636549	0.0114627	-5.55	0.000	-.0861215	-0.0411883
npl_hat2	-133.8291	23.06633	-5.80	0.000	-179.0382	-88.6199
npl_hat3	1172.283	182.669	6.42	0.000	814.2583	1530.308
npl_hat4	-2562.557	372.9279	-6.87	0.000	-3293.482	-1831.631
constant	0.9989106	0.1765348	5.66	0.000	0.6529087	1.344913
sigma u	0.03151339	(fraction of variance due to u _i)				
sigma e	0.02336212					
Rho	0.64533432					

test npl_hat2 npl_hat3 npl_hat4
 (1) npl_hat2 = 0
 (2) npl_hat3 = 0
 (3) npl_hat4 = 0
 chi2(3) = 279.15
 Prob > chi2 = 0.0000

xtreg cov fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0633

 between = 0.1005

 overall = 0.0847

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 544

Number of groups = 68

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 38.90

Prob > chi2 = 0.0003

cov	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0651431	0.0645069	-1.01	0.313	-0.1915744	0.0612882
swp	0.0883657	0.0412329	2.14	0.032	0.0075507	0.1691808
opt	-0.2474007	0.2373247	-1.04	0.297	-0.7125485	0.2177472
fut	0.0047522	0.054152	0.09	0.930	-0.1013838	0.1108882
cap	1.221907	1.271605	0.96	0.337	-1.270394	3.714207
liq	2.635851	0.557683	4.73	0.000	1.542812	3.72889
loan	0.0203188	0.4137335	0.05	0.961	-0.790584	0.8312216
cr	0.7375429	0.4516063	1.63	0.102	-0.1475892	1.622675
size	0.1539228	0.0529317	2.91	0.004	0.0501787	0.2576669
constant	-0.6220659	0.5590083	-1.11	0.266	-1.717702	0.4735703
sigma u	0.75210661	(fraction of variance due to u _i)				
sigma e	0.72321497					
Rho	0.51957577					

predict cov_hat, xb

generate cov_hat2= cov_hat^2

generate cov_hat3= cov_hat^3

generate cov_hat4= cov_hat^4

xtreg cov fwd swp opt fut nim size cov_hat2 cov_hat3 cov_hat4, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0859

 between = 0.1111

 overall = 0.1004

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 544

Number of groups = 68

Obs per group: min = 8

 avg = 8.0

 max = 8

Wald chi2(10) = 52.07

Prob > chi2 = 0.0000

cov	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.6748588	0.355199	1.90	0.057	-0.0213185	1.371036
swp	-0.8643372	0.4562017	-1.89	0.058	-1.758476	0.0298018
opt	2.488335	1.295052	1.92	0.055	-0.0499202	5.02659
fut	-0.0619558	0.0593666	-1.04	0.297	-0.1783121	0.0544005
cap	-12.56134	6.654601	-1.89	0.059	-25.60412	0.4814397
liq	-29.22498	14.18375	-2.06	0.039	-57.02462	-1.425333
loan	-0.3744994	0.4227736	-0.89	0.376	-1.203121	0.4541217
cr	-6.579543	3.553434	-1.85	0.064	-13.54415	0.3850599
size	-1.606873	0.8250464	-1.95	0.051	-3.223935	0.010188
cov_hat2	12.40705	5.595607	2.22	0.027	1.439866	23.37424
cov_hat3	-5.300377	2.332158	-2.27	0.023	-9.871323	-0.7294307
cov_hat4	0.7202154	0.3087139	2.33	0.020	0.1151474	1.325283
constant	10.16948	5.07361	2.00	0.045	0.2253863	20.11357
sigma u	0.69816611	(fraction of variance due to u _i)				
sigma e	0.71356489					
Rho	0.48909357					

test cov_hat2 cov_hat3 cov_hat4

(1) cov_hat2 = 0

(2) cov_hat3 = 0

(3) cov_hat4 = 0

 chi2(3) = 12.18

Prob > chi2 = 0.0068

Appendix VI. Hausman Tests

Appendix VI.a.

xtreg risk fwd swp opt fut cap liq loan cr nim size, fe
 Fixed-effects (within) regression
 Group variable: ident
 R-sq: within = 0.0664
 between = 0.0349
 overall = 0.0006

Number of obs = 357
 Number of groups = 7
 Obs per group: min = 51
 avg = 7.0
 max = 7
 F(10,302) = 2.15
 Prob > F = 0.0210

corr(u_i, X_b) = -0.7849

risk	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0001664	0.0018278	-0.09	0.928	-0.0037633	0.0034305
swp	-0.0000346	0.0000816	-0.42	0.672	-0.0001951	0.000126
opt	0.0028549	0.00559	0.51	0.610	-0.0081454	0.0138553
fut	0.001243	0.009168	0.14	0.892	-0.0167984	0.0192843
cap	-0.0221073	0.0320353	-0.69	0.491	-0.0851479	0.0409333
liq	-0.029528	0.010445	-2.83	0.005	-0.0500822	-0.0089738
loan	0.0146007	0.0118099	1.24	0.217	-0.0086393	0.0378408
cr	0.0034734	0.0092239	0.38	0.707	-0.0146777	0.0216246
nim	0.0632955	0.0340875	1.86	0.064	-0.0037835	0.1303745
size	0.0070737	0.0024294	2.91	0.004	0.002293	0.0118545
constant	-0.0508974	0.0222787	-2.28	0.023	-0.0947385	-0.0070563
sigma u	0.0144661	(fraction of variance due to u _i)				
sigma e	0.01397623					
rho fov	0.51721823					

F test that all u_i=0: F(51, 302) = 2.46 Prob > F = 0.0000

est store eql

xtreg risk fwd swp opt fut cap liq loan cr nim size, re
 Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.0338
 between = 0.0738
 overall = 0.0428

Number of obs = 364
 Number of groups = 52
 Obs per group: min = 7
 avg = 7.0
 max = 7

Random effects u_i ~ Gaussian

Wald chi2(11) = 13.72

corr(u_i, X_b) = 0 (assumed)

Prob > chi2 = 0.1863

risk	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0006444	0.0011207	-0.57	0.565	-0.002841	0.0015522
swp	-0.0000101	0.0000796	-0.13	0.899	-0.0001661	0.000146
opt	0.0039291	0.0042987	0.91	0.361	-0.0044963	0.0123545
fut	-0.0066569	0.0071132	-0.94	0.349	-0.0205986	0.0072848
cap	-0.0190414	0.0260149	-0.73	0.464	-0.0700297	0.0319469
liq	-0.0163322	0.0088679	-1.84	0.066	-0.0337129	0.0010485
loan	0.0214452	0.0075701	2.83	0.005	0.0066082	0.0362823
cr	0.0030761	0.0084964	0.36	0.717	-0.0135765	0.0197287
nim	.0423813	0.0266367	1.59	0.112	-0.0098257	0.0945883
size	-0.0001499	0.0008782	-0.17	0.864	-0.0018711	0.0015714
constant	0.0134222	0.0105099	1.28	0.202	-0.0071769	0.0340213
sigma u	0.00643253	(fraction of variance due to u _i)				
sigma e	0.01397623					
rho	0.17480063					

hausman eq1

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) Eq1	(B)		
fwd	-.0001664	-.0006444	.000478	.0014439
swp	-.0000346	-.0000101	-.0000245	.0000178
opt	.0028549	.0039291	-.0010742	.0035734
fut	.001243	-.0066569	.0078998	.005784
cap	-.0221073	-.0190414	-.0030659	.0186944
liq	-.029528	-.0163322	-.0131958	.0055189
loan	.0146007	.0214452	-.0068445	.0090646
cr	.0034734	.0030761	.0003973	.0035904
nim	.0632955	.0423813	.0209142	.0212707
size	.0070737	-.0001499	.0072236	.0022651

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(10) = (b-B)'[(V_b-V_B)^{-1}](b-B)$

18.14

Prob>chi2 = 0.0526

xtreg beta fwd swp opt fut cap liq loan cr nim size, fe

Fixed-effects (within) regression

Group variable: ident

R-sq: within = 0.0066

between = 0.0001

overall = 0.0013

Number of obs = 357

Number of groups = 7

Obs per group: min = 51

avg = 7.0

max = 7

F(10,302) = 0.20

Prob > F = 0.9961

corr(u_i, Xb) = -0.1629

beta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0558452	1.221088	0.05	0.964	-2.347072	2.458763
swp	-0.007069	8.545117	-0.13	0.897	-0.1143406	0.1002011
opt	-0.161057	3.734456	-0.04	0.966	-7.509907	7.187793
fut	-2.333158	6.124778	-0.38	0.704	-14.3858	9.719487
cap	-15.78557	21.40139	-0.74	0.461	-57.90031	26.32917
liq	-3.175147	6.977858	-0.46	0.649	-16.90653	10.55623
loan	0.8127391	7.889677	0.10	0.918	-14.71296	16.33844
cr	-5.310082	6.162067	-0.86	0.390	-17.43611	6.815942
nim	14.17219	22.77239	0.62	0.534	-30.64046	58.98484
size	-0.8944807	1.622994	-0.55	0.582	-4.08829	2.299329
constant	14.21757	14.88343	0.96	0.340	-15.07078	43.50592
sigma u	6.4820996	(fraction of variance due to u _i)				
sigma e	9.3369255					
rho fov	0.32522433					

F test that all u_i=0:

F(51, 302) = 3.07

Prob > F = 0.0000

est store eql

xtreg beta fwd swp opt fut cap liq loan cr nim size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0026

between = 0.0525

overall = 0.0181

Number of obs = 364

Number of groups = 52

Obs per group: min = 7

avg = 7.0

max = 7

Wald chi2(11) = 2.84

Prob > chi2 = 0.9849

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

beta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.4911395	0.8071839	-0.61	0.543	-2.073191	1.090912
swp	-0.0116554	0.0529162	-0.22	0.826	-1.1153693	0.0920584
opt	-1.522017	2.991909	-0.51	0.611	-7.386051	4.342018
fut	-0.4923387	4.949726	-0.10	0.921	-10.19362	9.208946
cap	-10.25938	17.84926	-0.57	0.565	-45.2433	24.72453
liq	-4.727091	6.061933	-0.78	0.436	-16.60826	7.15408
loan	-2.586337	5.360617	-0.48	0.629	-13.09295	7.92028
cr	-2.247955	5.713732	-0.39	0.694	-13.44666	8.950754
nim	5.489688	18.42996	0.30	0.766	-30.63237	41.61175
size	-0.5181086	.6520933	-0.79	0.427	-1.796188	0.7599708
constant	12.6641	7.554133	1.68	0.094	2.141727	27.46993
sigma u	5.4621631	(fraction of variance due to u _i)				
sigma e	9.3369255					
rho	0.25497272					

hausman eql

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eq1	(B)		
fwd	0.0558452	-0.4911395	0.5469848	0.9162472
swp	-0.0070698	-0.0116554	0.0045857	0.0130921
opt	-0.161057	-1.522017	1.36096	2.234869

fut	-2.333158	-0.4923387	-1.840819	3.607369
cap	-15.78557	-10.25938	-5.526185	11.80777
liq	-3.175147	-4.727091	1.551944	3.455932
loan	0.8127391	-2.586337	3.399076	5.78885
cr	14.17219	5.489688	8.682501	13.37603
nim	14.17219	5.489688	8.682501	13.37603
size	-0.8944807	-0.5181086	-0.3763721	1.486232

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$$\chi^2(10) = (b-B)'[(V_b - V_B)^{-1}](b-B)$$

6.76

Prob>chi2 = 0.7477

xtreg sderror fwd swp opt fut cap liq loan cr nim size, fe

Fixed-effects (within) regression

Group variable: ident

R-sq: within = 0.0292
 between = 0.0054
 overall = 0.0004

Number of obs = 357
 Number of groups = 7
 Obs per group: min = 51
 avg = 7.0
 max = 7

F(10,302) = 0.91
 Prob > F = 0.5264

corr(u_i, Xb) = -0.5659

sderror	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0154334	1.260784	-0.01	0.990	2.496467	2.465601
swp	-0.0029877	0.0562838	-0.05	0.958	-0.1137458	0.1077705
opt	2.17876	3.85586	0.57	0.572	-5.408995	9.766514
fut	-1.756887	6.323888	-0.28	0.781	-14.20135	10.68758
cap	-21.63045	22.09713	-0.98	0.328	-65.1143	21.8534
liq	-6.384797	7.204702	-0.89	0.376	-20.56257	7.792977
loan	-7.588012	8.146163	-0.93	0.352	-23.61844	8.442416
cr	-0.5097157	6.36239	-0.08	0.936	-13.02995	12.01051
nim	4.635179	23.5127	0.20	0.844	-41.63429	50.90464
size	-3.065078	1.675756	-1.83	0.068	-6.362716	0.2325592
constant	38.81013	15.36727	2.53	0.012	8.569641	69.05062
sigma u	6.7407071	(fraction of variance due to u _i)				
sigma e	9.6404603					
rho fov	0.32836085					

F test that all u_i=0: F(51, 302) = 2.19 Prob > F = 0.0000

est store eql

xtreg sderror fwd swp opt fut cap liq loan cr nim size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0199
 between = 0.0131
 overall = 0.0142

Number of obs = 364
 Number of groups = 52
 Obs per group: min = 7
 avg = 7.0
 max = 7

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Wald chi2(11) = 5.75
 Prob > chi2 = 0.8356

sderror	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.1655996	0.7599838	-0.22	0.828	-1.65514	1.323941
swp	-0.0023634	0.0541326	-0.04	0.965	-0.1084614	0.1037346
opt	1.034661	2.918062	0.35	0.723	-4.684636	6.753958
fut	-2.353079	4.828575	-0.49	0.626	-11.81691	7.110753
cap	-9.467693	17.6678	-0.54	0.592	-44.09594	25.16055
liq	-3.965076	6.023115	-0.66	0.510	-15.77017	7.84001
loan	-10.25297	5.13613	-2.00	0.046	-20.3196	-0.1863434
cr	-1.983725	5.773876	-0.34	0.731	13.30031	9.332864
nim	-0.7886463	18.08525	-0.04	0.965	36.23508	34.65779
size	-0.3811875	0.5950369	-0.64	0.522	-1.547438	0.7850633
constant	13.93284	7.128078	1.95	0.051	-0.0379362	27.90362
sigma u	4.402101					
sigma e	9.6404603					
rho	0.17253398	(fraction of variance due to u _i)				

hausman eql

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eq1	(B)		
fwd	-0.0154334	-.1655996	0.1501662	1.005983
swp	-0.0029877	-0.0023634	-0.0006242	0.015412
opt	2.17876	1.034661	1.144099	2.52043

fut	-1.756887	-2.353079	0.5961921	4.083679
cap	-21.63045	-9.467693	-12.16276	13.27149
liq	-6.384797	-3.965076	-2.41972	3.953456
loan	-7.588012	-10.25297	2.664962	6.322984
cr	-0.5097157	-1.983725	1.474009	2.67252
nim	4.635179	-0.7886463	5.423825	15.02567
size	-3.065078	-0.3811875	-2.683891	1.566554

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(10) = (b-B)'[(V_b - V_B)^{-1}](b-B)$

6.86

Prob>chi2 = 0.7382

Appendix VI.b.

xtreg eqta fwd swp opt fut nim size, fe
 Fixed-effects (within) regression
 Group variable: ident
 R-sq: within = 0.2398
 between = 0.4327
 overall = 0.3764

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 F(6,953) = 50.11
 Prob > F = 0.0000

corr(u_i, X_b) = 0.1173

eqta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0010413	0.0026817	0.39	0.698	-0.0042214	0.0063041
swp	-0.0001597	0.001875	-0.09	0.932	-0.0038393	0.0035198
opt	0.0059761	0.0074426	0.80	0.422	-0.0086297	0.0205819
fut	-0.0044597	0.0023679	-1.88	0.060	-0.0091065	0.0001871
nim	0.753973	0.0458848	16.43	0.000	0.6639261	0.8440199
size	-0.0031844	0.0023491	-1.36	0.176	-0.0077944	0.0014256
constant	0.1075852	0.0217824	4.94	0.000	0.0648381	0.1503323
sigma u	0.04280344	(fraction of variance due to u _i)				
sigma e	0.03296179					
rho fov	0.62774128					

F test that all u_i=0: F(136, 953) = 12.59 Prob > F = 0.0000

est store eq1

xtreg eqta fwd swp opt fut nim size, re
 Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.2383
 between = 0.4541
 overall = 0.3914

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 7

Random effects u_i ~ Gaussian
 corr(u_i, X_b) = 0 (assumed)

Wald chi2(11) = 407.50
 Prob > chi2 = 0.0000

eqta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0004265	0.0024974	-0.17	0.864	-0.0053212	0.0044683
swp	0.0000934	0.0017138	0.05	0.957	-0.0032656	0.0034524
opt	0.0071811	0.0071187	1.01	0.313	-0.0067712	0.0211335
fut	-0.0040584	0.0022004	-1.84	0.065	-0.0083711	0.0002544
nim	0.762976	0.0410469	18.59	0.000	0.6825256	0.8434264
size	-0.0061571	0.0016744	-3.68	0.000	-0.0094388	-0.0028754
constant	0.1344944	0.0159185	8.45	0.000	0.1032947	0.1656941
sigma u	0.04031467	(fraction of variance due to u _i)				
sigma e	0.03296179					
rho	0.59934407					

hausman eq1

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eq1	(B)		
fwd	0.0010413	-0.0004265	0.0014678	0.0009771
swp	-0.0001597	0.0000934	-0.0002531	0.0007605
opt	0.0059761	0.0071811	-0.001205	0.0021718
fut	-0.0044597	-0.0040584	-0.0004013	0.0008746
nim	0.753973	0.762976	-0.009003	0.0205078
size	-0.0031844	-0.0061571	0.0029727	0.0016477

b = consistent under H₀ and H_a; obtained from xtreg
 B = inconsistent under H_a, efficient under H₀; obtained from xtreg

Test: H₀: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)⁽⁻¹⁾](b-B)

7.54

Prob>chi2 = 0.2738

xtreg liqta fwd swp opt fut nim size, fe
 Fixed-effects (within) regression
 Group variable: ident
 R-sq: within = 0.0189
 between = 0.0041
 overall = 0.000

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 F(6,953) = 3.06
 Prob > F = 0.0057

corr(u_i, X_b) = -0.1924

liqta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0024545	0.0040131	-0.61	0.541	-0.01033	0.005421
swp	0.0007614	0.0028058	0.27	0.786	-0.0047449	0.0062677
opt	0.0005717	0.0111376	0.05	0.959	-0.0212854	0.0224287
fut	-0.0123686	0.0035434	-3.49	0.001	-0.0193224	-0.0054148
nim	0.1147351	0.068665	1.67	0.095	-0.0200169	0.2494871
size	0.0032032	0.0035154	0.91	0.362	-0.0036956	0.0101019
constant	0.045106	0.0325966	1.38	0.167	-0.0188635	0.1090755
sigma u	0.06489531	(fraction of variance due to u _i)				
sigma e	0.04932614					
rho fov	0.63382052					

F test that all u_i=0: F(136, 953) = 11.38 Prob > F = 0.0000

est store eq1

xtreg liqta fwd swp opt fut nim size, re

Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.0121
 between = 0.0697
 overall = 0.0474

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 7

Random effects u_i ~ Gaussian

Wald chi2(11) = 20.88
 Prob > chi2 = 0.0019

corr(u_i, X_b) = 0 (assumed)

liqta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0029925	0.0037321	-0.80	0.423	-0.0103073	0.0043222
swp	-0.0016862	0.002555	-0.66	0.509	-0.0066939	0.0033214
opt	0.00593	0.0106785	0.56	0.579	-0.0149996	0.0268595
fut	-0.0090124	0.0032896	-2.74	0.006	-0.0154598	-0.002565
nim	0.1864097	0.0610387	3.05	0.002	0.0667759	0.3060434
size	-0.00205	0.0024367	-0.84	0.400	-0.0068257	0.0027258
constant	0.0912208	0.023124	3.94	0.000	0.0458986	0.1365431
sigma u	0.05569703	(fraction of variance due to u _i)				
sigma e	0.04932614					
rho	0.56043932					

hausman eq1

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eq1	(B)		
fwd	-0.0024545	-0.0029925	0.000538	0.0014753
swp	0.0007614	-0.0016862	0.0024476	0.0011596
opt	0.0005717	0.00593	-0.0053583	0.0031647
fut	-0.0123686	-0.0090124	-0.0033562	0.001317
nim	0.1147351	0.1864097	-0.0716746	0.0314507
size	0.0032032	-0.00205	0.0052532	0.0025339

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)⁽⁻¹⁾](b-B)

29.38

Prob>chi2 = 0.0001

xtreg glta fwd swp opt fut nim size, fe
 Fixed-effects (within) regression
 Group variable: ident
 R-sq: within = 0.1331
 between = 0.0028
 overall = 0.0095

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 F(6,953) = 24.38
 Prob > F = 0.0000

corr(u_i, Xb) = -0.1924

glta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0243832	0.0066256	-3.68	0.000	-0.0373856	-0.0113809
swp	0.0079365	0.0046324	1.71	0.087	-0.0011543	0.0170274
opt	-0.0129208	0.018388	-0.70	0.482	-0.0490065	0.0231648
fut	0.0010412	0.0058501	0.18	0.859	-0.0104394	0.0125219
nim	-0.1764308	0.1133649	-1.56	0.120	-0.3989044	0.0460428
size	0.0613878	0.0058038	10.58	0.000	0.049998	0.0727775
constant	0.0020743	0.0538166	0.04	0.969	-0.1035384	0.107687
sigma u	0.16932536	(fraction of variance due to u _i)				
sigma e	0.08143677					
rho fov	0.81214225					

F test that all u_i=0: F(136, 953) = 24.96 Prob > F = 0.0000

est store eq1

xtreg glta fwd swp opt fut nim size, re

Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.1313
 between = 0.0030
 overall = 0.0100

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 7

Random effects u_i ~ Gaussian

Wald chi2(11) = 106.83
 Prob > chi2 = 0.0000

corr(u_i, Xb) = 0 (assumed)

glta	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0190659	0.0064842	-2.94	0.003	-0.0317747	-0.0063571
swp	0.005168	0.004485	1.15	0.249	-0.0036224	0.0139584
opt	-0.0103942	0.0182663	-0.57	0.569	-0.0461954	0.0254071
fut	-0.0017349	0.0057113	-0.30	0.761	-0.0129289	0.0094592
nim	-0.2282109	0.1083449	-2.11	0.035	-0.440563	-0.0158588
size	0.0426956	0.0047916	8.91	0.000	0.0333043	0.0520869
constant	0.1739838	0.0460699	3.78	0.000	0.0836885	0.2642792
sigma u	0.13895608	(fraction of variance due to u _i)				
sigma e	0.08143677					
rho	0.74434242					

hausman eq1

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eq1	(B)		
fwd	-0.0243832	-0.0190659	-0.0053174	0.0013613
swp	0.0079365	0.005168	0.0027686	0.0011593
opt	-0.0129208	-0.0103942	-0.0025267	0.0021122
fut	0.0010412	-0.0017349	0.0027761	0.0012668
nim	-0.1764308	-0.2282109	0.0517801	0.0333613
size	0.0613878	0.0426956	0.0186922	0.0032749

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)⁽⁻¹⁾](b-B)
 130.76

Prob>chi2 = 0.0000

xtreg llrgl fwd swp opt fut nim size, fe
 Fixed-effects (within) regression
 Group variable: ident
 R-sq: within = 0.0154
 between = 0.0547
 overall = 0.0258

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 F(6,953) = 2.48
 Prob > F = 0.0219

corr(u_i, Xb) = -0.1377

llrgl	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.001663	0.0049685	0.33	0.738	-0.0080874	0.0114134
swp	-0.0078505	0.0034738	-2.26	0.024	-0.0146676	-0.0010333
opt	-0.0043316	0.0137891	-0.31	0.753	-0.031392	0.0227288
fut	4.48e-06	0.004387	0.00	0.999	-0.0086048	0.0086137
nim	.2116991	0.0850117	2.49	0.013	0.0448674	0.3785308
size	-0.0042776	0.0043523	-0.98	0.326	-0.0128187	0.0042635
constant	0.0751262	0.0403568	1.86	0.063	-0.0040721	0.1543246
sigma u	0.03708762	(fraction of variance due to u_i)				
sigma e	0.06106898					
rho fov	0.26944476					

F test that all u_i=0: F(136, 953) = 2.77 Prob > F = 0.0000

est store eql

xtreg llrgl fwd swp opt fut nim size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0127

 between = 0.0929

 overall = 0.0367

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 7

Wald chi2(11) = 25.89

Prob > chi2 = 0.0002

llrgl	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0006262	0.0038064	0.16	0.869	-0.0068343	0.0080866
swp	-0.0028107	0.0025251	-1.11	0.266	-0.0077599	0.0021385
opt	-0.0106285	0.0115963	-0.92	0.359	-0.0333569	0.0120999
fut	0.0002494	0.0034141	0.07	0.942	-0.0064421	0.0069409
nim	0.2477194	0.0582892	4.25	0.000	0.1334748	0.3619641
size	-0.0019747	0.001886	-1.05	0.295	-0.0056712	0.0017217
constant	0.0516718	0.0177285	2.91	0.004	0.0169246	0.086419
sigma u	0.02924934	(fraction of variance due to u_i)				
sigma e	0.06106898					
rho	0.18659414					

hausman eql

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) Eq1	(B)		
fwd	0.001663	0.0006262	0.0010368	0.0031933
swp	-0.0078505	-0.0028107	-0.0050398	0.0023856
opt	-0.0043316	-0.0106285	0.0062969	0.0074608
fut	4.48e-06	0.0002494	-0.000245	0.0027549
nim	0.2116991	0.2477194	-0.0360203	0.0618818
size	-0.0042776	-0.0019747	-0.0023029	0.0039224

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)

5.21

Prob>chi2 = 0.5171

xtreg stdroa fwd swp opt fut nim size, fe
 Fixed-effects (within) regression
 Group variable: ident
 R-sq: within = 0.0016
 between = 0.0102
 overall = 0.0059

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 F(6,953) = 0.26
 Prob > F = 0.9568

corr(u_i, Xb) = 0.0342

stdroa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0002417	0.0007074	0.34	0.733	-0.0011466	0.0016299
swp	-0.0003142	0.0004946	-0.64	0.525	-0.0012848	0.0006564
opt	-0.0007718	0.0019633	-0.39	0.694	-0.0046246	0.003081
fut	0.0003453	0.0006246	0.55	0.581	-0.0008805	0.0015711
nim	0.0102069	0.0121038	0.84	0.399	-0.0135462	0.0339601
size	0.00007	0.0006197	0.11	0.910	-0.0011461	0.0012861
constant	0.0045985	0.0057459	0.80	0.424	-0.0066776	0.0158746
sigma_u	0.00854047	(fraction of variance due to u_i)				
sigma_e	0.00869488					
rho_fov	0.49104169					

F test that all u_i=0: F(136, 953) = 7.63 Prob > F = 0.0000

est store eq1

xtreg stdroa fwd swp opt fut nim size, re
 Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.0014
 between = 0.0172
 overall = 0.0090

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 7

Random effects u_i ~ Gaussian
 corr(u_i, Xb) = 0 (assumed)

Wald chi2(11) = 3.14
 Prob > chi2 = 0.7910

stdroa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0002311	0.000631	0.37	0.714	-0.0010055	0.0014678
swp	-0.0003448	0.0004291	-0.80	0.422	-0.0011859	0.0004963
opt	-0.0002101	0.001825	-0.12	0.908	-0.003787	0.0033669
fut	0.0001783	0.0005571	0.32	0.749	-0.0009135	0.0012701
nim	0.0158052	0.0101818	1.55	0.121	-0.0041508	0.0357612
size	0.0000777	0.0003853	0.20	0.840	-0.0006774	0.0008328
constant	0.0043367	0.0036438	1.19	0.234	-0.002805	0.0114784
sigma_u	0.00809135	(fraction of variance due to u_i)				
sigma_e	0.00869488					
rho	0.4640928					

hausman eq1

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) Eq1	(B)		
fwd	0.0002417	0.0002311	0.0000105	0.0003199
swp	-0.0003142	-0.0003448	0.0000306	0.0002459
opt	-0.0007718	-0.0002101	-0.0005618	0.0007236
fut	0.0003453	0.0001783	0.000167	0.0002825
nim	0.0102069	0.0158052	-0.0055983	0.0065447
size	0.00007	0.0000777	-7.69e-06	0.0004853

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)

1.92

Prob>chi2 = 0.9271

Appendix VI.c.

xtreg sr fwd swp opt fut cap liq loan cr nim nonim size, fe

Fixed-effects (within) regression

Group variable: ident

R-sq: within = 0.1583

between = 0.0016

overall = 0.0192

Number of obs = 518

Number of groups = 74

Obs per group: min = 7

avg = 7.0

max = 7

F(9,950) = 7.40

Prob > F = 0.0000

corr(u_i, X_b) = -0.8894

sr	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0000786	0.0002646	0.30	0.766	-0.0004414	0.0005987
swp	-0.0000408	0.0001567	-0.26	0.795	-0.0003488	0.0002671
opt	-0.000067	0.0007182	-0.09	0.926	-0.0014786	0.0013446
fut	-0.0002004	0.0014641	-0.14	0.891	-0.003078	0.0026772
cap	-0.0046091	0.0049112	-0.94	0.349	-0.0142618	0.0050435
liq	-0.0008416	0.001917	-0.44	0.661	-0.0046093	0.0029262
loan	-0.0054027	0.0017266	-3.13	0.002	-0.0087963	-0.0020091
nim	0.0016082	0.0066282	0.24	0.808	-0.0114192	0.0146355
nonim	0.0028148	0.0067359	0.42	0.676	-0.0104243	0.0160538
cr	-0.0010402	0.0014469	-0.72	0.473	-0.0038841	0.0018037
size	-0.0020309	0.0003047	-6.66	0.000	-0.0026298	-0.001432
constant	0.0229643	0.0028722	8.00	0.000	0.0173191	0.0286096
sigma _u	0.00289746	(fraction of variance due to u _i)				
sigma _e	0.00248754					
rho	0.57568326					

F test that all u_i=0:

F(73,433) = 1.82

Prob > F = 0.0002

est store eql

xtreg sr fwd swp opt fut cap liq loan cr nim nonim size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0775

between = 0.0195

overall = 0.0401

Number of obs = 518

Number of groups = 74

Obs per group: min = 7

avg = 7.0

max = 7

Wald chi2(11) = 21.69

Prob > chi2 = 0.0269

Random effects u_i ~ Gaussian

corr(u_i, X_b) = 0 (assumed)

sr	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0000737	0.0001436	-0.51	0.607	-0.0003551	0.0002076
swp	-0.0000328	0.0000947	-0.35	0.729	-0.0002184	0.0001527
opt	-0.0001705	0.000517	-0.33	0.741	-0.0011838	0.0008427
fut	0.0006778	0.0010976	0.62	0.537	-0.0014734	0.002829
cap	-0.0082174	0.0031481	-2.61	0.009	-0.0143875	-0.0020472
liq	-0.0022986	0.0014697	-1.56	0.118	-0.0051791	0.0005819
loan	-0.0019263	0.0008757	-2.20	0.028	-0.0036425	-0.00021
nim	0.0105474	0.0035746	2.95	0.003	0.0035413	0.0175536
nonim	0.0064649	0.004671	1.38	0.166	-0.0026901	0.01562
cr	-0.0008533	0.0013176	-0.65	0.517	-0.0034358	0.0017291
size	-0.0002501	0.0000972	-2.57	0.010	-0.0004407	-0.0000595
constant	0.0046287	0.001205	3.84	0.000	0.0022669	0.0069905
sigma _u	0.00025769	(fraction of variance due to u _i)				
sigma _e	0.00248754					
rho	0.01061745					

hausman eql

---- Coefficients ----		(b-B)	sqrt(diag(V _b -V _B)) S.E.
(b)	(B)	Difference	

	Eq1			
fwd	0.0000786	-0.0000737	0.0001524	0.0002223
swp	-0.0000408	-0.0000328	-7.99e-06	0.0001248
opt	-0.000067	-0.0001705	0.0001035	0.0004986
fut	-0.0002004	0.0006778	-0.0008782	0.000969
cap	-0.0046091	-0.0082174	0.0036082	0.0037695
liq	-0.0008416	-0.0022986	0.001457	0.0012308
loan	-0.0054027	-0.0019263	-0.0034764	0.0014881
ninim	0.0016082	0.0105474	-0.0089393	0.0055816
nonim	0.0028148	0.0064649	-0.0036502	0.0048532
cr	-0.0010402	-0.0008533	-0.0001868	0.000598
size	-0.0020309	-0.0002501	-0.0017808	0.0002888

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(11) = (b-B)'[(V_b - V_B)^{-1}](b-B)$

67.67

Prob>chi2 = 0.0000

Appendix VI.d.

xtreg eff fwd swp opt fut cap liq loan cr size, fe
 Fixed-effects (within) regression
 Group variable: ident
 R-sq: within = 0.0293
 between = 0.0088
 overall = 0.0143

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 F(9,950) = 3.18
 Prob > F = 0.0003

corr(u_i, X_b) = -0.1152

eff	Coef.	Std. Err.	T	P> t	[95% Conf. Interval]	
fwd	-0.0398841	0.023235	-1.72	0.086	-0.0854819	0.0057138
swp	0.0009822	0.0163029	0.06	0.952	-0.0310117	0.032976
opt	-0.0439675	0.0247298	-1.78	0.076	-0.0924989	0.0045638
fut	-0.0043258	0.0188914	-0.23	0.819	-0.0413995	0.0327478
cap	0.1213136	0.2995149	0.41	0.686	-0.4664738	0.7091009
liq	0.0831493	0.1952206	0.43	0.670	-0.2999642	0.4662629
loan	-0.4615872	0.1191277	-3.87	0.000	-0.695371	-0.2278034
cr	-0.4829768	0.1580101	-3.06	0.002	-0.7930659	-0.1728877
size	0.0150077	0.0223509	0.67	0.502	-0.0288551	0.0588706
constant	-0.5153803	0.2007031	-2.57	0.010	-0.9092529	-0.1215076
sigma u	0.332524					
sigma e	0.29758866					
rho	0.5552731	(fraction of variance due to u _i)				

F test that all u_i=0: F(136, 950) = 9.28 Prob > F = 0.0000

est store eql

xtreg eff fwd swp opt fut cap liq loan cr size, re
 Random-effects GLS regression
 Group variable: ident
 R-sq: within = 0.0269
 between = 0.0361
 overall = 0.0319

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8
 Wald chi2(11) = 31.08
 Prob > chi2 = 0.0003

Random effects u_i ~ Gaussian
 corr(u_i, X_b) = 0 (assumed)

eff	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0273294	0.0209917	-1.30	0.193	-0.0684725	0.0138136
swp	0.001432	0.0144689	0.10	0.921	-0.0269266	0.0297905
opt	-0.0512779	0.0240085	-2.14	0.033	-0.0983337	-0.004222
fut	-0.0036215	0.0169867	-0.21	0.831	-0.0369149	0.0296719
cap	0.2466432	0.2613055	0.94	0.345	-0.2655062	0.7587927
liq	-0.0248705	0.1786011	-0.14	0.889	-0.3749222	0.3251812
loan	-0.3891019	0.0997686	-3.90	0.000	-0.5846447	-0.1935591
cr	-0.4651	0.1549141	-3.00	0.003	-0.7687259	-0.161474
size	0.0343819	0.0144019	2.39	0.017	0.0061546	0.0626092
constant	-0.7396981	0.14413	-5.13	0.000	-10.022188	-0.4572086
sigma u	0.30905173					
sigma e	0.29758866					
rho	0.51888924	(fraction of variance due to u _i)				

hausman eql

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eql	(B)		
fwd	-0.0398841	-0.0273294	-0.0125547	0.0099605
swp	0.0009822	0.001432	-0.0004498	0.0075124
opt	-0.0439675	-0.0512779	0.0073103	0.0059292
fut	-0.0043258	-0.0036215	-0.0007043	0.0082665
cap	0.1213136	0.2466432	-0.1253296	0.1463852
liq	0.0831493	-0.0248705	0.1080198	0.078821
loan	-0.4615872	-0.3891019	-0.0724853	0.0650971
cr	-0.4829768	-0.4651	-0.0178768	0.0311258
size	0.0150077	0.0343819	-0.0193742	0.0170923

b = consistent under H₀ and H_a; obtained from xtreg
 B = inconsistent under H_a, efficient under H₀; obtained from xtreg
 Test: H₀: difference in coefficients not systematic
 chi2(9) = (b-B)'[(V_b-V_B)⁻¹](b-B)
 10.29
 Prob>chi2 = 0.3274

xtreg nim fwd swp opt fut cap liq loan cr size, fe

Fixed-effects (within) regression

Group variable: ident

R-sq: within = 0.3454

between = 0.3683

overall = 0.3614

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

avg = 8.0

max = 8

F(9,950) = 55.69

Prob > F = 0.0000

corr(u_i, X_b) = -0.1133

nim	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.001481	0.0015111	-0.98	0.327	-0.0044464	0.0014845
swp	0.0008423	0.0010603	0.79	0.427	-0.0012384	0.002923
opt	-0.0017818	0.0016083	-1.11	0.268	-0.004938	0.0013744
fut	0.0007547	0.0012286	0.61	0.539	-0.0016563	0.0031658
cap	0.3957789	0.0194788	20.32	0.000	0.3575523	0.4340054
liq	0.0356904	0.0126961	2.81	0.005	0.0107747	0.060606
loan	-0.0198622	0.0077474	-2.56	0.011	-0.0350663	-0.0046582
cr	0.0226592	0.0102761	2.21	0.028	0.0024926	0.0428257
size	-0.0047409	0.0014536	-3.26	0.001	-0.0075935	-0.0018883
constant	0.0407852	0.0130527	3.12	0.002	0.0151699	0.0664006
sigma u	0.031681	(fraction of variance due to u _i)				
sigma e	0.01935357					
rho	0.72823391					

F test that all u_i=0:

F(136, 950) = 18.83

Prob > F = 0.0000

est store eql

xtreg nim fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.3431

between = 0.3937

overall = 0.3811

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

avg = 8.0

max = 8

Wald chi2(11) = 585.02

Prob > chi2 = 0.0003

Random effects u_i ~ Gaussian

corr(u_i, X_b) = 0 (assumed)

nim	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0008489	0.0014388	-0.59	0.555	-0.003669	0.0019711
swp	0.0010147	0.0009995	1.02	0.310	-0.0009443	0.0029737
opt	-0.002262	0.0015932	-1.42	0.156	-0.0053845	0.0008606
fut	0.000861	0.0011656	0.74	0.460	-0.0014235	0.0031455
cap	0.3994678	0.0181613	22.00	0.000	0.3638724	0.4350633
liq	0.037663	0.0121618	3.10	0.002	0.0138262	0.0614998
loan	-0.0153398	0.007022	-2.18	0.029	-0.0291027	-0.0015769
cr	0.0256189	0.0102336	2.50	0.012	0.0055615	0.0456763
size	-0.0027882	0.0011116	-2.51	0.012	-0.0049669	-0.0006094
constant	0.0196593	0.0108229	1.82	0.069	-0.0015531	0.0408718
sigma u	0.02887826	(fraction of variance due to u _i)				
sigma e	0.01935357					
rho	0.69006519					

hausman eql

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eq1	(B)		
fwd	-0.001481	-0.0008489	-0.0006321	0.0004617
swp	0.0008423	0.0010147	-0.0001724	0.0003537
opt	-0.0017818	-0.002262	0.0004802	0.0002202
fut	0.0007547	0.000861	-0.0001063	0.0003884
cap	0.3957789	0.3994678	-0.003689	0.0070422

liq	0.0356904	0.037663	-0.0019726	0.0036443
loan	-0.0198622	-0.0153398	-0.0045224	0.0032732
cr	0.0226592	0.0256189	-0.0029598	0.0009343
size	-0.0047409	-0.0027882	-0.0019527	0.0009366

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(9) = (b-B)'[(V_b - V_B)^{-1}](b-B)$

32.99

Prob>chi2 = 0.0000

xtreg cad fwd swp opt fut cap liq loan cr size, fe

Fixed-effects (within) regression

Group variable: ident

R-sq: within = 0.1518

between = 0.5929

overall = 0.4070

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

avg = 8.0

max = 8

F(9,950) = 18.90

Prob > F = 0.0000

corr(u_i, X_b) = -0.1389

cad	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.1556598	0.2239426	-0.70	0.487	-0.5951391	0.2838196
swp	-0.0074394	0.15713	-0.05	0.962	-0.3158013	0.3009226
opt	0.0589381	0.2383499	0.25	0.805	-0.408815	0.5266913
fut	0.0300584	0.182078	0.17	0.869	-0.3272631	0.3873799
cap	-27.1413	2.886772	-9.40	0.000	-32.80648	-21.47611
liq	-2.246277	1.881567	-1.19	0.233	-5.938786	1.446231
loan	10.04809	1.148171	8.75	0.000	7.794841	12.30133
cr	2.649506	1.522926	1.74	0.082	-0.3391812	5.638194
size	-0.4226575	0.2154217	-1.96	0.050	-0.8454148	0.0000998
constant	7.965512	1.934408	4.12	0.000	4.169305	11.76172
sigma_u	2.2141905	(fraction of variance due to u _i)				
sigma_e	2.8682063					
rho	0.37341361					

F test that all u_i=0:

F(136, 950) = 4.04

Prob > F = 0.0000

est store eql

xtreg cad fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.1479

between = 0.6476

overall = 0.4363

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

avg = 8.0

max = 8

Random effects u_i ~ Gaussian

Wald chi2(11) = 403.97

corr(u_i, X_b) = 0 (assumed)

Prob > chi2 = 0.0003

cad	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0594289	0.1822191	0.33	0.744	-0.2977141	0.4165718
swp	-0.1234026	0.1236498	-1.00	0.318	-0.3657517	0.1189466
opt	0.0709957	0.2236084	0.32	0.751	-0.3672688	0.5092601
fut	0.0308411	0.147534	0.21	0.834	-0.2583202	0.3200024
cap	-27.00417	2.216785	-12.18	0.000	-31.34899	-22.65935
liq	-2.67334	1.576606	-1.70	0.090	-5.763431	0.4167511
loan	11.27457	0.8328075	13.54	0.000	9.6423	12.90685
cr	2.444406	1.458129	1.68	0.094	-0.4134744	5.302287
size	-0.1011348	0.1053276	-0.96	0.337	-0.3075731	0.1053034
constant	4.379263	1.117436	3.92	0.000	2.189129	6.569397
sigma_u	1.7960301	(fraction of variance due to u _i)				
sigma_e	2.8682063					
rho	0.28166527					

hausman eql

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eq1	(B)		
fwd	-0.1556598	0.0594289	-0.2150886	0.1301786
swp	-0.0074394	-0.1234026	0.1159632	0.0969565
opt	0.0589381	0.0709957	-0.0120575	0.0825224
fut	0.0300584	0.0308411	-0.0007827	0.1067057
cap	-27.1413	-27.00417	-0.1371304	1.84914

liq	-2.246277	-2.67334	0.4270626	1.026941
loan	10.04809	11.27457	-1.226487	0.7903979
cr	2.649506	2.444406	0.2051002	0.4395028
size	-0.4226575	-0.1011348	-0.3215226	0.1879165

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(9) = (b-B)'[(V_b - V_B)^{-1}](b-B)$

13.36

Prob>chi2 = 0.1470

xtreg roa fwd swp opt fut cap liq loan cr size, fe

Fixed-effects (within) regression

Group variable: ident

R-sq: within = 0.0582

between = 0.0006

overall = 0.0143

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

avg = 8.0

max = 8

F(9,950) = 6.52

Prob > F = 0.0000

corr(u_i, X_b) = -0.1739

roa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.000186	0.0010118	-0.18	0.854	-0.0021716	0.0017996
swp	-0.0005821	0.0007099	-0.82	0.412	-0.0019753	0.0008112
opt	-0.0000612	0.0010769	-0.06	0.955	-0.0021746	0.0020522
fut	-0.0002203	0.0008227	-0.27	0.789	-0.0018348	0.0013941
cap	-0.0061066	0.0130429	-0.47	0.640	-0.0317029	0.0194897
liq	0.0062791	0.0085013	0.74	0.460	-0.0104043	0.0229625
loan	-0.0136115	0.0051876	-2.62	0.009	-0.023792	-0.0034309
cr	-0.0477499	0.0068808	-6.94	0.000	-0.0612533	-0.0342465
size	-0.00159	0.0009733	-1.63	0.103	-0.0035	0.0003201
constant	0.037584	0.00874	4.30	0.000	0.0204321	0.0547359
sigma u	0.0139253	(fraction of variance due to u _i)				
sigma e	0.01295906					
rho	0.53589424					

F test that all u_i=0:

F(136, 950) = 6.58

Prob > F = 0.0000

est store eql

xtreg roa fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0439

between = 0.2154

overall = 0.1273

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

avg = 8.0

max = 8

Wald chi2(11) = 76.35

Prob > chi2 = 0.0003

Random effects u_i ~ Gaussian

corr(u_i, X_b) = 0 (assumed)

roa	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0003321	0.0008853	-0.38	0.708	-0.0020673	0.001403
swp	-0.0003764	0.0006056	-0.62	0.534	-0.0015634	0.0008106
opt	-0.0005649	0.0010463	-0.54	0.589	-0.0026156	0.0014858
fut	0.0000318	0.0007163	0.04	0.965	-0.0013721	0.0014356
cap	0.0395395	0.0108913	3.63	0.000	0.0181929	0.060886
liq	0.0110833	0.007589	1.46	0.144	-0.0037908	0.0259574
loan	-0.0190852	0.0041221	-4.63	0.000	-0.0271644	-0.0110061
cr	-0.0451722	0.0067834	-6.66	0.000	-0.0584675	-0.031877
size	0.0006638	0.0005548	1.20	0.232	-0.0004235	0.0017511
constant	0.0149721	0.0057127	2.62	0.009	0.0037753	0.0261688
sigma u	0.01038712	(fraction of variance due to u _i)				
sigma e	0.01295906					
rho	0.39115555					

hausman eql

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eq1	(B)		
fwd	-0.000186	-0.0003321	0.0001461	0.0004899
swp	-0.0005821	-0.0003764	-0.0002057	0.0003705
opt	-0.0000612	-0.0005649	0.0005037	0.000255
fut	-0.0002203	0.0000318	-0.0002521	0.0004046
cap	-0.0061066	0.0395395	-0.0456461	0.0071762

liq	0.0062791	0.0110833	-0.0048042	0.0038313
loan	-0.0136115	-0.0190852	0.0054738	0.0031496
cr	-0.0477499	-0.0451722	-0.0025777	0.0011538
size	-0.00159	0.0006638	-0.0022537	0.0007997

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(9) = (b-B)'[(V_b - V_B)^{-1}](b-B)$

53.52

Prob>chi2 = 0.0000

xtreg roe fwd swp opt fut cap liq loan cr size, fe

Fixed-effects (within) regression

Group variable: ident

R-sq: within = 0.0848

between = 0.0003

overall = 0.0234

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

avg = 8.0

max = 8

F(9,950) = 9.78

Prob > F = 0.0000

corr(u_i, X_b) = -0.4498

roe	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.010874	0.0146045	-0.74	0.457	-0.0395349	0.0177869
swp	-0.0045548	0.0102473	-0.44	0.657	-0.0246648	0.0155552
opt	-0.0133203	0.0155441	-0.86	0.392	-0.0438251	0.0171845
fut	0.0039413	0.0118743	0.33	0.740	-0.0193616	0.0272442
cap	0.1429783	0.1882625	0.76	0.448	-0.2264801	0.5124366
liq	0.1509616	0.1227075	1.23	0.219	-0.0898474	0.3917707
loan	-0.2621777	0.0748786	-3.50	0.000	-0.4091243	-0.115231
cr	-0.8043086	0.0993185	-8.10	0.000	-0.9992176	-0.6093997
size	-0.0327172	0.0140488	-2.33	0.020	-0.0602875	-0.0051468
constant	0.5768894	0.1261535	4.57	0.000	0.3293176	0.8244611
sigma u	0.13060173	(fraction of variance due to u _i)				
sigma e	0.18705169					
rho	0.32773109					

F test that all u_i=0:

F(136, 950) = 2.49

Prob > F = 0.0000

est store eql

xtreg roe fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0721

between = 0.1077

overall = 0.0804

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

avg = 8.0

max = 8

Random effects u_i ~ Gaussian

Wald chi2(11) = 89.24

corr(u_i, X_b) = 0 (assumed)

Prob > chi2 = 0.0003

roe	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0078597	0.0107821	0.73	0.466	-0.0132728	0.0289923
swp	-0.0031976	0.00723	-0.44	0.658	-0.0173682	0.010973
opt	-0.0178152	0.0140802	-1.27	0.206	-0.0454119	0.0097816
fut	0.0059506	0.0087574	0.68	0.497	-0.0112136	0.0231147
cap	0.2936455	0.1293074	2.27	0.023	0.0402076	0.5470834
liq	0.0603043	0.0948176	0.64	0.525	-0.1255348	0.2461433
loan	-0.2302551	0.0481493	-4.78	0.000	-0.324626	-0.1358841
cr	-0.7579755	0.0927784	-8.17	0.000	-0.9398179	-0.5761332
size	0.0085472	0.005643	1.51	0.130	-0.0025129	0.0196073
constant	0.1681055	0.0624272	2.69	0.007	0.0457505	0.2904605
sigma u	0.08007792	(fraction of variance due to u _i)				
sigma e	0.18705169					
rho	0.15488765					

hausman eql

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eq1	(B)		
fwd	-0.010874	0.0078597	-0.0187338	0.0098508
swp	-0.0045548	-0.0031976	-0.0013572	0.0072618
opt	-0.0133203	-0.0178152	0.0044949	0.0065853
fut	0.0039413	0.0059506	-0.0020093	0.0080192
cap	0.1429783	0.2936455	-0.1506673	0.1368296

liq	0.1509616	0.0603043	0.0906574	0.0778893
loan	-0.2621777	-0.2302551	-0.0319226	0.057345
cr	-0.8043086	-0.7579755	-0.0463331	0.0354446
size	-0.0327172	0.0085472	-0.0412643	0.0128657

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(9) = (b-B)'[(V_b - V_B)^{-1}](b-B)$

20.21

Prob>chi2 = 0.0167

xtreg npl fwd swp opt fut cap liq loan cr size, fe
 Fixed-effects (within) regression
 Group variable: ident
 R-sq: within = 0.2242
 8

Number of obs = 544
 Number of groups = 68
 Obs per group: min =
 8
 avg = 8.0
 max = 8
 F(9,950) = 9.78
 Prob > F = 0.0000

between = 0.1256
 overall = 0.1529

corr(u_i, Xb) = -0.1030

npl	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0036282	0.0028358	1.28	0.201	-0.0019442	0.0092006
swp	-0.0011932	0.0018432	-0.65	0.518	-0.0048153	0.0024288
opt	0.0077679	0.0101158	0.77	0.443	-0.0121102	0.0276461
fut	-0.0013209	0.0023346	-0.57	0.572	-0.0059086	0.0032667
cap	-0.1179218	0.0613131	-1.92	0.055	-0.2384055	0.0025618
liq	-0.0032204	0.0236675	-0.14	0.892	-0.0497283	0.0432875
loan	-0.0549489	0.0205173	-2.68	0.008	-0.0952665	-0.0146313
cr	0.1367217	0.0186156	7.34	0.000	0.100141	0.1733025
size	-0.0138408	0.0033208	-4.17	0.000	-0.0203663	-0.0073152
constant	0.2135445	0.0310042	6.89	0.000	0.1526195	0.2744694
sigma u	0.04340799	(fraction of variance due to u _i)				
sigma e	0.02890061					
rho	0.69286789					

F test that all u_i=0: F(67,467) = 15.40 Prob > F = 0.0000

est store eql

xtreg npl fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Number of obs = 1096
 Number of groups = 137
 Obs per group: min = 8
 avg = 8.0
 max = 8

Group variable: ident

R-sq: within = 0.2210

between = 0.1622

overall = 0.1802

Random effects u_i ~ Gaussian

Wald chi2(11) = 144.57

corr(u_i, Xb) = 0 (assumed)

Prob > chi2 = 0.0000

npl	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	0.0036337	0.0026824	1.35	0.176	-0.0016237	0.008891
swp	-0.0013395	0.0017237	-0.78	0.437	-0.0047178	0.0020388
opt	0.0043778	0.0097845	0.45	0.655	-0.0147995	0.0235551
fut	-0.000682	0.002238	-0.30	0.761	-0.0050684	0.0037043
cap	-0.0835898	0.0540044	-1.55	0.122	-0.1894365	0.0222569
liq	-0.0038479	0.022946	-0.17	0.867	-0.0488213	0.0411254
loan	-0.0540318	0.0177319	-3.05	0.002	-0.0887856	-0.019278
cr	0.1490451	0.0184195	8.09	0.000	0.1129437	0.1851466
size	-0.0105992	0.0023787	-4.46	0.000	-0.0152613	-0.0059371
constant	0.1785238	0.0245252	7.28	0.000	0.1304553	0.2265924
sigma u	0.03757043	(fraction of variance due to u _i)				
sigma e	0.02890061					
rho	0.62824829					

hausman eql

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eq1	(B)		
fwd	0.0036282	0.0036337	-50.50e-06	0.00092
swp	-0.0011932	-0.0013395	0.0001463	0.000653
opt	0.0077679	0.0043778	0.0033901	0.0025677
fut	-0.0013209	-0.000682	-0.0006389	0.0006648

cap	-0.1179218	-0.0835898	-0.034332	0.0290313
liq	-0.0032204	-0.0038479	0.0006275	0.005799
loan	-0.0549489	-0.0540318	-0.0009171	0.0103218
cr	0.1367217	0.1490451	-0.0123234	0.0026954
size	-0.0138408	-0.0105992	-0.0032416	0.0023172

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(9) = (b-B)'[(V_b - V_B)^{-1}](b-B)$

-121.13

Prob>chi2 = 0.0000

xtreg cov fwd swp opt fut cap liq loan cr size, fe

Fixed-effects (within) regression

Group variable: ident

R-sq: within = 0.0721

8

between = 0.0194

overall = 0.0288

Number of obs = 544

Number of groups = 68

Obs per group: min =

avg = 8.0

max = 8

F(9,950) = 4.03

Prob > F = 0.0001

corr(u_i, Xb) = -0.3047

cov	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0583388	0.0709624	-0.82	0.411	-0.1977839	0.0811064
swp	0.061238	0.0461254	1.33	0.185	-0.029401	0.151877
opt	-0.2406397	0.2531399	-0.95	0.342	-0.7380741	0.2567946
fut	0.0299821	0.058422	0.51	0.608	-0.0848204	0.1447846
cap	0.3350541	1.534311	0.22	0.827	-2.679954	3.350062
liq	2.382726	0.5922596	4.02	0.000	1.218902	3.54655
loan	0.2474071	0.5134287	0.48	0.630	-0.7615093	1.256324
cr	0.8339636	0.4658412	1.79	0.074	-0.0814409	1.749368
size	.2962591	0.0831001	3.57	0.000	0.1329626	0.4595556
constant	-2.006031	0.7758545	-2.59	0.010	-3.53063	-0.4814332
sigma u	0.86382835	(fraction of variance due to u _i)				
sigma e	0.72321497					
rho	0.58791073					

F test that all u_i=0:

F(67,467) = 8.81

Prob > F = 0.0000

est store eql

xtreg cov fwd swp opt fut cap liq loan cr size, re

Random-effects GLS regression

Group variable: ident

R-sq: within = 0.0633

between = 0.1005

overall = 0.0847

Random effects u_i ~ Gaussian

corr(u_i, Xb) = 0 (assumed)

Number of obs = 1096

Number of groups = 137

Obs per group: min = 8

avg = 8.0

max = 8

Wald chi2(11) = 38.90

Prob > chi2 = 0.0000

cov	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
fwd	-0.0651431	0.0645069	-1.01	0.313	-0.1915744	0.0612882
swp	0.0883657	0.0412329	2.14	0.032	0.0075507	0.1691808
opt	-0.2474007	0.2373247	-1.04	0.297	-0.7125485	0.2177472
fut	0.0047522	0.054152	0.09	0.930	-0.1013838	0.1108882
cap	1.221907	1.271605	0.96	0.337	-1.270394	3.714207
liq	2.635851	0.557683	4.73	0.000	1.542812	3.72889
loan	0.0203188	0.4137335	0.05	0.961	-0.790584	0.8312216
cr	0.7375429	0.4516063	1.63	0.102	-0.1475892	1.622675
size	0.1539228	0.0529317	2.91	0.004	0.0501787	0.2576669
constant	-0.6220659	0.5590083	-1.11	0.266	-1.717702	0.4735703
sigma u	0.75210661	(fraction of variance due to u _i)				
sigma e	0.72321497					
rho	0.51957577					

hausman eql

	---- Coefficients ----		(b-B) Difference	sqrt(diag(V _b -V _B)) S.E.
	(b) Eql	(B)		
fwd	-0.0583388	-0.0651431	0.0068043	0.0295723
swp	0.061238	0.0883657	-0.0271277	0.0206736
opt	-0.2406397	-0.2474007	0.0067609	0.0880729
fut	0.0299821	0.0047522	0.0252299	0.0219246

cap	0.3350541	1.221907	-0.8868528	0.8585629
liq	2.382726	2.635851	-0.2531251	0.1994019
loan	0.2474071	0.0203188	0.2270883	0.3040289
cr	0.8339636	0.7375429	0.0964206	0.1142794
size	0.2962591	0.1539228	0.1423363	0.0640615

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(9) = (b-B)'[(V_b - V_B)^{-1}](b-B)$

11.05