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Monetary and Macroprudential Policies in a Dollarized Economy : the Case of Lebanon

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Joseph Bitar. Monetary and Macroprudential Policies in a Dollarized Economy : the Case of Lebanon. Economics and Finance. Université de Bordeaux, 2022. English. NNT: 2022BORD0251 . tel-03882379

HAL Id: tel-03882379

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THÈSE PRÉSENTÉE POUR OBTENIR LE GRADE DE
DOCTEUR DE L'UNIVERSITÉ DE BORDEAUX
ÉCOLE DOCTORALE Santé, Politique, Santé Publique
n° 545

SPÉCIALITÉ SCIENCES POLITIQUES

par

Joseph Bitar

**Politiques Monétaire et
Macroprudentielle dans une
Économie Dollarisée**

Le Cas du Liban

Sous la direction de : Edwin Le Héron

Soutenue le 26 Septembre 2022

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Thesis submitted for the degree of Doctor of Philosophy
of the University of Bordeaux

Doctoral School: ED SP2

Speciality: Political Sciences

by

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The Case of Lebanon

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Titre: Politiques Monétaire et Macroprudentielle dans une Économie Dollarisée - Le Cas du Liban

Résumé:

Dans le chapitre 1, nous analysons en profondeur le cas unique de la dollarisation du Liban entre 1997 et 2017 : une économie fortement dollarisée avec des déficits publics récurrents et un financement monétaire de la dette publique, ainsi qu'une inflation contenue et un régime de taux de change fixe qui dure depuis plus de 20 ans. Ce qui rend le cas du Liban spécifique, c'est le niveau élevé de liquidités en devises entre les mains du système bancaire en raison des entrées abondantes de capitaux au cours des trois dernières décennies, et les niveaux élevés des réserves internationales brutes de la banque centrale contrastant avec son niveau faible et parfois négatif de réserves internationales nettes. Nous avons mis en lumière un certain nombre de domaines jusqu'ici inexplorés en finance internationale et en économie monétaire, principalement la différence entre les réserves internationales brutes et nettes et leurs coûts budgétaires relatifs, ainsi qu'une classification synthétique des techniques de stérilisation. Nous expliquons le mécanisme de « gel » monétaire qui a permis de contenir l'inflation au Liban, malgré le financement monétaire des déficits publics récurrents du pays. Nous évaluons également les résultats de la politique monétaire et de taux de change du Liban au cours des deux dernières décennies et formulons un certain nombre de recommandations politiques à la lumière des études précédentes.

Dans le chapitre 2, nous analysons les questions de liquidité liées à la dollarisation financière. Nous formalisons les mécanismes monétaires sous la dollarisation, mettant en lumière l'interconnexion de la balance des paiements avec la monnaie et les agrégats de crédit dans une petite économie ouverte dollarisée. Après avoir présenté le mécanisme de création monétaire en dollars dans le cadre de la dollarisation financière, nous proposons une nouvelle mesure de la liquidité en dollars dans les économies dollarisées définie comme les avoirs extérieurs bruts du secteur bancaire, égaux à la somme des réserves internationales brutes de la banque centrale et des liquidités étrangères brutes du secteur bancaire local.

Dans le chapitre 3, nous soutenons qu'au-delà de ses caractéristiques traditionnelles de crise de change et de dette, la crise actuelle du Liban met en lumière la faiblesse inhérente des systèmes monétaires dollarisés. Cette crise peut être considérée comme une crise monétaire, car les problèmes de liquidité et de solvabilité du système bancaire dollarisé du pays ont entraîné la perte du « caractère monétaire » de ses dépôts libellés en dollars. Nous analysons les différentes dimensions de cette crise et nous formulons des recommandations politiques, inspirées de l'expérience de la crise de convertibilité argentine de 2001-2002. Enfin, nous examinons les implications redistributives de différents scénarios de conversion.

Dans le chapitre 4, nous passons en revue et analysons les utilisations des

réserves obligatoires comme outil prudentiel et comme instrument de politique monétaire. Nous analysons également leur utilisation pour la gestion des flux de capitaux et pour la dédollarisation dans les économies émergentes. Nous soutenons que les réserves obligatoires sont un outil sous-optimal et obsolète, et nous suggérons d'imposer des impôts directs sur les dépôts bancaires et les paiements d'intérêts sur les prêts, comme une alternative plus efficace aux réserves obligatoires.

Dans le chapitre 5, nous procédons à une analyse complète des risques systémiques de liquidité et de change (FX) impliqués par l'intermédiation en devises (dollarisation partielle du système bancaire national).

Mots Clés: Dollarisation, Liquidité, Liban

Unité de recherche: UMR 5116 - Centre Emile Durkheim - Science politique et sociologie comparatives (CED), Sciences Po Bordeaux - 11 allée Ausone, 33607 Pessac

Title: Monetary and Macroprudential Policies in a Dollarized Economy - The Case of Lebanon

Summary:

In Chapter 1, we make a thorough analysis of the unique dollarization case of Lebanon in the years between 1997 and 2017: a heavily dollarized economy with recurring public deficits and monetary financing of the public debt, together with a contained inflation and a de facto fixed exchange rate lasting for more than 20 years. What makes Lebanon's case specific is the high level of foreign currency liquidity in the hands of the banking system due to the abundant capital inflows in the last three decades, and the high levels of the central bank's gross international reserves contrasting with its low and sometimes negative levels of net international reserves. We shed light on a number of areas that were unexplored so far in international finance and monetary economics, mainly the difference between gross and net international reserves and their relative fiscal costs, together with a synthetic classification of sterilization techniques. We explain the monetary "freezing" mechanism that helped contain inflation in Lebanon, despite the monetary financing of the country's recurring public deficits. We also assess the results of Lebanon's monetary and exchange rate policy in the last two decades, and make a number of policy recommendations in light of previous studies.

In Chapter 2, we analyze the liquidity questions relating to financial dollarization. We formalize monetary mechanisms under dollarization, shedding light on the interconnection of the balance of payments with money and credit aggregates in a small open dollarized economy. After presenting the dollar money creation mechanism under financial dollarization, we propose a new measure of dollar liquidity in dollarized economies defined as the Gross Foreign Assets of the Locational Banks Sector, equal to the sum of the central bank's gross international reserves and the gross liquid foreign assets of the locational banks sector.

In Chapter 3, we argue that above its traditional currency and debt crisis features, Lebanon's ongoing crisis sheds the light on the inherent weakness of dollarized monetary systems. This crisis can be seen as a monetary crisis, as the country's dollarized banking system's liquidity and solvency problems led to the loss of the "moneyness" of its dollar denominated deposits. We analyze the different dimensions of this crisis and we make policy recommendations, inspired by the experience of the Argentine 2001-2002 convertibility crisis. Finally, we look into the redistributive implications of different conversion scenarios.

In Chapter 4, we review and analyze the uses of reserve requirements as a prudential tool and as a monetary policy instrument. We also analyze their use for capital flows management and for de-dollarization in emerging economies. We argue that reserve requirements are a sub-optimal and outdated policy tool, and we suggest imposing direct taxes on banks deposits and loans interest payments, as a more efficient alternative to reserve requirements.

In Chapter 5, we make a comprehensive analysis of the liquidity and the foreign exchange (FX) systemic risks implied by foreign currency intermediation

(partial dollarization of the domestic banking system).

Keywords: Dollarization; Liquidity; Lebanon

Research Unit: UMR 5116 - Centre Emile Durkheim - Science politique et sociologie comparatives (CED), Sciences Po Bordeaux - 11 allée Ausone, 33607 Pessac

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The views expressed in this thesis are those of the author and do not necessarily represent those of the University of Bordeaux.

Acknowledgments

My first and utmost gratitude goes for my PhD supervisor Professor Edwin Le Héron. I was not only lucky to benefit from his deep mastery of monetary theory, but also to know a man with such an ethical and professional stature. I am also very grateful to the jury members for their work in examining and assessing my contributions. Also, I would like to thank everyone who contributed directly and indirectly to building this thesis: journals editors and reviewers, conferences participants, colleagues, ex-colleagues, and administrative staff. Finally, I would like to thank my family and friends for their continuous support during my thesis years.

Résumé

L'objectif de la thèse est de faire une analyse de la gestion monétaire du Liban depuis 1997, qui a été menée sous une dollarisation partielle, avec un régime de taux de change fixe. Nous nous concentrons sur les questions de liquidité liées à la dollarisation financière. Dans les systèmes monétaires partiellement dollarisés, l'offre de liquidité en dollars n'est pas directement contrôlée par la banque centrale. Nous montrons dans cette thèse que la liquidité en dollars est étroitement liée aux transactions de la balance des paiements (à la fois réelles et financières), ce qui fait de la position extérieure un élément clé de la gestion monétaire des économies dollarisées. En particulier, dans de nombreuses petites économies ouvertes comme le Liban, les envois de fonds et les transferts de capitaux des expatriés jouent un rôle clé dans la fourniture de liquidités en dollars à l'économie nationale. Les déficits de la balance des paiements se traduiraient finalement (et parfois rapidement) par une pression sur le taux de change de la monnaie nationale.

Un des principaux résultats de la thèse est l'incompatibilité de la dollarisation financière partielle avec la fixité du taux de change, ce qui a été démontré par la crise monétaire actuelle au Liban. La surévaluation potentielle du taux de change peut entraîner des déficits extérieurs qui se traduisent par une diminution de la liquidité en dollars dans le système monétaire national dollarisé. Ce résultat peut être considéré comme une généralisation des analyses précédentes des problèmes de liquidité dans les régimes de dollarisation totale de jure et de currency board aux systèmes monétaires partiellement dollarisés. En outre, les résultats de la thèse plaident en faveur d'une réglementation macroprudentielle plus stricte du risque de liquidité en dollars dans les systèmes bancaires dollarisés, parallèlement aux réglementations macroprudentielles existantes en matière de change (FX).

En termes de cadre théorique, notre analyse adhère au modèle de financement de l'intermédiation bancaire dans lequel les banques sont modélisées comme des intermédiaires financiers dont les prêts sont financés par la création ex-nihilo de dépôts. La plupart des publications académiques précédentes ont adopté le modèle des fonds prêtables, dans lequel les banques sont modélisées comme des intermédiaires qui reçoivent des dépôts de ressources physiques des épargnants avant de les prêter aux emprunteurs. Nous considérons plutôt les dépôts bancaires comme le résultat du crédit bancaire, et non comme une source de financement sur laquelle les banques s'appuient pour fournir du crédit.

Lorsqu'il s'agit de systèmes monétaires dollarisés, le point de confusion relatif à l'intermédiation en dollars est que la liquidité en dollars ne peut être générée que par des sources étrangères, et non créée par la banque centrale nationale. Cela crée une fausse impression que le financement en dollars des banques suit la logique des fonds prêtables dans laquelle les dépôts financent le crédit, alors que

ce n'est pas le cas en réalité. Les dépôts étrangers ne sont une source de liquidité en dollars que lorsqu'ils résultent de transactions transfrontalières, tandis que les mécanismes de création de monnaie en dollars dans le système bancaire national restent les mêmes que les mécanismes de création de monnaie nationale. Le fait de négliger la création de monnaie en dollars dans les économies dollarisées a conduit à d'importantes erreurs d'analyse dans la littérature académique sur la dollarisation.

Nous avons regroupé nos analyses en cinq chapitres, comme suit.

Dans le chapitre 1, nous analysons en profondeur le cas unique de la dollarisation du Liban entre 1997 et 2017 : une économie fortement dollarisée avec des déficits publics récurrents et un financement monétaire de la dette publique, ainsi qu'une inflation contenue et un taux de change fixe de facto depuis plus de 20 ans. Ce qui rend le cas du Liban spécifique, c'est le niveau élevé de liquidités en devises étrangères entre les mains du système bancaire en raison de l'abondance des entrées de capitaux au cours des trois dernières décennies, et les niveaux élevés des réserves internationales brutes de la banque centrale qui contrastent avec les niveaux faibles et parfois négatifs de ses réserves internationales nettes. Nous mettons en lumière un certain nombre de domaines jusqu'ici inexplorés en finance internationale et en économie monétaire, principalement la différence entre les réserves internationales brutes et nettes et leurs coûts budgétaires relatifs, ainsi qu'une classification synthétique des techniques de stérilisation. Nous expliquons le mécanisme de " gel " monétaire qui a permis de contenir l'inflation au Liban, malgré le financement monétaire des déficits publics récurrents du pays. Nous évaluons également les résultats de la politique monétaire et de change du Liban au cours des deux dernières décennies, et formulons un certain nombre de recommandations politiques à la lumière des études précédentes.

Ce chapitre a été publié dans *Economic Systems* (Elsevier) : Bitar J., The unique dollarization case of Lebanon, *Economic Systems*, 45(2), juin 2021.

<https://www.sciencedirect.com/science/article/abs/pii/S0939362520300728>

Dans le chapitre 2, nous analysons les questions de liquidité liées à la dollarisation financière. Nous formalisons les mécanismes monétaires sous la dollarisation, en mettant en lumière l'interconnexion de la balance des paiements avec les agrégats de monnaie et de crédit dans une petite économie ouverte dollarisée. Après avoir présenté le mécanisme de création de monnaie en dollars dans le cadre de la dollarisation financière, nous proposons une nouvelle mesure de la liquidité en dollars dans les économies dollarisées, définie comme les actifs étrangers bruts du secteur des banques locales, égale à la somme des réserves internationales brutes de la banque centrale et des actifs étrangers liquides bruts du secteur des banques locales. Nos résultats empiriques pour le Liban suggèrent que notre mesure de la liquidité en dollars a un lien contemporain significatif et positif avec le total des dépôts bancaires et un lien retardé avec le total des crédits bancaires au secteur privé dans la période allant de 2002T1 à 2017T2. Nous testons la robustesse de nos résultats pendant la période de crise financière et monétaire en cours au Liban, qui est en fait une crise de liquidité en dollars. Nous testons également nos résultats en utilisant les données de deux autres

grandes économies dollarisées : Pérou et Russie.

Ce chapitre a été publié dans *Ensayos Económicos* (Banque centrale d'Argentine) : Bitar J., Dollar liquidity, money and credit in a small open dollarized economy, *Ensayos Económicos - Central Bank of Argentina*, n° 79, mai 2022, p. 5-39.

http://www.bcra.gov.ar/PublicacionesEstadisticas/Resumen_ensayos.asp?id=1583

Dans le chapitre 3, nous soutenons qu'au-delà de ses caractéristiques traditionnelles de crise de change et de dette, la crise actuelle du Liban met en lumière la faiblesse inhérente des systèmes monétaires dollarisés. Cette crise peut être considérée comme une crise monétaire, car les problèmes de liquidité et de solvabilité du système bancaire dollarisé du pays ont conduit à la perte du « caractère monétaire » de ses dépôts libellés en dollars. Nous analysons les différentes dimensions de cette crise et nous formulons des recommandations politiques, inspirées de l'expérience de la crise de convertibilité argentine de 2001-2002. Enfin, nous examinons les implications redistributives de différents scénarios de conversion.

Ce chapitre a été publié dans *Review of Middle East Economics and Finance* (De Gruyter) : The monetary crisis of Lebanon, *Review of Middle East Economics and Finance*, 17(2), août 2021, pp. 71-96.

<https://www.degruyter.com/document/doi/10.1515/rmeef-2020-0050/html>

Dans le chapitre 4, contrairement à la littérature antérieure adoptant la vision des fonds prêtables, nous suivons le modèle de financement de l'intermédiation bancaire afin d'analyser les mécanismes monétaires relatifs aux réserves obligatoires et de calculer les marges des banques sur leurs activités de prêt et de dépôt. Nous montrons que, lorsqu'elles sont rémunérées à un taux inférieur au taux d'intérêt du marché monétaire, les réserves obligatoires augmentent l'écart entre les taux d'intérêt des prêts et des dépôts bancaires, sans aucun impact sur le niveau des taux d'intérêt. Nous passons en revue et analysons les utilisations des réserves obligatoires comme outil prudentiel et comme instrument de politique monétaire. Nous analysons également leur utilisation pour la gestion des flux de capitaux et pour la dédollarisation dans les économies émergentes. Nous soutenons que les réserves obligatoires sont un outil de politique sous-optimal et obsolète, et nous suggérons d'imposer des taxes directes sur les dépôts bancaires et les paiements d'intérêts sur les prêts, comme une alternative plus efficace aux réserves obligatoires.

Ce chapitre a été publié dans *International Journal of Finance and Economics* (Wiley) : Bitar J., A note on reserve requirements and banks liquidity, *International Journal of Finance and Economics* (2020).

<https://onlinelibrary.wiley.com/doi/10.1002/ijfe.2403>

Dans le chapitre 5, nous effectuons une analyse complète des risques systémiques de change et de liquidité impliqués par l'intermédiation en devises (dollarisation partielle du système bancaire national). Nous expliquons le compromis entre l'effet positif de l'intermédiation en devises sur la croissance en période de calme et son effet négatif en termes de fragilité financière. Nous passons en revue les études narratives et économétriques par pays qui ont été réalisées jusqu'à présent pour évaluer l'efficacité des mesures macroprudentielles liées au change. À travers les résultats des études passées et une comparaison

des expériences des économies d'Amérique latine et des économies européennes en transition, nous montrons les avantages des mesures macroprudentielles administratives par rapport aux mesures liées aux prix pour faire face aux risques systémiques de liquidité et de change. Nous montrons qu'il est possible de neutraliser ces risques systémiques sans chercher à limiter ou à interdire directement l'intermédiation en devises (c'est-à-dire en dédollarisant). Nous soutenons que la dédollarisation est un objectif plus ambitieux qui doit être justifié par les autres inconvénients de l'intermédiation en devises, et nous soulignons qu'une gestion monétaire saine devrait être une condition préalable à la dédollarisation.

Ce chapitre a été publié dans *Latin American Journal of Central Banking* (Elsevier) : Bitar J., Foreign currency intermediation : systemic risk and macroprudential regulation, *Latin American Journal of Central Banking*, 2(2), juin 2021.

<https://www.sciencedirect.com/science/article/pii/S2666143821000089>

En conclusion, l'étude de la politique monétaire du Liban sous la dollarisation partielle nous a permis de mettre en lumière un certain nombre de mécanismes monétaires qui ont été négligés par la littérature académique jusqu'à présent. Les principales contributions analytiques et conceptuelles de cette thèse sont :

- La formalisation des mécanismes monétaires dans les économies dollarisées.
- Développer une compréhension approfondie de la liquidité en dollar dans les économies dollarisées.
- Analyser les crises de liquidité des systèmes monétaires dollarisés.
- Faire une analyse approfondie des réserves obligatoires des banques centrales.
- Suggérer un cadre macroprudentiel pour faire face aux risques systémiques liés à la dollarisation financière.

Nos résultats ont montré que les problèmes de liquidité dans le cadre de la dollarisation sont bien plus complexes que les problèmes de risque de change. Ainsi, les modèles macroéconomiques antérieurs qui abordaient la dollarisation uniquement sous l'angle de ses implications en termes de risque de change ne parviennent pas à rendre compte de la complexité des systèmes monétaires dollarisés. Une nouvelle génération de modélisation macroéconomique des économies dollarisées est nécessaire pour faire face à ce fait.

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Introduction

The objective of the thesis is to make an analysis of Lebanon's monetary management since 1997, which was conducted under partial dollarization, with a fixed exchange rate regime. We focus on liquidity issues relating to financial dollarization. In partially dollarized monetary systems, dollar liquidity supply is not directly controlled by the central bank. We show in this thesis that dollar liquidity is closely linked to balance of payments transactions (both real and financial), which makes the external position a key element in dollarized economies monetary management. In particular, in many small open economies like Lebanon, remittances and capital transfers from expatriates play a key role in the provision of dollar liquidity to the domestic economy. Balance of payments deficits would ultimately (and sometimes quickly) translate into a pressure on the domestic currency's exchange rate.

After making a general analysis of Lebanon's monetary policy in the period 1997-2017 in Chapter 1, we make an in-depth analysis of dollar liquidity and monetary mechanisms in dollarized economies in Chapter 2. In Chapter 3, we analyze the ongoing monetary crisis in Lebanon, through the lens of our findings in the first two chapters. Chapter 4 is dedicated to the analysis of reserve requirements, a widely utilized tool in dollarized economies. Chapter 5 is dedicated to the analysis of the macroprudential implications of financial dollarization.

We have left the interest rate dimension of monetary policy at the margin of our work, because *Banque du Liban* (Lebanon's central bank) did not pursue standard inflation targeting that relies on controlling short term interest rates as is standard in most advanced economies and in a good number of emerging economies. In a separate paper – Bitar and Boileau (2021), using ARDL and DOLS cointegration models, we found that interest rates levels and spreads in Lebanon were mainly influenced by international factors (US interest rates and measures of emerging markets risk sentiment), and less by domestic variables. The reason behind this is that Lebanon does not enjoy monetary sovereignty, and is dominated by its need for hard currencies for its international trade operations. This is especially important because the country suffers a recurring structural trade deficit, due to the weakness of its industrial and export sectors. Also, the country's reliance on imports makes domestic inflation largely determined by the domestic currency's exchange rate. In such a context, inflation targeting would turn into exchange rate targeting, as the interest rate would be used by the domestic central bank as a tool for exchange rate management.

One main result of the thesis is the incompatibility of partial financial dollarization with the fixity of the exchange rate, which has been demonstrated by the ongoing monetary crisis in Lebanon. The potential overvaluation of the exchange rate can lead to external deficits that result in the shrinking of dollar liquidity in the domestic dollarized monetary system. This result can be seen as

a generalization of previous analyses of liquidity issues under total de jure dollarization and currency board regimes to partially dollarized monetary systems. In addition, the thesis results call for a stricter macroprudential regulation of the dollar liquidity risk in dollarized banking systems, alongside the existing foreign exchange (FX) related macroprudential regulations.

Dollarization literature and dollar liquidity in dollarized monetary systems

Dollarization can take multiple forms. The basic form of dollarization that has been traditionally referred to as “currency substitution” is the use of a foreign currency as a medium of exchange for transactions – see for example Ize and Levy-Yeyati (2003). This often comes with the foreign currency being the unit of account too, as domestic agents tend to use it to price goods and services as well as to denominate contracts. The term “assets dollarization” has been commonly used to describe the use of the foreign currency as store of value, by holding foreign currency term deposits at domestic banks, for example – see Honohan (2008). “Liabilities dollarization” often described domestic debt in foreign currency, mainly *vis-à-vis* non-resident counterparts. The term “loans dollarization” was mostly used for local banks foreign currency credit to resident agents - See for example De Nicolo, Honohan and Ize (2003), and Levy-Yeyati (2006).

Ponsot (2019) draws a typology of dollarization regimes based on the institutionalist monetary approach, beyond the common interpretations of dollarization through the purely functionalist approach to money. He makes a point that *de facto* dollarization is not just a simple process of substituting the functions of money, but more broadly, a crisis of the legitimacy of the domestic currency, gradually eroding monetary sovereignty. His four regimes typology is based on a double distinction, between partial dollarization and full dollarization on the one hand, and between *de facto* dollarization and *de jure* dollarization on the other hand. The first regime corresponds to the most common situation: one or more foreign currencies coexist alongside the domestic currency, without any recognition from the authorities. In the second regime, the authorities take note of dollarized practices and legalize some of them while maintaining the national unit of account. The third regime is the *de facto* full dollarization, *i.e.*, the non-assumed full loss of monetary sovereignty resulting from a deficit of political sovereignty. The fourth regime corresponds to *de jure* and full dollarization. The list of dollarized countries reveals the existence of cases of “official bi-monetization” (second regime) where a foreign currency is legal alongside the national currency. Lebanon falls in this category.

Away from the traditional classifications, we broadly define dollarization in this thesis as resident agents’ use of the foreign currency in any economic activity. Le Heron (2016) highlights money as an institution that embodies the confidence between monetary authorities and economic agents. He adds to the three traditional functions of money, another three functions: the financing of the economy through the credit and financial market activities of banks;

speculation in the form of an arbitrage between money and financial assets; and a monetary policy function. When confidence in the dollar is higher than that in the domestic currency, dollar starts playing the role that the domestic currency is supposed to play, and dollar liquidity (mainly international reserves) becomes an essential component of the domestic monetary system, both for exchange rate management, and because it constitutes the “ultimate” liquidity in the eyes of economic agents. Dollarization is a phenomenon that is not exclusive to some emerging and developing economies. It is a generalized phenomenon that goes in parallel with the globalization of real and financial activities that leads domestic agents to contract, trade, save, borrow and invest using a currency other than their domestic currency.

Financial dollarization in the form of foreign currency bank intermediation is a common feature in a large number of emerging and developing economies. Honohan (2008) notes that in 45 countries, more than half of total bank deposits were denominated in foreign currency at some stage since 1990. Going further, Rajan and Tokatlidis (2005) stress that dollarization is a response to institutional infirmities and that countries have to learn to “live with dollarization” until those infirmities are fixed.

Past literature on dollarization has mainly focused on the causes and determinants of deposits and liabilities dollarization – see for example Honohan and Shi (2001), Ize and Levy-Yeyati (2003), Havrylyshyn and Beddies (2003), Feige (2003), Honohan (2008) Haiss and Rainer (2012), on the advantages and inconveniences of dollarization – see for example De Nicolo, Honohan and Ize (2003), on the effects of dollarization on macroeconomic performance, and on the implications of dollarization for monetary policy and for the choice of an exchange rate regime - see for example Calvo and Vegh (1996), Balino, Bennett, and Borensztein (1999), Levy-Yeyati (2006).

In this thesis, we focus on the liquidity dimension relating to dollarized monetary systems that has been at the margin of previous studies on dollarization. The early literature on dollarization - see for example Broda , Levy-Yeyati and Sturzenegger (2001) - has broadly approached the liquidity issue from the point of view of the absence of a lender of last resort that is able to provide high powered money to banks in dollarized economies. Later, Levy-Yeyati (2008) and Ize, Kiguel and Levy-Yeyati (2005) approach dollar liquidity in dollarized economies from the angle of the insurance against bank runs and the limit it imposes to the central bank as a lender of last resort.

Although dollar liquidity crises in dollarized economies have not been extensively analyzed in past literature, we could find few papers that alluded to them. Rajan and Tokatlidis (2005) pointed that a dollar shortage arising from a variety of causes including excessive government borrowing, an external liquidity shock, or an overvalued exchange rate, can be magnified by a dollarized banking system, and lead to a total collapse of the financial system, the exchange rate, and other asset prices. Also, dollar deposits convertibility risk in dollarized economies, resulting from the lack of their coverage in foreign liquid assets, has been mentioned in few academic papers. Rogers (1992) discusses the dollar convertibility risk of Mexdollars, *i.e.*, dollar denominated demand de-

posits held in Mexican banks, after Mexdollars were forcibly converted to pesos amid a severe balance of payments crisis in August 1982. Honohan (2008) sees forced conversion as one of the risks inherent to dollarized banking systems.

In this thesis, we propose a measure of dollar liquidity in dollarized monetary systems that we define as the gross foreign assets of the locational banking system, equal to the sum of the central bank's gross international reserves and the gross liquid foreign assets of the locational banks sector. We formalize monetary mechanisms under dollarization, shedding light on the connection of our liquidity measure with money and credit aggregates in a small open dollarized economy.

It is worthy to note that some differing patterns can exist between international liquidity rich countries - that can exhibit as a result some structural problems similar to those of the "Dutch disease" case – see for example Luiz Carlos Bresser-Pereira (2008) – and countries that suffer a shortage of international liquidity.

The financing model of bank intermediation, the endogeneity of money, and the Money View

In terms of theoretical framework, our analysis adheres to the financing model of bank intermediation in which banks are modeled as financial intermediaries whose loans are funded by ex-nihilo creation of ledger-entry deposits. Most of the previous mainstream academic literature adopted the loanable funds model, where banks are modeled as intermediaries that receive deposits of physical resources from savers before lending them to borrowers. We rather see bank deposits as the result of bank credit, and not a funding source banks rely on to provide credit.

Mainstream monetary economics has been dominated for decades by a wrong perception deeming that banks collect client deposits and lend the collected amounts subsequently to borrowers. This vision translated into a wrong macro modeling of the monetary sector and a wrong micro modeling of banks' behavior. The mainstream academic literature on the theory of money has been recently discredited by a number of central banks. The clearest position in that regards is that expressed in the Bank of England Quarterly Bulletin 2014 Q1 - McLeay, Radia and Thomas (2014) that states: "The reality of how money is created today differs from the description found in some economics textbooks: Rather than banks receiving deposits when households save and then lending them out, bank lending creates deposits. In normal times, the central bank does not fix the amount of money in circulation, nor is central bank money multiplied up into more loans and deposits."

In that regards, Jakab and Kumhof (2019) state that the conceptual and modeling framework that is almost universally used in the literature is the intermediation of loanable funds model, whose critical feature is that it adopts a shortcut that describes banks as intermediaries of physical resources akin to warehouses, *i.e.*, banks receive deposits of physical resources from savers before lending them to borrowers. They argue that a more realistic framework is

the financing through money creation model that describes banks as financial institutions that create digital purchasing power for their borrowers, with all physical resource trading taking place outside the banking sector. They stress that banks create their own funding in the act of lending, and because both entries are in the name of the same customer, a new loan involves no intermediation. No real resources need to be diverted from other uses by other agents, in order to be able to lend to the new customer. Instead, new purchasing power is injected into the economy independently of the economy's pre-loan income flow.

Werner (2016) refers to the currently prevalent loanable funds vision of banking as the “financial intermediation theory” supposing that banks collect deposits and then lend them out, just like other non-bank financial intermediaries. Since, according to this theory, banks are virtually identical with other non-bank financial intermediaries, they are not usually included in the economic models used by academics or by central bankers. He recalls the financing model of banking that was predominant a century ago, to which he refers as the “credit creation theory” that does not consider banks as financial intermediaries that gather deposits to lend out, but instead argues that each individual bank creates credit and money newly when granting a bank loan. Werner (2016) provides an empirical test of loan booking in a bank's software and finds that only the financing model (or the credit creation theory) of banking conforms to the facts. Werner (2012) notes that the modern fiat money system is one in which about 97% of the money supply is created and allocated by banks. In such a system, the amount of money actually used for transactions can only increase when banks create new credit.

Le Heron (2020) points to the fact that in the first part of Keynes' General Theory, firms' expectations of demand and of the profitability of their investments determine the level of output and the need for financing. Therefore, the demand for money is endogenous to output, and the supply of money is demanded as banks finance creditworthy firms. He notes that, later, Horizontalist post-Keynesians adopted the first part of the General Theory and developed the theory of endogenous money, driven by the demand for money necessary to the financing of effective demand. In this approach, money is mainly a flow. Banking behaviour can explain a possible rationing of the endogenous demand for money. Taking into account the lender's risk is necessary to fully endogenize the demand and supply of money.¹

When it comes to dollarized monetary systems, the confusing point relating to dollar intermediation is that dollar liquidity can only be generated through foreign sources, and not created by the domestic central bank. This creates a false impression that dollar funding of banks follows the loanable funds logic in which deposits fund credit, while it does not in reality. Foreign deposits are a

¹Le Heron (2020) notes that Structuralist post-Keynesians, and also Keynesians with the IS-LM model, took up the second approach and developed the preference for liquidity view. While the demand for money remains endogenous in their analysis, notably with speculative motive, the money supply is considered exogenous, *i.e.*, determined by the monetary authority. The theory of liquidity preference focuses on the portfolio theory between money and financial assets, where money is mainly a stock.

source of dollar liquidity only when they result from cross-border transactions, while dollar money creation mechanisms in the domestic banking system remain the same as the domestic money creation mechanisms.

Overlooking dollar money creation in dollarized economies has led to important analytical errors in the academic literature on dollarization. An example is the influential Luca and Petrova (2008) paper deeming that banks holding dollar deposits are induced to lend in dollars to match the currency composition of their assets to their liabilities because of regulatory constraints or internal limits on currency mismatch. Their reasoning overlooks the fact that dollar lending automatically creates dollar deposits, and thus, is neutral in terms of currency matching. . . In addition, regulatory constraints on currency matching do not necessarily imply that credit extended to domestic firms by banks need to be denominated in dollar because domestic banks can satisfy the currency matching constraint by holding other dollar denominated assets, such as foreign securities and government bonds.

As regards the issue of the convertibility of domestic dollar deposits in dollarized economies, we find the Money View advocated by Perry Mehrling to be a good theoretical framework. The Money View perceives the monetary system as a payments system that is fundamentally hierarchical - Mehrling (2012) and Mehrling (2013). At the top of the monetary pyramid is a unit of account, e.g. gold or dollar. Below this are a range of institutions issuing different credit money forms. This hierarchy implies a promise to pay the higher ranking form of money. Murau (2018) explains that due to the US's position at the apex of the international hierarchy of money, the US dollar is by far the most important unit of account used to create credit money. The money form situated at the top is the final means of settling payments. In today's world, the liabilities issued by the US federal reserves are ranked higher than those of US commercial banks, which in turn are ranked higher than those of the Eurodollar deposits issued by non-US international banks. The Money View literature suggests one key criterion to decide whether a liability is money or not: if it trades at par on demand to another form of credit money that is further up in the hierarchy. This implies that public or private liabilities are part of the "monetary pyramid", if they can instantaneously or almost instantaneously be converted into higher ranking money. However, the promise to pay at par on demand is not equally strong for all credit money forms. The further we go down in the monetary pyramid, the higher is the risk of breaking away from par. The reason for this is that par clearance needs to be actively established, either by political measures and guarantees or via market forces and private guarantees. Eurodollar deposits of banks in emerging markets dollarized monetary systems are at the lowest level of this monetary hierarchy. The level directly above them, are Eurodollar deposits in non-US international banks, which in turn, come below deposits at US banks in the hierarchy. US dollar notes, as direct liabilities of the US Federal Reserve, stand at the top of this hierarchy.

Thesis plan and chapters

We grouped our analyses in five chapters, as follows:

In Chapter 1, we make a thorough analysis of the unique dollarization case of Lebanon in the years between 1997 and 2017: a heavily dollarized economy with recurring public deficits and monetary financing of the public debt, together with a contained inflation and a *de facto* fixed exchange rate lasting for more than 20 years. What makes Lebanon’s case specific is the high level of foreign currency liquidity in the hands of the banking system due to the abundant capital inflows in the last three decades, and the high levels of the central bank’s gross international reserves contrasting with its low and sometimes negative levels of net international reserves. We shed light on a number of areas that were unexplored so far in international finance and monetary economics, mainly the difference between gross and net international reserves and their relative fiscal costs, together with a synthetic classification of sterilization techniques. We explain the monetary “freezing” mechanism that helped contain inflation in Lebanon, despite the monetary financing of the country’s recurring public deficits. We also assess the results of Lebanon’s monetary and exchange rate policy in the last two decades, and make a number of policy recommendations in light of previous studies.

In Chapter 2, we analyze the liquidity questions relating to financial dollarization. Along Werner (2016)’s observation that it does not make much sense to build economic theories of the financial sector if these are not based on institutional and accounting realities, we base our analysis on balance sheet dynamics and the resulting accounting relationships in order to derive our conclusions. We formalize monetary mechanisms under dollarization, shedding light on the interconnection of the balance of payments with money and credit aggregates in a small open dollarized economy. After presenting the dollar money creation mechanism under financial dollarization, we propose a new measure of dollar liquidity in dollarized economies defined as the Gross Foreign Assets of the Locational Banks Sector, equal to the sum of the central bank’s gross international reserves and the gross liquid foreign assets of the locational banks sector. Our empirical results for Lebanon suggest that our measure of dollar liquidity has a significant and positive contemporaneous connection with total banks deposits and a lagged connection with total banks credit to the private sector in the period extending from 2002Q1 to 2017Q2. We test our results for robustness during the ongoing financial and monetary crisis period in Lebanon that is in essence a dollar liquidity crisis. We also test our results using data from two other major dollarized economies: Peru and Russia.

In Chapter 3, we argue that above its traditional currency and debt crisis features, Lebanon’s ongoing crisis sheds the light on the inherent weakness of dollarized monetary systems. This crisis can be seen as a monetary crisis, as the country’s dollarized banking system’s liquidity and solvency problems led to the loss of the “moneyness” of its dollar denominated deposits. We analyze the different dimensions of this crisis and we make policy recommendations, inspired by the experience of the Argentine 2001-2002 convertibility crisis. Finally, we

look into the redistributive implications of different conversion scenarios.

In Chapter 4, we make a thorough analysis of reserve requirements, a monetary instrument widely used in dollarized monetary systems. Unlike past literature adopting the loanable funds view, we follow the financing model of bank intermediation in order to analyze the monetary mechanisms relating to reserve requirements, and compute banks margins on their lending and deposit activities. We show that, when remunerated at a rate below the money market interest rate, reserve requirements increase the spread between bank loans and deposits interest rates, without any impact on the level of interest rates. We review and analyze the uses of reserve requirements as a prudential tool and as a monetary policy instrument. We also analyze their use for capital flows management and for de-dollarization in emerging economies. We argue that reserve requirements are a sub-optimal and outdated policy tool, and we suggest imposing direct taxes on banks deposits and loans interest payments, as a more efficient alternative to reserve requirements.

In Chapter 5, we make a comprehensive analysis of the liquidity and the foreign exchange (FX) systemic risks implied by foreign currency intermediation (partial dollarization of the domestic banking system). We explain the trade-off between the positive effect of foreign currency intermediation on growth in tranquil times and its negative effect in terms of financial fragility. We review the narrative and econometric country studies that have been done so far to assess the effectiveness of FX-related macroprudential measures. Through the results of past studies and a comparison of the experiences of Latin American and transition European economies, we show the advantages of administrative macroprudential measures over price-related measures in dealing with liquidity and FX systemic risks. We show that neutralizing those systemic risks is possible without aiming at directly limiting or banning foreign currency intermediation (*i.e.*, dedollarizing). We argue that dedollarization is a more ambitious target that must be justified by the other inconveniences of foreign currency intermediation, and we stress that sound monetary management should be a prerequisite to dedollarization. Restoring confidence through an ethical monetary management that prioritizes social welfare is key in that regards.

In conclusion, our results have shown that liquidity issues under dollarization are far more complex than currency mismatch issues. Thus, previous macroeconomic modeling that approached dollarization solely from the angle of its currency mismatch implications fails to account for the complexity of dollarized monetary systems. A new generation of macroeconomic modeling of dollarized economies is needed to cope with this fact. We hope to be able to contribute towards the improvement of small open economies macroeconomic modeling by integrating the results of our analyses in future works. Two promising research projects are underway with co-authors: a Stock-Flow Coherent modeling of the Lebanese economy stressing the international liquidity dimension, and an extension of the international liquidity analyses performed in this thesis to the cases of full dollarization and currency boards.

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1 The Unique Dollarization Case of Lebanon

Abstract

We make a thorough analysis of the unique dollarization case of Lebanon: a heavily dollarized economy with recurring public deficits and monetary financing of the public debt, together with a contained inflation and a de facto fixed exchange rate lasting for more than 20 years. What makes Lebanon's case specific is the high level of foreign currency liquidity in the hands of the banking system due to the abundant capital inflows in the last three decades, and the high levels of the central bank's gross international reserves contrasting with its low and sometimes negative levels of net international reserves. We shed light on a number of areas that were unexplored so far in international finance and monetary economics, mainly the difference between gross and net international reserves and their relative fiscal costs, together with a synthetic classification of sterilization techniques. We explain the monetary "freezing" mechanism that helped contain inflation in Lebanon, despite the monetary financing of the country's recurring public deficits. We also assess the results of Lebanon's monetary and exchange rate policy in the last two decades, and make a number of policy recommendations in light of previous studies.

Keywords: Dollarization; Emerging Markets Exchange Rate Regimes; Sterilization; International Reserves; Lebanon

JEL Classification: F30; F41; E50, E40

This chapter has been published in *Economic Systems* (Elsevier) : Bitar J., The unique dollarization case of Lebanon, *Economic Systems*, 45(2), June 2021

<https://www.sciencedirect.com/science/article/abs/pii/S0939362520300728>

1.1 Introduction

Lebanon's monetary sector has been defying the mainstream emerging markets literature in the last two decades: a heavily dollarized economy with recurring public deficits and a monetary financing of the public debt, together with a contained inflation and a de facto fixed exchange rate lasting for more than 20 years.² Understanding and analyzing this unique case is a big challenge to economists.

Dollarization started during the 1975-1989 Lebanese civil war that witnessed recurring depreciation episodes, leading to a generalized loss of confidence in the local currency. At present, Lebanese banks hold dollar deposits and provide dollar loans to their resident customers, alongside local currency deposits and loans. The deposits dollarization ratio is 71.25% and the loan dollarization ratio is 67.65% at 2017 end. Lebanon's exchange rate regime is classified as "stabilized arrangement" in the IMF AREAER³ for 2017. The exchange rate of the US dollar (USD) has been fixed since December 1997 at the mid rate of 1507.5 Lebanese Pounds (LBP), thanks to daily interventions of Banque du Liban (BdL - Lebanon's central bank) in the domestic interbank foreign exchange market. Since the adoption of the de facto fixed exchange rate regime, the country did not experience episodes of high inflation, as was the case during and after the civil war. In the period 2002-2017, the average annual real GDP growth rate was 4%, and the average annual inflation rate was 3.3%⁴. Gross public debt is high (154% of GDP at 2017 end), and the country suffers a chronic current account deficit (23.5% of GDP in 2017) due to the weakness of its export sector.

In this chapter, we aim at analyzing the Lebanese case in light of the findings of the literature on dollarization and emerging markets exchange rate regimes. We shed the light on the specificity of the Lebanese case, namely the high level of foreign currency liquidity in the hands of the banking system due to the abundant capital inflows in the last three decades, the high levels of gross international reserves contrasting with low and sometimes negative levels of net international reserves of the central bank (Lebanon's central bank borrows foreign liquidity, in the form of domestic banks dollar deposits), and the monetary "freezing" mechanism (the transformation of banks sight deposits into term deposits) that helped containing inflation, alongside the strong nominal anchor of the fixed exchange rate.

In the course of our analysis, we compute the fiscal cost of holding net and borrowed international reserves by Lebanon's central bank. We explain the main motives behind the choice of the de facto fixed exchange rate regime - dollarization, the small size of the export sector, institutional weakness and corruption. We also analyze the nominal and real interest rates implications of Lebanon's fixed exchange rate regime. Finally, we analyze the implication of

²In this chapter, we limit our study to the 1997-2017 period. The subsequent crisis period will be separately studied in chapter 3, as it involves a monetary regime change.

³International Monetary Fund - Annual Report on Exchange Arrangements and Exchange Restrictions

⁴Source: IMF WEO - October 2017.

dollarization on the design of foreign currency macroprudential regulations, and we discuss the ways of promoting de-dollarization and preparing the move to a floating exchange rate regime in Lebanon.

This chapter is a thorough documentation of the rarely analyzed and unique Lebanese case of dollarization - Desquilbet (2007) is the only published paper we are aware of, that makes a thorough analysis of Lebanon's monetary policy. Moreover, it contributes to the literature on sterilization by suggesting a synthetic classification of sterilization techniques into three categories: countering the increase of the money base; increasing the mandatory deposits rate; and "freezing" the money base. It also contributes to the analytical literature on the cost of international reserves, by computing the cost of net international reserves (both sterilized and unsterilized interventions) and borrowed international reserves, while past literature - as summarized, for example, by Adler and Mano (2018) - has only taken into account the cost of sterilized net international reserves (i.e., the difference between the return on the domestic assets the central bank disposes of in the sterilization process, and the return on the foreign liquid assets the central bank holds as a result of its intervention). Another important contribution of this chapter is the introduction of the monetary "freezing" mechanism that can apply to banks clients deposits (i.e., the transformation of sight deposits into term deposits) or to the money base (i.e., the transformation of banks excess reserves into term deposits at the central bank).

The remainder of the chapter is organized as follows. In the second section, we analyze Lebanon's stylized facts. In the third section, we suggest a classification of sterilization techniques and we make an analysis of the fiscal cost of gross and net international reserves. The fourth section is dedicated to the analysis of Lebanon's monetary and exchange rate policy in the last two decades. The last section concludes.

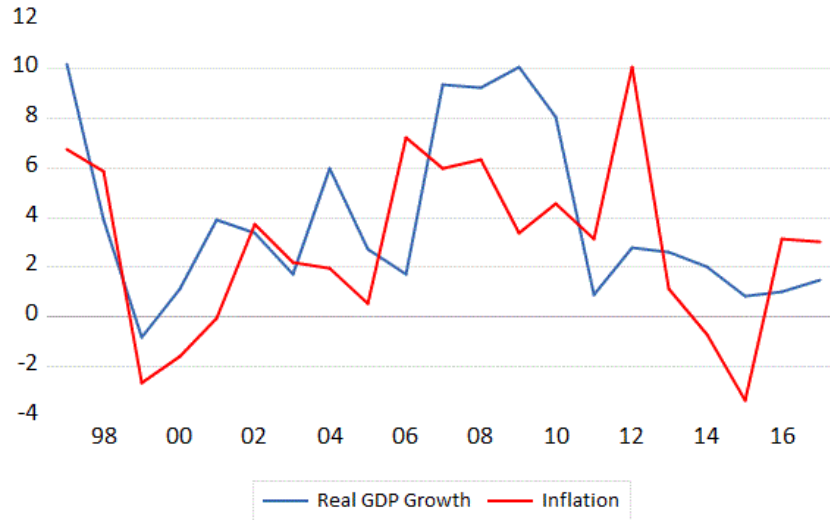
1.2 Lebanon's stylized facts

While the causes of dollarization in Lebanon go back to the hyper-inflationary environment during the 1975-1989 Lebanese civil war, the persistence of both deposits and loans dollarization has been characterizing the Lebanese banking sector for the last three decades, despite the relatively stable inflationary environment and the fixed exchange rate versus the US dollar since December 1997 (Figure 1 shows Lebanon's inflation and growth dynamics since 1997). Two main characteristics make the Lebanese dollarization case unique:

- Unlike the majority of emerging economies, capital inflows and, consequently, foreign currency liquidity in the hands of the domestic banking sector have been constantly abundant, despite the chronic current account deficit.

- The high level of gross international reserves in the hands of the central bank, that contrasts with its low and sometimes negative level of net international reserves.

Figure 1: Lebanon's CPI Inflation and Real GDP Growth (%)



Data Source: IMF WEO

1.2.1 Dollarization of deposits, credit and transactions

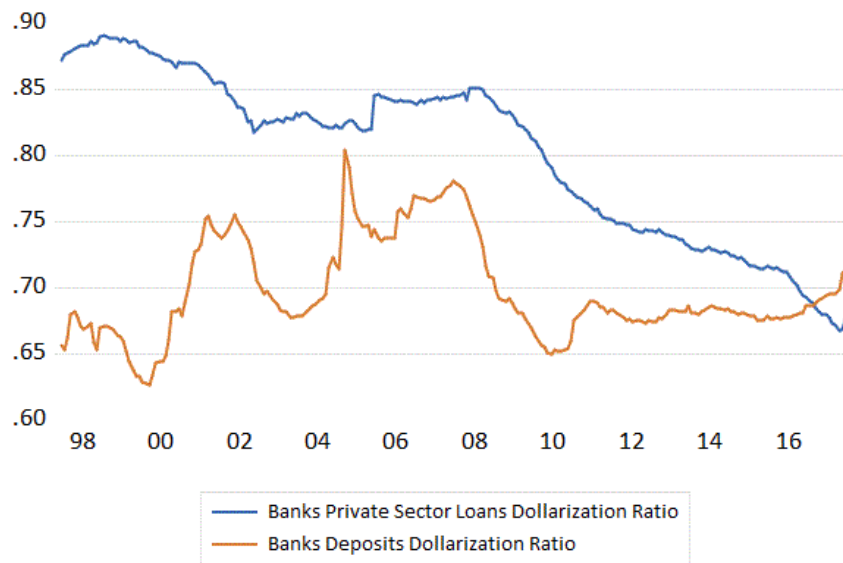
Dollarization can take multiple forms. The basic form of dollarization that has been traditionally referred to as “currency substitution” is the use of a foreign currency as a medium of exchange for transactions. This often comes with the foreign currency being the unit of account too, as domestic agents tend to use it to price goods and services as well as to denominate contracts. The term “assets dollarization” has been commonly used to describe the use of the foreign currency as store of value, by holding foreign currency term deposits at domestic banks, for example. “Liabilities dollarization” often described domestic debt in foreign currency, mainly vis-a-vis non-resident counterparts. The term “loans dollarization” was mostly used for local banks foreign currency credit to resident agents⁵. Away from the above traditional classifications, we broadly define dollarization as resident agents’ use of the foreign currency in any economic activity. Seen as such, dollarization is a phenomenon that is not exclusive to some emerging and developing economies. It is a generalized phenomenon that goes in parallel with the globalization of real and financial activities, that leads domestic agents to contract, trade, save, borrow and invest using a currency other than their domestic currency.

In Lebanon, dollarization has taken in the last three decades one of its most complete forms: individuals and companies use the dollar for transactions, hold

⁵See Cuaresma, Fidrmuc and Hake (2014) for an analysis of the determinants of loan dollarization

dollar accounts in domestic banks and contract dollar loans with those banks. The Lebanese government issues dollar denominated bonds (called Eurobonds) subscribed by the domestic banking system as well as by foreign investors. Figure 2 shows the evolution of the deposits and loans dollarization ratios of domestic banks. The share of dollar loans declined in the last two decades, but remains relatively high at the end of 2017, while the share of dollar deposits seems to increase in period of tensions and to decrease in politically and economically stable periods, without showing any clear long term trend.

Figure 2: Banks Deposits and Loans Dollarization Ratios in Lebanon



Data Source: BdL Website

Mora, Neaime and Aintablian (2013) find that Lebanese exporting firms, which are naturally hedged against currency risk, are more likely to incur dollar debt. Firms also partly hedge themselves by passing currency risk to customers and suppliers. They mitigate the portfolio allocation theory of liabilities dollarization - see, for example, Luca and Petrova (2008) - deeming that banks holding dollar deposits are induced to lend in dollars to match the currency composition of their assets to their liabilities because of regulatory constraints or internal limits on currency mismatch. They point to the fact that those constraints do not necessarily imply that credit extended to domestic firms will be denominated in dollars because domestic banks can satisfy the dollar portfolio constraint by holding other assets, such as foreign securities and government bonds. In contrast to a large number of dollarized economies where domestic banks dollar funding is done through foreign banks dollar loans to domestic banks - see, for

example, Basso, Calvo-Gonzalez and Jurgilas (2011) and Rosenberg and Tirpak (2009), the dollar funding of Lebanese banks goes mainly through dollar customer deposits, that have constituted a stable funding source in the last two decades.

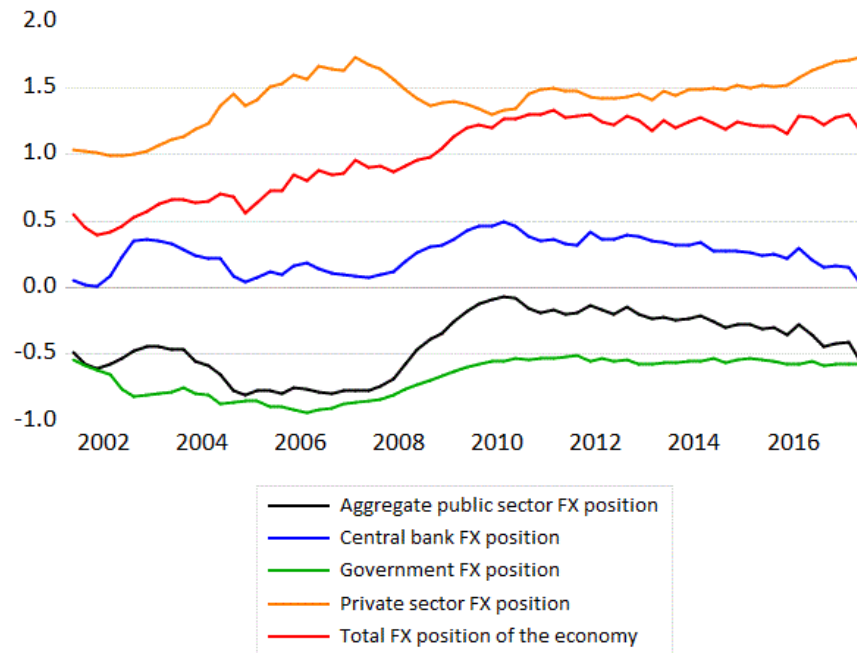
We followed the calculation method of Ponomarenko, Solovyeva and Vasilieva (2013) in order to compute sectoral net foreign exchange (FX) exposures in Lebanon, in the spirit of the balance sheet approach of Allen, Rosenberg, Keller, Setser and Roubini (2002). In the absence of aggregate banks data detailing the currency composition of their balance sheet components, we assumed perfect currency matching of the latter, in line with FX exposure regulations set by Banque du Liban. We computed the central bank's FX assets by summing its gross international reserves with its Lebanese government USD Eurobond holdings estimates (in the absence of official data on the latter), and the central bank's FX liabilities as the sum of foreign currency mandatory deposits and other foreign currency deposits of commercial banks at the central bank. We computed the government's FX liabilities as the total amount outstanding of its USD Eurobonds. The government does not hold FX assets. We computed the private non-bank sector's (non-financial companies and households) FX liabilities as the total loans of commercial banks to that sector. Private sector's direct foreign borrowing is very limited as most Lebanese firms are SMEs and do not have access to direct financing from foreign banks or capital markets. The private sector's FX assets are mainly comprised of USD deposits at commercial banks. We did not account for non-bank financial companies (mainly small wealth management companies), as their size is negligible in Lebanon's banks dominated financial system. We did not account for dollar currency in circulation, USD Eurobond holdings by the private non-bank sector and foreign currency external assets of the private non-bank sector, as no data is available for the latter. Therefore, we can reasonably think that our estimate of the private sector's FX assets is considerably under-estimated.

Figure 3 shows our estimates of the net sector FX positions (FX assets minus FX liabilities) as ratios to GDP for the central bank, the government and the private non-bank sector (non-financial companies and households). The aggregate public sector position is the sum of the government and the central bank positions. The total FX position of the economy is the sum of the FX positions of the government, the central bank, the non-bank private sector, and commercial banks (that is assumed to be neutral in our estimates). Structural sectoral FX exposures in Lebanon could be described as follows: the aggregate public sector has a negative dollar exposure due to the dollar denominated share of public debt (USD Eurobonds), unmatched by dollar government assets. The banks sector has little or no currency exposure, due to FX risk management regulations of banks balance sheets. The non-bank private sector, comprising households and companies, has been in an aggregate structural positive position, with its total dollar deposits exceeding by far its total dollar loans. However, on the individual level, households and companies can hold both positive and negative FX positions. The total FX position of the economy is largely positive due to the large positive FX position of the private non-bank sector, which

means that the depreciation of the LBP would not have an overall negative balance sheet impact, except for the government sector.

However, all sectors also have an indirect FX exposure, as a result of the default risk on their USD denominated assets. Commercial banks have an indirect FX exposure resulting from dollar loans to unhedged non-bank borrowers. Also, the whole economy exhibits an indirect FX exposure resulting from the government default risk on its USD Eurobonds (the private sector deposits dollars at commercial banks, which hold government USD Eurobonds, and USD deposits at the central bank. Also, the central bank holds government USD Eurobonds).

Figure 3: Lebanon’s Sectoral FX Positions Estimates, as Ratios to GDP



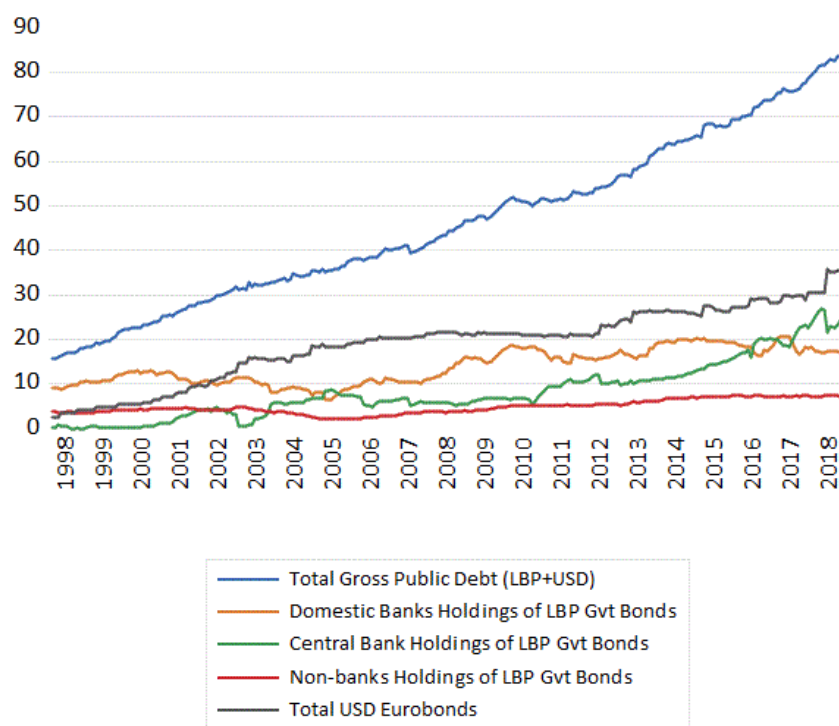
Data Source: BdL Website, IMF WEO and Author’s Estimates

1.2.2 Public debt composition and financing

As shown in Figure 4, Lebanon’s public debt has been steadily growing in the last three decades. The government issues LBP denominated bonds and bills alongside USD denominated bond (Eurobonds). We plotted the LBP denominated debt breakdown by holders to show the monetary financing of this debt by the central bank as well as by commercial banks (depository institutions). The share of non-banks holders is minor, comparing to the latter. In the same graph, we plotted the amounts outstanding of USD Eurobonds. Also, a minor

share of the latter is held by non-bank and foreign investors, and the larger share is held by the central bank and commercial banks. However, this is not to be seen as monetary financing as it does not involve the creation of domestic currency.

Figure 4: Lebanon’s Government Public Debt Breakdown by Holders (USD Bn)



Data Source: BdL Website

1.2.3 Capital flows, gross international reserves and net international reserves

Cumulative capital inflows have largely exceeded the persistent current account deficit in Lebanon since the end of the civil war in 1989, leading to high foreign currency liquidity in the hands of the domestic banks sector. Measures of capital controls relying on de jure information, typically drawn from the IMF’s Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) - for example: Fernandez, Klein, Rebutti, Schindler and Uribe (2015) - place Lebanon in the intermediate “gate” category, because of some restrictions, authorizations, or notification obligations on international transactions in a num-

ber of asset classes. However, previous studies viewed Lebanon’s de facto degree of capital mobility as high, considering the size of capital inflows and outflows - for example: Mora, Neaime and Aintablian (2013) and Poddar, Goswami, Sole, and Echevarria Icaza (2006).

Figure 5 shows the cumulative excess of capital inflows over current and capital account deficits, as well as the increase of Lebanon’s central bank international reserves (IR)⁶ - ex-gold - and domestic banks foreign assets. The gross foreign assets of the consolidated locational banks sector (equal to the sum of the central bank’s international reserves and domestic banks foreign assets) evolution mirrors the cumulative excess of the balance of payments, adjusted for valuation changes. Although capital inflows slowed down in the last decade, the level of foreign liquidity of the consolidated locational banks sector remained high.

Lebanon’s central bank imposes mandatory reserves requirements on banks foreign currency deposits, and holds remunerated foreign currency deposits of domestic banks in excess of those mandatory reserves. These operations do not increase net international reserves as they increase the foreign exchange liabilities of the central bank in the same amount, but they do increase gross international reserves. Gross international reserves are the amounts available for a central bank to intervene in the foreign exchange market.⁷

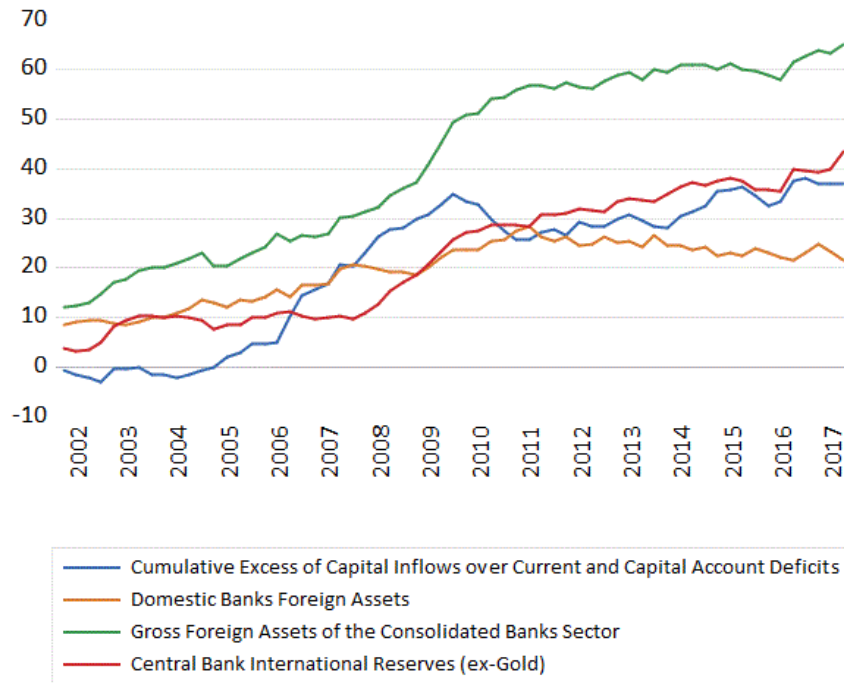
$$\text{Gross IR (GIR)} = \text{Net IR (NIR)} + \text{Borrowed IR (BIR)}$$

Figure 6 shows the evolution of Lebanon’s central bank GIR, NIR and BIR. The central bank borrows dollar liquidity from domestic banks in the form of deposit accounts. Those are either remunerated dollar mandatory reserves (as a percentage of domestic banks clients dollar accounts) or remunerated dollar term deposits. Therefore BIR is equal to the amount of USD domestic banks deposits at the central bank in the Lebanese case. As those deposits amounts are not provided by Lebanon’s central bank statistics department, we estimated them in a conservative way, by assuming a perfect currency matching on the consolidated commercial banks balance sheet. We estimated NIR amounts by deducting estimated BIR amounts from GIR. We notice a substantial increase of estimated commercial banks USD deposits at the central bank (BIR), while the amount of estimated NIR fluctuates with the need to intervene in the foreign exchange market. NIR have been in negative grounds during episodes of exchange market pressure.

⁶Aizenman and Lee (2007) define two motives for holding international reserves: the precautionary motive is a self-insurance to avoid costly liquidation of long-term projects when the economy is susceptible to sudden stops. The mercantilist motive is reserves accumulation favoring export growth by preventing or slowing the domestic currency appreciation. Their empirical results support precautionary motives over mercantilist motives.

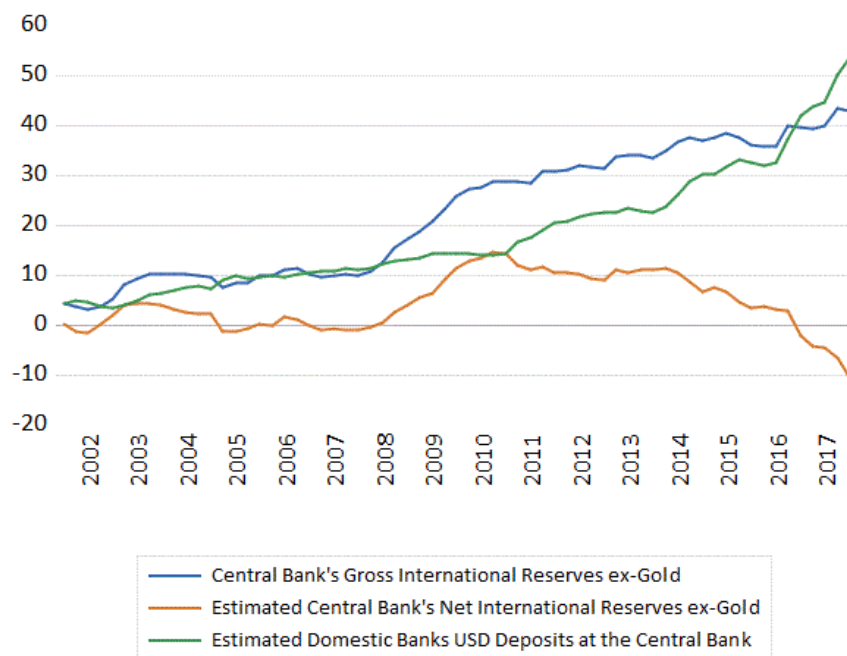
⁷The formal definition of international reserves by the IMF (BPM6, paragraph 6.64) is the following: “...those external assets that are readily available to and controlled by monetary authorities for meeting balance of payments financing needs, for intervention in exchange markets to affect the currency exchange rate, and for other related purposes (such as maintaining confidence in the currency and the economy, and serving as a basis for foreign borrowing)”. As defined, the concept of international reserves is based on the balance-sheet framework, with “reserve assets” being a gross concept. It does not include external liabilities of the monetary authorities.

Figure 5: Lebanon's International Liquidity Evolution (USD Bn)



Data Source: BdL Website

Figure 6: Lebanon's Central Bank Estimated Gross and Net International Reserves (USD Bn)



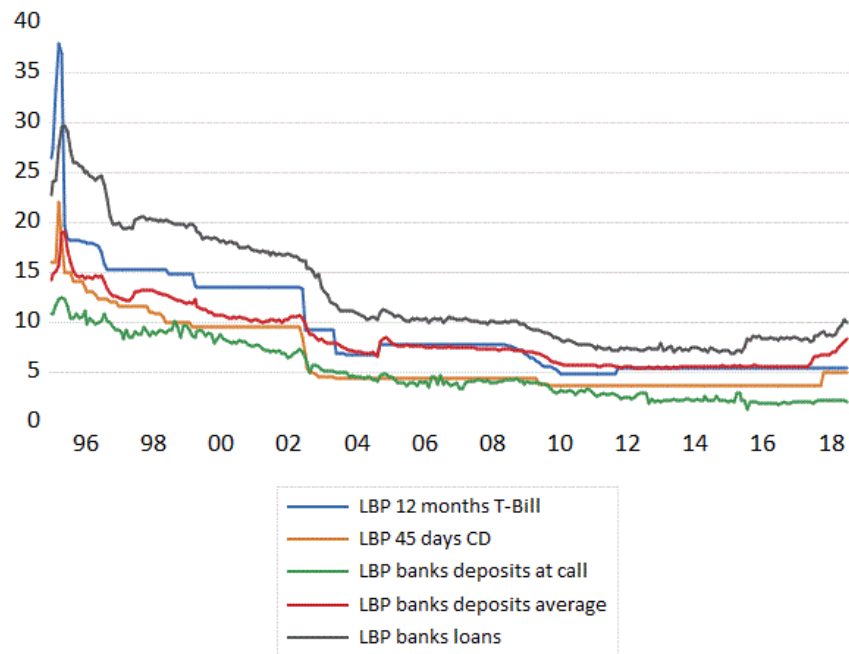
Data Source: BdL Website and Author's Estimates

1.2.4 Lebanon's monetary policy targets, interest rates and the money base

Lebanon's monetary policy is solely focused on maintaining the peg of the LBP to the USD. Inflation and growth are not explicit monetary policy objectives, as is the case in most developed and developing countries. Lebanon's central bank has adopted unconventional monetary policy operational targets. Poddar, Goswami, Sole, and Echevarria Icaza (2006) state that the main objective of Banque du Liban is to maintain the exchange rate peg of the domestic currency to the USD, through two operational targets: first, the spread between USD deposit interest rates and international markets interest rates, which attracts capital to the country to finance the current account deficit and external debt; second, the spread between LBP interest rates and USD interest rates in Lebanon, to promote deposits in LBP. These two spreads are essentially measures of banking sector risk and currency risk, respectively. They point that, as the central bank operates the primary T-bill market, which is the main source of placement of domestic banks LBP excess liquidity, the T-bill rate effectively functions as a monetary policy instrument. The stability of the T-bill rate re-

flects the fact that market pressures are absorbed through other means, primarily issuance of BdL certificates of deposit (CD) to absorb excess LBP liquidity. In the absence of a well-functioning secondary market for T-bills, the rate in the primary market, or alternatively the rate on central bank CDs issued on tap, acts as the key reference interest rate for the economy. Their econometric investigation confirms that there is a substantial pass-through of international USD interest rates to domestic interest rates, and the latter are affected by liquidity conditions as well as by Lebanon's perceived sovereign risk. Lebanon's domestic interbank market is not very active and exhibits occasional interest rates spikes in cases of liquidity shortages - the IMF's Financial System Stability Assessment (2017) states that only 1.7% of total banks assets are financed by interbank liabilities. Figure 7 shows the dynamics of the main LBP interest rates. We can clearly notice the co-movement of the interest rate on LBP 12-months T-Bill and average LBP banks deposits, and that of the LBP 45-days CD and LBP deposits at call. LBP loans rates move in the same direction as deposits rates, with banks keeping an operational margin above the latter.

Figure 7: Main LBP Interest Rates (in %)



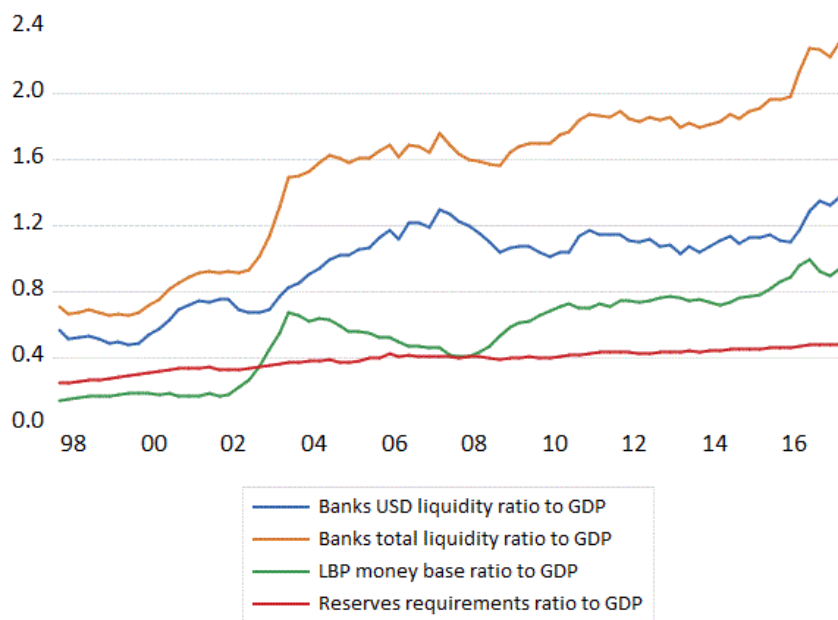
Data Source: BdL Website

The monetary financing of the public debt and abundant capital inflows have fueled banks liquidity levels. The LBP money base increased substantially, together with domestic banks USD liquidity. Figure 8 shows estimated domestic banks USD liquidity, equal to the sum of their liquid foreign assets and their estimated USD deposits at BdL, as well as the estimated LBP money base, equal to the sum of currency in circulation and estimated domestic banks LBP deposits at the central bank, as ratios to nominal GDP. The sum of both aggregates is the estimated total liquidity of banks.

Banks are obliged to hold reserves requirements at the BdL, equal to the sum of 25% of their demand liabilities in LBP and 15% of their term and other liabilities in LBP. These reserves pay a zero interest rate, but certain deductions are allowed under a number of special lending schemes to some productive sectors. Banks are required to hold 15% of all their liabilities denominated in foreign currencies, as reserves at BdL. These deposits are remunerated on the basis of prevailing market interest rates. Reserves requirements rates did not vary since June 2, 2001. Figure 8 shows estimated reserves requirements (at the rate of 15%, as the bulk of bank deposits are term deposits).

Imposing reserves requirements is a way of sterilizing (mopping) banks liquidity. However, their estimated level is way below the level of domestic banks liquidity, thus, their impact in terms of monetary transmission could be reasonably thought to be limited, as they do not impose a liquidity constraint on banks. This impact would be especially limited for USD loans, as USD reserves requirements are remunerated at market rates, and thus, do not constitute a tax on USD intermediation.

Figure 8: Ratios of Domestic Banks LBP and USD Liquidity and Reserves Requirements to GDP



Data Source: BdL Website and Author’s Estimates

1.2.5 Monetary aggregates and “freezing” in Lebanon

Figure 9 shows the growth of key monetary components from January 1998 to December 2017: M1 (which comprises LBP currency in circulation and LBP sight deposits), total banks sight deposits (current and checking accounts and sight deposits, both LBP and USD), and total banks term deposits (both LBP and USD). Figure 10 shows this evolution in terms of ratios to nominal GDP. We notice a larger growth of total term deposits comparing to M1 and total sight deposits.

Boostani, Ameli and Karami (2018) show that Iran’s M1 demand function is stable but not M2 from 1973 to 2015 using the Engle and Granger co-integration method. The instability of broad money demand comes from the fact that a considerable share of M2 is comprised of long-term interest bearing deposits. In the absence of developed financial markets, these deposits are the only option available for domestic agents to use as saving instruments. They show that there is a positive relationship between the interest rate on one-year deposits and the long term deposits to nominal GDP ratio, while there is a negative relationship with M1 to nominal GDP ratio. They conclude that M2 is not a suitable measure for monitoring inflation. An augmented M1 (M1+) may be a better variable to

explain the price trend and ensure money demand stability. Along similar lines, Barnett and Al Khareif (2015) compare the simple-sum monetary aggregates (M1 and M2) for Saudi Arabia with the new Divisia monetary indexes (D1 and D2). A Divisia monetary index is a money supply measure that weighs the monetary components (currency, demand deposits, savings and time deposits) according to their usefulness in transactions. It takes into account the price of a monetary asset, called its user cost i.e. the interest return forgone by holding a monetary asset rather than holding a higher return less-liquid asset. They find that both D1 and M1 are identical, given the perfect substitutability of the monetary components within those aggregates. For the broader monetary aggregates M2 and D2 where the perfect substitutability assumption is not realistic, the two monetary indices differ substantially.

In light of those analyses, we can presume that the increase of the banking system balance sheet in a bank based financial system, due to either capital inflows or monetary financing of the public debt (loans of the central bank and domestic banks to the government), does not automatically translate into an increase of the narrow monetary aggregate, which is the relevant aggregate to consider when it comes to the transaction services of money. An increase of the nominal interest rate can induce the transformation of sight deposits into term deposits within the banks liabilities side, therefore “freezing” their transaction services. This mechanism could partially explain the contained inflation in Lebanon - alongside the successful fixed exchange rate nominal anchor - despite the large increase of the consolidated banks balance sheet. This mechanism might be less relevant in a financial system with developed financial markets as agents would be able to direct their savings towards bonds and equity securities away from banks term deposits.

Also, gains in financial and non-financial wealth may act as a source of money demand, over and above traditional motives, in a portfolio framework. Wealth gains may explain the increase in the ratio of broad money to GDP - see for example Boone, Mikol and Noord (2004) and Mehrotra and Ponomarenko (2010). However, what the “freezing” mechanism emphasizes is the shift from the liquid component to the illiquid component, within the broad money aggregate.

The increase in the interest rate triggering the “freezing” mechanism can be engineered by the central bank - in line with a standard anti-inflationary monetary policy logic. It can also result from the market led increase in interest rates levels, as a consequence of the increasing risk premium, relating to higher public debt or to higher current account deficits. In Table 1, we computed the unconditional correlation coefficients of the share of term deposits in total banks deposits with both the average interest rate banks pay on term deposits, and the differential of this average interest rate with the average interest rate banks pay on sight deposits, in LBP and USD, using monthly data between January 1998 and December 2017⁸.

⁸We also performed simple OLS regressions linking the share of term deposits in total banks deposits with the four variables separately. We identified the following linear relationships:

$$\begin{aligned} \text{TERM_DEPOSITS_SHARE} &= 0.8720 + 0.001813 * \text{LBP_TERM_SIGHT} \\ \text{TERM_DEPOSITS_SHARE} &= 0.8737 + 0.000596 * \text{LBP_TERM} \end{aligned}$$

Table 1: Correlation between the Share of Term Deposits in Total Banks Deposits and Interest Rates

	LBP_TERM_SIGHT	LBP_TERM	USD_TERM_SIGHT	USD_TERM	TERM_DEPOSITS_SHARE
LBP_TERM_SIGHT	1	0.1797	0.5244	0.2189	0.1452
LBP_TERM		1	0.4218	0.8737	0.2005
USD_TERM_SIGHT			1	0.7167	0.5636
USD_TERM				1	0.3710

LBP_TERM_SIGHT: Interest rate differential between LBP Term Deposits and LBP Sight Deposits

LBP_TERM: Interest rate on LBP Term Deposits

USD_TERM_SIGHT: Interest rate differential between USD Term Deposits and USD Sight Deposits

USD_TERM: Interest rate on USD Term Deposits

TERM_DEPOSITS_SHARE: Share of Term Deposits (USD+LBP) in total banks deposits

Data Source: BdL Website

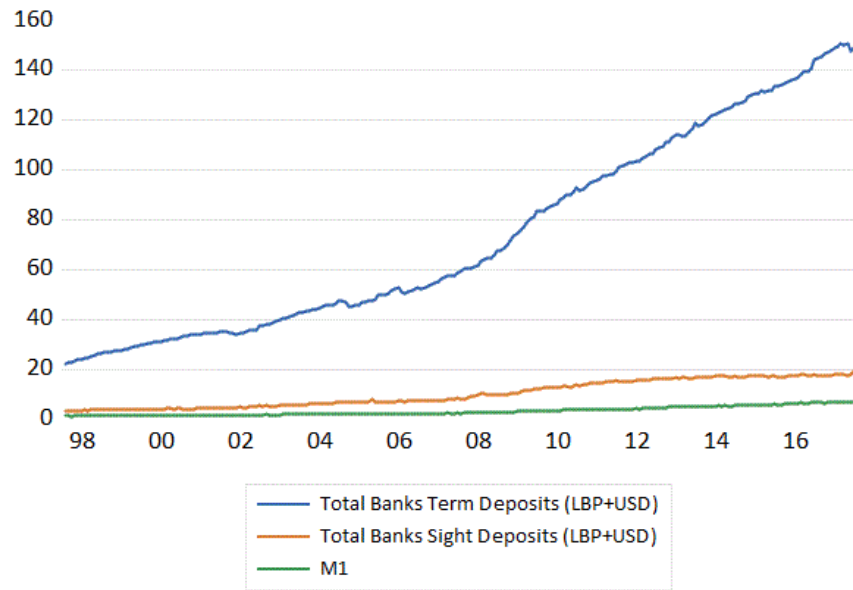
We notice a positive correlation with both interest rate levels and differentials, and a positive correlation between the levels and the differentials, in both LBP and USD. This simple correlation analysis suggests that a positive association exists indeed between the share of term deposits and both the level of interest rates on term deposits and their differential to the interest rates on sight deposits. More robust conclusions would necessitate a thorough econometric study that is beyond the scope of our current chapter.

It is important to stress that this “freezing” of deposits is not a permanent solution to contain inflation, although it has been lasting for almost two decades in the Lebanese case. Once the market sentiment deteriorates, depositors would require the liquidation of their term deposits, which would ultimately lead to high inflation and to the depreciation of the domestic currency.

$$\text{TERM_DEPOSITS_SHARE} = 0.8526 + 0.009104 * \text{USD_TERM_SIGHT}$$

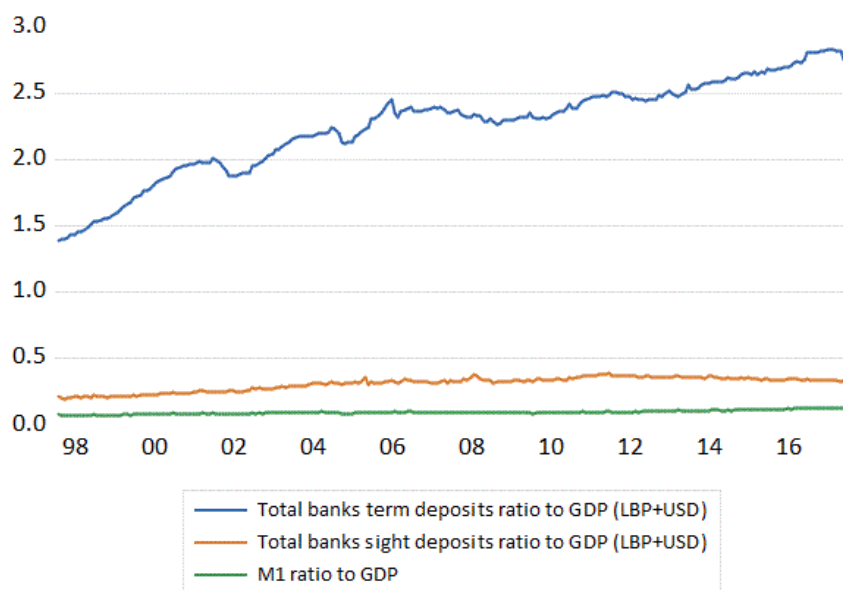
$$\text{TERM_DEPOSITS_SHARE} = 0.8674 + 0.002556 * \text{USD_TERM}$$

Figure 9: Lebanon's Banks Sight and Term Deposits (USD Bn)



Data Source: BdL Website

Figure 10: Lebanon's Banks Sight and Term Deposits Ratio to GDP



Data Source: BdL Website

1.3 Sterilization and the cost of international reserves

1.3.1 Sterilization and “freezing”

There is no consensus in the literature on the definition and characterization of sterilization operations. Reinhart and Reinhart (2008) point that when faced with substantial international capital flows, authorities look for ways of monetary control, while delivering a stable exchange rate. The preference for relatively stable exchange rates often necessitates accumulating international reserves. Authorities mainly use reserves requirements in order to contain the consequences of unsterilized interventions on domestic liquidity. Controls on capital inflows, on capital outflows, and changes in official exchange rate bands are also used. Lee (1997) argues that the classical forms of sterilization mainly through the use of open market operations (selling treasury bills and other instruments to reduce the domestic component of the monetary base) can be effective for a time. However, the use of supplementary measures, including some indirect capital controls, may also be both desirable and effective. Aizenman and Glick (2008) find that the greater accumulation of foreign reserves has been associated with a greater intensity of sterilization by developing countries in Asia and Latin America – i.e. a significant increase in the coefficient of ster-

ilization.⁹ Glick and Hutchison (2000) find that FX interventions have an immediate effect on exchange rates and interest rates, but also set in motion further portfolio adjustments, in conjunction with the objective of maintaining monetary control. The monetary base has been in large part insulated from exchange rate policies.¹⁰

We can conclude from the above that the term sterilization has been used in the literature for a heterogeneous group of techniques that aim at limiting the monetary effect of foreign exchange interventions. While some authors include means of limiting the flows of capital per se (any forms of capital controls), we prefer to only include under the sterilization umbrella the means to deal with the monetary consequences of those flows. We can group sterilization techniques in three categories:

- The standard sterilization technique is to counter the increase of the domestic currency money base, resulting from the purchase of foreign currency by the central bank. This is done through either open market sales of domestic currency bonds, or the reduction of its credit to resident counterparts (mainly domestic banks and government). This sterilization technique alters (decreases) the size of the central bank's balance sheet.

- Another widespread technique is to influence the money multiplication mechanism through the variation of reserves requirements rates of banks. Increasing the mandatory deposits rates of banks automatically reduces the money multiplier. Therefore, the increase in the domestic currency money base resulting from the central bank's foreign exchange intervention cannot translate into an increase in money supply.

- The last category of sterilization techniques that is overlooked by the economic literature is what we would like to call the "freezing" of the money base. It consists in transforming the domestic currency reserves deposits of domestic banks (liquid liabilities) at the central bank into less liquid liabilities (time deposits and central bank bills) that are not part of the money base. The money base is strictly comprised of domestic currency liquid deposits of banks at the central bank and currency in circulation. Term deposits of banks at the central bank and central bank bills are excluded from the money base, as they do not constitute readily available high powered money for banks.

In contrast to the first technique, the second and third sterilization tech-

⁹They estimate the extent of sterilization by a simple OLS regression of the monetary authorities change in net domestic assets $\Delta DC/RM$ on the change in net foreign assets held on their balance sheet $\Delta FR/RM$, where change is measured over four quarters, and scaled by the level of the reserve money stock four quarters ago. They also include the four-quarter growth rate of nominal GDP on the right-hand side to control for other explanatory variables that might influence the demand for money. They define the regression coefficient β on the variable $\Delta FR/RM$ as the coefficient of sterilization. A unitary coefficient, i.e. $\beta = -1$, represents full monetary sterilization of reserves changes, while $\beta = 0$ implies no sterilization. A value of the sterilization coefficient between these levels, $-1 < \beta < 0$, indicates partial sterilization.

¹⁰Using a simple VECM model for Japan and Germany between 1974 and 1990, they find that the direct impact of a given foreign exchange market intervention on the central bank's domestic credit falls markedly after a few months, implying that sterilization lessens. Central banks apparently make systematic efforts to gradually unwind their foreign asset positions after initial interventions.

niques do not impact the size of the central bank's balance sheet.

Figure 11 shows BIR's and NIR's impact on the central bank's balance sheet, with different sterilization techniques. As BIR accumulation does not impact the domestic currency money base, it does not entail any sterilization.

Figure 11: BIR, NIR and Sterilization Impact on the Central Bank's Balance Sheet

Borrowed International Reserves

Assets	Liabilities
(+) Liquid foreign assets	(+) Foreign currency banks deposits at the central bank
	(+) Foreign currency loans from foreign financial institutions

Net International Reserves (Standard Sterilization)

Assets	Liabilities
(+) Liquid foreign assets	
(-) Domestic currency bonds	

Net International Reserves (Sterilization through mandatory reserves)

Assets	Liabilities
(+) Liquid foreign assets	(+) Mandatory reserves in domestic currency

Net International Reserves (Sterilization through "freezing")

Assets	Liabilities
(+) Liquid foreign assets	(+) Banks long term deposits/CB Bills in domestic currency

Net International Reserves (No Sterilization)

Assets	Liabilities
(+) Liquid foreign assets	(+) Banks reserves deposits in domestic currency

1.3.2 Costs of international reserves and sterilization

Adler and Mano (2018) argue that the fiscal costs of sustained foreign exchange interventions are high enough to be taken into account when conducting exchange rate policy. They find ex-ante total costs of sustaining foreign exchange positions in the range of 0.3-0.9 percent of GDP per year. Also, ex-post costs have been relatively large on account of both sizable deviations from the uncovered interest rate parity (domestic currencies appreciation) and the rapid growth of central banks foreign exchange positions. Kletzer and Spiegel (2004) argue that a forward-looking central bank will incorporate sterilization costs in its monetary policy decisions. Central banks choose more accommodating nominal exchange rate strategies, the higher is the cost of maintaining an announced peg or crawl. Taking into account that spreads represent a true default risk

premium rather than deviations from uncovered interest rate parity, they argue that actual sterilization costs become lower. They show that most emerging countries only attempt sterilization over limited periods, which suggests that sterilization costs are incorporated into their policy decisions.

The literature has focused so far on the fiscal cost of sterilized NIR only. Adler and Mano (2018) assume that if the FX intervention is unsterilized, the expansion of the money supply does not entail larger interest payments, and if it is fully sterilized, it does. This is why most past studies often refer to the cost of sterilization, rather than the cost of international reserves. We will show in this section that holding gross international reserves (GIR), whether they are comprised of BIR or NIR, comes at a fiscal cost, no matter if the monetary authorities sterilize their foreign exchange interventions or not. We analyze BIR's and NIR's ex-ante fiscal cost in what follows.¹¹

The spread between the domestic interest rate (i) and the corresponding world interest rate (i^*) is:

$$i - i^* = d + E(e'/e) \quad (1)$$

Where (d) is the domestic country's asset default risk premium, and $E(e'/e)$ the expected depreciation of the domestic currency (following the uncovered interest rate parity).

As regards BIR, sterilization is not required as they do not induce an increase in the domestic currency money base. However, their unit fiscal cost amounts to the interest differential between the interest rate the central bank pays on its foreign currency liabilities (foreign currency deposits of domestic banks, foreign currency loans of the central bank, etc...) and the interest rate the central bank earns on its liquid foreign assets. This differential is equal to the sum of the risk premium (d), and a liquidity (term) premium if the assets and liabilities involved are of different maturities – there is no exchange rate premium in this case, as both assets and liabilities are denominated in the foreign currency.

$$BIR \text{ unit fiscal cost} = d + \text{term premium} \quad (2)$$

As regards NIR, the domestic currency money base is increased by an equivalent amount (NIR are international reserves resulting from foreign exchange interventions). The general calculations of sterilization costs developed in the literature ¹² apply, for the standard and “freezing” sterilization techniques: the ex-ante unit cost of sterilization is equal to the difference between the interest rate paid (or forgone) on sterilization instruments and the interest rate received on liquid foreign assets. This amounts to the sum of the default risk premium (d) and the expected depreciation of the domestic currency $E(e'/e)$ - the exchange rate premium, and a liquidity (term) premium if the assets and liabilities involved are of different maturities.

¹¹Ex-post costs take into account the realized gains and losses made on the holding of international reserves, mainly due to exchange rates and interest rates movements.

¹²For a good analysis of the cost of international reserves, please see Adler and Mano (2018)

$$\textit{Sterilized NIR unit fiscal cost} = d + E(e'/e) + \textit{term premium} \quad (3)$$

Thus, if the domestic currency exchange rate premium $E(e'/e)$ is positive (which is generally the case), the fiscal cost of BIR is lower than the fiscal cost of sterilized NIR.

When foreign exchange interventions are not sterilized, there is still a fiscal cost involved in case banks excess deposits at the central bank (domestic currency money base) are remunerated. Gray (2011) points that the remuneration rate of excess reserves (i.e., reserves held above reserve requirements levels) signals the stance of monetary policy. The interest on excess reserves (IOER) sets a floor to interbank rates, since a bank with surplus reserves would have no incentive to lend to another bank at the IOER rate, if it could obtain that rate with no risk. Therefore, the central bank is obliged to remunerate excess reserves, in order to keep money market rates within their target range. The increased domestic currency money base net unit cost is equal to the difference between the unit interest cost the central bank pays on banks domestic currency excess reserves (IOER) and the unit interest income the central bank receives on its liquid foreign assets. This amounts also to the sum of the risk premium (d) and the expected depreciation of the domestic currency $E(e'/e)$ (the exchange rate premium), and a liquidity (term) premium if the assets and liabilities involved are of different maturities. It is worthy to note that the exact unit fiscal cost in each case will depend on the market interest rates of the specific instruments involved.

$$\textit{Unsterilized NIR unit fiscal cost} = d + E(e'/e) + \textit{term premium} \quad (4)$$

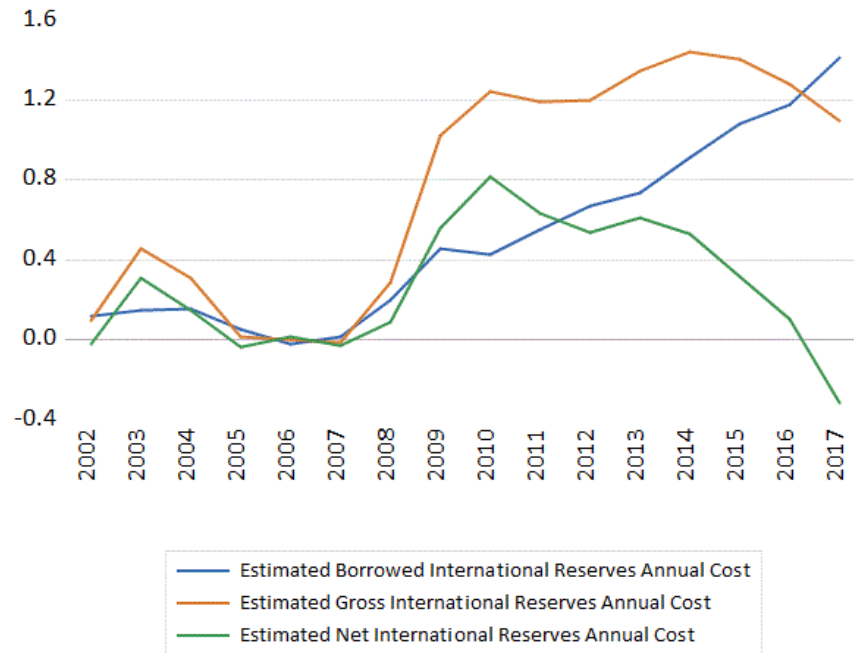
Finally, as regards sterilization through the variation of the mandatory deposits rate of banks at the central bank, it generates an income equal to the interest rate received on the corresponding foreign currency assets, if those mandatory deposits are not remunerated by the central bank. However, in some cases the central bank remunerates these mandatory deposits to avoid weighing on domestic banks profitability. Thus, the unit fiscal income/cost of sterilization is equal to the difference between the interest rate received on the corresponding foreign currency assets and the interest rate paid on mandatory deposits. In that regards, Gray (2011) points that, if there are surplus reserve balances in the economy, increasing the level of unremunerated (or under-remunerated) reserve requirements would be a cheap way of sterilizing the impact of the surplus. The alternatives consisting in draining liquidity through open market operations or paying interest on excess reserves represent a higher cost to the central bank.

Figure 12 shows the evolution of the annual estimated fiscal cost of NIR and BIR for Lebanon, as well as their sum amounting to the estimated total fiscal cost of GIR. We computed the estimated cost of BIR by multiplying their estimated amount by the interest differential between the USD term deposits average interest rate at banks (which is a conservative minimal estimation of the

interest rates paid by the central bank on USD deposits of domestic banks - the actual interest rate not being disclosed by the central bank) and the 1-month USD Libor (which is a reasonable estimate of the average return of the central bank's international reserves placements in international financial markets liquid assets). We computed the estimated fiscal cost of NIR by multiplying their estimated amount by the interest rate differential between LBP term deposits average interest rates at banks and 1-month USD Libor, following a similar reasoning to that of the calculation of the estimated cost of BIR.

Our conservative computations show that Lebanon's annual GIR costs have been constantly above the one billion US dollar mark in the last decade. Figure 12 shows an increase of BIR costs due to the increase of the USD amounts borrowed by the central bank from domestic banks, as well as the increase of the domestic USD interest rates differential to the 1-month USD Libor in the last decade. NIR costs decreased with the decrease of the amounts of the latter, leading to a negative NIR position in the last years.

Figure 12: Lebanon's International Reserves Estimated Annual Fiscal Costs (USD Bn)



Data Source: BdL Website and Author's Estimates

1.4 Lebanon’s monetary and exchange rate policy analysis

1.4.1 Dollarization and monetary policy

We will start by stating the findings of a number of recent papers with regards to the implications of dollarization on the conduct of monetary policy and financial stability. Rajan (2004) stresses the fact that dollarization is a response to institutional infirmities and that we have to learn to “live with dollarization” until those infirmities are fixed. This implies stepping up regulation and supervision to ensure that dollarization does not become excessive, and maintaining a reasonable fiscal position and adequate international reserves. He argues that a dollar shortage, arising from a variety of causes including excessive government borrowing, an external liquidity shock, or an overvalued exchange rate, can be magnified by a dollarized banking system, into a total collapse of the financial system, the exchange rate, and other asset prices. Alvarez-Plata and Garcia-Herrero (2008) show that highly dollarized countries tend to experience a larger exchange rate pass-through to inflation than countries with limited dollarization. The reason behind this would be that in a dollarized economy non-tradable goods are priced in foreign currency, resulting in exchange rate variations passing through to domestic inflation for a broader set of goods. Dollarization might increase the volatility of domestic money demand, due to the possibility of switching from domestic to foreign currency holdings. The fact that the foreign currency component of broad money cannot be directly influenced by monetary authorities implies weaker monetary transmission. They argue that in dollarized economies, an inflation targeting regime together with a floating exchange rate is difficult to implement because of the higher exchange rate pass-through on prices and the vulnerability of the economy to balance sheet effects. In the case of Peru, interventions in the foreign exchange market helped in the implementation of inflation targeting by smoothing exchange rate movements. They suggest that the reduction of the degree of dollarization should be ideally done through a mix of a hands-on approach based on administrative and legal measures, and a more hands-off approach based on good macroeconomic performance and the stability of the local currency. Levy-Yeyati (2006) shows empirically that financially dollarized economies tend to display a greater sensitivity of domestic prices to money creation, higher inflation rates, a greater propensity to suffer systemic banking crises, and a slower and more volatile output growth, without any visible gain in terms of domestic financial depth. These findings provide a case for promoting de-dollarization as an active policy. He notes that standard prudential best practices have traditionally addressed currency imbalances only at the bank level and through limits on open currency positions, and have remained silent on the higher credit risk of dollar loans to non-dollar earners. Alper, Kılınc and Yorukoglu (2015), looking at the case of Turkey, argue that shifts between domestic and foreign currency funding can reduce the effectiveness of policy interest rates, as those are effective mainly vis-à-vis domestic currency assets and liabilities. Another major issue related to financial intermediation in foreign currency is balance

sheet effects arising from exchange rate movements. Governments and banks do not generally have open foreign exchange positions, but households have a long position and firms have a short position. Balance sheet effects can be a major constraint on monetary policy transmission and can even change the direction of the policy response in turbulent times: in a crisis situation where the domestic currency loses value, with large currency mismatches in the economy, the central bank can be forced to increase interest rates to defend the currency and contain the negative balance sheet effects. Thus, the implementation of structural and cyclical macroprudential policies becomes very crucial in managing the domestic economy and containing the risks to financial stability.

To sum up, the main implications of dollarization on the conduct of monetary policy and financial stability are the following:

- the weakening of the nominal interest rate as a monetary policy tool
- a stronger exchange rate pass-through to inflation
- increased balance sheets vulnerability to direct and indirect foreign exchange risk

The main prescribed policy responses are:

- managing exchange rate volatility, or literally adopting a currency peg
- implementing macroprudential policies aimed at reducing direct and indirect foreign exchange risk exposure
- reducing the degree of assets and liabilities dollarization

We will discuss these policy implications in Lebanon's case in the following sections.

1.4.2 The choice of the exchange rate regime and the interest rate cost

Calvo (2006) argues that policy interest rate is an inherently weak instrument in emerging markets, especially in the presence of domestic liabilities dollarization. It can achieve poor nominal anchoring, and cannot prevent volatility. As a consequence, it may be advisable momentarily to switch to more robust instruments such as foreign exchange intervention or some kind of exchange rate peg during periods of high volatility. The central bank should be ready to operate as lender of last resort during a sudden stop of capital inflows by releasing international reserves in an effective manner. Therefore, the stock of international reserves or credible international credit lines should be large enough to prevent a major credit crisis. Acosta-Ormaechea and Coble (2011) find that in Chile and New Zealand (very low dollarization economies), a contractionary monetary policy shock reduces inflation and output, suggesting the existence of a strong transmission of monetary policy through the traditional interest rate channel. For Peru and Uruguay (high dollarization economies), the interest rate pass through is rather weak, however, the exchange rate channel may play a more substantial role in curbing inflationary pressures, as indicated by the relatively larger exchange rate pass through of these two economies. They find that as Peru and Uruguay reduced their levels of dollarization, the effectiveness of the monetary policy transmission has somewhat increased in these countries. Magud (2012)

uses a DSGE model with nominal rigidities and foreign currency denominated debt to show that the lower the share of tradables in a country's GDP, the more likely that a fixed exchange rate regime will be the optimal choice. The balance sheet effect implies that real devaluations, resulting from negative real shocks, increase the real value of debt. For producers of tradables, the expansionary effects of the real devaluation compensate the contractionary balance sheet effect. This is not the case for producers of non-tradables since they cannot re-direct the excess supply generated by the fall in domestic demand to the rest of the world. Hefeker (2010) develops a theoretical model to show that a tight peg to a low inflation currency can improve the institutional quality and reduce corruption in a country, as the government is induced to fight more strongly against fiscal leakages if the revenue from seignorage is lower. Governments thus face a trade-off between higher tax revenue, output and spending on one side and lower inflation and corruption on the other, when choosing their exchange rate regime.

Dollarization (via the foreign exchange risk linked to liabilities dollarization as well as the increased exchange rate pass-through to inflation), the small size of the export sector, institutional weakness and corruption favor the choice of a fixed exchange rate regime in Lebanon. However, in Lebanon's case, the de facto fixed exchange rate did not curb down corruption, and the resulting fiscal disorder. Desquilbet (2007) points to the fact that the combination of a fixed exchange rate regime and recurring fiscal deficits, puts Lebanon in a standard situation of first generation financial crises. This is confirmed by Neaime (2015) who uses unit root and cointegration methods to find that Lebanon's public deficit and external debt are not sustainable. He concludes that Lebanon's government will have to timely introduce adequate austerity measures to curb the negative implications of its rising budget and current account deficits, to avoid a future depreciation of the exchange rate, and perhaps fiscal and currency crises.

Also, it is argued that the fixed exchange rate regime in Lebanon has resulted in relatively high levels of nominal and real interest rates, weighing on the country's economic growth, mainly through their negative impact on private investment. The argument behind this claim is that the central bank is obliged to constantly keep interest rates at a relatively high level in order to defend the peg, by increasing the attractiveness of LBP assets versus USD assets, and by attracting capital inflows to cover the recurring current account deficit and build a substantial international reserves buffer. The literature on the interest rate defense of the currency has emphasized its temporary character and its long term adverse effects - It should be intended at allowing the government time to put order in its public finances.¹³

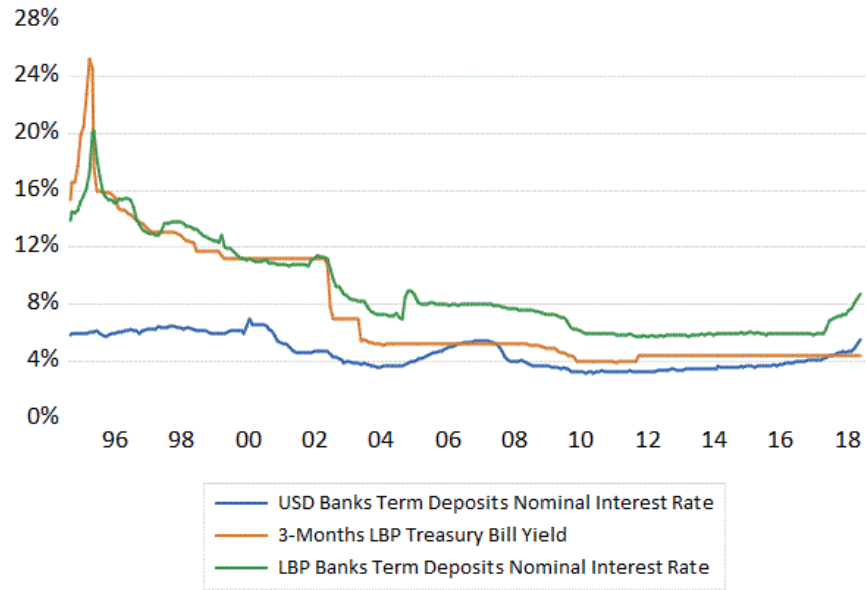
¹³Lahiri and Vegh (2003) suggest via a theoretical model that some active interest rate defense of a peg is optimal, but large increases in interest rates are likely to do more harm than good by generating higher inflation in the future, due to the increased fiscal costs of higher interest rates. In practice, the ability to delay a potential crisis buys precious time that may allow the fiscal authority to put its house in order. Lahiri and Vegh (2000) suggest via a theoretical model where all nominal exchange rates fluctuations are contractionary

Desquilbet (2007) notes that the de facto fixed exchange rate regime in Lebanon since 1997 has acted as a strong nominal anchor in the country's inflation stabilization process, and led to the decrease of the country's interest rate spreads with US rates. Figure 13 shows the evolution of Lebanon's LBP banks term deposits, 3-months LBP T-Bills, and USD banks term deposits nominal interest rates in the long run. Figure 14 shows the evolution of Lebanon's banks LBP term deposits and 3-months LBP T-Bills real interest rates. Since the adoption of the de facto fixed exchange rate regime in December 1997, LBP nominal interest rates have decreased gradually, and LBP real interest rates decreased too on average, although they remain highly correlated to effective inflation. We can notice the shrinking spread between the LBP and USD term deposits rates, following the adoption of the de facto fixed exchange rate regime. This shows that the decrease of LBP nominal rates was mainly driven by the decrease of the currency premium of the LBP, as a result of the credible peg.¹⁴

(not only appreciations) due to the existence of nominal wages rigidity, that policymakers have an incentive to prevent exchange rates fluctuations through a combination of interest rate policy and foreign exchange interventions. The optimal mix depends on the size of the output cost of the interest rate policy, the cost of foreign exchange intervention, and the speed of adjustment of nominal wages. They show that when interventions are costly it is optimal to allow some exchange rate fluctuations. Flood and Jeanne (2005) introduce the possibility of an active interest rate defense in first generation models of speculative attacks a la Krugman-Flood-Garber (KFG). This requires a departure from the uncovered interest parity (UIP) that implicitly assumes that the domestic currency interest rate is the passive reflection of devaluation expectations, and therefore there is no room for active interest rate policy. They bring in a wedge (by assuming a transaction cost due to domestic and foreign bonds being imperfect substitutes) that allows the domestic monetary authorities room to maneuver in setting the interest rate. In their model, the purpose of a successful interest rate defense is to prevent international reserves from falling into negative territory, while the stock of public debt decreases. If the fiscal situation is unsustainable, this strategy is bound to fail: increases in debt and in the interest rate feed each other until the fixed peg collapses.

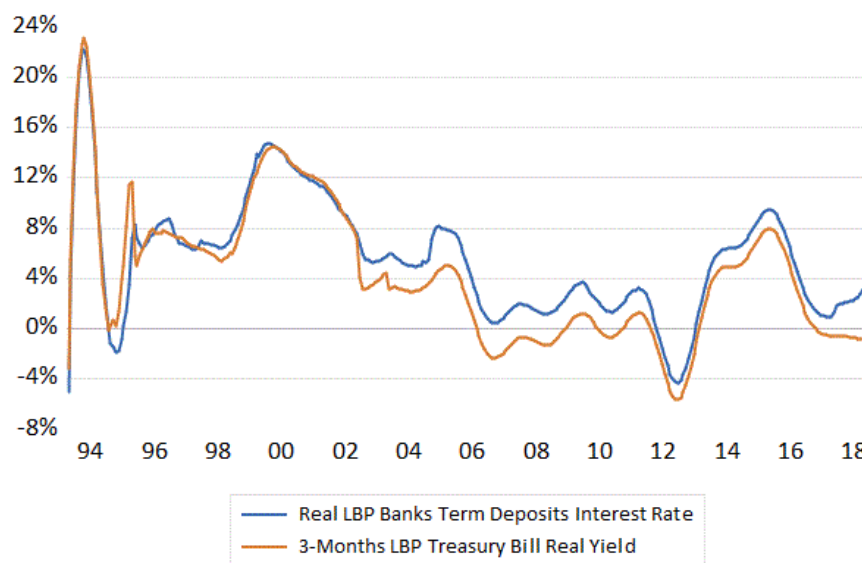
¹⁴The analysis of the impact of nominal and real interest rates movements on private investment in Lebanon during the past three decades is beyond the scope of our chapter.

Figure 13: Evolution of Lebanon's Nominal Interest Rates



Data Source: BdL Website

Figure 14: Evolution of Lebanon's Real Interest Rates



Data Source: BdL Website and IMF WEO

1.4.3 Macprudential foreign exchange regulations and dedollarization

Zettelmeyer, Nagy, and Jeffrey (2010) explain that borrowers might prefer the cheaper foreign currency loan because they ignore, underestimate, or excessively discount the foreign exchange risk involved (irrational behavior). Borrowers also assume that they will not be forced to repay in full in the event of a depreciation related insolvency, because of limited liability or because of the expectation of state support in the event of devaluation (moral hazard behavior). Focusing on emerging Europe, they argue that the policy response needs to focus primarily on improving macroeconomic institutions and policy credibility or on regulation or on a combination of both, together with measures to develop the legal and institutional infrastructure underlying local currency money and bond markets. However, in countries that lack credible macroeconomic frameworks and institutions, attempts to develop local currency markets are unlikely to succeed, and regulatory solutions may well be counterproductive. Catao and Terrones (2016) findings for Peru indicate that de-dollarization can be achieved through sound macroeconomic policies (mainly the introduction of inflation targeting in 2002) and some macro-prudential measures, especially higher loan provisioning and higher capital requirements on dollar loans.

Based on previous experiences, and taking into account the specific monetary characteristics of Lebanon, our views with regards to foreign exchange

macroprudential policies are the following:

- A regulation requiring domestic banks to strictly cover currency mismatches on their total balance sheet (and off-balance sheet positions) on a daily basis, must be a minimum requirement in dollarized economies. This measure ensures that banks avoid any foreign exchange exposure resulting from their normal operations, and prevents them from taking any speculative foreign exchange position that might put pressure on the domestic currency exchange rate. Even in the context of Lebanon's credible fixed exchange rate regime where USD/LBP exchange rate risk is very low, this measure would prevent banks from building large carry positions in order to profit from the spread between LBP and USD interest rates. Also, this measure protects the domestic banking system from direct currency risk in the event of a sudden (or forced) break of the peg. Lebanon's central bank has issued circulars limiting banks foreign currency exposures in many ways, but did not completely forbid currency mismatch on the total banks balance sheet level. Such a regulation would also boost the local market for forward foreign exchange contracts, that would be used actively for daily foreign exchange positions hedging.

- Banks indirect currency risk relates to extending loans in foreign currency to companies and households whose incomes are perceived or indexed in the domestic currency. Ranciere, Tornell and Vamvakidis (2010) suggest a measure of currency mismatch in the banking sector, which takes into account the indirect exchange rate risk that banks undertake when they lend to borrowers that will not be able to repay in the event of a sharp depreciation. We do not favor this approach, as it mixes two different risks, characterized by different probability distributions: while direct currency risk is uniformly distributed, indirect currency risk only materializes above certain depreciation thresholds. In our opinion, the best way to deal with this indirect risk is a macroprudential regulation requiring banks to assess the situation of each borrower applying for a foreign currency loan, and limit the amount loaned to its future expected incomes that are perceived in that currency. However, this regulation can only provide a partial cover as it is dependent on banks assessment, and therefore less strict than regulations imposing limits on directly observable aggregates. The indirect result of such a regulation would be the reduction of the loans dollarization rate in the economy, as non-eligible borrowers will not have access to dollar loans anymore.

- We do not favor macroprudential measures aimed at discouraging banking intermediation in foreign currencies, by making it more costly than domestic currency intermediation (i.e. higher loan provisioning, higher capital requirements, higher mandatory reserves). These measures can be counterproductive in the absence of sound macroeconomic management, as agents would circumvent them (at least partially) away from the banking sector, via market financing and direct foreign borrowing. Also, these measures would distort the market and make access to finance more costly, which would have adverse effects on the real economic activity.

- Our recommendation in Lebanon's case is to restrict the holding of foreign deposits accounts to term deposits only, and to legally forbid any use of the USD

for transaction purposes (forbidding checking accounts and payments in USD). That measure would enhance the transaction function of the LBP and reduce the deposits dollarization ratios in the banking system, without triggering an outflow of capital, as term savings accounts in USD will still be allowed. On top of that measure, regulatory authorities must impose the denomination in LBP of business and work contracts between local counterparts. Those two measures would help reduce the indexation of the economy as a whole to the USD, and consequently reduce the pass-through from foreign prices to domestic prices, allowing a better monitoring of domestic inflation. Lebanon's central bank has been reluctant so far to introduce such measures, in order to avoid disturbing the prevailing market functioning rules. We believe that the credible peg in place since 1997 provides an environment stable enough to implement such measures.

1.4.4 Preparing the move to a floating exchange rate regime

The last question we would like to tackle in this chapter is Lebanon's exit strategy to a floating exchange rate regime, whether this regime switch is voluntary or forced by foreign exchange market pressures and the drying of international reserves. As argued in our previous sections, we do not see a solid argument in favor of a voluntary exit at this stage. However, if the macroeconomic conditions remain unsustainable, the country must be ready for a regime switch that might occur abruptly.

Agenor (2004) summarizes the literature on exits to more flexible exchange regimes. Countries that choose to exit from an exchange rate peg or a currency band regime have typically faced one (or several) of three types of problems: an unsustainable real exchange rate misalignment coupled with growing external imbalances and persistent losses in foreign currency reserves¹⁵; an inability to use interest rates or to maintain them at sufficiently high levels to defend the currency; and highly volatile capital flows that tend to affect domestic liquidity and create macroeconomic instability. He argues that conditions for a successful exit depend importantly on the initial level of international reserves and intervention rules during the transition; the ability to adopt in a timely manner an alternative anchor to expectations; the capacity to implement an independent monetary policy under a more flexible exchange rate regime; and the degree to which transparency is maintained during the exit process. These factors also affect the choice of the pace of exit (i.e. overnight vs gradual). In practice, gradual exits from an adjustable peg have often taken the form of a shift to a

¹⁵Rebelo and Vegh (2008) propose a theoretical model in which the fixed exchange rate regime becomes unsustainable due to an unexpected increase in government spending. In contrast to the Krugman–Flood–Garber (KFG) model of balance of payments crises in which a peg is abandoned if and only if international reserves reach a critical lower bound, their model is consistent with evidence suggesting that many countries exit fixed exchange rate regimes with still plenty of international reserves in the central bank's vault. They show that when there are no exit costs, it is optimal to abandon the peg immediately, and when there are exit costs (for ex. output losses and cost of bailing out the banking system), the optimal abandonment time is a decreasing function of the size of the fiscal shock.

band regime, where the exchange rate is allowed to float within certain limits. The band itself can be either horizontal or diagonal, with widening margins over time. During the transition, there may be a need for clearly defined intervention rules to prevent destabilizing movements in the exchange rate within the band.

IMF report “From Fixed to Float: Operational Aspects of Moving Toward Exchange Rate Flexibility” (2004) argues that for a successful transition to a float, the following four ingredients are generally needed: a deep and liquid foreign exchange market (reducing the central bank’s market-making role, increasing the information flows in the market, eliminating regulations that stifle market activity, and improving the market micro-structure), a coherent intervention policy (correcting misalignment, calming disorderly markets, and accumulating reserves or supplying foreign exchange to the market), an appropriate alternative nominal anchor (monetary or inflation targeting)¹⁶, and adequate systems to review and manage public and private sector exchange rate risk (information systems for monitoring risks, formulas and analytical techniques to measure exchange rate risk, and internal and regulatory risk policies and procedures).

To sum up, the four prerequisites that should be in place to ensure a smooth transition to a floating exchange rate regime are:

- a macroprudential regulation enforcing strict currency matching on banks balance sheets in order to eliminate direct foreign exchange risk, and a regulation aimed at minimizing indirect foreign exchange risk exposure of banks.

- an adequate institutional and structural framework for the implementation of an alternative monetary policy, guaranteeing the independence of the central bank.

- a liquid foreign exchange market, or the commitment of the central bank to perform a market making role in order to ensure the liquidity of foreign exchange transactions.

- an adequate level of international reserves giving the central bank the ability to intervene in the foreign exchange market in a coherent way, in order to smooth any excessive volatility of the exchange rate in the transition period.

Our recommendation for Lebanon is to aim at ensuring those four prerequisites as soon as possible, even if the regime switch does not seem imminent, in order to be fully ready in case any exchange market pressure arises. Achieving the four targets would also be beneficial if the country keeps its fixed exchange rate regime for a longer period, as this will contribute to a better functioning of the monetary and prudential system in general.

¹⁶Roger (2009) overviews the major elements of inflation targeting frameworks. These include: Institutional arrangements i.e. legislation or public commitments providing clear prioritization and specification of the policy target, and giving the central bank the necessary autonomy to pursue the objective; Explicit quantitative targets for inflation, often in terms of headline CPI; A high degree of autonomy and accountability for performance in achieving the objective as well as a high degree of transparency of monetary policy strategy and implementation; Analytical capabilities and data availability to conduct a forward-looking assessment of inflation pressures and the appropriate policy response; An economic structure and a sound financial system that promote transmission from the policy instruments to inflation outcomes.

1.5 Conclusion

We made a thorough analysis of the unique Lebanese dollarization case. This allowed us to shed light on a number of areas that were unexplored so far in international finance and monetary economics, mainly the difference between gross and net international reserves and their relative fiscal costs, together with a synthetic classification of sterilization techniques. We also explained the monetary “freezing” mechanism that helped contain inflation in Lebanon, despite the monetary financing of the country’s recurring public deficits. We also assessed the results of Lebanon’s monetary policy in the last two decades, and the impact of the de facto fixed exchange rate regime on nominal and real interest rates. Finally, we made a number of policy recommendations aiming at limiting banks foreign exchange exposure and at reducing the degree of dollarization, in light of previous studies.

Our chapter contributes to the better understanding of the mechanisms involved in dual currency systems in general. As dollarization has taken different forms in different countries (dollarization of deposits, assets, liabilities, transactions, foreign financing of banks and corporate etc), the institutional, legal, macroeconomic and behavioral context is key in each specific case. As a consequence, multi-country or panel studies would fail to shed light on the mechanisms involved under different dollarization configurations. Similar studies are needed for other countries with other forms of dollarization, in order to better understand the micro and macro mechanisms at play.

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2 Dollar Liquidity, Money and Credit in a Small Open Dollarized Economy

Abstract

This chapter analyzes the liquidity questions relating to financial dollarization. We formalize monetary mechanisms under dollarization, shedding light on the interconnection of the balance of payments with money and credit aggregates in a small open dollarized economy. After presenting the dollar money creation mechanism under financial dollarization, we propose a new measure of dollar liquidity in dollarized economies defined as the Gross Foreign Assets of the Locational Banks Sector, equal to the sum of the central bank's gross international reserves and the gross liquid foreign assets of the locational banks sector.

Our empirical results for Lebanon suggest that our measure of dollar liquidity has a significant and positive contemporaneous connection with total banks deposits and a lagged connection with total banks credit to the private sector in the period extending from 2002Q1 to 2017Q2. We test our results for robustness during the ongoing financial and monetary crisis period in Lebanon, that is in essence a dollar liquidity crisis. We also test our results using data from two other major dollarized economies: Peru and Russia.

Keywords: Dollarization; Balance of Payments; Dollar Liquidity; Money Supply; Emerging Markets

JEL Classification: E42; E51; F34

This chapter has been published in *Ensayos Económicos* (Central Bank of Argentina): Bitar J., Dollar liquidity, money and credit in a small open dollarized economy, *Ensayos Económicos* - Central Bank of Argentina, No. 79, May 2022, pp. 5-39

http://www.bcra.gov.ar/PublicacionesEstadisticas/Resumen_ensayos.asp?id=1583

2.1 Introduction and literature review

Financial dollarization is a common feature in a large number of emerging and developing economies. Honohan (2008) notes that in 45 countries, more than half of total bank deposits were denominated in foreign currency at some stage since 1990. Rajan and Tokatlidis (2005) stress that dollarization is a response to institutional infirmities and that countries have to learn to “live with dollarization” until those infirmities are fixed. Having that in mind, dollar liquidity management should be approached as a persistent monetary policy concern in dollarized economies.

Our chapter is an attempt to formalize monetary mechanisms in dual currency environments. A good understanding of those mechanisms is needed for monetary authorities in economies that allow any form of dollarization of their financial sector, in order to be able to better monitor inflation and achieve financial stability. This chapter is singular in the sense that it focuses on the liquidity dimension linked to the dollarization of banking systems, while most past literature has focused on the currency mismatch that liability dollarization induces and its macroeconomic implications. We study the relationship between the balance of payments (BoP) and the deposit and credit components of the locational banks balance sheet in a dollarized small open economy. We use the term locational in order to refer to the residence criteria, following the terminology of the Bank for International Settlements.

This is, to our knowledge, the first analysis of its kind in the literature relating to dollarization. The detailed analysis of monetary mechanisms under partial dollarization that we undertake in this chapter is very important for the academic literature on dollarization. By focusing solely on some behavioral patterns, past literature has suffered from crucial conceptual shortcomings. One of the common errors in this literature consists in treating equivalently domestic dollar denominated assets and liabilities and foreign dollar denominated assets and liabilities. Another common error relates to the misunderstanding of the basic monetary mechanisms in dollarized monetary systems. For example, some of the most influential papers in the dollarization literature fail to account for the fact that dollar denominated credit made by domestic banks in a dollarized economy results in the creation of dollar denominated deposits. This is to be seen as “domestic dollar” creation.

Past literature on dollarization has mainly focused on the causes and determinants of deposits and liabilities dollarization, on the advantages and inconveniences of dollarization, on the effects of dollarization on macroeconomic performance, and on the implications of dollarization for monetary policy and for the choice of an exchange rate regime - see for example: Calvo and Vegh (1996), Balino, Bennett, and Borensztein (1999), Honohan and Shi (2001), De Nicola, Honohan and Ize (2003), Ize and Levy-Yeyati (2003), Feige (2003), Havrylyshyn and Beddies (2003), Levy-Yeyati (2006), Honohan (2008), Haiss and Rainer (2012). Levy-Yeyati (2008) and Ize, Kiguel and Levy-Yeyati (2005) approach dollar liquidity in dollarized economies from the angle of the insurance against bank runs and the limit it imposes to the central bank as a lender of

last resort. Our approach is different in the sense that we view dollar liquidity as an ongoing monetary policy concern.

In dollarized economies, banks generally hold foreign currency reserves at the central bank or alternatively hold foreign cash or bonds. One of the main contributions of our chapter is to show that, in economies where banks are allowed to hold liquid foreign assets, the variation of the Gross Foreign Assets of the Locational Banks Sector aggregate (equal to the sum of the central bank's gross international reserves and domestic banks liquid foreign assets) is a better measure of the bottom line of the balance of payments (i.e. the sum of the net current and capital accounts and net financial inflows) than is the change in gross international reserves alone. It allows to account for the variation of the economy's international liquidity (dollar liquidity) more accurately than does the change of the central bank's international reserves. We back our reasoning with the more general analysis of balance of payments transactions made in the recent paper by Kumhof, Rungcharoenkitkul and Sokol (2020). We show that standard textbook assumptions do not hold if domestic banks are allowed to hold foreign assets. The inflow of capital in a fixed exchange rate regime does not automatically lead to the growth of the domestic money base, resulting from the increase of the central bank's international reserves, if the resulting foreign liquid assets are not converted into domestic base money by the domestic banks sector.

We then explain how BoP flows impact in different ways deposits at domestic banks, depending on their nature: flows in the form of bank deposits transfers translate fully, FDI and portfolio flows translate partially, while loans of foreign banks to domestic banks do not have a direct impact on domestic banks deposits. We also argue that credit of domestic banks to the private non-bank sector responds with a lag to BoP flows¹⁷. Those mechanisms operate whether the banking system is partially dollarized or not. The currency composition of deposits and credit (banks liabilities and assets dollarization ratios), that has been extensively studied in the literature, depends mainly on the domestic non-bank sector preferences.

¹⁷Historically, capital inflows have often fueled domestic banks credit in advanced and emerging economies alike - see for example: Mendoza and Terrones (2008), Montiel and Reinhart (2001), Magud, Reinhart and Vesperoni (2014), Boudias (2015), Lane and McQuade (2014), Calderon and Kubota (2012), Igan and Tan (2017). The standard textbook prediction tells us that in an economy with a free floating exchange rate regime, capital inflows would appreciate the domestic currency without any effect on monetary aggregates. Under a fixed exchange rate, the central bank would have to intervene, accumulating international reserves in order to maintain the peg. Part or all of this reserves accumulation can be offset through sterilization, effected through open market sales of domestic bonds by the central bank (see for example: Krugman et al. (2010); Calvo, Leiderman and Reinhart (1994); Dominguez (2009)). In practice, sterilization is often partial, and foreign exchange intervention is associated with an increase of the monetary base. Consequently, economies with less flexible exchange rate regimes are more likely to experience credit expansions in the presence of large capital inflows, as the expanding monetary base allows banks to expand their credit to the domestic non-bank sector. Also, the magnitude of the effect of capital inflows on domestic banks credit might vary, depending on their nature, i.e. Foreign Direct Investments (FDI), Portfolio Investments (PI), and Other Investments (OI - mainly capital transfers channeled through banks).

The existing literature on dollar liquidity, resulting both from foreign banks loans and dollar bank deposits, has identified its effects on domestic banks credit¹⁸, but no clear measure of the dollar liquidity of the economy has been defined so far. Previous papers used foreign currency liquidity proxies including flows measures, like gross and net capital inflows or foreign banks loans to domestic banks, and stock measures, like dollar deposits in the banking system or non-core foreign currency liabilities of domestic banks. Also, the monetary mechanisms involved remained unclear. Referring to dollar liquidity, Levy-Yeyati (2008) and Ize, Kiguel and Levy-Yeyati (2005) are the only papers that we are aware of, that clearly state that in dollarized economies, “reserves holdings can be centralized at the central bank or decentralized at individual banks (in the form of reserve money or liquid asset requirements)”. This view is in line with our monetary analysis results.

We compare our measure of dollar liquidity to the IMF’s “foreign currency liquidity” and “international reserves” concepts. Then, we discuss the dollar liquidity risk implied by dollar loans made by domestic banks to the domestic non-bank sector, as well as the liquidity and FX risks implied by the conversion of domestic currency banks deposits into dollar deposits. We argue that the absence of a dollar lender of last resort in a dollarized economy warrants applying the strictest degree of liquidity standards for the foreign currency part of banks balance sheets.

We test the mechanisms we identified using quarterly data for Lebanon, whose deposit dollarization ratio varied from 51% to 77%, and credit dollarization ratio varied from 68% to 89%, during the 2002-2017 period. Our analytical results are confirmed as we find a contemporaneous positive effect of our favored measure of dollar liquidity on total locational banks deposits, and a lagged positive effect on banks private credit. For robustness, we perform the same tests during Lebanon’s financial and monetary crisis period that started in October 2019, using monthly data. Our results are even more robust during the crisis.

Lebanon’s crisis is a dollar liquidity crisis by essence, which justifies our analytical interest in the liquidity dimension linked to dollarized monetary systems that has been somehow neglected in the dollarization literature that focused mainly on the currency mismatch implications of liability dollarization. The main contribution of this chapter is to stress the importance of monitoring dollar liquidity, as measured by the Gross Foreign Assets of the Locational Banks Sector aggregate, by the monetary authorities of dollarized economies. By doing so, they can have better control over monetary aggregates and credit and, consequently, achieve their inflation and financial stability targets, as well as exchange rate stability, and avoid costly monetary and banking crises.

¹⁸As regards dollar liquidity, past literature has mainly focused on international dollar liquidity provision through cross-border interbank loans. Borio, McCauley and McGuire (2011) argue that, as emerging market central banks tighten monetary policy, they face the challenge of borrowers obtaining credit from abroad or in lower-yielding international currencies such as the US dollar. Private borrowers obtain credit directly from abroad or indirectly access credit that local banks obtain from abroad, mainly from foreign banks. Alper, Kilinc and Yorukoglu (2015) argue that foreign currency funding in the form of dollar client deposits can be considered as stable as other domestic sources of funds.

Although dollar liquidity crises in dollarized economies have not been extensively analyzed in past literature, we could find few papers that alluded to them. Rajan and Tokatlidis (2005) pointed that a dollar shortage arising from a variety of causes including excessive government borrowing, an external liquidity shock, or an overvalued exchange rate, can be magnified by a dollarized banking system, and lead to a total collapse of the financial system, the exchange rate, and other asset prices. Also, dollar deposits convertibility risk in dollarized economies¹⁹, resulting from the lack of their coverage in foreign liquid assets, has been mentioned in few academic papers. Rogers (1992) discusses the dollar convertibility risk of Mexdollars, i.e. dollar denominated demand deposits held in Mexican banks, after Mexdollars were forcibly converted to pesos amid a severe balance of payments crisis in August 1982. Honohan (2008) sees forced conversion as one of the risks inherent to dollarized banking systems.

Finally, we test our results for robustness in the context of two other major dollarized economies with different economic and monetary structures and exchange rate regimes: Russia and Peru. By doing so, we show empirically that the monetary mechanisms we identified are not specific to the Lebanese monetary system. They are universal mechanisms that apply in any institutional context.

The remainder of the chapter is organized as follows: Section 2 is dedicated to the analysis of monetary mechanisms and their relation to the balance of payments in a dollarized economy. Section 3 is dedicated to the empirical analysis in the case of Lebanon in the period 2002-2017. In section 4, we test the robustness of our results during Lebanon's monetary and financial crisis period. In section 5, we test the robustness of our results with data from Peru and Russia. Section 6 concludes.

2.2 Monetary mechanisms and the balance of payments in a dollarized economy

2.2.1 Deposits dollarization

Dollarization of deposits is the willingness and the ability of the economy's residents to hold bank deposits denominated in a currency other than the domestic currency. Liabilities (or credit) dollarization is the willingness and the ability of the economy's residents to borrow money from a domestic bank in a currency other than the domestic currency. We will call the foreign currency "dollar" in the following sections, but that does not exclude that Euro and other major currencies can play that role.²⁰

¹⁹Dollar denominated deposits convertibility should not be confused with the domestic currency convertibility, which is the ease with which a country's currency can be converted into gold or another currency.

²⁰Looking back at the motives for holding deposits and contracting loans in dollar, we see that hyperinflation is the main trigger of dollarization, as documented in most past research - See for example: Calvo and Vegh (1996), Balino, Bennett, and Borensztein (1999). Hyperinflation deteriorates the ability of the domestic currency to play its roles as a store of value, unit of account and sometimes as a medium of exchange. Monetary authorities can forbid

We will start our analysis of the dollar money supply mechanisms in a dollarized economy by the initial trigger of a dollar deposit in a domestic bank, which is the receipt of a payment, an income transfer or a capital transfer X from a foreign country by the client a of domestic Bank A (any form of fund transfer relating to a BoP flow) - Table 2. We will call the foreign country “United States” (US) in the following sections.

Table 2: Deposits dollarization

Bank A		US Bank	
1. Dollar Deposit at US Bank = X	2. Dollar Deposit of Client a = X	1. Loan to US non-bank sector = X	2. Dollar Deposit of Bank A = X
Total = X	Total = X	Total = X	Total = X

We show the case where dollar deposits are allowed in domestic banks and subject to reserve requirements at the rate r in Table 3. Banks reserve requirements on dollar deposits are held in the form of dollar deposits of the central bank at US Banks. They are of the same nature as other assets included in the international reserves of the central bank. However, the nature of reserve requirements holding makes the use of these deposits for foreign exchange intervention unadvised. From a liquidity risk point of view, if these reserves were used for foreign exchange interventions, and the dollar deposits they are linked to get withdrawn from the domestic banks by their non-bank depositors, the central bank would not be able to release these deposits to banks. Therefore, it is best practice for central banks in dollarized economies to separate reserve requirements amounts from international reserves amounts.

The IMF’s “international reserves and foreign currency liquidity - guidelines for a data template (2013)” specifies that foreign currency deposits held at the monetary authorities by commercial banks of the reporting country in respect of the regulatory reserves/liquidity requirements, as well as foreign currency deposits with a remaining maturity of one year or less, should be deducted from the reported international reserves amount. Some emerging economies central banks currently abide by this rule while others do not²¹.

domestic banks by law from accepting dollar deposits and/or providing dollar loans. However, forced de-dollarization has had adverse effects in the past (for example: Bolivia in 1982, Peru in 1985), as it led to capital outflows and had negative impacts on output growth in many economies.

²¹For example: Lebanon’s central bank includes dollar reserve requirements amounts in its international reserves figure.

Table 3: Deposits dollarization with reserve requirements

Bank A		US Bank		Domestic Central Bank	
1. Dollar Deposit at US Bank = $X \cdot (1-r)$	3. Dollar Deposit of Client a = X	1. Loan to US non-bank sector = X	2. Dollar Deposit of Bank A = $X \cdot (1-r)$	1. Dollar Deposit at US Bank = $X \cdot r$	2. Dollar Reserves of Bank A = $X \cdot r$
2. Dollar Reserves at CB = $X \cdot r$			3. Dollar Deposit of CB = $X \cdot r$		
Total = X	Total = X	Total = X	Total = X	Total = $X \cdot r$	Total = $X \cdot r$

2.2.2 Credit dollarization and dollar creation

Dollar denominated loans made by a domestic bank to the non-bank sector should be met by a stable dollar source (a dollar term deposit at the domestic bank or a loan from an international bank) in order to limit the dollar liquidity risk. The domestic central bank cannot act as the lender of last resort, in case of international payments, or dollar cash withdrawals out of the domestic bank's dollar deposits resulting from the dollar loan. The alternative would be emergency dollar facility lines that the domestic bank can contract with a US bank, ideally covering the total amounts of dollar loans granted.

We present in Table 4 the case of a domestic bank A that holds a dollar deposit of an amount X and gives a dollar loan of the same amount to the non-bank sector client a'.

By giving a dollar loan, the domestic bank “creates dollar money”²². While the domestic banking sector's gross dollar assets held at the US Bank is X , the dollar money aggregate in the domestic economy is $2X$. The simple transaction of giving a dollar denominated loan financed by a dollar deposit in a dollarized economy is money creation in a currency (the dollar) other than the sovereign currency. In other words, while its gross dollar assets are X , the banking system “multiplied” this amount (by a factor of 2 in our example) in the same way the banking system multiplies the domestic base money in a standard fractional reserves monetary system. Thus, gross dollar assets of the locational banks sector (including the central bank) could be seen as the “dollar money base” of the economy. Gross dollar assets of the locational banks sector are either originated

²²The only paper we are aware of, that mentions this dollar creation process is Rodriguez (1993), that refers to locally created dollar as “argendollars” for Argentina, and “perudollars” for Peru. It makes a narrative analysis of the current account implications of the increased dollar supply, but does not analyze the dollar creation process per se.

as counterparts of real transactions (operations of the current/capital accounts of the balance of payments), or as counterparts of financial flows (operations of the financial account of the balance of payments). The domestic banks sector bears a dollar liquidity risk as a result of this operation.

If the gross dollar assets of the domestic banking system are obtained through long term dollar loans from foreign banks, dollar loans given by domestic banks to the domestic non-bank sector do not multiply dollar deposits. If the amount of credit to the domestic non-bank sector does not exceed the amount of those foreign banks loans, this could be seen as full “funding” through foreign banks loans. The domestic banks sector does not bear a dollar liquidity risk as a result of this operation.

Table 4: Credit dollarization

Bank A		US Bank		Domestic Central Bank	
1. Dollar Deposit at US Bank = $X \cdot (1-2r)$	4. Dollar Deposit of Client a = X	1. Loan to US non-bank sector = X	2. Dollar Deposit of Bank A = $X \cdot (1-2r)$	1. Dollar Deposit at US Bank = $X \cdot 2r$	2. Dollar Reserves of Bank A = $X \cdot 2r$
2. Dollar Reserves at CB = $X \cdot 2r$	5. Dollar Deposit of Client a' = X		3. Dollar Deposit of CB = $X \cdot 2r$		
3. Dollar Loan to Client a' = X					
Total = $2 \cdot X$	Total = $2 \cdot X$	Total = X	Total = X	Total = $X \cdot 2r$	Total = $X \cdot 2r$

2.2.3 The BoP balance and the Gross Foreign Assets of the Locational Bank Sector (GFA_LBS) aggregate

In financially dollarized economies, domestic banks hold deposits in foreign currencies, either exclusively at the central bank, or at both the central bank and at foreign correspondent banks, if the holding of foreign currency accounts at foreign banks is allowed by law. In this case, and in contrast to the standard textbook assumption (see for example: Krugman et al., 2010), dollar inflows to the domestic banking system as a result of balance of payments surpluses, only translate into domestic base money if they are converted into domestic currency by banks and the central bank intervenes in the foreign exchange market to avoid the appreciation of the domestic currency. In that event, the central

bank increases its international reserves in exchange for domestic currency deposits of domestic banks at the central bank²³. Therefore under dollarization, if banks are allowed to hold foreign assets, balance of payments surpluses in a fixed exchange regime do not automatically lead to an increase in the central bank international reserves.

The standard textbook implicit assumption is that domestic banks are either forbidden by law or do not have the willingness to hold liquid foreign assets, in the form of deposits at foreign banks or foreign bonds. In practice, every balance of payments flow materialized by a nonresident counterpart transferring funds to the domestic economy creates a liability (deposit) of a foreign bank in favor of a domestic counterpart bank. In that regard, a recent paper by Kumhof, Rungcharoenkitkul and Sokol (2020) highlights the role of the banking system, as an inseparable component of all cross-border real and financial flows and stocks. They point to the fact that any economic transaction, including both physical and financial trades, consists of two inseparably linked components or “legs”, the second of which always involves the transfer of a retail or interbank monetary settlement medium. Any gross financial or real inflow must be matched by an inseparable automatic (thus unintentional) gross outflow resulting from settlement mechanics, in line with the balance of payments double-entry bookkeeping rules. This translates in practice into a short term liquid liability (a deposit) of the foreign bank, in favor of the domestic bank. That deposit is acquired ultimately by the central bank in a fixed exchange rate regime, increasing its international reserves (see for example: Krugman et al., 2010 - Chapter 13 p. 312-313). Thus, the bottom line of the BoP must be the sum of the current account and capital account balances, plus the non-banks and the long term commercial banks portion of the financial account balance (and not only the non-reserve portion of the financial account balance). This definition excludes cross-border short term interbank flows from the standard textbook BoP bottom line definition, as they only constitute counterparts of real and financial transactions, and not independent economic decisions.

If the unrealistic textbook assumption is eased, in an economy where domestic banks are allowed to hold liquid foreign assets, the bottom line of the BoP (i.e., the variation of the economy’s international reserves) must be equal to the variation of the Gross Foreign Assets of the Locational Bank Sector (GFA_LBS), and not only the variation of the central bank’s gross foreign assets (central bank’s international reserves). GFA_LBS is the sum of the central bank’s gross foreign liquid assets (gross international reserves) and the locational domestic banks gross foreign liquid assets. In practical terms, the computation of this aggregate should only include the liquid gross foreign currency assets of the central bank and the liquid gross foreign currency assets of domestic banks whose counterparts are non-resident agents. The level of the Gross Foreign Assets of the Locational Bank Sector in the economy is equal to the cumulative balances of the current and capital accounts plus the non-banks and the long

²³The central bank could sterilize this increase in the domestic currency base money subsequently.

term commercial banks portion of the financial account of the BoP (i.e. excluding the short-term interbank portion of the financial account of the BoP), adjusted to valuation changes²⁴.

The GFA_LBS aggregate is key in dollarized economies:

- It is an important aggregate alongside the central bank's international reserves when it comes to the ability to maintain a currency peg. The central bank can potentially borrow liquid foreign assets from domestic banks, and use them to defend the external value of the domestic currency. Alternatively, the central bank can oblige domestic banks to place their foreign liquid assets in the form of deposits at the central bank by means of regulations, in order to increase the amount of its gross international reserves.

- It can be seen as the "dollar liquidity" or "dollar money base" in the economy. The ratio of dollar deposits in the locational banking system to the GFA_LBS can be seen as the "dollar multiplier".

2.2.4 "Dollar Liquidity" and IMF's "Foreign Currency Liquidity"

The IMF's concept of "foreign currency liquidity" defined in the "international reserves and foreign currency liquidity - guidelines for a data template (2013)", is broader than that of IMF's concept of international reserves in at least three respects:

(1) while reserve assets refer to external assets of the monetary authorities, foreign currency liquidity concerns foreign currency resources and drains on such resources of the monetary authorities and the central government.

(2) while reserve assets represent the monetary authorities' claims on non-residents, foreign currency liquidity relates to the authorities' foreign currency claims on and obligations to residents and nonresidents.

(3) while the concept of reserve assets is based on the balance sheet framework, the concept of foreign currency liquidity encompasses inflows and outflows of foreign currency that result from both on and off-balance-sheet activities of the authorities.

Our measure of "dollar liquidity" (GFA_LBS) is different to the IMF's concept of "foreign currency liquidity" in the following respects:

(1) it does not only include assets of the monetary authorities (and of the central government generally), but also liquid foreign assets of the banking system.

(2) it only includes claims on and obligations to non-residents.

²⁴As documented in the academic literature on capital flows, an economy attracts capital due to a positive interest rate differential to the rest of the world. Thus, the GFA_LBS aggregate is a function of this interest rate differential, in addition to other traditional pull and push factors. The structural part of this aggregate is important in economies that attract capital for reasons such as bank secrecy laws, home bias of expatriates, etc... This aggregate can be directly influenced as well by the ability of domestic banks and the central bank to contract loans with foreign banks, foreign central banks and international organizations. Also the level of the GFA_LBS is a function of structural imbalances in the current/capital accounts of the economy, like long term trade competitiveness and income remittances of expatriates.

Our measure of “dollar liquidity” is similar to the IMF’s concept of “foreign currency liquidity” in the following respect:

(3) it encompasses inflows and outflows of foreign currency that result from both on and off-balance-sheet activities. Any potential drain of foreign currency resulting from off-balance-sheet activities of authorities and banks, should be deducted from the dollar liquidity aggregate.

2.2.5 The “dollar multiplier” and dollar liquidity risk

We consider the example below (Table 5) where dollar liquidity (GFA_LBS) is generated by short term deposits (Client a) for half ($X/2$) and by foreign banks loans (or long term deposits) for the other half ($X/2$), and where the domestic banks sector grants dollar credit to the domestic non-bank sector (Client a’) equal to the total amount of GFA_LBS (X). The final amount of dollar deposits is $1.5 X$, thus the dollar multiplier is 1.5 in this case, as part of dollar funding ($X/2$) is done through long term stable sources. If all the dollar liquidity in the domestic banks sector results from long term foreign banks loans, there is no multiplication - it is simply a foreign funding of dollar loans, as is well documented in the literature on international banking and foreign currency intermediation.

From a macroprudential point of view, if the “dollar multiplier” (the ratio of dollar deposits in the locational banking system to the GFA_LBS) exceeds 1, the domestic banking system bears a dollar liquidity risk, in the absence of a dollar lender of last resort. The dollar liquidity risk can typically come (but not only) from the standard bank intermediation maturity mismatch between dollar sight deposits (that could be withdrawn out of the banking system in the form of notes - or transferred abroad) and dollar credit to the domestic non-bank sector that is of longer maturity.

At the level of the economy, in case dollar liquidity (GFA_LBS) is generated through sight or short term dollar client deposits, this could be seen as unstable funding. In case dollar liquidity (GFA_LBS) results from foreign banks dollar loans, this is to be seen as stable funding if the maturity of the loans that domestic banks obtain from foreign banks equals or exceeds the maturity of the loans that domestic banks grant to domestic agents. Foreign banks dollar loans to domestic banks, do not increase total deposits in the locational domestic banks balance sheet directly, but increase domestic banks dollar non-core liabilities.

Also, dollar liquidity risk should be considered at the individual bank level. Liquidity standards similar to those of Basel III - LCR and NSFR²⁵ – should be applied. However, the Basel III standards do not put enough emphasis on multi-currency environments and the availability of foreign currency liquidity in the hands of the locational domestic banking systems. They only account for the currency risk resulting from any currency mismatch between assets and

²⁵For details on the Basel 3 liquidity standards see:

- Basel 3: The Liquidity Coverage Ratio and Liquidity Risk Monitoring Tools (2013), Basel Committee on Banking Supervision.

- Basel 3: The Net Stable Funding Ratio (2014), Basel Committee on Banking Supervision.

liabilities. However, the absence of a dollar lender of last resort in a dollarized economy warrants applying the strictest degree of liquidity standards for the foreign currency part of banks balance sheets. It could be argued that in some institutional settings, the central bank does not have to or could not be willing to act as a dollar lender of last resort and to supply banks with dollar liquidity out of its international reserves. Also, it could be argued that the dollar lender of last resort intervention of the central bank would sometimes operate less smoothly than what is expected. In such instances, liquidity management of banks must mainly rely on individual banks dollar liquidity positions. Our analysis suggests separating domestic dollar denominated assets and liabilities from foreign dollar denominated assets and liabilities in the design of specific LCR/NSFR style liquidity regulations for dollarized banking systems. As our chapter focuses on the macro dimension of the dollar liquidity risk in dollarized economies, we keep the detailed analysis of the design of individual banks dollar liquidity regulations beyond the scope of this chapter.

Table 5: Banks dollar credit and the “dollar multiplier”

Locational Banks Sector (Bank A + Central Bank)		US Bank	
1. Dollar Deposit at US Bank = X	3. Dollar Deposit of Client a = X/2	1. Loan to US non-bank sector = X/2	2. Dollar Deposit of (Bank A + Central Bank) = X
	4. Loan from US Bank = X/2	2. Loan to Bank A = X/2	
2. Dollar Loan to Client a' = X	5. Dollar Deposit of Client a' = X		
Total = 2.X	Total = 2.X	Total = X	Total = X

2.2.6 Bank deposits currency conversion, dollar liquidity and FX risk

In a partially dollarized monetary system, money supply is made of two components: (1) domestic money supply (domestic currency bank deposits and bank

notes) and (2) dollar money supply (dollar bank deposits and bank notes)²⁶. The interaction between the two components of the money supply happens only when the domestic non-bank sector converts domestic money into dollars or the other way round. Foreign exchange transactions between domestic banks and between domestic banks and the central bank do not affect money supply as these are operations involving banks reserves in dollar and banks reserves in domestic currency at the central bank (base money), without any effect on the denomination of the non-bank sector deposits at domestic banks.

We now consider the case where half of the domestic currency money supply (e.X/2; initial domestic currency money supply is determined by banks credit in domestic currency to Client a", equal to e.X in our example) gets converted into dollar deposits by the domestic non-bank sector (Table 6). The dollar multiplier becomes equal to 2 as a result of this currency conversion. Also, Table 6 shows a currency mismatch on the locational banks balance sheet: the currency composition of banks assets does not vary while banks dollar liabilities share increases. In sum, the conversion of the domestic currency component of the money supply into dollar deposits creates additional liquidity risk as well as FX risk on the locational banks sector balance sheet. At the individual bank's level, FX risk could be covered, with the central bank bearing the residual FX risk. If the exchange market pressure reaches a degree at which the central bank is not capable (considering its international reserves level) or unwilling to maintain the stability of the domestic currency exchange rate, the domestic currency would depreciate.

²⁶We will not make an analysis of the determinants of the degree of deposits and liabilities dollarization in this chapter as this question has been extensively studied in the literature relating to dollarization. Monetary analysis of small open dollarized economies can be performed independently from the dollarization ratio consideration that mainly relates to the degree of confidence that domestic economic agents have in their domestic currency and the arbitrages they can make in a dual currency system.

Table 6: Deposits currency conversion, dollar liquidity and FX risk

Locational Banks Sector (Bank A + Central Bank)		US Bank	
1. Dollar Deposit at US Bank = X	3. Dollar Deposit of Client a = X/2	1. Loan to US non-bank sector = X/2	3. Dollar Deposit of (Bank A + Central Bank) = X
	4. Loan from US Bank = X/2	2. Loan to Bank A = X/2	
2. Dollar Loan to Client a' = X	5. Dollar Deposit of Client a' = X		
6. DC Loan to Client a'' = e.X	7. DC Deposit of Client a'' = e.X/2		
	8. Dollar Deposit of Client a'' = X/2		
Total = 3.X	Total = 3.X	Total = X	Total = X

2.2.7 BoP surpluses, banks deposits and banks credit

Net capital flows (excluding locational banking system short-term flows) added to the balance of the current and capital accounts of the BoP, should translate directly or indirectly into a variation of the deposits of the locational bank sector, as the point of entry of most of those flows is through the transfer of funds to the domestic economy in the form of bank deposits. Capital inflows in the form of bank transfers (Other Investments) directly feed domestic banks total deposits. However, Other Investments also include foreign banks dollar loans to domestic banks, that do not increase total deposits in the locational domestic banks balance sheet directly, but increase domestic banks dollar non-core liabilities. This foreign funding of domestic banks has been extensively analyzed in the literature on capital flows and bank credit in emerging markets.

Capital inflows in the form of FDI and Portfolio Investments translate totally or partially into domestic banks deposits if the beneficiary companies use the proceeds of these flows to finance their domestic investments and working capital, in which case they will need to transfer their foreign funds into deposits in the domestic banking system. In a bank based economy where the financial market is absent or of small size, the share of banks deposits transfers tends to be higher than Portfolio Investments. Consequently the effect of BoP inflows on total banks deposits is larger and comes without a significant lag.

As a result, the bottom line of the BoP (variation of GFA_LBS) should be positively correlated to banks total deposits. It is worth mentioning that this correlation should exist whether the banking system is partially dollarized or not. The currency denomination of those deposits variations is either fully in domestic currency if dollarization of deposits is legally forbidden, or both in the domestic currency and foreign currencies if foreign currency deposits are allowed. The central bank can reverse (totally or partially) the increase of total deposits at domestic banks, if it reacts to capital flows by sterilizing them through the open market sales of securities.

The increase of dollar liquidity in the economy due to balance of payments flows gives room for domestic banks to expand dollar credit to the non-bank sector. Also, the conversion of dollar deposits into domestic currency deposits by non-bank depositors creates simultaneously an equal amount of domestic currency base money (as banks convert their foreign assets to domestic currency deposits at the central bank to avoid any currency mismatch in their balance sheet) and domestic currency deposits at banks, in the same way as described in standard textbooks. The additional domestic currency base money gives the possibility to banks to offset the facilities they may have had from the central bank previously. This increase in domestic base money can also be used to create domestic money via the standard money multiplier mechanism: banks can use these surplus domestic currency reserves to extend domestic currency loans to the domestic non-bank sector. However, this process is not automatic as loan demand by the non-bank sector is mainly determined by their activity needs and the loans nominal (and real) interest rate level. Also, the willingness of banks to offer loans to the private non-bank sector will depend on the risk adjusted return they can achieve in alternative uses of this liquidity, mainly central bank term deposits, government bonds, and foreign bonds. Therefore, increasing banks liquidity (either in the domestic currency or in dollar) should not be seen as an automatic trigger of credit growth to the domestic non-bank private sector. It should also be noted that a lag could be observed between the time the excess banks liquidity is observed and the time banks release loans to the non-bank sector, due to the administrative process involved in banks credit provision.

The results of the monetary and liquidity analyses we performed help explain the empirical findings of past studies:

- Net current account balances induce a variation of both banks total deposits and the economy's dollar liquidity (GFA_LBS). These effects can sometimes come with a lag.

- Deposits transfers of non-residents increase domestic banks total deposits and the economy's dollar liquidity (GFA_LBS), in the same period they are effected.

- Foreign banks loans to domestic banks increase the economy's dollar liquidity (GFA_LBS) in the same period, but not total banks deposits directly.

- Portfolio Investments and FDI increase both dollar liquidity (GFA_LBS) and total banks deposits, sometimes partially and with a lag. This can explain the weaker impact of Portfolio Investments and FDI on domestic banks credit. However, the main reason of the weak impact of FDI and Portfolio Investments on domestic banks credit remains the fact that these flows are not directly intended at increasing domestic banks liquidity, as are foreign banks loans to domestic banks, whose main economic motive is to allow the latter to expand credit to the domestic economy.

- The increase of dollar liquidity (GFA_LBS) resulting from BoP flows, can boost both dollar credit and domestic currency credit of domestic banks. This impact would come with a lag, and is conditional on the existence of a demand for credit by the non-bank sector.

2.3 Empirical analysis: the case of Lebanon

We test the interconnections we identified in the previous section, between our favored measure of dollar liquidity (GFA_LBS) and total banks deposits and credit to the non-bank sector, in the case of Lebanon in the period 2002-2017. We also look into the use that Lebanese domestic banks made of their dollar liquidity, particularly in the form of liquid foreign assets and deposits at the central bank. In the last stage, we check our results for robustness during Lebanon's monetary and financial crisis that started in October 2019. That crisis is by essence a dollar liquidity crisis, which further justifies our focus on the liquidity dimension of dollarized monetary systems.

Lebanon has known one of the most complete forms of financial dollarization for more than three decades. Dollarization started during the Lebanese civil war that witnessed recurring depreciation episodes of the domestic currency. At present, Lebanese banks hold dollar deposits and provide dollar loans to their resident customers, alongside domestic currency deposits and loans. The deposits dollarization ratio was 70.67% and the loan dollarization ratio is at 68.46% at 2018 end, just before the start of the country's crisis. As a consequence, all the mechanisms emphasized in our analysis would fully play in the country's context. Lebanon's exchange rate regime is classified as "stabilized arrangement" in the IMF AREAER²⁷ for 2016. The exchange rate of the US dollar (USD) has been fixed since December 1997 at the mid rate of 1507.5 Lebanese Pounds (LBP), thanks to daily interventions of Banque du Liban in the domestic interbank foreign exchange market. From the adoption of the de facto fixed exchange rate regime until October 2019, the country has not experienced episodes of high inflation, as was the case during and after the civil war

²⁷International Monetary Fund - Annual Report on Exchange Arrangements and Exchange Restrictions.

(1975-1989). In the period 2002-2017, the average annual real GDP growth rate was 4%, and the average annual inflation rate was 3.3%²⁸.

2.3.1 Data

We obtained balance of payments and locational domestic commercial banks balance sheet data from the Banque du Liban website “statistics and research” section. We obtained Lebanon’s annual real GDP growth figures from the IMF WEO October 2017. The sample for the empirical analysis is the period from January 2002 to September 2017 as the data is available for all the aggregates during that period. All the data has been converted into USD Billions. Whenever the data is in LBP, it has been converted at the official USD/LBP exchange rate of 1507.5, which has been fixed since December 1997. The fact that during the sample period starting in January 2002 the exchange rate has been fixed excludes any bias that could come from currency valuation changes. We converted monthly series to quarterly series in the 2002-2017 period analysis by summing flow aggregates over the quarter, and by using quarter end figures for stock aggregates.

2.4 Stylized facts

Descriptive statistics of the balance of payments components and capital flows sub-components quarterly series are detailed in Table 7. Detailed variables description can be found in Table 14 in the Appendix. Looking at the means and the sums over the period, we notice a negative net (current/capital) account balance that is overcompensated by net capital inflows, leading to a substantial increase in the gross international reserves of the central bank²⁹. Over the period BdL’s international reserves have increased by a cumulative amount of USD 35.25 Bn (not accounting for valuation changes). We can notice that other investments (OI) are more important than portfolio investments (PI) and direct investments (FDI) in the composition of net capital flows, with a higher mean, sum and standard deviation over the period. This is explained by the fact that the Lebanese financial sector is essentially bank based, with a small size capital market, as is the case in the majority of small open emerging economies. We show the movements of BoP components (Figure 15) as well as capital flows components (Figure 16) quarterly series for the study period (Q1 2002 – Q2 2017).

Figure 17 shows the evolution of the Lebanese domestic commercial banks locational balance sheet components, from Q1 1997 to Q3 2017. We notice that the large increase in the total bank deposits amount (BK_TOTAL_DEP) has been mainly translated into an increase of the banks’ deposits at the central

²⁸Source: IMF WEO - October 2017.

²⁹The balance of payments accounting identity holds in every period: $RES_CHANGE = CAP_FLOWS + CURR_ACC + EO$.

Figures are expressed in USD Billions.

bank (DEP_CB). We notice that the increases of the credit to the domestic non-bank private sector (CR_PRIV), the credit to the government sector (CR_PUBLIC) and banks foreign assets holdings (BK_FOREIGN_ASSETS) have been relatively moderate, in comparison to the large increase of total banks deposits.

BdL made no specific sterilization effort to counter the impact of large BoP inflows, but its facilities to domestic banks were naturally reduced to a minimum, as a consequence of their high liquidity balances. This is evidenced by the large deposits (denominated in both domestic currency and dollar) of commercial banks at the BdL, as well as their foreign assets holdings in the form of deposits at foreign banks and foreign bonds. This abundant liquidity and the increase of monetary aggregates ratios to GDP did not translate into high inflation, thanks to the exchange rate peg that proved to be a strong nominal anchor.

Figure 18 shows the evolution of the ratio of total foreign currency deposits (of residents and non-residents) to the GFA_LBS. This ratio reached a maximum level of 2.05 during the analysis period, and has been constantly above 1. This shows that the domestic banks system has multiplied the amount of its gross dollar assets, by granting dollar denominated loans to the domestic non-bank sector. The co-movement of this ratio with the ratio of foreign currency denominated bank credit to the private non-bank sector to the GFA_LBS is clear visually. This shows the multiplying effect of foreign denominated loans on the foreign currency money supply. However, no direct mathematical relationship exists between the two ratios, as the choice of the currency of denomination of banks deposits depends ultimately on depositors preferences³⁰.

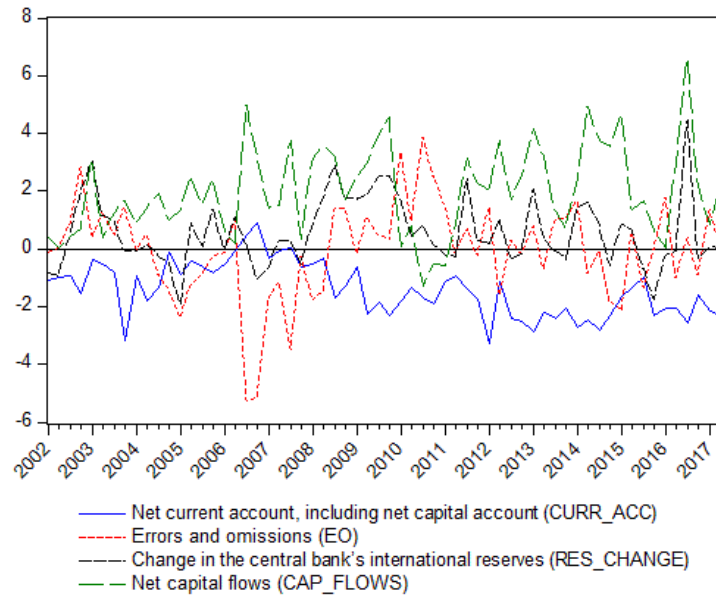
Table 7: Balance of Payments Components - Descriptive Statistics

	CURR_ACC	EO	RES_CHANGE	CAP_FLOWS	PI	OI	FDI
Mean	-1.414788	-0.026300	0.568676	2.009763	0.181786	1.291592	0.536385
Median	-1.378880	-0.021035	0.280700	1.705120	0.091370	1.209025	0.477130
Maximum	0.884890	3.829250	4.451590	6.617240	2.535400	3.670490	1.396760
Minimum	-3.300940	-5.278950	-1.878830	-1.285860	-2.124680	-1.483700	-0.069210
Std. Dev.	0.929704	1.672484	1.195253	1.577724	0.798354	1.226430	0.290598
Sum	-87.71688	-1.630630	35.25789	124.6053	11.27071	80.07872	33.25586
No. Obs	62	62	62	62	62	62	62

Note: All aggregates are in USD Billions.

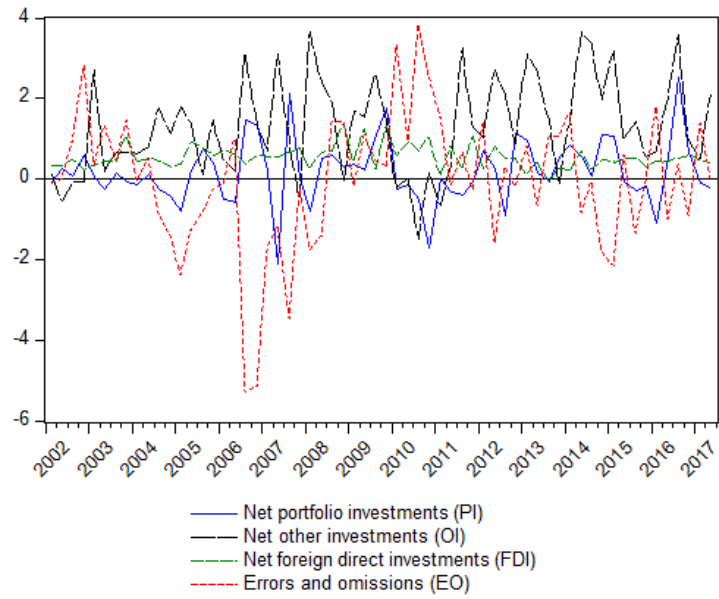
³⁰Analysis of agents preferences with regards to the use of domestic currency and dollar is outside the scope of our chapter.

Figure 15: Balance of Payments Components



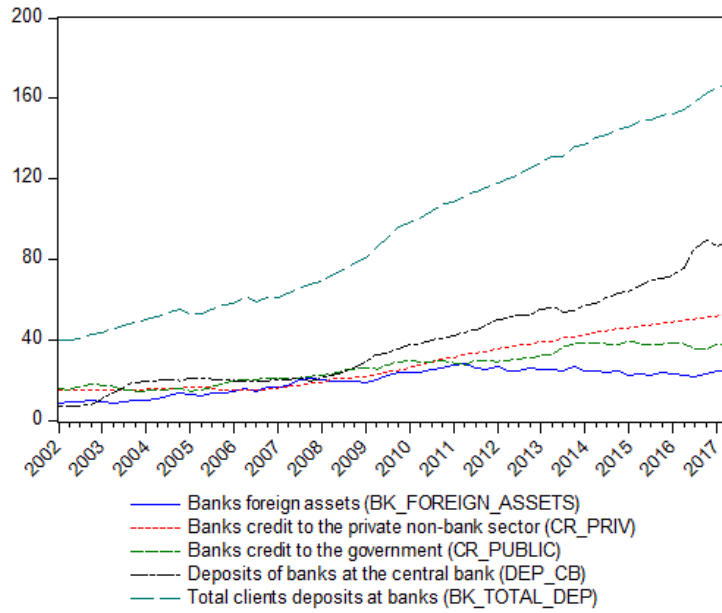
Note: All aggregates are in USD Billions.
Data Source: Banque du Liban.

Figure 16: Capital Flows Components



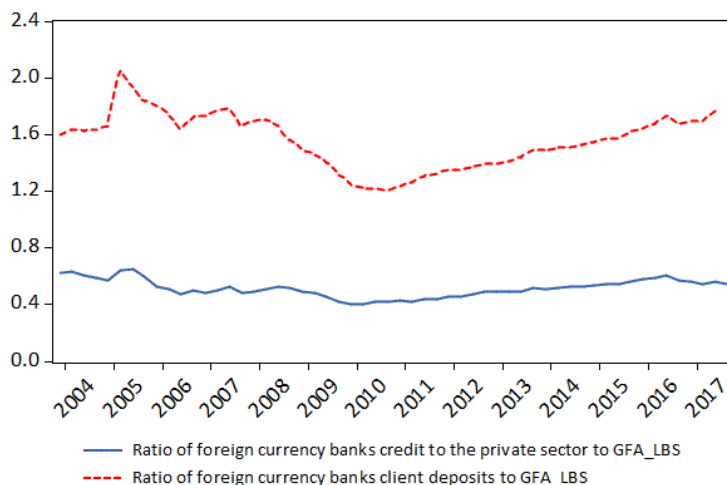
Note: All aggregates are in USD Billions.
Data Source: Banque du Liban.

Figure 17: Banks Locational Balance Sheet Components



Note: All aggregates are in USD Billions.
Data Source: Banque du Liban.

Figure 18: Foreign Currency Deposits and Credit to GFA_LBS



Data Source: Banque du Liban.

2.4.1 Empirical strategy

The empirical case of Lebanon is relevant to illustrate the mechanisms we identified, as the country has a longstanding history of both assets and liabilities dollarization, as well as open current, capital and financial accounts of the BoP. The country's de facto fixed exchange rate regime since 1997 improves the quality of the analysis by making the bottom line of the balance of payments more salient, in the sense that balances are not automatically offset via exchange rate movements. Also the fixed exchange rate avoids any statistical discrepancy relating to exchange rate movements.

We aim at analyzing the interconnections between BoP total flows and domestic banks locational balance sheet components. We perform a series of OLS regressions between flow variables, in order to reveal the short-run dynamic interconnections that we emphasized in the previous section of the chapter. Long run regressions are not necessary, as our analysis focuses on short run mechanics. The variables used in our regressions have been tested for unit roots: flow variables and stock variables in first difference do not show unit roots³¹.

We estimate the following equations:

$$\Delta Y_t = \gamma_0 + \sum_{k=1}^p \psi_k \Delta Y_{t-k} + \sum_{j=1}^m \sum_{l_j=0}^{q_j} \beta_{j,l_j} \Delta X_{j,t-l_j} + \epsilon_t \quad (5)$$

Where ΔY_t is the dependent flow variable or the first difference of the dependent stock variable at time t , γ_0 is a constant, ψ_k are coefficients associated

³¹Unit root tests results are available upon request.

with lags of ΔY_t , β_{j,l_j} coefficients associated with lags of m regressors $\Delta X_{j,t}$ (flow variables or first difference of stock variables) for $j = 1, \dots, m$, and ϵ_t is the standard error term.

We test the relationships of total banks deposits growth, banks credit to the private non-bank sector growth, and banks credit to the government growth (as dependent variables), with the BoP bottom line (explanatory variable). We also test the relationships of the two forms of banks dollar liquidity i.e. banks deposits at the central bank (that translate into international reserves of the central bank) and banks foreign assets (as dependent variables), with the BoP bottom line (explanatory variable). We first use our favored measure of the bottom line of the BoP (change in GFA_LBS), then the traditional measure of the bottom line of the BoP (change in the central bank's international reserves).

The change in the central bank's gross international reserves data series could be obtained directly from the balance of payments statistics and can be considered of good quality as it is directly taken from the accounting of the central bank. However, it was impossible to construct the GFA_LBS data series from balance of payments data as it would ideally have been done, as it requires the breakdown of banking flows into short-term and long-term flows, which is unavailable in Lebanon's statistics. This breakdown is also unavailable in other countries BoP statistics at present, but it is a desirable development both for dollarized and non-dollarized economies. Therefore, we proxied the GFA_LBS flow data using the first difference of its stock data, i.e. the sum of central bank's gross international reserves and commercial banks liquid foreign assets. This approximation integrates valuation effects, that are inherent to any stock-flow relationship, to the constructed GFA_LBS flow data series. However, in Lebanon's case valuation effects could be deemed to be minor as the exchange rate has been fixed through the study period, and the constituents of GFA_LBS are safe liquid assets whose market values are not very volatile.

Our regressions series is intended at uncovering the contemporaneous and lagged correlations of the locational banks balance sheet components with the BoP bottom line measures. We do not aim at performing fully fledged econometric analyses intending at explaining the determinants of each of those banks balance sheets components (thus, we do not introduce any control variable in the regressions). We include two lags (or three lags, if the third lag shows high statistical significance) of the dependent variables in order to account for their statistical inertia and to compensate for part of the information lost with omitted variables, that would be contained in the lagged dependent variables.

We focus on total bank deposits and total bank credit, and not on dollar denominated deposits and credit, as the inflow of dollar liquidity is deemed to impact LBP liquidity (through USD liquidity conversion into LBP liquidity), and consequently, the supply of LBP denominated credit. Also, as discussed in the previous section, the currency denomination of clients bank deposits is mainly determined by their preference and their assessment of currency risk.

In the private credit regression, the impact of credit demand could be accounted for by including real GDP growth, following Den Haan, Sumner and Yamashiro (2007). However, the unconditional correlation between the change

in GFA_LBS and real GDP growth over the study period is high (equal to 0.39), which suggests a pro-cyclical inflow of capital into the economy. Therefore, when we include both variables as explanatory variables, real GDP growth becomes insignificant. This makes it impossible to disentangle the impact of real GDP growth on dollar liquidity inflows (determinant of credit supply) from its impact on credit demand. An econometric identification allowing to disentangle credit supply and credit demand effects would require the availability of more granular banking data, in the spirit of Khwaja and Mian (2008). Therefore, the relationship we identify between domestic banks credit to the private non-bank sector and dollar liquidity could be seen as correlational (not causal), as it is conditional on the behavior of credit demand that we are not able to identify separately with our set of data.

2.4.2 Econometric results

Effect of GFA_LBS variation on banks deposits, banks credit to the private non-bank sector, banks credit to government, banks deposits at the central bank, and banks foreign assets. In Table 8 we show the results of the regression of the total deposits of the locational commercial banks balance sheet (BK_TOTAL_DEP) in first difference on GFA_LBS in first difference³². The regression result shows a clear contemporaneous positive relationship between the GFA_LBS in first difference and total deposits in first difference. We regress the credit to the private non-bank sector in first difference over the GFA_LBS in first difference and its first, second and third lags. We find a strongly significant positive relationship with lag 3. The result of this second regression shows that over the period, the liquidity resulting from BoP flows has been used by banks to provide credit to the private non-bank sector with a lag of 3 semesters, which could be the average lag needed for banks credit process. We do not find any statistical relationship between the first difference of the GFA_LBS and the credit of commercial banks to the public sector. In the case of Lebanon, domestic banks credit to the public sector has been steadily increasing, without a dynamic connection with banks dollar liquidity.

We also look into the use commercial banks make of their dollar liquidity. We find a strongly significant positive contemporaneous relationship between the GFA_LBS in first difference and the growth of commercial banks deposits at the central bank. The regression also shows an alternating inertia in the banks' deposits at the central bank time series between quarters (i.e., a positive correlation with lags 1 and 3 and a negative correlation with lag 2). We also find a significant positive contemporaneous relationship between commercial banks foreign assets in first difference and the GFA_LBS in first difference.

We compute the cumulative dynamic multipliers of GFA_LBS, as the sum of its point estimates for statistically significant lags, for all the dependent

³²We use this measure in the absence of the change of the Gross Foreign Assets of the Locational Bank Sector (as the bottom line of the BoP) - the latter is not available to us as part of the BoP statistics. This is a minor concern in our case as valuation changes are of small magnitude, as explained in the previous section.

variables. We have multipliers of 0.68 for total bank deposits, 0.12 for bank credit to the private sector, 0.37 for banks deposits at the central bank, and 0.48 for banks foreign assets.

Table 8: GFA_LBS Regressions Results

D(BK_TOTAL_DEP)	Coefficient	Prob.	D(CR_PRIV)	Coefficient	Prob.
C	0.824471***	0.0014	C	0.110121	0.2866
D(BK_TOTAL_DEP(-1))	0.003027	0.9716	D(CR_PRIV(-1))	0.185565	0.1396
D(BK_TOTAL_DEP(-2))	0.325182***	0.0003	D(CR_PRIV(-2))	0.466968***	0.0005
D(GFA_LBS)	0.686727***	0.0000	D(GFA_LBS)	0.009152	0.8273
			D(GFA_LBS(-1))	-0.037541	0.3651
			D(GFA_LBS(-2))	0.049498	0.2378
			D(GFA_LBS(-3))	0.122388***	0.0050
Adj. R-squared	0.578813		Adj. R-squared	0.427085	
No. observations	63		No. observations	60	
Sample (adj)	2002Q1 2017Q3		Sample (adj)	2002Q4 2017Q3	

D(DEP_CB)	Coefficient	Prob.	D(BK_FOREIGN_ASSETS)	Coefficient	Prob.
C	0.406157	0.2213	C	-0.166760	0.2771
D(DEP_CB(-1))	0.512206***	0.0001	D(BK_FOREIGN_ASSETS(-1))	-0.036713	0.7382
D(DEP_CB(-2))	-0.575145***	0.0000	D(BK_FOREIGN_ASSETS(-2))	-0.065165	0.5556
D(DEP_CB(-3))	0.593751***	0.0000	D(GFA_LBS)	0.480201***	0.0000
D(GFA_LBS)	0.372886**	0.0145			
Adj. R-squared	0.390054		Adj. R-squared	0.294976	
No. observations	63		No. observations	63	
Sample (adj)	2002Q1 2017Q3		Sample (adj)	2002Q1 2017Q3	

Note: ***p < 0.01; **p < 0.05; *p < 0.1

Effect of the change in the central bank's international reserves (RES_CHANGE) on banks deposits, banks credit to the private non-bank sector, banks credit to government, banks deposits at the central bank, and banks foreign assets. In Table 9 we perform the same regressions over the traditional measure of the bottom line of the BoP i.e. the change in the central bank's international reserves (RES_CHANGE) - and its first, second and third lags for the credit to the private sector. RES_CHANGE is equal in accounting terms to the sum of the net current account, the net capital account and the net financial flows, adjusted to net errors and omissions. We find a clear contemporaneous positive relationship between RES_CHANGE and total banks deposits in first difference.

We regress the credit to the private non-bank sector in first difference over

RES_CHANGE and its lags. The result of this regression shows again that during the analysis period BoP flows have been translated into banks credit to the private non-bank sector with a lag of 3 semesters. We do not find any statistical relationship between RES_CHANGE and banks credit to the public sector.

As regards the uses commercial banks make of their dollar liquidity, we find a strongly significant positive contemporaneous relationship between RES_CHANGE and banks deposits at the central bank. However, we find a significant negative contemporaneous relationship between commercial banks foreign assets in first difference and RES_CHANGE. This last result contrasts with the result we obtained when we regressed commercial banks foreign assets in first difference over GFA_LBS in first difference. This comes from the fact that GFA_LBS in first difference includes the variation of commercial banks foreign assets, while RES_CHANGE accounts for the variation of the central bank's international reserves only. Although GFA_LBS and the central bank's international reserves are closely related aggregates in the case of Lebanon, due to the fact that international reserves account for a large share of GFA_LBS through our study period, the last regression shows the superiority of GFA_LBS as a measure of dollar liquidity. In order to explain the negative relationship between RES_CHANGE and commercial banks foreign assets growth, we regress banks deposits at the central bank in first difference over banks foreign assets in first difference (Table 10) and find significant negative contemporaneous and lag 1 statistical relationships. This last regression shows the trade-off between Lebanese banks deposits at the central bank and their holding of foreign assets, as part of their foreign currency liquidity management. This interchangeability between banks gross foreign assets and their deposits at the central bank (feeding the central bank's international reserves) - the two constituents of GFA_LBS - is another backing for our argument in favor of the GFA_LBS change being a more adequate measure of the BoP bottom line than is the change of the central bank's international reserves.

Table 9: Change in Central Bank's International Reserves Regressions Results

D(BK_TOTAL_DEP)	Coefficient	Prob.
C	1.052413***	0.0018
D(BK_TOTAL_DEP(-1))	-0.031900	0.7880
D(BK_TOTAL_DEP(-2))	0.398525***	0.0006
RES_CHANGE	0.481869***	0.0012
Adj. R-squared	0.284962	
No. observations	62	
Sample (adj)	2002Q1 2017Q2	

D(CR_PRIV)	Coefficient	Prob.
C	0.154177	0.1064
D(CR_PRIV(-1))	0.371595***	0.0055
D(CR_PRIV(-2))	0.304045**	0.0218
RES_CHANGE	-0.008716	0.8625
RES_CHANGE(-1)	0.022563	0.6668
RES_CHANGE(-2)	-0.078400	0.1262
RES_CHANGE(-3)	0.178075***	0.0005
Adj. R-squared	0.458646	
No. observations	59	
Sample (adj)	2002Q4 2017Q2	

D(DEP_CB)	Coefficient	Prob.
C	0.340497	0.2448
D(DEP_CB(-1))	0.374903**	0.0023
D(DEP_CB(-2))	-0.339296**	0.0193
D(DEP_CB(-3))	0.447415***	0.0015
RES_CHANGE	0.674223***	0.0001
Adj. R-squared	0.357164	
No. observations	62	
Sample (adj)	2002Q1 2017Q2	

D(BK_FOREIGN_ASSETS)	Coefficient	Prob.
C	0.426860**	0.0124
D(BK_FOREIGN_ASSETS(-1))	-0.133859	0.2909
D(BK_FOREIGN_ASSETS(-2))	-0.024406	0.8482
RES_CHANGE	-0.263673**	0.0342
Adj. R-squared	0.045213	
No. observations	62	
Sample (adj)	2002Q1 2017Q2	

Note: ***p < 0.01; **p < 0.05; *p < 0.1

Table 10: Banks Deposits at the Central Bank and Banks Foreign Assets Correlation Regression

D(DEP_CB)	Coefficient	Prob.
C	0.808135***	0.0063
D(BK_FOREIGN_ASSETS)	-0.896955***	0.0001
D(BK_FOREIGN_ASSETS(-1))	-0.343592**	0.0457
D(DEP_CB(-1))	0.231849*	0.0552
D(DEP_CB(-2))	-0.036564	0.7696
D(GFA_LBS)	0.699199***	0.0001
Adj. R-squared	0.320250	
No. observations	62	
Sample (adj)	2002Q1 2017Q2	

Note: ***p < 0.01; **p < 0.05; *p < 0.1

In sum, our results suggest that BoP inflows positively impact banks total deposits contemporaneously, while their positive effect on credit to the private non-bank sector is three quarters lagged. The lag we identified could be explained by the time the private sector credit process takes to materialize. Dollar liquidity does not have a direct impact on domestic banks credit to the government, during our analysis period. Also, increasing dollar liquidity in the banking system is invested in the same quarter, either in central bank deposits or in foreign assets (international banks deposits and international bonds).

Our result on the relationship of dollar liquidity with domestic banks credit is in line with the results of previous studies of the link between international capital flows and credit cycles in emerging and developing economies. However, by focusing on dollar liquidity, we accounted for the bottom line of the balance of payments (i.e. the sum of net capital flows and the net current account), not only capital flows.

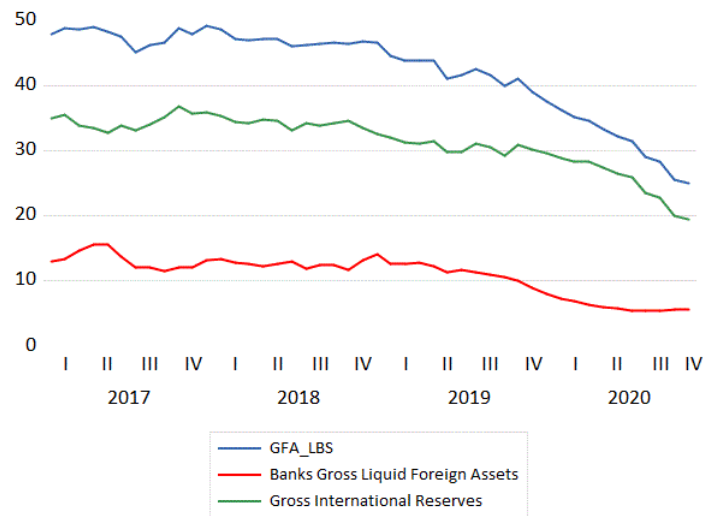
2.5 Robustness test I: Lebanon's 2019 monetary and financial crisis period

The initial study has been performed during the period spanning from January 2002 to September 2017, which could be considered a stable financial and monetary era in Lebanon, despite the occurrence of the 2008-2009 global financial crisis that did not affect the country's economy substantially as it did in other parts of the world. However, we decided not to publish this paper until now, in order to test our results for robustness during the monetary and financial crisis that hit Lebanon in October 2019 and that is still ongoing at the time we are finalizing this chapter. The reason is that this crisis is a dollar liquidity crisis in essence, and thus, we wanted to test whether the monetary mechanisms we highlight in this chapter hold during stressed periods. Figure 19 shows the

rapid decrease of dollar liquidity (GFA_LBS) and its two components, i.e. gross international reserves and the gross liquid foreign assets of the banking sector in Lebanon, in the three years period leading to the crisis and during the crisis. Figure 20 shows the evolution of the ratio of total USD bank deposits over GFA_LBS in Lebanon during the three years leading to the crisis and after the onset of the crisis. The coverage of USD bank deposits by the dollar liquidity in the hands of the locational bank sector (GFA_LBS) has substantially deteriorated during the crisis. This has led to the suspension of the convertibility of domestic banks USD deposits into international dollar deposits (funds transfers to overseas banks) and into US dollar notes.

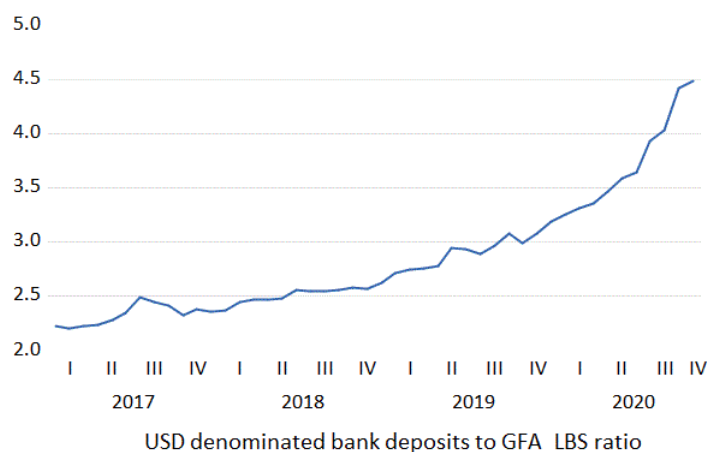
Secondly, since the start of 2017, Banque du Liban started publishing monetary and financial statistics following the IFRS9 standards, which entailed a substantial change in data computing methods. Finally, a third change we made in our robustness tests is that we use the monthly frequency for the crisis period, instead of the quarterly frequency that we used for the initial study. All three changes constitute substantive robustness checks to our initial results.

Figure 19: GFA_LBS, gross international reserves, and banks gross liquid foreign assets (USD Bn)



Data source: BdL Website

Figure 20: Ratio of USD deposits at domestic banks to GFA_LBS



Data source: BdL Website

The results in Table 11 show that the positive contemporaneous relationship between the $\overline{GFA_LBS}$ in first difference and total deposits in first difference holds during the crisis period (the sample for these regressions comprise monthly data from March 2017 to January 2021). Also, a positive contemporaneous correlation is revealed between credit to the private non-bank sector in first difference and the $\overline{GFA_LBS}$ in first difference during this period. While the correlation of $\overline{GFA_LBS}$ with total bank deposits is quantitatively comparable to the one we obtained in the quiet period, its correlation with credit to the private non-bank sector does not come with any lag. This reflects the capital flight, that could not be fully contained by the informal capital control measures adopted by the banking system since the onset of the crisis, that happened in parallel with the reimbursement of dollar denominated bank loans by non-bank sector borrowers who were worried to be left with excessive liabilities in case of an official devaluation of the Lebanese pound - that did not happen so far, despite the large depreciation of the LBP versus the USD on the black FX market that emerged since the onset of the crisis. Thus in this crisis episode, the reduction of banks credit to the private non-bank sector was primarily explained by borrowers demand behavior, not by the diminished supply of loans by banks as a consequence of their shrinking dollar liquidity.

The bottom line is that the strong statistical relationship of dollar liquidity as defined by the $\overline{GFA_LBS}$ and total bank deposits holds even in crisis periods, in the presence of capital flight and (informal) capital controls.

Table 11: GFA_LBS Regressions Results - Crisis Period

D(BK_TOTAL_DEP)	Coefficient	Prob.	D(CR_PRIV)	Coefficient	Prob.
C	0.034890	0.8576	C	-0.064170	0.4335
D(BK_TOTAL_DEP(-1))	0.529227***	0.0000	D(CR_PRIV(-1))	0.657159***	0.0000
D(GFA_LBS)	0.611795***	0.0005	D(GFA_LBS)	0.184409***	0.0086
Adj. R-squared	0.475684		Adj. R-squared	0.597798	
No. observations	47		No. observations	47	
Sample (adj)	2017M03 2021M01		Sample (adj)	2017M03 2021M01	

Note: ***p < 0.01; **p < 0.05; *p < 0.1

2.6 Robustness test II: Russia and Peru

In this section, we test our results for robustness in the context of two major dollarized economies with different economic and monetary structures and exchange rate regimes: Russia and Peru. By doing so, we aim at showing that the monetary mechanisms we identified apply in any institutional context.

2.6.1 Russia

We use monthly data extending from January 2001 to January 2021 for the central bank's gross international reserves, banks' foreign liquid assets, banks' total deposits, and banks' credit to the resident private non-bank sector. For Russia, we could also get the breakdown of commercial bank deposits into domestic currency (ruble) denominated and dollar denominated. We obtained the data directly from the Bank of Russia economic research team. We elected to convert all the data into USD (not the other way round, into RUB), using the RUB/USD exchange rate series we obtained from the St Louis Fed website, as the target variable in our analysis is dollar liquidity.

The results of our regressions are presented in Table 12 below. We see a clear contemporaneous positive relationship between GFA_LBS in first difference and total deposits in first difference, with a high coefficient of 0.82. We also regress total deposits in first difference over the central bank's international reserves (IR_EX_GOLD) in first difference, and we find a contemporaneous positive relationship too, with a slightly lower coefficient of 0.78. The adjusted R-squared is also superior for the GFA_LBS first difference regression. This confirms the superiority of GFA_LBS over the central bank's international reserves alone as a measure of dollar liquidity.

We find a strongly significant contemporaneous positive relationship between the credit to the private non-bank sector in first difference and GFA_LBS in first difference, with a coefficient equal to 1. However, as explained earlier in the chapter, we cannot interpret this in causal terms because the demand side is very important to account for when it comes to bank credit. Finally, data availability in the case of Russia allows us to test the relationship between dollar

liquidity as defined by GFA_LBS and total USD denominated bank deposits (BK_DEP_USD) in the locational Russian banking system. We find no statistical relationship between the two aggregates. This result proves the wrongness of previous studies in the dollarization literature that associate dollar liquidity to dollar denominated deposits in the domestic banking system, or assume any direct relationship between them.

Finally, as shown by the evolution of the dollar multiplier in Figure 21, the dollar liquidity position of the Russian monetary system has always been very strong with a dollar multiplier never exceeding 0.43, even in the periods of economic and financial stress of 2008-2009 and 2013-2016.

Table 12: Regressions Results for Russia

D(BK_TOTAL_DEP)	Coefficient	Prob.	D(BK_TOTAL_DEP)	Coefficient	Prob.
C	1029.365	0.4433	C	1342.247	0.3254
D(BK_TOTAL_DEP(-1))	-0.011763	0.8482	D(BK_TOTAL_DEP(-1))	0.019662	0.7503
D(GFA_LBS)	0.828935***	0.0000	D(IR_EX_GOLD)	0.786130***	0.0000
Adj. R-squared	0.190186		Adj. R-squared	0.159128	
No. observations	240		No. observations	240	
Sample (adj)	2001M02 2021M01		Sample (adj)	2001M02 2021M01	

D(CR_PRIV)	Coefficient	Prob.	D(BK_DEP_USD)	Coefficient	Prob.
C	173.7479	0.9085	C	716.1138**	0.0122
D(CR_PRIV(-1))	0.173429***	0.0028	D(BK_DEP_USD(-1))	0.105086	0.1076
D(GFA_LBS)	1.005390***	0.0000	D(GFA_LBS)	0.026256	0.2440
Adj. R-squared	0.275341		Adj. R-squared	0.006387	
No. observations	240		No. observations	240	
Sample (adj)	2001M02 2021M01		Sample (adj)	2001M02 2021M01	

Note: ***p < 0.01; **p < 0.05; *p < 0.1

Figure 21: Dollar Multiplier in Russia



Data Source: Bank of Russia and authors' calculations

2.6.2 Peru

We use monthly data extending from march 1992 to February 2021, obtained from the central bank of Peru's website - all the data is in USD. For Peru, we could obtain the time series of commercial banks short-term foreign liquid liabilities, in addition to the time series we could obtain for the other countries in this study. This allowed us to compute GFA_LBS_N , which is equal to GFA_LBS net of those liabilities. In general, short-term liquid interbank liabilities are of minor importance in emerging markets banks as correspondent banks holding interbank deposits are mostly international banks based in developed economies. Short-term interbank liabilities of emerging and developing economies' banks are mostly made of long-term facilities that become due within the next year.

The regressions in Table 13 show that, for Peru, GFA_LBS_N has a stronger positive statistical connection with banks total deposits than GFA_LBS , which in turn has a stronger statistical connection with banks total deposits than the variation of the central bank's international reserves (IR_EX_GOLD). The statistical connection of banks total deposits in Peru with those three aggregates is both contemporaneous and one month lagged - this is mainly due to possible accounting lags. The sum of the contemporaneous and the first lag coefficients for GFA_LBS_N is equal to 0.56. We could not find a statistical connection between GFA_LBS_N and banks credit to the private non-bank sector in the case of Peru, which proves our point that the connection of dollar liquidity with

banks credit to the non-bank private sector is not automatic as is the case with banks total deposits, but mainly depends on the existence of a demand for that credit. Finally, we found a very weak statistical connection of dollar liquidity (GFA_LBS_N) with USD denominated bank deposits, with a low coefficient of 0.09 and an adjusted R-squared for the regression of 0.039, supporting our point regarding the weak connection between both aggregates.

Finally, as shown by the evolution of the dollar multiplier in Figure 22, the dollar liquidity position of the Peruvian monetary system has always been strong with a dollar multiplier that slightly exceeded unity only during the period of economic and financial stress of 1999-2002.

Table 13: Regressions Results for Peru

D(BK_TOTAL_DEP)	Coefficient	Prob.
C	151.4421***	0.0000
D(BK_TOTAL_DEP(-1))	-0.050785	0.3282
D(GFA_LBS_N)	0.362236***	0.0000
D(GFA_LBS_N(-1))	0.205489***	0.0000
Adj. R-squared	0.287094	
No. observations	348	
Sample (adj)	1992M03 2021M02	

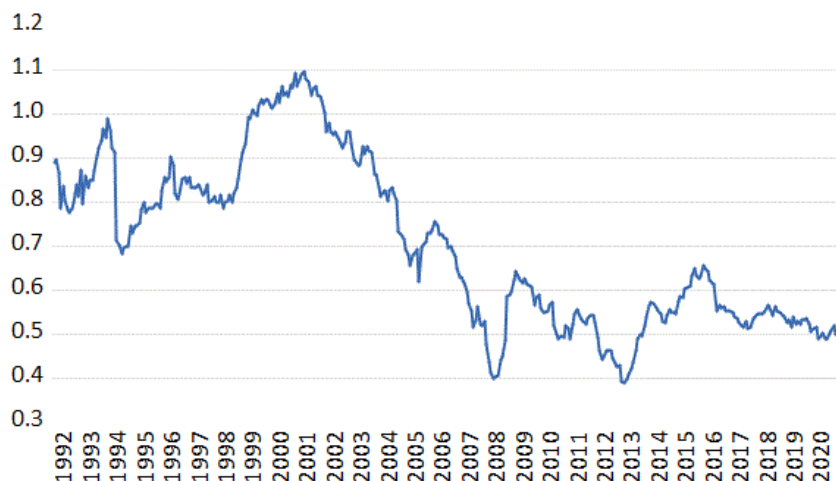
D(BK_TOTAL_DEP)	Coefficient	Prob.
C	147.8139***	0.0000
D(BK_TOTAL_DEP(-1))	-0.050843	0.3304
D(GFA_LBS)	0.337096***	0.0000
D(GFA_LBS(-1))	0.186567***	0.0000
Adj. R-squared	0.278889	
No. observations	348	
Sample (adj)	1992M03 2021M02	

D(BK_TOTAL_DEP)	Coefficient	Prob.
C	148.5493***	0.0000
D(BK_TOTAL_DEP(-1))	-0.028662	0.5837
D(IR_EX_GOLD)	0.335219***	0.0000
D(IR_EX_GOLD(-1))	0.177385***	0.0000
Adj. R-squared	0.263871	
No. observations	348	
Sample (adj)	1992M03 2021M02	

D(BK_DEP_USD)	Coefficient	Prob.
C	67.72144***	0.0046
D(BK_DEP_USD(-1))	0.125014***	0.0181
D(GFA_LBS_N)	0.089935***	0.0009
Adj. R-squared	0.039848	
No. observations	348	
Sample (adj)	1992M03 2021M02	

Note: ***p < 0.01; **p < 0.05; *p < 0.1

Figure 22: Dollar Multiplier in Peru



Data Source: BCRP website and authors' calculations

2.7 Conclusion

We aimed in this chapter at filling a gap in the literature relating to dollarization by analyzing the main monetary mechanisms in dollarized economies. We focused on the liquidity dimension linked to financial dollarization, that is often overlooked in the literature. We stressed the importance of a strict liquidity risk management of banks in a dollarized economy, in the absence of a dollar lender of last resort. We shed light on the interconnection between balance of payments flows, money and credit in small open dollarized economies. The empirical study in the case of the small open dollarized economy of Lebanon confirmed the results of our analysis. We found positive short-run connections between our favored measure of dollar liquidity (the Gross Foreign Assets of the Locational Banks Sector aggregate) and total banks deposits, banks foreign assets and banks deposits at the central bank. We also found a lagged positive connection with credit to the private non-bank sector. This study also uncovered the preferences of Lebanese banks in the use they make of the dollar liquidity resulting from balance of payments flows. We tested our results empirically using data from two other major dollarized economies (Peru and Russia) to show that the monetary mechanisms we identified operate under any institutional context and exchange rate regime.

Our results stress the importance of managing the Gross Foreign Assets of the Locational Banks Sector aggregate by the monetary authorities of dollarized economies, because of its impact on monetary aggregates and credit, and

ultimately on inflation, the exchange rate, and financial stability. Lebanon's ongoing crisis is in essence a dollar liquidity crisis of the country's dollarized banking system. This induces a necessity to closely monitor the balance of payments bottom line. Large balance of payments surpluses (i.e., a rapid growth of GFA_LBS) inject excess liquidity and can lead to the overheating of the economy and potentially to financial crises. Large balance of payments deficits (i.e., a rapid decrease of GFA_LBS) drain dollar liquidity and can lead to a disruption of the economic activity. This monitoring can be achieved through the simultaneous management of capital flows and of the current account. However, policymakers have to bear in mind that net capital inflows and current account surpluses are not equal sources of dollar liquidity. While current account surpluses increase the net foreign assets of the economy, net capital inflows are liabilities that need to be reversed ultimately. This last observation suggests that persistent external imbalances (i.e. recurring current account deficits financed by capital inflows) would ultimately threaten the availability of dollar liquidity in dollarized economies as is currently the case in Lebanon, leading to a dollar liquidity crisis. Thus, dollarization provides an additional incentive for policymakers to avoid exchange rate overvaluation and large external deficits.

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Appendix

Table 14: Variables Description

Variable	Description
CURR_ACC	sum of the net current account and the net capital account of the balance of payments
CAP_FLOWS	net total capital flows computed as the sum of other investments, portfolio investments and direct investments
EO	errors and omissions component of the balance of payments
RES_CHANGE	change in the central bank's international reserves component of the balance of payments
PI	net portfolio investments component of capital flows
FDI	net foreign direct investments component of capital flows
OI	net other investments component of capital flows
BK_TOTAL_DEP	total deposits including resident and non-resident sight and term deposits at commercial banks both in LBP and USD
BK_DEP_USD	total USD denominated bank deposits at domestic commercial banks
DEP_CB	total amount of LBP and USD deposits of commercial banks at the central bank, including mandatory reserve requirements
CR_PRIV	total amount of commercial banks credit to the private non-bank sector both in LBP and USD
CR_PUBLIC	total amount of commercial banks credit to the Lebanese government both in LBP and USD, comprised mainly of LBP government bonds and bills and USD Eurobonds
BK_FOREIGN_ASSETS	total amount of foreign assets held by banks mainly in the form of USD deposits at foreign banks and foreign investment grade bonds
GFA_LBS	gross foreign assets of the locational banks sector (= IR_EX_GOLD + BK_FOREIGN_ASSETS)
FX_DEP / GFA_LBS	ratio of the sum of total residents foreign currency deposits and total non-residents deposits in Lebanese commercial banks over GFA_LBS
FX_CR_PRIV / GFA_LBS	ratio of total foreign currency credit of Lebanese commercial banks to the private non-bank sector over GFA_LBS
IR_EX_GOLD	BdL international reserves excluding gold

Figure 23: Multipliers comparison

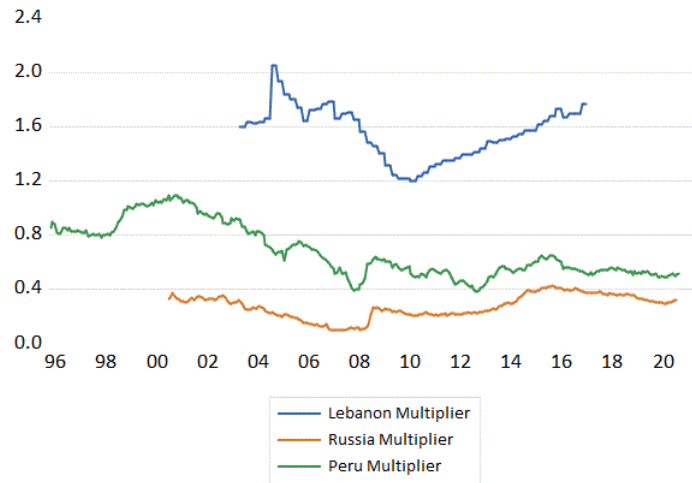
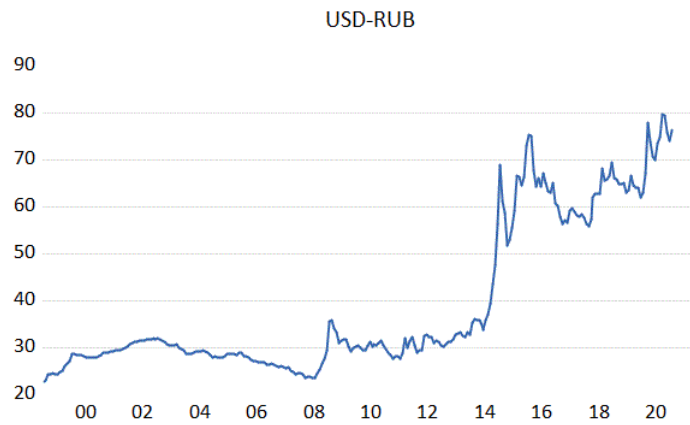


Figure 24: USD/RUB exchange rate evolution



Data source: St Louis Fed Website

Figure 25: USD/PEN exchange rate evolution



Data source: Google Finance

3 The Monetary Crisis of Lebanon

Abstract

Above its traditional currency and debt crisis features, Lebanon's on-going crisis sheds the light on the inherent weakness of dollarized monetary systems. This crisis can be seen as a monetary crisis, as the country's dollarized banking system's liquidity and solvency problems led to the loss of the "moneyness" of its dollar denominated deposits. We analyze the different dimensions of this crisis and we make policy recommendations, inspired by the experience of the Argentine 2001-2002 convertibility crisis. Finally, we look into the redistributive implications of different conversion scenarios.

Keywords: Dollarization; Monetary Crisis, Currency Crisis; Emerging Markets; Lebanon

JEL Classification: E42; E63; F33; G01

This chapter has been published in Review of Middle East Economics and Finance (De Gruyter) : The monetary crisis of Lebanon, Review of Middle East Economics and Finance, 17(2), August 2021, pp. 71-96

<https://www.degruyter.com/document/doi/10.1515/rmeef-2020-0050/html>

3.1 Introduction

On October 17 2019, Lebanon witnessed the start of a currency and public debt crisis. This crisis is deep rooted in the twin deficit that Lebanon has been enduring for almost three decades. Lebanon’s public debt reached very high levels and net foreign assets reached their record lows as shown in Figure 26. Using unit root and cointegration methods, Neaime (2004) and Neaime (2015) showed that Lebanon’s public deficit and external debt were not sustainable. Lebanon’s public debt has been financed in major part through central bank and domestic commercial banks credit (i.e. monetary financing) denominated in both Lebanese pound (LBP) and US dollar (USD). Lebanon’s recurring current account deficit has been financed through abundant capital inflows, mainly in the form of deposits at the domestic banking system. Figure 27 shows the components of the country’s balance of payments (i.e., the net current account, net capital flows, the change in gross international reserves, and the errors and omissions) in the two decades preceding the crisis.

The USD/LBP exchange rate has been fixed since December 1997 at the mid rate of 1507.5 Lebanese pounds per US dollar, thanks to daily interventions of Banque du Liban (BdL - Lebanon’s central bank) in the domestic interbank foreign exchange market. Lebanon’s exchange rate regime has been classified for many years as “stabilized arrangement” in the IMF AREAER³³. From the adoption of the de facto fixed exchange rate regime until the burst of the crisis in October 2019, the country did not experience episodes of high inflation, as was the case during and after the civil war. In the period 2002-2017, the average annual real GDP growth rate was 4%, and the average annual inflation rate was 3.3%³⁴. Desquilbet (2007) and Bitar (2021-A) provide thorough analyses of Lebanon’s monetary policy under the de facto exchange rate regime.

Following the start of the crisis in October 2019, the official exchange rate was kept fixed at the mid price of 1507.5 Lebanese pounds per US dollar for months, while the black market rate was increasing steadily. At the same time, inflation picked up very quickly. Lebanon’s government announced default on its USD denominated debt (USD Eurobonds) on March 7 2020.

Lebanon’s banking system is highly dollarized: the deposits dollarization ratio stands at 71%, and the loans dollarization ratio stands at 68% at the end of 2018. Two papers have studied the development of the dollarized monetary system in Lebanon. Mueller (1994) documents how Lebanese households and enterprises increasingly resorted to using foreign currency for transaction, store of value and unit of account purposes due to the high inflation and currency depreciation during Lebanon’s 1975-1989 civil war. This reliance on foreign currency persisted even after the end of the civil war, despite the normalization of the political and economic situation, and a significant reflow of funds from abroad. He links that fact to a ratchet effect resulting from prolonged periods of financial innovation and the related fixed costs of developing, learning

³³International Monetary Fund - Annual Report on Exchange Arrangements and Exchange Restrictions

³⁴Source: IMF WEO - April 2020.

and applying the new money management techniques of the dollarized system. Papazian (2009) explains the persistently high dollarization ratios in Lebanon from a political economy viewpoint. He argues that the institutional weakness associated to the nature of the post civil war state failed to achieve a solid ground for trust and credibility in the LBP, leading to the postponement of the dedollarization of the country's monetary and financial system. Figure 28 shows that deposits dollarization has increased substantially in the three years leading to the crisis and during the crisis, while loans dollarization level was relatively stable before the crisis and decreased rapidly since the onset of the crisis.

In the next section, we analyze Lebanon's crisis in the lens of the first, second and third generation currency crises literature, the sovereign default literature, and external imbalances and balance of payments crises literature.

In the third section, we argue that Lebanon's crisis is more than a currency crisis resulting from deep rooted macroeconomic imbalances. It is a "monetary crisis" that hit the dollarized monetary system of the country³⁵. We show that USD denominated deposits at the domestic dollarized banking system lost their "moneyness" in the crisis, due to the fact that they are not sufficiently covered by the liquid foreign dollar assets of the banking system (including the central bank's international reserves). Foreign liquid assets of the banking system have been drained over the years by the recurring current account deficits of the country, while external liabilities, generated through abundant capital inflows in the form of deposits at the domestic banking sector, were cumulating. This could be seen as a liquidity issue that developed into a solvability issue, resulting in the suspension of the convertibility of USD deposits at domestic banks into international Eurodollar deposits and US dollar notes. We refer to the Money View advocated by Perry Mehrling - see Mehrling (2012, 2013) - to explain this monetary crisis.

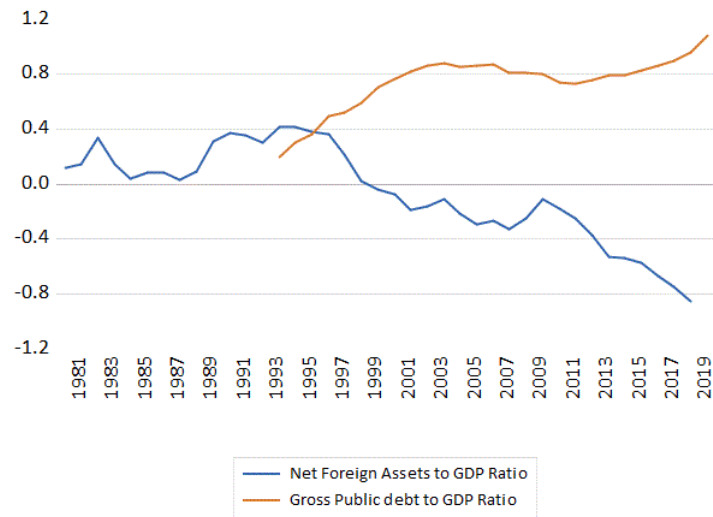
This dollar deposits convertibility risk in dollarized economies has been mentioned in few academic papers, but has not been analyzed in details so far. Dollar denominated deposits convertibility should not be confused with the domestic currency convertibility, which is the ease with which a country's currency can be converted into gold or another currency. Rogers (1992) discusses the dollar convertibility risk of Mexdollars, i.e. dollar denominated demand deposits held in Mexican banks. In March 1977, Mexico's monetary authority took many steps to encourage residents to hold Mexdollars. Temporarily, these assets were an insulation from the outflow of short-term capital. In August 1982, Mexdollars were forcibly converted to pesos at 70 to the dollar, amid a severe balance of payments crisis. New Mexdollar accounts were permitted after 1982, but only for special purposes such as international trade. Honohan (2008) sees forced conversion as one of the risks inherent to dollarized banking systems.

In the fourth section, we discuss the policy implications of our analysis. Based on Argentina's successful pesification experience in 2002, we propose the forced conversion of USD banks assets and liabilities into LBP, as the optimal

³⁵Bitar (2021-B) makes a thorough analysis of the development, advantages and inconveniences of dollarized monetary systems and the liquidity and foreign exchange systemic risks they involve.

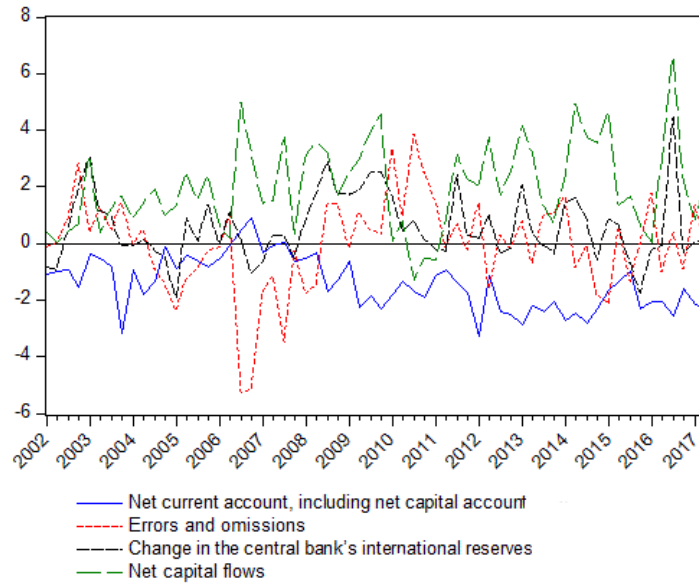
solution to deal with this economic and monetary crisis. This forced conversion would break the indexation of the country's liabilities to the USD, and allow the economy to achieve a real adjustment through devaluation, with no detrimental balance sheet effects, since all financial contracts would have been converted into the domestic currency. We argue that a forced conversion at the official exchange rate of 1507.5 that has prevailed since 1997 would be the best scenario in terms of fairness among the different stakeholders. It would also be the least inflationary scenario as it does not induce any increase in the total money supply. In the last section we conclude.

Figure 26: Lebanon's gross public debt and net foreign assets ratios to GDP



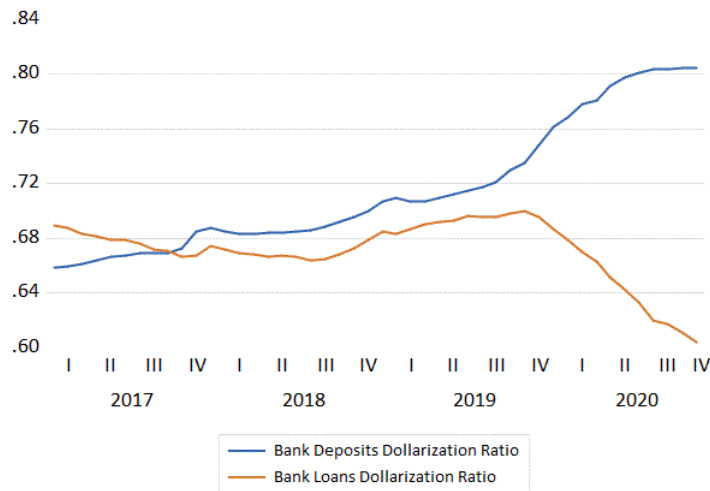
Data sources: IMF WEO, BdL Website, Lane and Milesi-Ferretti's External Wealth of Nations Database

Figure 27: Lebanon's balance of payments components 2002-2018



Data source: BdL Website

Figure 28: Lebanon's bank deposits and loans dollarization ratios



Data source: BdL Website

3.2 A multifaceted crisis

In this section we analyze Lebanon’s crisis in light of the relevant existing literature on currency, debt and balance of payments crises.

3.2.1 The currency crisis

We can first see Lebanon’s currency crisis through the lens of the traditional first, second and third generation currency crises literature. First generation models of currency crises deem that currency collapses occur as a result of the inconsistency between expansive domestic economic policies and the fixity of the exchange rate. Once a country starts to operate such inconsistent policies, it is only a matter of time before a speculative attack depletes the reserves of the central bank, obliging it to float the currency - see for example Krugman (1979). Long before the crisis burst, Desquilbet (2007) has warned of the build-up of a first generation crisis configuration in Lebanon. Second generation models link currency crises to market expectations and argue that speculative attacks can take place due to sudden shifts in market expectations, not necessarily linked to worsening fundamentals – see for example Obstfeld (1996). Third generation crises models explore various mechanisms through which a country’s balance sheet exposures may lead to currency and banking crises. In situations where the economy has accumulated substantial amounts of short term foreign debt (i.e. debt that matures in one year or less), if the foreign exchange reserves are insufficient, the country would not be able to pay its obligations if foreign creditors pull out suddenly - see for example Chang and Velasco (2001). In Lebanon’s case, the balance sheet impact of the rapid withdrawal of bank deposits of non-residents, and the capital flight after the onset of the crisis have contributed to the propagation and amplification of its effects.

Athukorala and Warr (2002) define currency crises as rapid outflows of financial capital in anticipation of possible currency depreciation, inducing depletion of reserves, financial instability and subsequent economic contraction. A currency crisis occurs when market participants lose confidence in the currency of a country, and seek to escape assets denominated in that currency. “Vulnerability” means susceptibility to a currency crisis, which results from an unsustainable deterioration of macroeconomic conditions or from errors in the country’s economic policy. A state of vulnerability by itself does not give rise to a currency crisis. There needs to be a certain disturbance, a “trigger” that will push a vulnerable situation into an actual collapse. Ozkan (2005), looking at the Turkish currency crisis of 2000-2001, highlights the importance of three factors that caused the financial crisis and the collapse of the Turkish lira: the weak fiscal position resulting from high levels of interest payments on domestic borrowing, the weak external position caused by the loss of competitiveness in the face of the tight exchange rate commitment, and the weaknesses in the financial and especially the banking sector. We observe those three fundamental factors in Lebanon, while the trigger in Lebanon’s case is the political and social unrest that started on October 17, 2019.

3.2.2 The debt crisis

Lebanon's crisis is not just a currency crisis, as the government has announced default on its USD denominated debt on March 7 2020. Reinhart (2002) established the empirical regularity of the joint occurrence of sovereign default and currency devaluation as the Twin Ds phenomenon, using data for 58 countries over the period 1970 to 1999. Na, Schmitt-Grohe, Uribe, Yue (2017), using a large country sample in the period 1975-2013, find that the large devaluation that occurs at the time of default is typically not followed by an increase in the rate of depreciation of the exchange rate. They argue that in the run-up to default, domestic absorption experiences a severe contraction, while downward nominal wage rigidity prevents real wages from adjusting, resulting in involuntary unemployment. Thus, the optimal policy calls for a devaluation of the domestic currency which reduces the real value of wages, explaining the fact that default episodes are typically accompanied by large devaluations. In contrast, Asonuma (2016) argues that once the sovereign declares default, the economy suffers output costs due to default and loses access to the international financial market, leading to a further depreciation of the real exchange rate.

Lebanon's public debt is denominated both in LBP and USD. Figure 29 shows the currency composition of the gross public debt and the breakdown by holder type of LBP denominated government bonds (T-Bills) - the data on the breakdown by holder type of USD Eurobonds is not publicly available. The lion share of LBP denominated debt is held by the central bank and domestic banks, implying a substantial monetary financing of the public debt. We can notice in particular the rapid increase of central bank's direct financing of the public debt since 2015. As regards USD denominated Eurobonds, although the data by holder type is not available, it is commonly known that domestic banks hold a major share, and the central bank holds a substantial amount too (estimated at circa USD 5Bn at the end of 2019). The share held by external (non-resident) lenders is also substantial and varied over time, while the share of resident non-bank private lenders is relatively small.

Sovereign debt in local currency is traditionally viewed to present a low default risk level because governments have the possibility to monetize it when the fiscal situation deteriorates. In contrast, debt denominated in foreign currency is generally seen as relatively risky given the volatility of exchange rates and the impossibility to print a foreign currency. Jeanneret, Paget-Blanc and Souissi (2014) analyze the risk of default directly using observed sovereign default events (and not agency ratings and bond spreads as in most studies), in a sample of 100 emerging and developed countries over the period 1996-2012. They provide evidence that local and foreign currency debt present a similar default rate, suggesting that both types of debt are equally risky. They show that global factors do not matter for the explanation of the sovereign default probability, but only for the premium that international investors require for bearing that risk (i.e. the default spread). Local economic, financial, and political conditions remain the most important factors affecting a government's decision to default. Along the same lines, Amstad, Packer and Shek (2018) doc-

ument that the difference in the level of local currency versus foreign currency risk for sovereign debt has steadily decreased over time for all regions. Based on a panel of 73 rated emerging economies sovereigns between 1995 and 2015, they find that higher international reserves and greater banking sector exposure to government debt helped narrowing that gap. They also find no support for the often cited hypothesis that inflation might increase the relative creditworthiness of local currency obligations. Sovereigns' willingness to inflate away their local debt appears to be limited, and higher inflation can even diminish the relative standing of local currency obligations. However in Lebanon's case, the government has apparently elected to default only on its USD denominated debt, while inflating away LBP denominated government bonds.

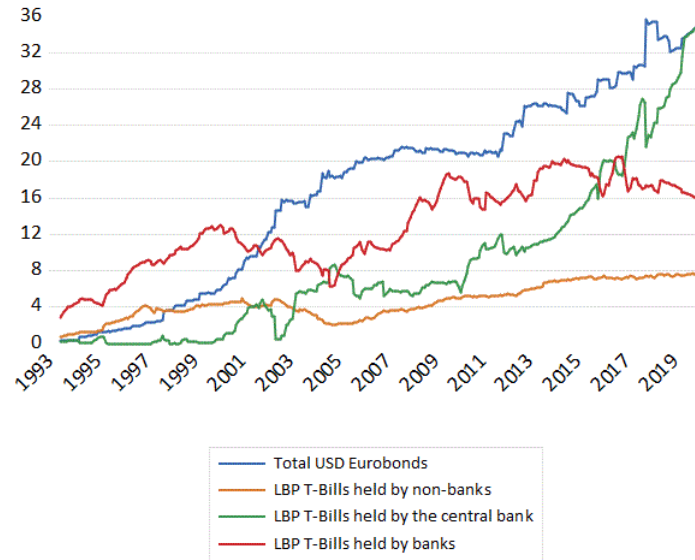
The main concern when it comes to Lebanon's sovereign default is its direct impact on domestic banks solvability, as their exposure to sovereign credit is high relative to their total balance sheets. Gennaioli, Martin and Rossi (2011) build a theoretical model where sovereign default weakens domestic banks balance sheets because banks hold sovereign bonds, causing private credit to decline. Stronger financial institutions boost the leverage of banks, therefore increasing default costs by amplifying these balance sheet effects. Using a panel of emerging and developed countries over the years 1980 -2005, they find that the post-default credit crunch is more severe in countries where banks hold more public debt, and in countries where financial institutions are stronger.

Figure 30 shows the aggregate levels of Lebanon's domestic banks exposures to government debt, both in LBP and USD, as well as their exposure in the form of USD deposits at the central bank. As explained in Bitar (2021-A), Lebanon's central bank has adopted the uncommon practice of using its borrowed foreign currency reserves (in the form of commercial banks USD deposits at the central bank) to intervene in the local FX market, in order to preserve the de facto peg that has been lasting since December 1997. This has resulted in negative net international reserves (difference between the gross foreign assets of the central bank and the borrowed reserves in the form of USD deposits of domestic banks at the central bank) in many instances. Figure 31 shows the gross international reserves and the estimated net international reserves of the central bank in the period leading to the crisis, and during the crisis. The widening gap between the central bank's gross foreign assets and its USD liabilities to domestic banks reached circa USD 60Bn in October 2020, thus posing a solvability problem. It might seem unusual to talk about a central bank's solvability, as in standard monetary systems the central bank has the privilege of creating the highest ranking form of money, but in a dollarized monetary system the US dollar cannot be created by the central bank.

LBP denominated debt will be monetized eventually. However, it is unclear at this stage how the USD denominated government bonds and central bank's USD deposits will be paid back. The uncertainty at this stage is over the level of the haircut that would be applied to them, and whether they will be paid back in USD or in LBP. These parameters will determine the extent of domestic banks losses as a result of the sovereign default and the central bank's USD insolvability. Ultimately, loss sharing will be determined as part of a

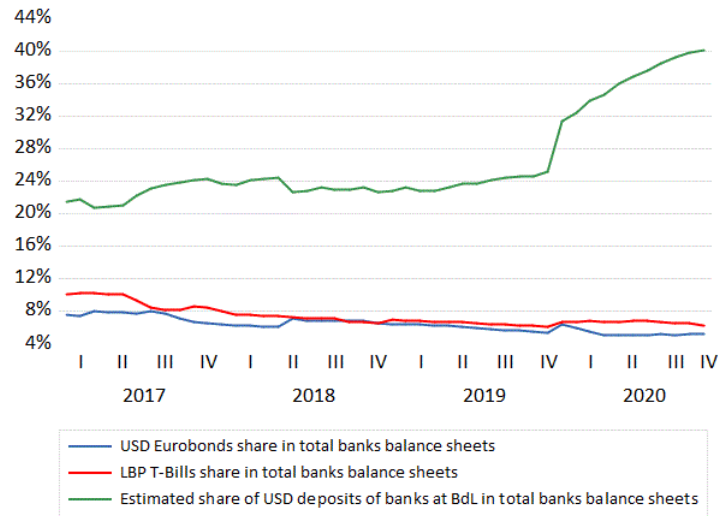
political and social negotiation, where considerations relating to the large-scale corruption that led to the sovereign default would play a major role.

Figure 29: Lebanon's public debt breakdown by currency and by holder type (USD Bn)



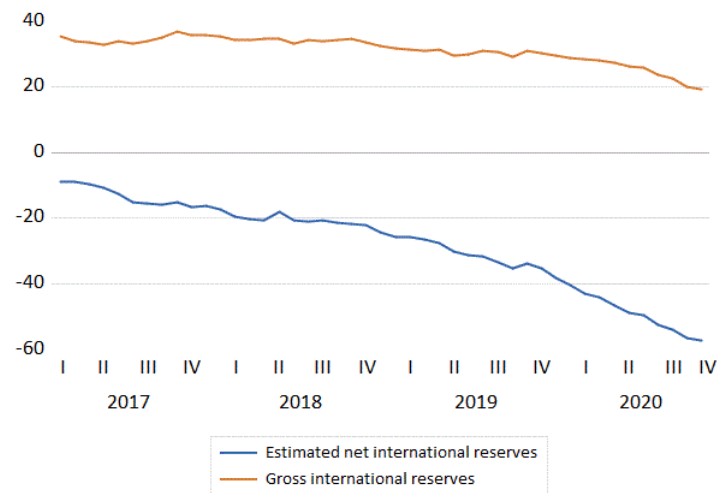
Data source: BdL Website

Figure 30: Lebanese banks credit exposure to government and central bank as a share of their total balance sheet



Data source: BdL Website and author's calculations

Figure 31: Central bank's gross international reserves and estimated net international reserves (USD Bn)



Data source: BdL Website and author's calculations

3.2.3 The balance of payments crisis

Lebanon has been running recurring current account deficits for almost three decades, due to the lasting lack of the competitiveness of its export sector. These recurring deficits were mainly financed by abundant capital inflows in the form of deposits at domestic banks, together with portfolio investments and foreign direct investments that were substantial in many instances. A large part of those inflows came from the Lebanese diaspora around the world. Thus, part of bank deposits in Lebanon, denominated in USD as well as those converted to LBP, represent the liabilities that finance the country's external deficit.

In line with the literature initiated by the seminal work of Gourinchas and Rey (2007)³⁶, at short to medium horizons the brunt of external imbalances adjustment should go through asset returns (the valuation channel), whereas at longer horizons it occurs via trade rebalancing (the trade channel). The valuation channel operates mainly through expected exchange rate changes. The dynamics of the exchange rate plays a major role since it has the dual role of changing the differential in the rates of return between assets and liabilities denominated in different currencies, and of affecting future net exports. Alternatively, the valuation channel would operate through default risk, as assets value is a decreasing function of the perceived default risk associated to them. Therefore, the devaluation of a country's assets could either go through the depreciation of its currency if those assets are denominated in the country's currency, or alternatively, through the depreciation of those assets linked to their increasing default risk premium.

In Lebanon's case, as the bulk of external liabilities are made of USD deposits of non-residents at domestic banks, the valuation channel cannot operate through exchange rate movements, as those are indexed to the USD. Also, as those bank deposits are of monetary nature, they could only have been seen as trading at par to the international US Dollar, and therefore, their "market value" could not be reduced as would be that of a marketable security (bond for example). Also, the trade channel could not work as a result of the fixed exchange rate, that Lebanon's central bank has maintained since December 1997. The negative net international reserves levels (Figure 31) are the best indicator that the exchange rate has been overvalued for years, preventing the reversal of the country's lasting trade deficit. This has led to record negative net foreign assets levels as shown in Figure 26.

This discussion sets the stage for the main analysis of the chapter, i.e. the monetary crisis of Lebanon's dollarized system, that we will make in the next section.

³⁶for a review of this literature see Gourinchas and Rey (2014).

3.3 The monetary crisis

3.3.1 Dollar liquidity coverage

The excess of capital inflows over current account deficits has provided abundant dollar liquidity to Lebanon's dollarized banking system. Bitar (2019) specified a measure of dollar liquidity defined as the Gross Foreign Assets of the Locational Banking Sector (GFA_LBS)³⁷, equal to the sum of the gross international reserves of the central bank (central bank dollar liquidity) and the gross liquid foreign assets of the domestic banking system (banks dollar liquidity). Previous studies analyzing dollar liquidity in dollarized banking systems include Ize, Kiguel and Levy-Yeyati (2006) and Levy-Yeyati (2008).

As Bitar (2019) shows, the change in GFA_LBS (rather than the change of international reserves) is to be seen as the bottom line of the balance of payments in dollarized banking systems (i.e the excess of inflows over outflows). GFA_LBS is equal to the excess of cumulative capital inflows (excluding short-term interbank flows) over cumulative current account deficits - adjusted for valuation changes. As argued in Bitar (2019), the ratio of total USD client deposits held by the domestic banking sector over GFA_LBS, is to be seen as a measure of the liquidity coverage of the USD component of the domestic banking system balance sheet (the higher this ratio, the lower the dollar liquidity coverage). If this ratio exceeds 1, USD bank client deposits are not fully covered by the foreign liquid assets of the locational banking sector (including the central bank), which implies a liquidity risk in case of a run on USD bank deposits. The dollar liquidity aggregate GFA_LBS is in fact a broader aggregate than the central bank's gross international reserves (it also includes commercial banks gross foreign liquid assets) that are seen as the country's foreign liquid assets in the present economic debate in Lebanon.

Table 15 shows the main transactions impacting USD bank deposits and GFA_LBS in Lebanon's context. Bank A is a representative dollarized domestic bank (representing the domestic consolidated banking sector, including the central bank) and US Bank is a foreign correspondent bank (representing the rest of the world financial system). While Bitar (2019) analyzes different transactions impacts on banks balance sheets in details, we will only focus on four representative transactions in this chapter:

- Transaction 1. represents a capital inflow into the country done by client a, in the form of a USD bank deposit at Bank A of an amount X.
- Transaction 2. represents a current account outflow (for example goods import) done by client c, of an amount W.
- Transaction 3. represents a USD loan of Bank A to client b, of an amount Y.
- Transaction 4. represents a LBP loan of Bank A to client d of an amount e.Z (where e is the USD/LBP exchange rate), converted into a USD deposit by client d, of an amount Z.

³⁷We use the term Locational following the Bank for International Settlements definition of residency.

As a result of the four representative transactions, total USD deposits at Bank A equal $X+Y+Z-W$. Capital inflows, domestic USD loans (dollar money creation) and conversion of LBP deposits to USD deposits increase total USD deposits, while current account outflows reduce them. GFA_LBS (total deposits of Bank A at US Bank) equal $X-W$. Capital inflows (outflows) increase (decrease) total dollar liquidity in the hands of the domestic banking sector, while current account outflows reduce it.

Balance of payments transactions, i.e. capital flows and current account transactions, impact in a similar manner GFA_LBS and total USD deposits, therefore do not impact the dollar liquidity coverage of USD bank deposits directly. Domestic USD loans impact this coverage, however, as they would be paid back ultimately, the initial transaction that generated the USD deposit would be reverted. Therefore, what constitutes a net liquidity risk on the consolidated level is only the conversion of LBP deposits into USD deposits by the non-bank sector. As a result, current account outflows (goods import for example) and capital outflows, that require the prior conversion of LBP deposits into USD deposits, result indirectly in the deterioration of the dollar liquidity coverage of USD bank deposits.

Table 15: Transactions impacting USD bank deposits and GFA_LBS

Bank A		US Bank	
1. Dollar deposit at US Bank = X	1. Dollar deposit of client a = X	1. Loan to US private sector = X	1. Dollar deposit of Bank A = X
2. Dollar deposit at US Bank = -W	2. Dollar deposit of client c = -W		2. Dollar deposit of US client = W
3. Dollar loan to client b = Y	3. Dollar deposit of client b = Y		2. Dollar deposit of Bank A = -W
4. LBP loan to client d = Z.e	4. Dollar deposit of client d = Z		
Total = $X+Y+Z-W$	Total = $X+Y+Z-W$	Total = X	Total = X

3.3.2 From liquidity to solvability

The build-up of a liquidity shortage happens because of an overvaluation of the exchange rate leading to a current account deficit and/or to excessive conversions of the LBP bank deposits into USD bank deposits. The overvaluation of the LBP exchange rate as a result of the fixed exchange rate that Lebanon's central bank excessively defended, building a negative net international reserves position,

led to the increase of the ratio of total USD bank deposits over GFA_LBS. If the exchange rate has been allowed to adjust in line with market forces, this overvaluation and the resulting dollar liquidity shortage could have been prevented.

While capital outflows and conversion of the domestic non-bank sector of LBP bank deposits into USD bank deposits can result in a dollar liquidity shortage, current account deficits, being “real losses” incurred by the country as a result of the nation living beyond its means, simultaneously impact liquidity and solvability. At some point, if the reversal of those “real losses” seems impossible or very distant in time, what has been a liquidity matter becomes a solvability problem.

3.3.3 The suspension of USD bank deposits convertibility

Figure 32 shows the evolution of GFA_LBS, gross international reserves and the gross liquid foreign assets of the banking sector in Lebanon, in the three years period leading to the crisis and during the crisis. Figure 33 shows the evolution of the ratio of total USD bank deposits over GFA_LBS in Lebanon during the three years leading to the crisis and after the onset of the crisis. We notice that during the crisis, the coverage of USD bank deposits by the dollar liquidity in the hands of the locational bank sector has substantially deteriorated. This has led to the suspension of the convertibility of domestic banks USD deposits into international dollar deposits (funds transfers to overseas banks) and into US dollar notes. The suspension of convertibility was a gradual decision made by banks, as a response to the shrinking of their foreign liquidity individually, and that of the whole banking system (as defined by GFA_LBS). Dollar denominated client deposits held with the Lebanese banking system have been labeled “Lollars” (i.e., Lebanese dollars) by the local press, similarly to Mexdollars in Mexico and Argendollars in Argentina, in order to stress the fact that they are not equivalent to the US dollar.

From the onset of the October 2019 crisis, capital controls have been instated in a formal way, through central bank decisions, and informally by individual banks decisions. Banks transfers abroad were not allowed anymore, and banks put increasingly restrictive limits on the withdrawal of US dollar notes by clients - similar to Argentina’s “Corralito” in 2001-2002 - i.e. allowing depositors to maintain access to their funds as long as they remained within the domestic banking system. However, de facto capital control and suspension of convertibility measures taken by the central bank and banks cannot be considered official or legal since no law was enacted with that regard - a draft capital control law is still debated in the parliament. The enactment of that draft law would have some (positive) economic implications, only if it can reverse the fraudulent capital outflows that occurred since October 17, 2019 (and prevent further outflows), which would restore some of the international reserves loss of the central bank.

Those exchange restrictions and controls led to the emergence of a parallel foreign exchange market whose main actors were exchange offices. Despite

several attempts by the central bank and the government to contain this movement, the unofficial US dollar notes exchange rate kept increasing as shown in Figure 34. The official exchange rate was kept at the mid price of 1507.5 for months, while the black market rate was increasing steadily, peaking at around 9500 LBP per USD at the end of June 2020. At the same time, inflation picked up very quickly, mainly due to the increase of imported goods prices, as shown in Figure 35. Month-on-Month CPI inflation started accelerating from October 2019, and peaked at 25.36% in April 2020.

The striking evidence is that private agents informally started trading USD deposits at domestic banks (in the form of cheques) for US dollar notes, at prices that fluctuated with market information and changing banks restrictions. They were already applying an informal “haircut” on USD deposits at banks, that were not valued anymore at par with US dollar notes. This “haircut” has reached at the time we are finalizing this chapter around 65% of the nominal value of USD denominated bank deposits - i.e. a USD denominated domestic bank cheque was exchanged in the black market for US dollar notes, for 35% of its nominal value.

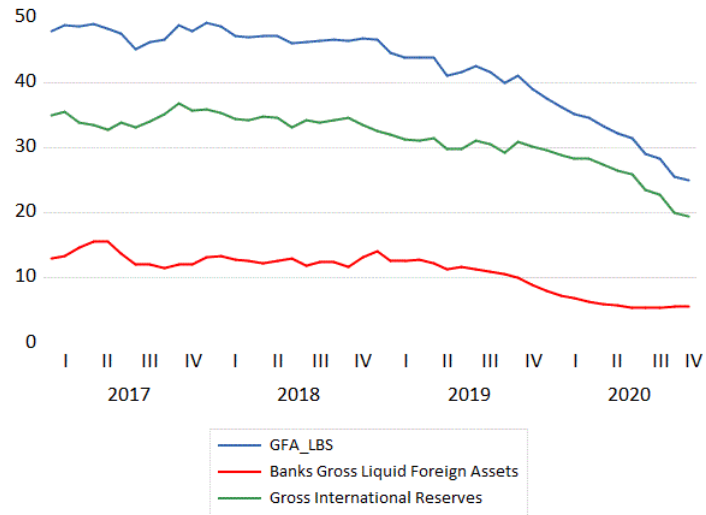
The other striking occurrence is that banks have labeled USD deposits received before October 17, 2019 (the crisis start date) as “old money”, while USD notes deposited and bank transfers from abroad received after that date were labeled as “fresh money”. While “old money” is subject to capital control measures, “fresh money” was exempt and could be withdrawn and transferred abroad freely. Although questionable from a legal standpoint, this measure aimed at preserving funds transfers into the country, by separating them from domestic banks USD deposits whose convertibility was suspended.

The worsening financial condition of banks led to a partial disintermediation of the economy, resulting in the shrinking of the consolidated banks balance sheet size. Despite the restrictions on deposits withdrawal since the onset of the crisis, depositors have managed to withdraw a large share of their LBP denominated deposits, which led to a very rapid increase of the amount of LBP currency notes in circulation as shown in Figure 36. Also, Figure 36 shows the rapid decline in the amount of residents LBP denominated bank deposits, while the amount of residents USD denominated bank deposits remained quite stable, mainly due to restrictions on withdrawals. Part of USD denominated bank deposits could be withdrawn in USD notes at the start of the crisis. Also, at a later stage, USD deposits were still withdrawn in LBP notes at the preferential rate of 3900 LBP/USD for small amount withdrawals. They were also used by debtors to settle USD denominated bank loans. However, there have been large conversions from LBP deposits to USD deposits that counterbalanced those decreases in USD deposits. Also, some depositors preferred to withdraw their LBP denominated deposits, with the hope that keeping their USD denominated deposits at banks would hedge them against the depreciation of the domestic currency, while still bearing banks credit risk and the dollar convertibility risk.

Finally, with dollar liquidity becoming scarce, almost all real transactions in the domestic economy were conducted in LBP. In sum, the dollar liquidity crisis has led to the dedollarization of the economy’s real transactions, and the trans-

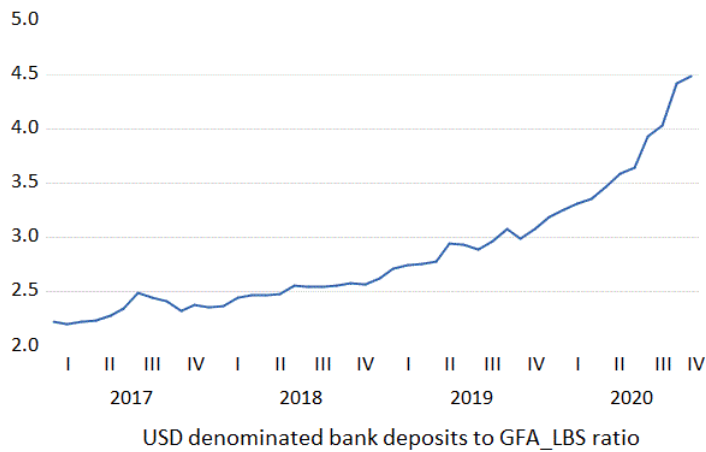
formation of banks USD denominated deposits into banks USD denominated risky credit.

Figure 32: GFA_LBS, gross international reserves, and banks gross liquid foreign assets (USD Bn)



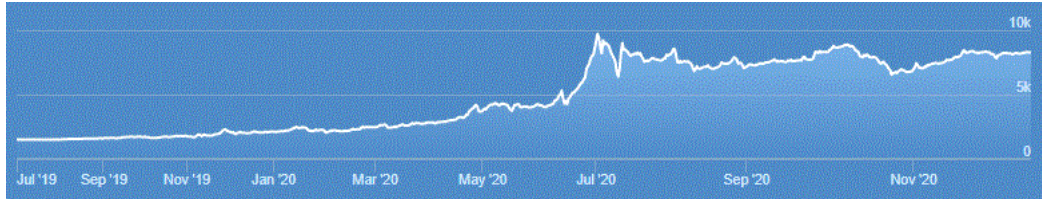
Data source: BdL Website

Figure 33: Ratio of USD deposits at domestic banks to GFA_LBS



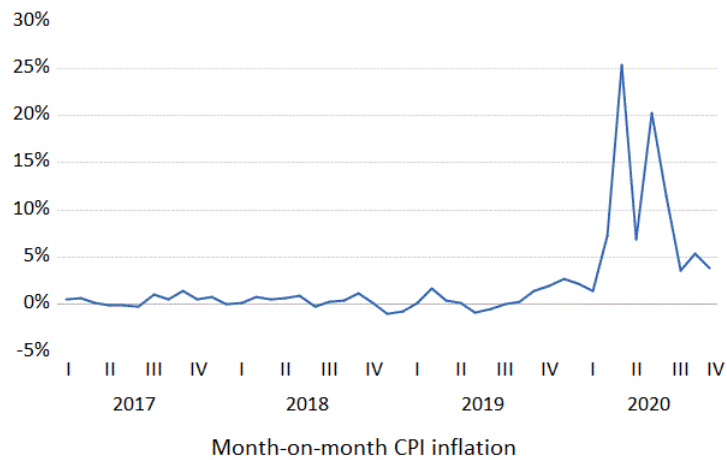
Data source: BdL Website

Figure 34: USD/LBP black market rate evolution



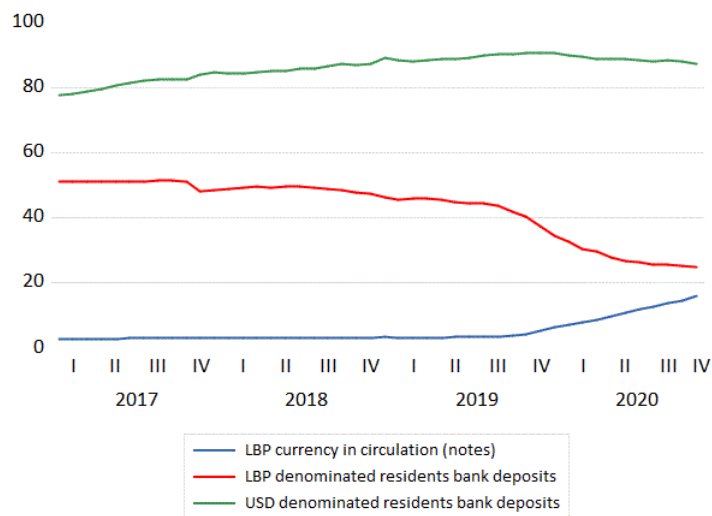
Graph Source: lirarate.com website

Figure 35: Monthly CPI inflation (in %)



Data Source: Lebanon's Central Administration of Statistics Website

Figure 36: LBP currency in circulation, residents LBP and USD bank deposits (in USD Bn equivalent)



Data source: BdL Website

3.3.4 The Money View

So far, we have analyzed Lebanon’s monetary crisis using the mainstream literature’s concepts of liquidity and solvency. We find the Money View advocated by Perry Mehrling to be a good theoretical framework to understand Lebanon’s monetary crisis. The Money View perceives the monetary system as a payments system that is fundamentally hierarchical - Mehrling (2012) and Mehrling (2013). At the top of the monetary pyramid is a unit of account, e.g. gold or dollar. Below this are a range of institutions issuing different credit money forms. This hierarchy implies a promise to pay the higher ranking form of money. Murau (2018) explains that due to the US’s position at the apex of the international hierarchy of money, the US dollar is by far the most important unit of account used to create credit money. The money form situated at the top is the final means of settling payments. In today’s world, the liabilities issued by the US federal reserves are ranked higher than those of US commercial banks, which in turn are ranked higher than those of the Eurodollar deposits issued by non-US international banks. The Money View literature suggests one key criterion to decide whether a liability is money or not: if it trades at par on demand to another form of credit money that is further up in the hierarchy. This implies that public or private liabilities are part of the “monetary pyramid”, if they can instantaneously or almost instantaneously be converted into higher ranking money. However, the promise to pay at par on demand is not equally strong for all credit money forms. The further we go down in the monetary

pyramid, the higher is the risk of breaking away from par. The reason for this is that par clearance needs to be actively established, either by political measures and guarantees or via market forces and private guarantees.

Lebanon's crisis has shown that Eurodollar deposits of banks in emerging markets dollarized monetary systems are at the lowest level of this monetary hierarchy. The level directly above them, are Eurodollar deposits in non-US international banks, which in turn, come below deposits at US banks in the hierarchy. US dollar notes, as direct liabilities of the US Federal Reserve, stand at the top of this hierarchy. USD deposits at Lebanon's domestic banks lost their "moneyness" from the moment they stopped trading at par to Eurodollar deposits in international banks, and to US dollar notes. Their status switched to risky USD denominated "credit" that trade at a discount to their par value, on the liabilities side of domestic banks' balance sheets.

3.4 Policy implications

3.4.1 Forced conversion of banks' balance sheets to LBP

We have shown that Lebanon's crisis is multifaceted. Above its traditional currency, debt and balance of payments crises aspects, it is what we called a "monetary crisis". We stressed the importance of monitoring dollar liquidity in dollarized banking systems, as measured by the Gross Foreign Assets of the Locational Bank Sector (GFA_LBS) aggregate. Dollar liquidity increases (decreases) with capital inflows (outflows), and decreases (increases) with current account deficits (surpluses). The indexation of the country's liabilities, mainly comprised of USD denominated domestic bank deposits held by non-residents, has prevented Lebanon's long-standing external disequilibrium from adjusting through the valuation channel. Even if Lebanon had adopted a floating exchange rate in the last two decades, the adjustment would have been only partial as it would have only operated through the trade channel, which would have been reasonably weak considering the small size of the country's export sector.

We shed the light on the inherent weakness of dollarized monetary systems that appears in times of crises. Lebanon's crisis has questioned the "moneyness" of foreign currency deposits in dollarized domestic banks. If those deposits are not fully covered by the locational bank sector's liquid foreign assets, not only they present a liquidity risk, but also their "moneyness" is at risk, as their immediate convertibility at par to international Eurodollars or to US dollar notes is not guaranteed. The return of the convertibility and the "moneyness" of USD deposits at Lebanese banks would require a substantial reversal of the current account balance, allowing the build-up of the liquid foreign assets of the banks sector, which is an uncertain long-term process. In contrast to analyses of the Argentine "Corralito" that focused on the liquidity risk linked to dollar bank deposits - see for example Ize, Kiguel and Levy-Yeyati (2006), we showed in this chapter that a recurring current account deficit in dollarized economies can result in a bank deposits solvability problem.

As USD deposits at Lebanese banks would not be convertible again soon to

international Eurodollars or to US dollar notes, we view the forced conversion of banks balance sheets to LBP as the most reasonable and economically efficient option at this stage. The current developments in the banking sector back our position: not only the total amount of dollar liquidity is still degrading, also no new dollar liquidity is injected in the banking system because depositors and exporters are refusing to risk their dollar liquidity by entrusting it to banks with huge dollar liquidity deficits that lost the confidence of the public. This proposed forced conversion would break the indexation of the country's liabilities to the USD and would allow the valuation channel of external adjustment to operate through the depreciation of the exchange rate that occurred informally and would inevitably extend to the official USD/LBP exchange rate.

Argentina's 2001-2002 convertibility crisis has strong similarities with Lebanon's ongoing crisis: a fixed exchange rate regime (a quasi currency board) together with a highly dollarized banking system and a substantial current account deficit. Years before the crisis, Caprio, Dooley, Leipziger and Walsh (1996) warned of the potential liquidity risks inherent to Argentina's quasi currency board regime. On February 4 2002, the Argentine government introduced an asymmetric pesification of banks balance sheets, alongside the flexibilization of the exchange rate, converting dollar denominated deposits at an exchange rate of 1.4 and dollar denominated loans at par. This had a direct negative effect on banks net worth. Thus for Lebanon, we would recommend this forced conversion to be symmetric on banks assets and liabilities sides, in order to avoid any impact on banks solvability.

Argentina's pesification was generalized to the whole economy, implying the conversion of all prices, wages, private and public contracts and financial claims. The compelled conversion rate was lower than the exchange rate prevailing in the free market which was one dollar to 1.8 pesos on the conversion date (February 6, 2002) and reached 3.5 at the end of the first semester 2002. Thus, this measure implied substantial losses for dollar capital holders and creditors who denounced a violation of their property rights. Pesification resulted in a redistributive effect, in favor of dollar debtors and peso depositors. For Lebanon, the closer the conversion rate to the official exchange rate that prevailed since December 1997 (1507.5 LBP per USD), the fairer this conversion would be to the holders of LBP bank deposits, and to USD debtors.

Despite the wide criticism that followed Argentina's pesification in terms of violation of property rights, as well as its impact in terms of capital outflows and banks disintermediation in the short run, prominent economists have backed it - see for example Hausmann and Velasco (2002). Baldi-Delatte (2009), relying on a solvable dynamic macroeconomic model simulations, shows that Argentina's pesification allowed a beneficial real adjustment that was achieved through the devaluation which had no detrimental effects on corporate balance sheets, since all financial contracts have been compulsory converted into peso. On the other hand, the devaluation boosted exports and had a standard expansionary impact. Using firm level data, Calomiris (2007) shows that devaluation benefited tradable firms, and that dollar debt pesification benefited dollar debtors. Damill, Frenkel and Rapetti (2015) document that as a result of the convertibility crisis,

by mid-2002 Argentina's GDP was 21% lower than its previous peak of mid-1998. Then the economy began a rapid and strong recovery, which then turned into rapid and strong economic growth. GDP growth was at an 8.1% annual rate from the first quarter of 2002 to the same period in 2007 - see Frenkel and Rapetti (2008). Marshall (2008) states that Argentina's forced pesification is now widely acknowledged to promote greater macroeconomic robustness as well as healthy profits for the banking sector.

The alternative action that would bring the amount of USD bank deposits closer to that of dollar liquidity (as measured by GFA_LBS), would be a bank bail-in applying a haircut on banks deposits, which means admitting explicitly the default of banks on their USD deposits. The bail-in option has the advantage of making domestic banks shareholders bear part of the default burden, which is demanded by Lebanon's public opinion, as the latter accuses banks of complacency in the excessive financing of government debt and in the country's financial corruption. However, this option does not terminate the indexation of those deposits to the US dollar and the dollarization of the country's banking system, leaving it vulnerable to similar crises in the future. A mixed solution consisting in a bail-in, followed by the forced conversion of banks balance sheets into LBP would achieve both targets.

It could be argued that, going forward, the country might need capital inflows in the form of USD bank deposits of non-residents, in the absence of an active capital market in Lebanon. The solution would be to allow term deposits in foreign currencies, while forbidding any form of sight deposits, transactions and contracts denominated in foreign currencies. Those term deposits should be subject to strict liquidity management rules, imposing a high degree of coverage in the form of low risk liquid foreign assets. Another concern is the impairment of the confidence of non-resident/foreign investors in the country's banking system following the suspension of convertibility (and the potential forced conversion). This confidence will be hard to reestablish, but an equal treatment of those investors and resident investors in the loss sharing process will be key for future return of confidence.

3.4.2 The redistributive implications of inconvertibility and the forced conversion of Lebanon's banks balance sheets

The distribution of losses resulting from the government's default and the central bank's dollar insolvability among stakeholders should be considered in two separate dimensions. The first dimension relates to the legal/political process of the determination of responsibilities and the recovery and repatriation of the funds lost due to the country's large-scale corruption. This legal/political process will also determine the losses that banks' shareholders must bear. This aspect is beyond the scope of our chapter; however, it is important to note that in the event that some of the lost funds are recovered, it would be possible in the future to redistribute them to stakeholders proportionately to their incurred losses.

We will only discuss in what follows the second dimension that relates to

monetary management. We make an analysis of stakeholders' gains and losses under different scenarios of dollar convertibility suspension and forced conversion of banks' balance sheets USD denominated components into LBP, taking the situation that prevailed before October 17, 2019 with the fixed exchange rate of 1507.5 LBP/USD as the initial state. In our analysis, we can objectively view the USD/LBP black market rate as the equilibrium exchange rate resulting from market forces, despite some alleged manipulations in that market.

Convertibility suspension As the official exchange rate (1507.5 LBP/USD) that applies to bank operations has not been changed, the real loss for LBP bank depositors due to the rapidly rising inflation and black market depreciation of the USD/LBP exchange rate has not been so far substantially higher than that borne by large USD depositors who were only authorized to withdraw small monthly amounts from their deposits at exchange rates above the official rate, that were gradually raised then fixed at the rate of 3900 LBP per USD. Small USD depositors whose withdrawals are naturally limited to the monthly amounts allowed to be withdrawn at the preferential rate of 3900 LBP/USD have fully benefited from this preferential treatment. This preferential treatment aimed at incentivizing USD bank depositors to withdraw their USD deposits in LBP notes, in an attempt to relieve banks from their legal obligation towards their USD depositors to convert their demand deposits into USD notes. However, USD denominated bank deposits withdrawals at the preferential rate have resulted in the rapid increase of LBP money supply, further fuelling inflation and the USD/LBP exchange rate depreciation. As regards bank loans, the official rate has been so far applied for all transactions, thus the real gain is equal for LBP and USD debtors as a result of the rapid inflation and the black market depreciation of the USD/LBP exchange rate. Thus, the only "preferential treatment" in the banking system has so far been given to USD depositors for their small amounts withdrawals. The real dollar value of USD denominated bank deposits and loans can be calculated by simply dividing their nominal amount by a coefficient equal to (black market exchange rate / 1507.5). Alternatively a "market value" of USD denominated bank deposits represented by the value of USD banking cheques on the black market, accounting for the market-perceived probability of the return of their convertibility and for the small amount withdrawal "preferential treatment" at the rate of 3900 LBP/USD, could be seen as the best real dollar value of banks USD denominated deposits.

In essence, the suspension of dollar convertibility can be seen as a light version of forced conversion. It is somehow an "optional forced conversion" as it gives USD bank depositors the only option to withdraw their deposits in LBP notes, at an exchange rate decided by monetary authorities (whether it is 3900 LBP/USD for small amount withdrawals or the official rate of 1507.5 LBP/USD for larger amounts). Otherwise, depositors will have to keep their USD denominated deposits within the local banking system. As the return to dollar convertibility of USD denominated bank deposits is highly unlikely for the reasons stated in the previous section, the current state of affairs in

the Lebanese banking sector can be seen as an “informal forced conversion” of USD deposits into LBP. Formalizing this forced conversion is of economic value because it eliminates any remaining uncertainty around USD denominated bank deposits and loans, it imposes clear terms for the conversion that guarantee a fair treatment for stakeholders, and it resets the country’s monetary system under clear rules.

Forced conversion We discuss in this subsection the redistributive implications of symmetric exchange rate forced conversion scenarios on stakeholders, as well as those scenarios’ implications on inflation and the USD/LBP exchange rate. We exclude in our discussion the possibility of asymmetric exchange rates conversions (i.e. a higher conversion rate for USD bank deposits than the conversion rate of USD bank loans) because those would put banks in a difficult financial condition, similarly to the Argentine case.

- If the forced conversion is to be done presently at the official exchange rate of 1507.5, the losses would be evenly distributed between USD and LBP bank depositors, and the gains of LBP and USD debtors, resulting from the decrease of the real value of their debt, would be equal. This would also induce no increase in the total money supply (that would only become totally denominated in LBP), as the USD denominated component of the money supply would be converted at the fixed official rate. Thus this scenario does not have any direct inflationary consequences.

- If the forced conversion is to be done at the intermediate arbitrary rate of 3900 LBP/USD that is currently applied to small amount USD deposits withdrawals - that is lower than the black market exchange rate - USD depositors will bear a lesser loss than LBP depositors, and USD debtors will make a lesser real gain than LBP debtors. This scenario has inflationary implications as it increases the total money supply by a factor equal to the share of USD deposits in total deposits multiplied by $(3900 - 1507.5) / 1507.5$

- If the forced conversion is to be done at the black market exchange rate at the time of conversion, USD bank depositors would not bear any direct loss, but the inflation and depreciation ensuing from the huge increase of the LBP money supply as a result of this conversion will erode the purchasing power of the converted LBP deposits subsequently. Similarly, USD bank debtors will not make any direct real gain in that scenario, but they would still make a real gain subsequently as a result of the ensuing inflation. This scenario has very high inflationary implications because it increases the total money supply by a factor equal to the share of USD deposits in total deposits multiplied by $(\text{black market exchange rate} - 1507.5) / 1507.5$

- The last scenario is that of no forced conversion with the exchange rate officially floated, i.e., the black market exchange rate becomes officially the market exchange rate applied to bank operations. USD bank depositors can withdraw their deposits in LBP notes at the prevailing USD/LBP market exchange rate and USD bank debtors should pay back their loans also at the prevailing USD/LBP market exchange rate. This scenario would result in a hyperinfla-

tionary spiral resulting from an ever increasing LBP money supply and an ever increasing market exchange rate. This would most certainly induce the default of a large number of USD bank debtors on their USD denominated loans.

In sum, in every possible scenario USD and LBP bank depositors will make real losses, while USD and LBP bank debtors will make real gains. The closer the conversion rate to the official exchange rate of 1507.5, the lesser the relative loss of LBP depositors compared to that of USD depositors, and the relative gain of LBP debtors compared to USD debtors. Therefore, a forced conversion at the official exchange rate of 1507.5 that has prevailed since 1997 would be the best scenario in terms of fairness among the different stakeholders. It would also be the least inflationary scenario as it does not induce any increase in the total money supply (in LBP-equivalent).

3.5 Conclusion

We shed the light on the inherent weakness of dollarized monetary systems in times of crises. We showed how USD denominated deposits at Lebanon's domestic dollarized banking system lost their "moneyness" in the crisis that hit the country since October 2019, due to the fact that they were not sufficiently covered by the liquid foreign assets of the banking system (including the central bank). This is a liquidity issue that developed into a solvability issue, resulting in the suspension of the convertibility of USD deposits at domestic banks into international Eurodollar deposits and US dollar notes.

Foreign liquid assets of the banking system have been drained over the years by the recurring current account deficits of the country resulting from the overvaluation of the domestic currency. The uncommon practice of using borrowed foreign liquidity to defend the fixed exchange rate has led to a large deficit in the central bank's international reserves account.

We argued that the return to dollar convertibility of USD bank deposits is unlikely. Based on Argentina's successful pesification experience in 2002, we proposed the forced conversion of USD banks' assets and liabilities into LBP, as the most economically efficient way to deal with this monetary crisis. We suggested that this forced conversion should ideally be operated at the fixed exchange rate of 1507.5 that prevailed since 1997 - both from an economic efficiency and stakeholders' fair treatment points of view.

Above all, the key to economic recovery and sustainable growth in Lebanon will be sound and transparent fiscal and monetary management. This chapter is an analysis of the monetary dimension of the ongoing crisis in Lebanon. We will make a full analysis of this crisis and its outcomes, once it completely unfolds.

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Appendix: Some side dynamics of the crisis

Dollarization of transactions during the crisis has evolved with time. While there is no data on the share and nature of transactions denominated in dollar in the economy, there was a clear tendency towards an increased use of the LBP at the start of the crisis, as LBP holders were keen to get rid of their LBP holdings, both in terms of LBP bank accounts and LBP cash notes. In addition, USD cash became less available in general in the hands of Lebanon's residents at that stage. However, with remittances flowing to the country from expatriates willing to help their families in the difficult crisis conditions – there is no reliable data on the amount of those flows (or their share in the GDP) that took the form of cash carry, international cash transfers, and minor transfers via the traditional banking sector – USD cash notes became available again and their share in transactions could have increased again with time, especially with the deteriorating value of the LBP.

High inflation levels that were observed were only in terms of LBP inflation. At the first stages of the crisis, the USD equivalent of the price index was going down, due to the less than proportionate increase of the prices of imports (pass-through inferior to one) mainly due to the foreign exchange subsidies that the central bank was providing on a large number of imported goods (mainly energy and food items), through the provision of USD at exchange rates way lower than the black market exchange rate. The announced motive behind this FX subsidy was to boost the purchasing power of the deteriorating LBP revenue earners.

However, with the shrinking amount of international reserves, FX subsidies were reduced and lifted gradually. This automatically led to the increase of dollar equivalent prices of imported goods, leading ultimately to dollar inflation more in line with the devaluation of the USD/LBP exchange rate. The difference being the slower increase (or decrease) in the dollar equivalent prices of domestically produced goods and services, as a result of the depressed global demand in the domestic economy. With that regards, the IMF's WEO figures point to a negative GDP growth of -7.15% in 2019, and -22% in 2020.

These price dynamics have clearly harmed LBP earners, and benefitted USD earners. However, through the development of the crisis a lot of companies in the private sectors started paying their employees mixed currency salaries, i.e., a part of the salary was paid in USD, and another part in LBP (and sometimes a part in Lollars too). Civil servants were hit the most as their salaries were fully paid in LBP, even though the government has gradually (but slowly) increased those salaries and provided some transport and other incentives to them.

A detailed quantitative study of those dynamics is beyond the scope of this chapter, and requires a large set of complex data on FX subsidies and salaries evolutions.

4 A note on reserve requirements and banks liquidity

Abstract

Unlike past literature adopting the loanable funds view, we follow the financing model of bank intermediation in order to analyze the monetary mechanisms relating to reserve requirements, and compute banks margins on their lending and deposit activities. We show that, when remunerated at a rate below the money market interest rate, reserve requirements increase the spread between bank loans and deposits interest rates, without any impact on the level of interest rates. We review and analyze the uses of reserve requirements as a prudential tool and as a monetary policy instrument. We also analyze their use for capital flows management and for de-dollarization in emerging economies. We argue that reserve requirements are a sub-optimal and outdated policy tool, and we suggest imposing direct taxes on banks deposits and loans interest payments, as a more efficient alternative to reserve requirements.

Keywords: Reserve Requirements; Banks Liquidity; Central Banks Operations

JEL Classification: E51; E58

This chapter has been published in International Journal of Finance and Economics (Wiley): Bitar J., A note on reserve requirements and banks liquidity, International Journal of Finance and Economics (2020)

<https://onlinelibrary.wiley.com/doi/10.1002/ijfe.2403>

Data Availability Statement: Data sharing is not applicable to this article as no new data were created or analyzed in this study

4.1 Introduction

Reserve requirements are the minimum percentages of liabilities that depository institutions (commercial banks) are required to keep in cash or as deposits with their central banks. Based on a 2010 IMF survey of 129 central banks, Gray (2011) finds that over 90 percent oblige depository institutions to hold minimum reserves against their liabilities. We show the table summarizing the levels of reserve requirements ratios applied by IMF member countries central banks in 2010, taken from Gray (2011), in Appendix 1 (Figure 1).

The role of reserve requirements has evolved significantly over time. Di Giorgio (1999) states that reserve requirements have initially been used for two distinct purposes: as an instrument to protect depositors from bank runs and crises, and as a key monetary policy instrument. He points out that the monetary policy function of reserve requirements gained priority over its prudential function, because of the development of other tools that can be activated for deposit protection. O'Brien (2007) documents that twenty-four out of the thirty OECD countries impose reserve requirements to influence their banking systems' demand for liquidity, in order to facilitate monetary policy implementation. These include twelve OECD countries that are also members of the European Economic and Monetary Union (EMU), that employ a single reserve requirements system. Brei and Moreno (2019) show that reserve requirements have been actively used as a monetary policy instrument in a number of emerging market economies. Their use has been motivated by the fact that the short-term interest rate may not be a sufficient tool to deal with both price and financial stability objectives.

Reserve requirements are an indirect, multiple impact policy tool. Their complex design makes their calibration difficult. O'Brien (2007) lists eleven main features of reserve requirements: reservable liabilities, required reserve ratios, reserve computation periods, reserve maintenance periods, types of reserve requirements, calculations of required reserves, eligible assets for satisfying reserve requirements, remuneration on reserve balances, non-compliance penalties, carry-over of reserve balances, and required clearing balances. The overlay of changing purposes and practices makes it not always fully clear what the current purpose of reserve requirements is, and complicates thinking about how a reserve system should be structured. In Appendix 2, we review the latest evolution of reserve requirements regulations in the two major developed economies (US and Eurozone) and in two emerging economies that are active users of reserve requirements (Brazil and Turkey).

Reserve requirements are high powered money (central bank deposits and vault cash). Throughout our analysis, we adopt the financing model, in which banks are modeled as financial intermediaries whose loans are funded by ex-nihilo creation of ledger-entry deposits. Most of the previous academic literature adopted the loanable funds model, where banks are modeled as intermediaries that receive deposits of physical resources from savers before lending them to borrowers. The view of banks as intermediaries of loanable funds is wrong - see Jakab and Kumhof (2018). The literature adopting the loanable funds vision,

goes as far as considering central bank credit and clients deposits as equivalent sources of funding (loanable funds) - see for example Herrera, Betancourt, Varela and Rodriguez (2010), Glocker and Towbin (2012). This assumption comes from the fact that client deposits transfers between banks are mirrored by central bank deposits transfers between those banks. What this assumption overlooks is that central bank credit creates high powered money, while the transfer of central bank money between banks as a result of client deposits transfers does not affect the total amount of high powered money. High powered money allows banks to provide loans to non-banks, and to create deposits by doing so. Bank deposits are rather the result of bank credit, and not a funding source banks rely on to provide credit.

In the next section, we present the monetary mechanisms relating to reserve requirements and we compute banks margins on their lending and deposit activities, as well as their total combined margin, in the presence of reserve requirements. We show that if the central bank remunerates reserve requirements at an interest rate below the money market interest rate, banks spread (the spread between banks lending interest rate and deposit interest rate) increases. However, reserve requirements do not impact the level of interest rates (the mid-rate, i.e., the average of the lending and deposit interest rates). We do the same for foreign currency intermediation in dollarized banking systems, where the opportunity cost of holding reserves is the international dollar interbank interest rate. We then suggest a remuneration-adjusted reserve requirements rate. In the third section, we review and analyze the uses of reserve requirements as a prudential tool and as a monetary policy instrument. We also analyze their use for capital flows management and for de-dollarization in emerging economies. In the conclusion, we suggest imposing direct taxes on banks deposits and loans interest payments, as a more efficient alternative to reserve requirements.

4.2 Monetary mechanisms and reserve requirements

4.2.1 Domestic currency

High-powered money and interbank settlements We first present a basic endogenous money creation process, starting with a Bank “A” giving a loan of an amount X to a non-bank sector client “a” (companies and individuals) - Step 1 (Table 1), and client “a” paying the whole amount X to a non-bank sector counterparty “b” whose account is held at Bank “B” - Step 2 (Table 2).

Table 16: Step 1

Bank A		Bank B		Central Bank (CB)	
Loan to a = X	Deposit of a = X				
Total = X	Total = X				

Table 17: Step 2

Bank A		Bank B		Central Bank (CB)	
Loan to a = X	Liability to B = X	Claim on A = X	Deposit of b = X		
Total = X	Total = X	Total = X	Total = X		

The above process could theoretically end at step 2, where Bank B holds a claim on Bank A in an interbank market. However, most of interbank payments are made in a centralized payment system through the exchange of high-powered money. In that regards, the BIS 2003 report on the role of central bank money in payment systems states: “In these systems, banks hold funds at a common agent (referred to in the report as “settlement institution”). Payments between these banks are made by exchanging the liabilities of this settlement institution (the “settlement asset”).” “In practice, most - although by no means all - payment systems settle in central bank money. In other words, the settlement institution is generally the central bank.” Step 3 (Table 3) shows that high-powered money at the central bank is necessary for interbank settlements in contemporaneous monetary systems, even in the absence of any fractional reserve requirements obligation. This mechanism is in line with the traditional “money divider” vision, where the central bank accommodates banks high-powered money needs.

Table 18: Step 3

Bank A		Bank B		Central Bank (CB)	
Loan to a = X	Facility from CB = X	Reserves at CB = X	Deposit of b = X	Facility to A = X	Reserves of B = X
Total = X	Total = X	Total = X	Total = X	Total = X	Total = X

Remunerated reserve requirements and banks margins

Case 1: Bank A is the lending bank and Bank B is the depositor bank We start at Step 3, where Bank B holds a deposit for its client b, and Bank A holds a loan on its client a. Banks are subject to a fractional reserve requirement obligation at a rate (r) percent of their deposits amount. RR is for reserve requirements, and ER is for excess reserves, which we define as the reserves of a bank held at the central bank above the amount of reserve requirements. In Case 1 (Table 4), the reserves of Bank B, resulting from the settlement of the payment of client a to client b, cover the RR amount equal to $r.X$, and ER equal to $(1-r).X$ are held by Bank B at the central bank.

Table 19: Case 1

Bank A		Bank B		Central Bank (CB)	
Loan to a = X	Facility from CB = X	Reserves at CB = X	Deposit of b = X	Facility to A = X	Reserves of B = X of which: RR = $r.X$ ER = $(1-r).X$
Total = X	Total = X	Total = X	Total = X	Total = X	Total = X

The lending bank's margin (Bank A) is equal to the spread between the lending interest rate and the policy interest rate:

$$Bank\ A\ margin = (i_L - i_{CB}).X$$

The depositor bank's margin (Bank B) is equal to the spread between the policy interest rate and the deposit interest rate, minus the product of the RR rate (r) with the spread between the policy interest rate and the interest rate the central bank pays on reserve requirements:

$$Bank\ B\ margin = [i_{CB}.(1-r) + i_{RRCB}.r - i_D].X = [(i_{CB} - i_D) - (i_{CB} - i_{RRCB}).r].X$$

Where:

i_L is the banks' loan interest rate.

i_D is the banks' deposit interest rate.

i_{CB} is the policy interest rate of the central bank. In order to make the analysis simpler, we assume a perfectly efficient money market (i.e. all money market interest rates are equal to the central bank policy rate): we assume i_{CB} to be the interest rate the CB pays on ER and standing deposit facilities, the interest rate the CB charges on standing lending facilities, as well as the

interbank interest rate on CB reserves. We will discuss the remuneration of ER in a subsequent section.

i_{RRCB} is the interest rate the central bank pays on reserve requirements.

Case 2: Bank A is the depositor bank, and the deposit is generated by a central bank loan to the government or a foreign exchange (FX) deposit A central bank loan to the government (GOV), i.e. a monetary financing of the public deficit - Case 2a (Table 5), and a foreign exchange (FX) deposit in a domestic bank of a non-dollarized economy (which means that this FX deposit is converted at the central bank to domestic money) - Case 2b (Table 6) - have the same effect: they increase the domestic high-powered money and the domestic money supply (bank deposits) in the same amount. If bank deposits created as a result of these transactions are subject to reserve requirements at a rate (r), the excess reserves created are equal to $(1-r).X$, similarly to Case 1.

Table 20: Case 2a

Bank A		Bank B		Central Bank (CB)	
Reserves at CB = X	Deposit of GOV = X			Loan to GOV = X	Reserves of A = X of which: RR = $r.X$ ER = $(1-r).X$
Total = X	Total = X			Total = X	Total = X

Table 21: Case 2b

Bank A		Bank B		Central Bank (CB)	
Reserves at CB = X	Converted FX Deposit = X			FX asset (Deposit at a Foreign Bank) = X	Reserves of A = X of which: RR = r.X ER = (1-r).X
Total = X	Total = X			Total = X	Total = X

In both cases, Bank A's margin is similar to the depositor bank's margin in Case 1:

$$\text{Bank A margin} = i_{CB} \cdot (1-r) \cdot X + i_{RRCB} \cdot r \cdot X - i_D X = [(i_{CB} - i_D) - (i_{CB} - i_{RRCB}) \cdot r] \cdot X$$

Case 3: Bank A is the lending and the depositor bank We start at Step 1, with Bank A subject to a fractional reserve requirement obligation at rate (r) of its deposits amount. This implies that Bank A should borrow a facility from the central bank of an amount equal to r.X, in order to comply with its RR obligation - Case 3 (Table 7).

Table 22: Case 3

Bank A		Bank B		Central Bank (CB)	
Loan to a = X	Deposit of a = X			Facility to A = r.X	Reserves of A = r.X
Reserves at CB = r.X	Facility from CB = r.X				
Total = (1+r).X	Total = (1+r).X			Total = r.X	Total = r.X

$$\text{Bank A margin} = (i_L - i_D) \cdot X - (i_{CB} - i_{RRCB}) \cdot r \cdot X \quad (6)$$

$$\text{Bank A margin} = [i_L - i_D - (i_{CB} - i_{RRCB}) \cdot r] \cdot X = (i_L - i_{CB}) \cdot X + [(i_{CB} - i_D) - (i_{CB} - i_{RRCB}) \cdot r] \cdot X$$

As Bank A is the loan provider and the deposit holder at the same time, its interest margin can be viewed as the sum of the loan margin: $(i_L - i_{CB}).X$, similar to Bank A in Case 1, and the deposit margin: $[(i_{CB} - i_D) - (i_{CB} - i_{RRCB}).r].X$, similar to Bank B in Case 1.

At this stage, we can conclude that whatever the money creation source is (bank loans to the non-bank sector, FX deposits conversion, monetary financing of the public deficit), banks loan and deposit margins are equal to:

$$\text{loan margin} = (i_L - i_{CB}).X \quad (7)$$

$$\text{deposit margin} = [(i_{CB} - i_D) - (i_{CB} - i_{RRCB}).r].X \quad (8)$$

As most banks have comparable loans and deposits amounts in general, Case 3 could be seen as the base case. Equation (1) shows that if a bank sets an interest margin target, in order to cover its operational costs and achieve a profit target, the bank spread (the spread between its lending interest rate and its deposit interest rate) $i_L - i_D$ should counterbalance $(i_{CB} - i_{RRCB}).r$ (the product of the reserve requirements rate (r) with the spread between the policy interest rate and the interest rate the central bank pays on reserve requirements). Therefore, if the central bank remunerates reserve requirements at an interest rate below the policy interest rate (or the money market interest rate), banks spread (the spread between banks lending interest rate and deposit interest rate) will increase. In that regards, Gray (2011) states: “RRs which are unremunerated, or at least remunerated substantially below prevailing market rates, should impact the spread between commercial banks’ deposit and lending rates. Banks need to set a certain spread between deposit and lending rates to cover overheads and allow for a profit; unremunerated RRs add to this spread.”

4.2.2 Foreign currency (dollar)

Dollar deposits and reserve requirements in a dollarized economy In a dollarized economy (i.e. where dollar bank intermediation is allowed), the basic trigger of a dollar deposit in Bank A is the receipt of a payment in favor of its client a, from a bank in a foreign country (United States - US) - Step a (Table 8). The dollar deposit at US Bank was initially created as a result of a loan of US Bank to a US non-bank sector client. Step b (Table 9) shows the case where dollar deposits are subject to reserve requirements at rate (r). It must be noted that the reserve holding of the central bank would not ordinarily consist of a dollar deposit at a US Bank, although that is certainly possible, but more generally of US treasury securities.

Table 23: Step a

Bank A		US Bank		Central Bank (CB)	
Dollar Deposit at US Bank = X	Dollar Deposit of a = X	Loan to US non-bank sector = X	Dollar Deposit of Bank A = X		
Total = X	Total = X	Total = X	Total = X		

Table 24: Step b

Bank A		US Bank		Central Bank (CB)	
Dollar Deposit at US Bank = $X \cdot (1-r)$	Dollar Deposit of a = X	Loan to US non-bank sector = X	Dollar Deposit of Bank A = $X \cdot (1-r)$	Dollar Deposit at US Bank = $X \cdot r$	Dollar Reserves of Bank A = $X \cdot r$
Dollar Reserves at CB = $X \cdot r$			Dollar Deposit of CB = $X \cdot r$		
Total = X	Total = X	Total = X	Total = X	Total = $X \cdot r$	Total = $X \cdot r$

Case 4: Bank A is a dollar depositor and lending bank In Case 4 (Table 10), Bank A holds a dollar term deposit of an amount X, and gives a dollar loan of the same amount X to its client a, creating a dollar sight deposit of the amount X. Both dollar term deposits and sight deposits are subject to reserve requirements at rate (r).

Table 25: Case 4

Bank A		US Bank		Central Bank	
Dollar Deposit at US Bank = $X.(1-2r)$	Dollar Term Deposit = X	Loan to US non-bank sector = X	Dollar Deposit of Bank A = $X.(1-2r)$	Dollar Deposit at US Bank = $X.2r$	Dollar Reserves of Bank A = $X.2r$
Dollar Reserves at CB = $X.2r$	Dollar Sight Deposit of a = X		Dollar Deposit of CB = $X.2r$		
Dollar Loan to a = X					
Total = $2.X$	Total = $2.X$	Total = X	Total = X	Total = $X.2r$	Total = $X.2r$

$$\text{Bank A margin} = i_{\$INT} \cdot (1 - 2r) \cdot X + i_{\$CB} \cdot 2r \cdot X + i_{\$L} \cdot X - i_{\$SD} \cdot X - i_{\$TD} \cdot X$$

$$\text{Bank A margin} = [i_{\$INT} + i_{\$L} - i_{\$SD} - i_{\$TD} - (i_{\$INT} - i_{\$CB}) \cdot 2r] \cdot X \quad (9)$$

Where:

$i_{\$INT}$ is the international interbank dollar interest rate.

$i_{\$CB}$ is the interest rate the central bank pays on dollar reserve requirements.

$i_{\$L}$ is banks interest rate on dollar loans.

$i_{\$SD}$ is banks interest rate on dollar sight deposits.

$i_{\$TD}$ is banks interest rate on dollar term deposits.

In a similar reasoning to that of Case 3 for domestic currency intermediation, the $(i_{\$INT} - i_{\$CB}) \cdot 2r$ component of equation (4) shows that if the central bank remunerates dollar reserve requirements at an interest rate below the international dollar interbank interest rate (which could be seen as an opportunity cost for banks), banks dollar spread (the spread between dollar loans interest rate and dollar deposits interest rate) will increase.

4.2.3 Remuneration-adjusted reserve requirements rate

We view reserve requirements as a regulatory means of constraining banks to hold reserves at an interest rate defined by the central bank. If reserve requirements are not imposed, banks would require an interest rate equal or close to

the money market interest rate, for holding those reserves. Gray (2011) notes that the majority of central banks do not remunerate reserve requirements. He argues that whether reserve requirements should be remunerated, depends on their purposes. If the goal is to widen the spread between deposit and lending rates, or to drain liquidity cheaply, then they should not be remunerated, or at least not fully. But if their purpose is only to support liquidity management, then remuneration is preferable, in order to avoid their distortionary impact on financial intermediation. If the central bank wishes to eliminate the potential distortion, remuneration of reserve requirements should ideally be at or close to the targeted policy rate. If the operational framework is efficient, this should approximate to short term interbank rates.

The remuneration rate of mandatory reserves depends also on central bank's operational costs. Mandatory reserves as a tax on financial intermediation provide an important source of revenue (seignorage) for the central bank. If the central bank cannot set a neutral remuneration interest rate because it is constrained by the overall costs of its operations, the remuneration or reserve requirements could be set slightly lower, for example, 25 bp below its policy target rate. For reserve requirements imposed on foreign currency liabilities of commercial banks and held in foreign currency, the opportunity cost would be the international interbank interest rate for the relevant currency.

As the impact of reserve requirements on interest rate spreads depends on their remuneration by the central bank, reserve requirements rates must be adjusted to take into account the effect of remuneration. Otherwise, the reported rates would not be comparable for panel impact studies purposes.

Alper, Binici, Demiralp, Kara and Ozlu (2014) suggest a remuneration-adjusted reserve requirements rate equal to:

$$r^* = r \cdot [(i_D - i_{RRCB}) / i_D]$$

Herrera, Betancourt, Varela and Rodríguez (2010) calculate a remuneration-adjusted reserve requirements ratio that, without remuneration, yields the same equilibrium interest rates and deposits/loans quantities as the reserve requirements rate that accounts for their remuneration. Their adjustment procedure accounts for the marginal net benefit of a deposit for a competitive retail bank that is subject to remunerated reserve requirements. Following their approach, Brei and Moreno (2019) use a remuneration-adjusted reserve requirements rate equal to:

$$r^* = r \cdot [1 - i_{RRCB} / i_L \cdot (1 - C_L / i_L)]$$

Where:

r^* is the remuneration-adjusted reserve requirements rate.

r is the reserve requirements rate.

i_{RRCB} is the interest rate the central bank pays on reserve requirements.

i_D is the banks' deposit interest rate.

i_L is the banks' loan interest rate.

C_L is the marginal operational costs of bank loans.

The main difference between the two approaches is the interest rate representing the opportunity cost of holding reserve requirements: Alper, Binici, Demiralp, Kara and Ozlu (2014) use i_D as the opportunity cost, while Herrera, Betancourt, Varela and Rodríguez (2010) use i_L . Herrera, Betancourt, Varela and Rodríguez (2010)'s formula is model-dependent and has a number of practical problems, when intended to be applied for empirical purposes. According to our analysis, the opportunity cost of holding reserves is the money market interest rate (equal to the policy interest rate of the central bank, if the money market is perfectly efficient). Therefore, we suggest the below simple remuneration-adjusted reserve requirements rate, that has the advantage of being easily usable for empirical purposes, in line with Alper, Binici, Demiralp, Kara and Ozlu (2014)'s method:

$$r^* = r \cdot [(i_{MM} - i_{RR}) / i_{MM}] \quad (10)$$

Where:

i_{MM} is the money market interest rate; with: $i_{MM} = i_{CB}$ (the policy interest rate of the central bank) if the money market is perfectly efficient.

4.3 The multiple uses of reserve requirements

4.3.1 Reserve requirements as a prudential tool

Gray (2011) argues that the prudential role of reserve requirements may be outdated, as their prudential (liquidity and solvency) goals can be met more effectively and efficiently with other tools, namely regulation (capital adequacy and liquidity requirements), deposit insurance, and standing lending facilities provided by the central bank.

As regards liquidity risk, Carlson (2015) documents that from the late 1830s until 1913, regulatory efforts aimed at promoting bank liquidity in the US consisted primarily of reserve requirements that mandated that individual institutions hold liquid assets. However, these requirements were not sufficient to provide liquidity and prevent banks from suspending deposit withdrawals during banking panics. Reserve requirements created, at best, a static pool of liquidity that banks would compete over during a crisis. The Federal Reserve was then established to enable the expansion of that pool of liquid assets to meet the extraordinary liquidity demands experienced during a crisis. Under the Basel III requirements, banks are subject to a liquidity coverage ratio (LCR). Under this requirement, banks are required to maintain a stock of high-quality and liquid assets as a buffer that is sufficient to cover potential net cumulative cash outflows at all times during a thirty day period. Carlson (2015) argues that the LCR is similar to reserve requirements in that it effectively requires liquid assets to be held against certain classes of liabilities (and lines of credit). As regards solvency risk, i.e. macroprudential considerations relating to excessive bank credit, OECD's report "Reserve Requirements: Current Use, Motivations

and Practical Considerations” (2018) notes that credit growth can be mitigated with other macroprudential tools such as countercyclical capital buffers, sectoral capital requirements, or borrower based tools such as loan-to-value and debt-service-to-income caps.

Our view is that the ultimate form of liquidity, i.e. central bank deposits, is ensured in modern monetary systems through central bank standing lending facilities, that often come with a punitive interest premium above money market rates. As a consequence, in the presence of a lender of last resort, liquidity considerations come down to accumulating high quality liquid assets that could be pledgeable against central bank lending facilities, in the event of a liquidity panic. Thus, accumulating reserves at the central bank is not necessary, as long as depository institutions hold a sufficient share of high quality liquid assets on their books, in line with the logic of the Basel III liquidity standards. More stringent liquidity requirements should be imposed in dollarized banking systems where the lender of last resort is absent, for the foreign currency share of banks intermediation. However, alternative tools may sometimes be difficult to implement in less developed financial systems without liquid securities markets. Therefore, reserve requirements could still be needed as a prudential policy tool in specific situations, depending on countries institutional and economic circumstances.

As regards solvency macroprudential considerations relating to excessive bank credit growth, our view is that they should be addressed from a qualitative angle, and not from a quantitative one as some studies have recently suggested. Increasing reserve requirements ratios and/or lowering their remuneration in order to make bank credit more expensive, may lead to that credit being directed to riskier borrowers, while denying good quality borrowers from access to bank credit, and therefore missing the main target. Borrower based tools that account for borrower quality, such as loan-to-value and debt-service-to-income caps, are in our view, the most suited tools to achieve solvency-related prudential targets, by limiting the growth of risky bank credit.

4.3.2 Reserve requirements as a monetary policy instrument

Monetary policy implementation, the money market, and reserve requirements Di Giorgio (1999) states that many central banks have shifted their operative procedures to the control of short term interest rates rather than of bank reserves, implying a diminished role of reserve requirements as a monetary policy tool. This view assumes that banks faced with a liquidity shock can fully compensate their diminished reserves by borrowing from the central bank, making reserve requirements changes completely neutral³⁸.

³⁸In a contrasting view, Alper, Hulagu, and Keles (2012) recall the bank lending channel literature to explain the liquidity effect of reserve requirements on banks credit. The literature on the bank lending channel, which started with the seminal work of Bernanke and Blinder (1988), suggests the existence of a relation between bank liquidity and bank lending: when the central bank increases the policy rate, it reduces banks reserves, triggering a reduction in banks deposits volume, thus urging banks to shrink their loan portfolio, unless banks are able to offset the drop in loanable funds. The authors argue that not only reserve requirements

As regards the role of reserve requirements in the implementation of monetary policy, Sellon and Weiner (1996) argue that the declining use of reserve requirements strengthens the link between the structure of the payments system and monetary policy operating procedures. Gray (2011) explains that the voluntary demand for central bank reserve balances tends to be unstable. It varies with short term liquidity flows, changes to the structure of the wholesale payment system, and the impact of economic shocks on precautionary demand for reserves. Thus, a system of low or zero reserve requirements may generate greater volatility of short-term interest rates, presenting a challenge for central banks in implementing monetary policy. However, if reserve requirements are set substantially above voluntary demand, the banking system's actual demand for reserves becomes very predictable. In that sense, reserve requirements are a useful monetary policy tool, because they make monetary policy implementation easier, and money market interest rates less volatile.

Open market operations are the standard tool used by central banks to manage banks liquidity. A substantial amount of excess reserves (i.e. reserves held above reserve requirements levels) in the interbank market would push money market interest rates down. In order to drain the liquidity surplus, central banks can also increase the level of reserve requirements. Gray (2011) points out that increasing the level of unremunerated (or under-remunerated) reserve requirements would be a cheap way of sterilizing the impact of the liquidity surplus. The alternatives consisting in draining through open market operations or paying interest on excess reserves represent a cost to the central bank. On the opposite side, reducing the level of reserve requirements in order to provide additional free reserve balances to the banking system has the benefit of not requiring any additional collateral to be provided by the banks, thus leaving collateral in the market to support interbank activity.

The remuneration rate of excess reserves can be used to signal the stance of monetary policy. The interest on excess reserves (IOER) sets a floor to interbank interest rates, since a bank with surplus reserves would have no incentive to lend to another bank at the IOER rate, if it could obtain that rate with no risk from the central bank. It acts similarly to the standing deposit facility interest rate of the central bank in an interest rate corridor system.

Our view is that interbank market interest rates volatility rather comes from the inadequate and inflexible refinancing operations rules operated by a lot of central banks around the world. Banks liquidity shocks would be efficiently absorbed by an agile liquidity management system: a system consisting of a narrow interest rate corridor with on tap standing lending and deposit facilities, coupled with efficient daily open market operations would decrease interbank interest rates volatility significantly, without the need for stabilizing the demand for central bank deposits by imposing reserve requirements.

can affect the aggregate credit supply by widening the spread between deposit rates and loan rates, but also by deteriorating the liquidity positions of banks, in line with the bank lending channel.

The impact of reserve requirements on banks interest rates and intermediation The simple arithmetics we performed in the previous section show that reserve requirements, remunerated at an interest rate below that of the money market interest rate, increase banks spread (the spread between banks lending and deposit interest rates)³⁹.

Case 1 of our analysis represents the extreme case where depository institutions and lending institutions are distinct entities. In that configuration, lending banks margins are not impacted by reserve requirements, as the latter are not imposed on loans. Depositor banks margins are impacted by reserve requirements, when they are remunerated at an interest rate below the money market interest rate. Also, this extreme case shows that the level of banks deposits and loans interest rates increase with the level of the money market interest rate which could be viewed as a refinancing interest rate, in line with the standard interest rate channel of monetary policy, in a bank based financial system. Case 3 of our analysis represents the other extreme where individual banks deposits and loans amounts are perfectly matched. It shows that reserve requirements, when remunerated at an interest rate below the money market interest rate, increase banks margins. However, this case shows that when banks loans and deposits amounts are perfectly matched, the interbank interest rate would not impact the level of banks deposits and loans interest rates substantially, as the policy interest rate of the central bank appears only in the bank margin formula as part of the differential between the policy rate and the interest rate the central bank pays on reserve requirements. This is explained by the fact that, in this situation, banks money market refinancing cost matches exactly with their money market placement income. This can help explain the relative disconnect observed in some cases between policy and interbank interest rates on one side, and banks deposit and loan interest rates on the other side, and could weaken the interest rate channel of monetary policy transmission, which relies on the strength of the pass-through of the central bank policy rate and interbank rate to banks interest rates. However, this disconnect requires the matching between loans and deposits amounts of all banks of the banking system at all times, which is a situation that is rather difficult to observe in practice.

The simple arithmetics we developed in the previous section are market structure independent, i.e. they would apply similarly to a perfectly competitive, imperfectly competitive, oligopolistic and monopolistic banking market structure – only bank margins would decrease with a higher degree of competition. Freixas and Rochet (2008) recognize that a correct modeling of the banking industry is crucial for a better understanding of some empirical results and puzzles that are still lacking a complete theoretical foundation. In that re-

³⁹A key question is whether it is the size of the spread between loan and deposit rates that matters more, or the level of the rates themselves. If a lot of depositors are also borrowers (they are borrowing to obtain liquidity), maybe not simultaneously (although that is certainly often the case) but at least intermittently (borrowing today, paying out the deposits tomorrow, getting other deposits back the day after tomorrow, etc.), then it is the spread that matters. While if most depositors sit on their deposits once they have received them, and most borrowers borrow once and then never see their deposits again, then the levels of rates matter for depositors and borrowers separately.

gards, our view is that designing models of the industrial organization of banks within the framework of the financing model of bank intermediation, instead of that of the loanable funds approach of banking, is a much needed development. The main difference with the loanable funds vision is the fact that client deposits in the financing model are not viewed as a “funding” source. As client deposits transfers between banks are mirrored by interbank central bank deposits transfers, banks compete in the deposits market in order to relieve themselves from the costly refinancing in terms of central bank high powered money. This arbitrage between the cost of direct refinancing from the central bank (or in the interbank money market) and the cost of attracting client deposits aligns the interest rates of client deposits with that of the interbank market, leading to deposits interest rates being equal to those of the interbank market, minus a markdown accounting for banks cost and profit margins.

Reinhart and Reinhart (1999) explain that the requirement to hold unremunerated reserves imposes a tax on banks that is passed through to some extent to banks customers. They note that the reserve tax is borne by those banks customers who only have poor substitutes for banking products. Baltensperger (1980) and Cagan (1972) see that banks have market power in the provision of deposits, but act as price takers in the loan market, because there is little competition for deposits or because differentiation has made bank deposits a unique product. Fama (1985) reversed these assumptions about market power, by arguing that bank customers have alternative investment choices that are perfect substitutes for banks deposits. In this case, the reserve tax is borne by borrowers and bank owners, not depositors. A formal quantitative analysis of the impact of reserve requirements on banks loans and deposits interest rates in different market configurations would require a full microeconomic modeling that is beyond the scope of our current chapter. However, we make a general discussion of the impact of the industrial organization of banking on loans and deposits interest rates in Appendix 3.

Empirical studies of the impacts of reserve requirements on interest rates and other variables are tricky in practice because of the complex nature of the instrument. Adjusting the reserve requirements ratio for their remuneration deals with one dimension only, without accounting for all the other regulatory and operational features of reserve requirements that would impact their effect on other variables. We are only aware of two empirical studies of the impact of reserve requirements on deposits and loans interest rates. Based on data of 97 major banks from five Latin American countries over the period 2000-2014, Brei and Moreno (2019) find an asymmetric response of loan and deposit interest rates to changes in reserve requirements. Higher reserve requirements are associated with lower deposit rates, whereas loan rates remain unchanged during normal times and increase during periods of large capital inflows. In contrast, looking at 19 banks in Turkey in the period 2010-2013, Alper, Binici, Demiralp, Kara and Ozlu (2014) find that an increase in reserve requirements impacts positively both loans and deposits interest rates. They link that result to the “liquidity channel” of higher reserve requirements, inducing the increase of the level of interest rates.

Most of past empirical work analyses the impact of reserve requirements on banks interest margins. Gelos (2009) examines the determinants of banks interest margins in Latin America, using bank and country level data from 85 countries, including 14 Latin American nations. High reserve requirements rates are found to be one of the main reasons of the higher interest margins in the region, alongside the high level of interest rates and banks low operational efficiency which is the reflection of the weaker competitive level of the banking sectors in the region. Chortareas, Garza-García and Girardone (2012), using a sample of over 1700 banks during the period 1999-2006, confirm the role of high reserve requirements, alongside low competitiveness and efficiency, in the persistent high interest rate spreads and low credit availability to the private sector in Latin America. For developed economies, using a sample of 614 banks, Saunders and Schumacher (2000) study the determinants of bank net interest margins in six European countries and the US during the period 1988-1995. They find the opportunity cost of reserve requirements, as proxied by non-earning assets to total average banks assets, to have a positive impact on banks interest margins. They also find banks market power and interest rates volatility to have a positive impact.

Reserve requirements, as a tax on banks, put depository institutions in a situation of competitive disadvantage with respect to other financial intermediaries. In many countries, this concern became more important as non-bank financial intermediaries evolved over time and gained larger shares of the credit market. In that regard, OECD's report "Reserve Requirements: Current Use, Motivations and Practical Considerations" (2018) notes that reserve requirements may move the activity and potential risk to non-regulated financial institutions, and may lead to financial disintermediation if calibrated excessively. Also, financial innovation can make reserve requirements less effective, by creating new instruments that are close substitutes of the assets subject to reserves.

4.3.3 The use of reserve requirements in emerging economies

Reserve requirements and capital flows to emerging economies When central banks in emerging countries increase the policy interest rate to cool down the economy and slow credits, capital flows in and increases credits, stimulating the economy. Thereby, on its own, interest rate may not be an effective policy tool. This deficiency in conventional monetary policy may suggest using alternative macroprudential policy tools that complement the policy rate tool, in an unconventional monetary policy framework. Federico, Vegh, Vuletin (2014) find that around two third of emerging markets use reserve requirements as a countercyclical macroeconomic stabilization tool. At the same time, many developing countries engage in procyclical monetary policy, reflecting the need to defend the currency in bad times by raising policy rates, and the reluctance to raise policy rates in good times to avoid attracting even more capital inflows and further appreciate the domestic currency. In such a situation, by providing a countercyclical tool, reserve requirements policy acts as a substitute for monetary policy. Hahm, Mishkin, Shin and Shin (2012) go even further, by ar-

guing that the introduction of unremunerated reserve requirements for foreign non-deposit liabilities of banks would raise the cost of their foreign funding, and thereby restrain the rapid growth of such liabilities during booms.

Brei and Moreno (2019) examine how banks adjust loan and deposit interest rates in response to changes in reserve requirements, based on disaggregated data from 128 major banks from seven Latin American countries over the period 2000-2014. They find that when facing higher reserve requirements, banks tend to increase loan interest rates, which contains credit growth, while they do not increase or even decrease deposit rates, which mitigates capital inflows and relieves pressure from the capital account. With conventional interest rate policy, banks increase both loan and deposit rates, when facing higher policy interest rates. This suggests that the use of reserve requirements was an efficient way to mitigate the dilemma posed by capital inflows in some Latin American economies⁴⁰.

However, with the development of market finance in emerging economies, we expect that reserve requirements would have less impact on capital flows, as the latter would be increasingly effected via market instruments, away from bank intermediated flows.

Reserve requirements on foreign currency deposits in dollarized economies

Reserve requirements can be an effective tool to favor the use of the domestic currency, and reduce the degree of dollarization in an economy. By increasing the reserve requirements rate on dollar deposits and/or reducing the interest rate paid on these reserve requirements, the central bank widens the interest spread between dollar loans (that become more expensive) and dollar deposits (that become less yielding)⁴¹.

In that regards, Gray (2011) states that some central banks impose higher reserve requirements on foreign currency liabilities, in order to discourage the use of foreign currencies in the domestic economy, without prohibiting it. Also, for the same purpose, reserve requirements held in a foreign currency could be remunerated at a spread below the international interbank rate for that currency. But there are also cases of lower reserve requirements on foreign currency liabilities, to make it easier for the banking sector to attract foreign currency deposits, whether to support the capital account of the country in general, or with the aim of facilitating the provision of export credits in foreign currency, in order to support the export sector. Reserve requirements differentiated by maturity and currency also address the issues of excessive maturity and currency mismatches. Alternative tools addressing the same issues are limits on the net open FX position of banks and liquidity ratios like the Basel III type NSFR and

⁴⁰Other country level empirical studies on the impact of reserve requirements on credit and capital flows show similar results - see for example: Montoro and Moreno (2011) for Brazil, Colombia and Peru; Dassatti Camors, Peydro, Rodriguez-Tous and Vicente (2019) for Uruguay; Mora (2014) for Lebanon; Perez-Forero and Vega (2014) and Armas, Castillo and Vega (2014) for Peru.

⁴¹Castillo, Vega, Serrano and Burga (2016) document the use of reserve requirements in Peru, in order to reduce the dollarization of the banking system.

LCR, differentiated by currency when appropriate.

Constraining banks to hold foreign currency denominated reserves at the central bank boosts the central bank's gross foreign assets, i.e. its gross international reserves. However, it could be argued that foreign currency mandatory reserves must be excluded from international reserves amounts, as they could be withdrawn if the foreign currency deposits they cover are withdrawn. Also, some central banks impose domestic currency denominated reserve requirements on foreign currency deposits. While this measure increases the cost of foreign currency intermediation, it does not achieve the liquidity purpose of holding reserves, as they are not denominated in the same currency as the deposits they cover. In the event of a run on foreign currency deposits, banks would not have readily available foreign currency liquidity to be able to respond to that run. This is critical in dollarized banking systems, in the absence of a foreign currency lender of last resort.

4.4 Conclusion

Our simple arithmetics reflecting the financing model of bank intermediation show that reserve requirements do not have a role in the determination of the level of banks interest rates. However, when remunerated at a rate below the money market interest rate, they increase the spread between bank loans and deposits interest rates, imposing an indirect tax on bank intermediation.

Reserve requirements are too blunt a tool, as any change in their calibration impacts a number of variables at the same time, without a direct control of monetary authorities over those impacts. Monetary authorities can elect to alter the reserve requirements rate and/or their remuneration interest rate, impacting at the same time their tax income, banks deposits interest rates and banks loans interest rates, banks balance sheet composition and liquidity management policy, as well as the central bank's balance sheet size and composition. The Tinbergen rule - Tinbergen (1952) - states that there must be N independent instruments - in the sense that the effects of any one instrument on the objectives are not proportional to those of any other or of any combination of others - in order for a policymaker to hit N policy targets. This rule sees economic tools and targets as a series of interdependent variables. The real world is different, as political economy and system rigidities make policy implementation less mathematical than what a correlation matrix supposes. Our rule for economic policy practice is: a good policy tool must influence one intermediate policy target at a time, without any impact on other intermediate targets, in order to be able to achieve its policy goal without unwarranted impacts on other economic variables. Any policy tool that impacts two or more intermediate policy targets at a time is sub-optimal, as it gives imperfect control to the policy-maker on the final outcome.

The two main features of reserve requirements, that are still useful for economic policy purposes in modern monetary systems, are their ability to influence bank spreads, and being a source of revenue for central banks. The alternative to reserve requirements, consisting in imposing direct taxes on banks deposits

and/or loans interest payments would be a better policy tool to achieve both targets, for the following reasons⁴²:

- Taxes can be easily calibrated by policy-makers, with a direct impact on deposits and loans interest rates. They are less complex and more straightforward than imposing under-remunerated reserve requirements on banks deposits, aiming at indirectly impacting loans interest rate. However, it is important to stress that the incidence of those taxes will still depend on the market power of banks and their clients, i.e. the respective elasticities of loans demand and deposits supply, just like for reserve requirements.

- Taxes on interest incomes can also be applied to interest received and paid on market instruments, avoiding the distortion against intermediated finance. In the case of emerging markets, direct taxes would be more effective in managing capital flows, as they impact both intermediated and market flows.

- Taxes differentiated by instruments, maturities and currencies are a more flexible tool, as they can be adjusted without any direct impact on banks liquidity and collateral, and on the central bank's balance sheet.

Reserve requirements might be sub-optimal and outdated as a prudential tool, as well as a monetary policy tool, in modern monetary systems. However, they might still be useful in less developed financial systems without liquid securities markets, where alternative tools are difficult to implement.

⁴²Hahm, Mishkin, Shin and Shin (2012) argue that a tax or levy on banks liabilities would have a similar effect to reserve requirements on those liabilities.

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Appendix 1: IMF international survey of reserve requirements rates in 2010

Figure 37: Reserve requirements levels by country in 2010

No RR	One RR	0-5	One RR	6-15	One RR	>15
Australia	Azerbaijan	0.5	Afghanistan	8	Bhutan	16
Canada	Bahrain	5	Albania	10	Cape Verde	25
Denmark	Burundi	3	Algeria	8	Comoros	25
Mexico	Czech Rep	2	Belize	8.5	Iraq	22
New Zealand	ECB	2	Chile	6.8	Liberia	15.5
Norway	Georgia	5	Costa Rica	15	Malawi	25
Sweden	Hungary	2	Croatia	13	Maldives	24.5
Timor Leste	India	5.75	ECCB	6	Sao Tome & Principe	16
United Kingdom	Kenya	4.5	Eritrea	10	Bhutan	25
	Lesotho	3	Ethiopia	15	Cape Verde	25
	Malaysia	1	Fiji	7	Comoros	22
	Mauritius	4.5	Ghana	9	Iraq	15.5
	Mongolia	5	Guatemala	14.8	Liberia	25
	Namibia	1	Guyana	12	Malawi	24.5
	Nepal	5.5	Jordan	7		
	Nigeria	1	Mauritania	7		
	Oman	5	Moldova	8		
	Papua New Guinea	3	Morocco	8		
	Qatar	4.75	Mozambique	8		
	Russia	2.5	Myanmar	10		
	Rwanda	5	Philippines	8		
	Samoa	4.5	Seychelles	10		
	Singapore	3	Sierra Leone	12		
	South Africa	2.5	Sri Lanka	7		
	Swaziland	2.5	Syrian Arab Rep.	10		
	Switzerland	2.5	Tanzania	10		
	The Bahamas	5	Uganda	9.5		
	Tonga	5	Zambia	8		
	Vanuatu	5				
9	29		28	8		

Range of RR	0-5	Range of RR	5-15	Range of RR	>15
Bangladesh	(2.5-5)	Argentina	(0-20)	Angola	(30-100)
BCEAO	(3-9)	Armenia	(8-12)	Brazil	(4-42)
Belarus	(0-6)	Bolivia	(2-12)	Kuwait	(10-100)
Bulgaria	(0-10)	Cambodia	(5-12)	Lebanon	(15-25)
Colombia	(0-11)	China	(14-16)	Paraguay	(15-21)
Iceland	(0-2)	Dominican Republic	(10-17)	Serbia	(10-100)
Indonesia	(1-7.5)	Egypt	(10-14)	Suriname	(25-33)
Israel	(0-6)	Honduras	(6-12)		
Japan	(0.05-1.3)	Iran	(10-17)		
Kazakhstan	(0-2.5)	Jamaica	(1-14)		
Korea	(0-7)	Macedonia	(10-20)		
Lao	(2-5)	Pakistan	(0-20)		
Poland	(0-3)	Peru	(6-30)		
Saudi Arabia	(4-7)	Romania	(0-25)		
Thailand	(0.2-6)	Tajikistan	(7-9)		
Tunisia	(1-7.5)	Trinidad & Tobago	(2-17)		
Ukraine	(0-4.7)	Turkey	(5-9)		
		United Arab Emirates	(1-14)		
		United States	(0-10)		
		Uruguay	(9-12)		
		Uzbekistan	(910-15)		
		Vietnam	(1-12)		
		Yemen	(7-20)		
17		23		7	

Table source: Gray (2011), IMF survey of central banks.

Appendix 2: Reserve requirements regulations in the US, the Eurozone, Brazil and Turkey

United States: For many years, reserve requirements were seen to play an important role in the implementation of monetary policy in the US by creating a stable demand for reserves. In January 2019, the FOMC announced its intention to implement monetary policy in an ample reserves regime. Reserves are considered ample when the Fed's supply is at least large enough so that the equilibrium Federal Funds Rate does not materially change with movements in the quantity of reserves of the banking system. When implementing monetary policy in an ample reserves regime, the Fed primarily relies on its administered interest rates to keep the Federal Funds Rate within the target range. Reserve requirements do not play a significant role in this operating framework. On March 15 2020, the Federal Reserve Board reduced reserve requirements ratios to zero percent effective March 26, 2020. This action eliminated reserve requirements for all depository institutions.

Euro Area: The European Central Bank requires credit institutions established in the euro area, as well as branches in the euro area of credit institutions established outside the euro area, to hold deposits on accounts with their national central bank - vault cash is not eligible for satisfying minimum reserves. The key functions of the minimum reserve system are to stabilize money market interest rates and to enlarge the structural liquidity shortage of the banking system. The amount of required reserves to be held by each institution is determined by its reserve base multiplied by the reserve ratio. This reserve ratio was set at 2% at the start of Stage 3 of the EMU and is lowered to 1% from 18 January 2012. Institutions deduct a uniform lump sum allowance of 100,000 Euros from their reserve requirements. Compliance with minimum reserve requirements is determined on the basis of the average daily balances of the institution's reserve accounts over one reserve maintenance period. Required reserves are remunerated at the marginal rate of the main refinancing operations during the reserve maintenance period. Liabilities included in the reserve base and to which the positive reserve ratio is applied are: overnight deposits, deposits with agreed maturity up to 2 years, deposits redeemable at notice up to 2 years, debt securities with agreed maturity up to 2 years, money market papers. Liabilities included in the reserve base and to which a zero reserve ratio is applied are: deposits with agreed maturity over 2 years, deposits redeemable at notice over 2 years, repos, debt securities with agreed maturity over 2 years. Liabilities excluded from the reserve base are: liabilities vis-à-vis other institutions subject to the Eurosystem's minimum reserve system, liabilities vis-à-vis the European Central Bank and the national central banks.

Unlike the previous Federal Reserve's mandatory reserves regulation that requires depository institutions to comply with reserve requirements on a daily

basis, the ECB's regulation allows depository institutions to comply on a 3-weeks average basis. It gave Euro zone's banks the time to comply with their reserves requirements during the 2008 crisis. This played a countercyclical role in the Euro zone while the Fed's regulation worsened banks' liquidity positions during the same period.

Brazil: Carvalho and Azevedo (2008) make a historical review of the use of reserve requirements in Brazil since their introduction in 1932. They document that they were mainly used as a fiscal tool until 1993, then as a monetary policy instrument until 2003. However, even after the explicit adoption of interest rates as the main monetary policy instrument, their phasing out has been hindered by the entanglements of fiscal and monetary policy. They point to the fact that the recent regulation on reserve requirements in Brazil is very cumbersome. Reserve ratios, interest accrued on reserves, forms of compliance (cash, securities or vault cash), and authorized deductions from the reservable base differ across types of banks liabilities and assets. The high frequency of changes in the regulation of reserve requirements in Brazil brings about an additional difficulty to banks. For the past thirty years, the number of changes in reserve ratios, calculation and maintenance periods, exemption base, required daily balances as a share of total requirement, and reporting procedures has been substantial. Robitaille (2011) makes a detailed narrative analysis of the Brazilian experience with reserve requirements as a liquidity management tool, before and during the global crisis. He highlights the practical complexity of reserve requirements and the changes they could induce in bank behavior that have undesirable consequences.

Currently, Banco Central do Brasil still uses reserve requirements as a monetary policy tool. However, in the last years, reserve requirements have assumed additional functions, like being a source of liquidity to guarantee the Brazilian Payments System (SPB) payments flow, and serving as a macroprudential tool contributing to the stability of the National Financial System (SFN). In December 2020, demand deposits were subject to unremunerated reserve requirements at a 21% rate, time deposits were subject to a 17% reserve requirements rate remunerated at the Selic rate (weighted average interest rate of the overnight interbank operations, collateralized by federal government securities, carried out at the Special System for Settlement and Custody), resources from realized guarantees were subject to unremunerated reserve requirements at a 45% rate, and savings deposits were subject to a 20% reserve requirements rate remunerated at a variable rate indexed to the reference rate (TR). Reserve balances must be held in specific reserves sub-accounts at the central bank.

Turkey: Reserve requirements are an important monetary policy instrument for the Central Bank of the Republic of Turkey, within the policy framework that took effect in the last quarter of 2010, aiming at reducing macro financial risks within the limits of a favorable inflation outlook.

On 19 November 2020, the reserve requirements regulation was simplified in order to increase the effectiveness of the monetary transmission mechanism. This consisted in repealing the reserve requirements practice that links reserve requirements ratios and remuneration rates to banks real loan growth rates, applying the same reserve requirements ratios and remuneration rates to all banks,

applying a remuneration rate of 12% to the Turkish lira denominated required reserves of all banks, and decreasing the commission rate applied to reserve requirements on USD denominated deposits and participation fund liabilities from 1.25% to 0%.

Reserve requirements rates are set at a higher level for FX liabilities than for Turkish lira liabilities. For Turkish lira liabilities, the reserve requirements rate is set at 6% for demand and one to three months notice deposits. For notice deposits of up to six months it is set at 4%, at 2% for notice deposits of up to a year, and at 1% for those over one year. For borrower funds of investment banks, the rate is set at 6%. For other liabilities of up to a year it is set at 6%, 3.5% for those up to three years and 1% for those longer than three years. For FX liabilities, the reserve requirements rate is set at 19% for demand and one to six months notice FX deposits and 13% for FX deposits with notice intervals longer than one year. Precious metal deposits accounts reserve requirements rates were raised to 22% for demand and notice deposits of up to one year and to 18% for those longer than a year. For borrower FX funds of investment banks, the rate is set at 19%. For other FX liabilities, the rate is 21% for notice deposits of up to one year, 16% for those up to two years, 11% for up to three years, 7% for up to five years and 5% for longer than five years. Vault cash is not eligible for satisfying reserve requirements.

Appendix 3: The microeconomics of banking, competition and interest rates

The microeconomic approach focuses on the implications of modeling banks as independent entities that optimally react to their environment, instead of simply considering the banking sector as passive, as in the standard macroeconomic approach to monetary policy. Bank loans and deposits interest rates are the prices of bank products. The theoretical starting point for the microeconomic analysis of bank interest rates is the application of a standard marginal cost pricing model to banking.

In a competitive model, banks are supposed to be price takers. They take as given the interest rates of loans and deposits, and the interest rate on the interbank market. The results of the competitive model exposed in Freixas and Rochet (2008) show that under the assumption of an exogenous interbank market rate controlled by the central bank (which is the case of modern banking systems), the interest rate on loans would be unaffected by reserve requirements, and only the deposit interest rate would be impacted.

The Monti-Klein model - see Klein (1971) and Monti (1972) - considers a monopolistic bank confronted with a downward-sloping demand for loans and an upward-sloping supply of deposits. Their results show that the smaller the interest elasticity of deposits supply and of loans demand, the greater the market power of the bank on those market segments. Bank margins are higher when banks have a higher market power. The Monti-Klein model can be reinterpreted

as a model of imperfect competition between a finite number of banks, which is a more accurate description of the present reality of banking sectors around the world.

Both models show that the interest rate pricing of loans and deposits is determined in terms of spreads to the interbank rate that is seen as the funding cost of banks. Thus, the interbank rate constitutes the level around which bank loans and deposits rates are determined, no matter what the market structure is. For perfectly competitive banking sectors, this could be seen in the model exposed in Freixas and Rochet (2008) – page 75. For monopolistic and oligopolistic market structures, the Monti-Klein Model shows a similar result, where the spread of loans and deposits interest rates to the interbank rate depends on their interest elasticity.

The Handbook of Competition in Banking and Finance (2017) reviews the existing literature on the link between the competition in the banking sector and banks interest rates. As long as banks are not facing completely elastic demand for loans and supply of deposits, we are in a world of imperfect competition. The most important reasons for imperfect competition in retail banking are market power of banks, market power of customers, existence of close substitutes for banking products (for example direct finance for borrowers, access to money markets for depositors), switching costs for customers, information asymmetries (adverse selection, moral hazard), and regulation (for example barriers to entry and exit, openness and contestability of banking markets).

The level of development and the quality of institutions could mitigate the increase of banks market power. Thus, more developed countries or regions such as the US and the EU generally have the most competitive banking markets, followed by Latin America. Banking sectors in Asia, Africa and the Middle East are generally less competitive, with marked differences between countries in the same region. Most empirical studies find that bank concentration, and the market power of banks, either remained constant or increased over the last 30 years. In the US, the market power of banks is consistently found to increase, whereas it remains constant or slightly increases in Europe depending on the country and period under consideration. For developing countries this trend is less marked.

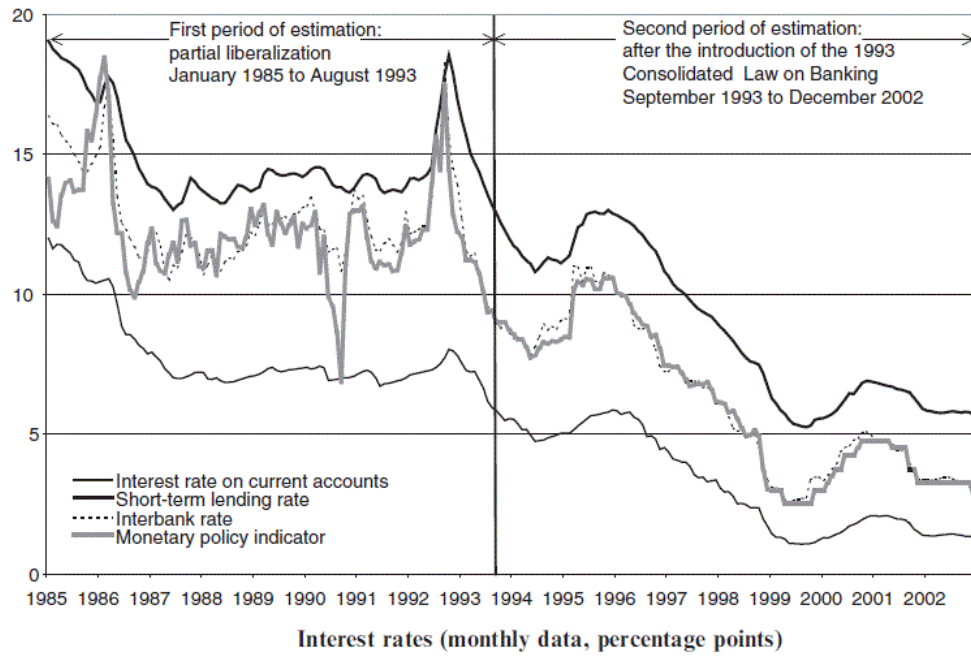
As money market interest rates represent the marginal cost of lending, loan rates should be equal to the money market rate plus a mark-up for maturity transformation, financial risks, and other management costs. Similarly, deposit rates should equal the money market interest rate plus a mark-down for management costs and costs of holding minimum reserve requirements. In modern banking a full pass-through from the money market interest rate to retail interest rates is likely to be the exception rather than the rule. The size of the long run pass-through differs widely across products and countries, and is an important indicator of the level of banking market competition. Imperfect competition is associated to a long run pass-through coefficient below one. A second feature of the interest rate pass-through is the speed with which changes in the marginal cost of funding are passed on to customers, i.e. how long it takes to reach the long run equilibrium. If a long run equilibrium exists, this is modeled as an error

correction process to overcome the disequilibrium over time. More competition would lead to a faster return to the long run equilibrium, while price rigidity in banking is seen as a feature of an imperfectly competitive banking market. A related feature that reveals imperfect competition is the degree of asymmetric adjustment. As banks have market power over their customers they can exploit this power by changing lending rates faster in response to increases than to decreases of money market rates, and vice versa for deposit rates. In sum, evidence on the size, speed, and asymmetry of the interest rate pass-through can reveal shortcomings in competitive pricing related to imperfect competition in banking.

The evidence for a positive impact of competition on the interest rate pass-through is overwhelming in empirical studies. The failure of some studies to identify positive competition effects relates mostly to problems in measuring competition at the product level with the right indicators. The most common approach to identify the degree of competition in the banking industry are measures of market structure, typically concentration ratios like market shares of the largest three or five banks, or the Herfindahl-Hirschman index. The more recent approach assumes that banks respond to changes in supply and demand conditions without taking into account market structure. Prominent measures of this approach are the Panzar–Rosse H-statistic and the Boone indicator, while other studies use the familiar Lerner index. These metrics should ideally be measured at the product level, as loan demand and deposit supply interest elasticities are essential determinants of the interest rate pass-through. Empirical studies of loans and deposits interest elasticities have been performed since early days and have adopted different econometric approaches. They found different elasticity ranges and some non-linearities depending on the country, period and the loan or deposit market segment under consideration.

The below Figure 2 taken from Gambacorta and Iannotti (2007) shows visually the improvement in the pass-through from the policy rate to the money market rate, and further to bank loans and deposits interest rates during the banking sector liberalization process in Italy, that substantially increased the degree of competition in the Italian banking sector during the 1985 – 2003 period.

Figure 38: Banking liberalization and interest rate pass-through in Italy (1985-2003)



Graph source: Gambacorta and Iannotti (2007)

5 Foreign Currency Intermediation: Systemic Risk and Macroprudential Regulation

Abstract

Despite the progress made on the empirical front, normative analyses are still lacking when it comes to foreign currency intermediation (partial dollarization of the domestic banking system) and the ways to address its systemic risks implications. In this chapter, we make a comprehensive analysis of the liquidity and the foreign exchange (FX) systemic risks implied by foreign currency intermediation. We explain the trade-off between the positive effect of foreign currency intermediation on growth in tranquil times and its negative effect in terms of financial fragility. We review the narrative and econometric country studies that have been done so far to assess the effectiveness of FX-related macroprudential measures. Through the results of past studies and a comparison of the experiences of Latin American and transition European economies, we show the advantages of administrative macroprudential measures over price-related measures in dealing with liquidity and FX systemic risks. We show that neutralizing those systemic risks is possible without aiming at directly limiting or banning foreign currency intermediation (i.e., dedollarizing). We argue that dedollarization is a more ambitious target that must be justified by the other inconveniences of foreign currency intermediation, and we stress that sound monetary management should be a prerequisite to dedollarization.

Keywords: Foreign currency intermediation; Dollarization; Systemic risk; Macroprudential regulation.

JEL Classification: E42; E58; F33; G28

This chapter has been published in Latin American Journal of Central Banking (Elsevier): Bitar J., Foreign currency intermediation: systemic risk and macroprudential regulation, Latin American Journal of Central Banking, 2(2), June 2021

<https://www.sciencedirect.com/science/article/pii/S2666143821000089>

5.1 Introduction

The debate on the risks related to foreign currency intermediation extends for decades, and many prominent economists have been involved in it. This chapter aims at updating the traditional financial dollarization debate with recent findings on cross-border banking and macroprudential regulations. It is motivated by the fact that, despite the progress made on the empirical front, normative analyses are still lacking when it comes to foreign currency intermediation (partial dollarization of the domestic banking system) and the way to address its systemic risks implications. We aim at analyzing the liquidity and foreign exchange (FX) systemic risks implied by foreign currency intermediation. The liquidity risk of banks under foreign currency intermediation is linked to the absence of a lender of last resort in the foreign currency. Moreover, banks face a direct FX risk linked to the currency mismatch on their balance sheets as well as an indirect FX risk resulting from the FX-related default risk of their unhedged borrowers.

After defining and discussing the main concepts relating to our analysis, we review the narrative and econometric country studies that have been done so far to assess the effectiveness of FX-related macroprudential measures. Building on their results, we propose a normative analysis to question the optimality of those measures beyond the debate that has focused so far on their effectiveness.

While capital controls are measures that restrict capital transactions (or transfers and payments necessary to effect them) by virtue of the residency of the parties to the transaction, FX-related prudential measures are measures that discriminate by virtue of the currency denomination of the capital transaction, not the residency of the parties to the transaction⁴³. We discuss the different FX-related macroprudential tools that have been used by different countries. We focus on the FX-related risks of the domestic banking system, as we see that direct cross-border foreign currency lending of foreign banks and nonbank lenders to the domestic nonbank sector is less of a problem for the domestic economy⁴⁴. However, if regulators see the need for the regulation of the nonbank sector, borrower-side regulations limiting foreign currency mismatch on its

⁴³See Ostry, Ghosh, Chamon, and Qureshi (2012) for a discussion.

⁴⁴In case of nonbank sector defaults resulting from a sharp movement of the exchange rate, the disruption in economic activity would only come from the defaulting debtors' side, without a direct influence on the stability of the domestic banking sector. This limits the loss for the domestic economy, as the loss on the creditor side is borne by a nonresident entity. However, when a large domestic firm defaults on its foreign debt obligations, this can have consequences for all other domestic firms (and even for the government), because lenders and rating agencies would consider the country riskier, which endangers future foreign borrowing. This can lead to higher interest charges to all domestic firms or even to a full suspension of foreign lending to those firms. This lack of access and/or higher costs of foreign capital can affect the domestic economy – for example, for financing imports and rolling over external debt. Moreover, a firm that borrows abroad is often a large company and is very likely to have domestic loans too. When the firm defaults on its foreign loans, there is a high probability that it will also default on its domestic loans. On balance, as the domestic economy would have largely benefited from the capital inflow resulting from foreign credit, the total outcome would most probably still be positive in the long run. Empirical studies exploring the effects of the default on foreign debt of the nonbank private sector are needed to shed some light on these questions.

balance sheets would be a good option to consider.

After being general at the beginning, studies on the effects of macroprudential measures are starting to focus on subsets of tools⁴⁵. Studies focused on FX-related macroprudential measures are starting to develop in the literature - for example: De Crescenzo, Golin, and Ott (2015), De Crescenzo, Golin, and Molteni (2017), and Ahnert, Forbes, Friedrich, and Reinhardt (2018). Different combinations of measures have been used so far to tackle indifferently FX risk and dedollarization in different countries. On the basis of these studies and a number of country experiences, we show the advantages of administrative measures over price-related measures as tools to achieve both targets.

We compare two diverging experiences with foreign currency intermediation in Central and Eastern Europe and in Latin America. Transition European economies have mainly seen the benefits of foreign currency intermediation in terms of capital inflows, credit availability, and economic growth, while Latin American economies have been mostly marked by the crisis amplification mechanisms associated with foreign currency intermediation. Past literature has linked the reduction of the systemic risk implied by foreign currency intermediation to the reduction of its share in domestic banking systems (i.e., dedollarization; see, for example, Zettelmeyer, Nagy, and Jeffrey, 2010, and Vidahazy and Yesin, 2020). We argue that neutralizing the systemic risks linked to foreign currency intermediation is possible without aiming at directly limiting or banning foreign currency intermediation. However, by neutralizing or reducing those systemic risks, foreign currency intermediation would be constrained and its positive influence on growth would be diminished. We argue that dedollarization is a different and more ambitious target that must be justified by the other inconveniences of foreign currency intermediation: the loss of monetary policy as a macroeconomic management tool, the loss of monetary sovereignty, and the seignorage paid to a foreign country. If domestic monetary management is unsound, measures aiming at banning or limiting the use of foreign currencies would be counterproductive, as agents would circumvent them (at

⁴⁵Dimova, Kongsamut, and Vandenbussche (2016) point to the fact that most of the existing econometric literature does not capture well the diversity in the design of macroprudential measures and the strength of the measures taken. This translates into studies in terms of instruments (i.e., policy measures ignoring their calibration and implementation context) that make categorical conclusions about their effectiveness, whereas it is reasonably expected that an instrument's effectiveness would depend on its proper calibration. Therefore, it is much more useful to assess measures' effectiveness rather than instruments' effectiveness. Assessing the effectiveness of macroprudential measures is a challenging task, as we cannot observe what would have happened if no measures had been taken. For example, it may be the case that the implementation of a measure prevented an increase in a financial stability risk metric and that, as a consequence, no change in that metric was observed. In such a case, one may conclude incorrectly that the measure was not effective. To overcome this issue, Tobal (2018) used the synthetic control method that controls for unobservable characteristics that vary over time by constructing a synthetic unit and using it as counterfactual - see Abadie and Gardeazabal (2003) and Abadie, Diamond, and Hainmueller (2010). Moreover, measures could have been anticipated to various extents, may work with different lags, may not be immediately and totally binding, and may interact with each other. In addition, the effect of macroprudential measures can be highly nonlinear, while most existing econometric studies are based on linear specifications. All these challenges have to be addressed properly by econometric studies.

least partially) away from the banking sector via market financing and direct foreign borrowing. Such measures have resulted in some cases in increased capital flight and disintermediation (Bolivia and Mexico in 1982 and Peru in 1985), which have had adverse effects on real economic activity. In some instances, the authorities have been obliged to reverse the measures (Bolivia and Peru).

The analysis we undertake in this chapter is important for policy makers in emerging and developing economies, who are currently still in the middle of the trial-and-error process of FX-related macroprudential policy design. Our main recommendations are as follows: (1) the ultimate measure to neutralize the direct FX systemic risk is a strict currency matching requirement of banks' balance sheets; (2) for indirect FX-induced credit systemic risk, we recommend limiting foreign currency credit to borrowers whose incomes are perceived in the foreign currency; (3) for foreign currency liquidity systemic risk, we recommend a 100% reserve requirements obligation on foreign currency deposits, held in low-risk liquid foreign assets. All three measures we propose directly target the sources of the systemic risk - as opposed to indirect price-related measures aimed at reducing those risks. As those measures restrict foreign currency intermediation, they pose a trade-off for regulators. We suggest that they should be relaxed if the domestic economy needs a higher level of foreign currency intermediation, bearing in mind that this would necessarily come at the cost of higher systemic risk. We argue that price-related measures can still be useful in some instances as transitory tools to induce agents to switch gradually towards the use of the domestic currency. However, when monetary management becomes sound and gains credibility, administrative measures must be implemented to restrict the use of foreign currency to transactions related to international trade exclusively.

The remainder of the chapter is organized as follows. In section 2, we review the ongoing research on systemic risk and macroprudential regulation related to foreign currency intermediation, and we define the main concepts of our analysis. In section 3, we discuss country experiences with FX-related macroprudential policy. In section 4, we propose regulations to deal with the systemic risks implied by foreign currency intermediation and discuss the trade-off they pose. In addition, we discuss the rationale behind dedollarization and expose the advantages of administrative measures over price-related measures in achieving it. In section 5, we make concluding remarks.

5.2 Literature review

In this section, we review the literature relating to systemic risk and macroprudential regulation linked to foreign currency intermediation. We define the concepts we use in this chapter by comparing them to the concepts used in the related literature. We group our literature review into five strands as follows: the rationale behind foreign currency intermediation, the systemic risks linked to foreign currency intermediation, the rationale behind macroprudential regulation, FX-related macroprudential regulation, and the trade-off posed by FX-related macroprudential regulation.

5.2.1 The rationale behind foreign currency intermediation

Foreign currency intermediation has two main benefits. Its first benefit is to provide an alternative stable currency to the economy when domestic monetary management is unsound. We broadly define sound monetary management as management that preserves the internal and external value of the domestic currency, resulting in low inflation and a relative stability of the nominal exchange rate. The broad literature on dollarization shows that the main trigger for holding deposits and contracting bank loans in foreign currencies, is episodes of domestic monetary instability characterized by a high inflation level. As documented in most past research (see, e.g., Levy-Yeyati, 2006), high levels of inflation deteriorate the ability of the domestic currency to play its roles as a store of value, a unit of account, and sometimes a medium of exchange. Other explanations such as the portfolio choice view have been proposed to explain foreign currency intermediation. For example, Havrylyshyn and Beddies (2003) show that foreign currency was used (in both cash and deposit forms) as one of the few alternative instruments for portfolio diversification in former Soviet Union countries. The second benefit of foreign currency intermediation is to facilitate the inflow of foreign capital to the economy when it is needed for domestic activity. Although this motive has not been explicitly put forward in the literature, it has always been implicitly present. Foreign currency funding of domestic banks is done through (1) customers' foreign currency deposits, as is prevalent in many Latin American countries - for a recent detailed survey on financial dollarization in Latin America, see Levy-Yeyati (2021) - and/or through (2) international banks' funding of domestic banks and local subsidiaries of foreign banks, as is prevalent in most emerging European countries; see, for example, Rosenberg and Tirpak (2008), Zettelmeyer, Nagy, and Jeffrey (2010), Basso, Calvo-Gonzalez, and Jurgilas (2011), Haiss and Reiner (2012), and Vidahazy and Yesin (2020). What is specific about this form of capital inflow is that it allows foreign banks to finance domestic small companies and households while reducing their credit risk by being indirectly exposed through local banks. Foreign banks willing to finance domestic nonfinancial small and medium companies cannot perform that task directly, as this requires an active presence in the local credit market. By providing this financing through local banks, foreign banks benefit from the implicit bailout guarantee of domestic governments aiming at preserving their banking systems. International interbank credit to emerging markets has been largely denominated in hard currencies so far, which reflects the "original sin" hypothesis that translates the unwillingness of international investors to be exposed to the risk of domestic currencies. However, as has been observed recently in international bonds markets, the stabilization of domestic currencies of emerging economies has led international investors to increase their share of investment in local currency denominated bonds (see, e.g., Jeanneret and Souissi, 2016). This trend might extend to international interbank credit, in which case its link with foreign currency intermediation would weaken.

5.2.2 Systemic risks linked to foreign currency intermediation

FSB – IMF – BIS (2009) defines systemic risk as a risk of disruption to financial services that is (i) caused by an impairment of all or parts of the financial system and (ii) has the potential to have serious negative consequences for the real economy. Foreign currency intermediation is associated with two types of systemic risks: a liquidity systemic risk and a foreign exchange (FX) systemic risk.

Foreign currency intermediation and liquidity systemic risk - We present in Table 26 the case of a domestic bank A that holds a foreign currency (FC) deposit of an amount X and gives a foreign currency loan of the same amount to the nonbank client a' . In our example, foreign currency deposits are subject to reserve requirements deposited at the central bank (CB) (r is the rate of reserve requirements). By giving a foreign currency loan, the domestic bank creates foreign currency money. While the domestic banking sector's gross foreign currency assets held at the international bank (Int. Bank) are X , the foreign currency money aggregate in the domestic economy is $2X$. The simple transaction of giving a foreign currency denominated loan financed by a foreign currency deposit is money creation in a currency other than the sovereign currency. In other words, while its gross foreign currency assets are X , the banking system "multiplies" this amount (by a factor of 2 in our example) in the same way that it multiplies the domestic money base in a standard fractional reserves monetary system. Thus, gross liquid foreign assets of banks can be seen as their "foreign currency money base." The domestic banking sector bears a foreign currency liquidity risk as a result of this operation. In the absence of a lender of last resort for foreign currency, banks must carefully manage liquidity risk, which limits their multiplication potential. The imposition of 100% reserve requirements on foreign currency deposits (total coverage) is the only way of preventing any foreign currency creation and the resulting foreign currency liquidity risk in dollarized banking systems. These reserves need to be held in the form of low-risk foreign liquid assets. Similarly, if the domestic bank funds this foreign currency loan with a foreign bank loan (i.e., with a noncore liability, not a customer's foreign currency deposit), this liquidity risk exists in the case that the foreign bank does not roll over its loan to the domestic bank until the expiry of the loan that the domestic bank granted to its client. This implies that the domestic bank has to ensure a stable foreign currency funding to avoid the foreign currency liquidity risk. When the domestic banking system is legally allowed to hold customers' foreign currency deposits and to extend foreign currency loans, the gross liquid foreign assets of the banking system (foreign currency liquidity) play the role of the money base in a fractional reserves system. Foreign currency liquidity originates either as a counterpart of real transactions (operations of the current/capital accounts of the balance of payments) or as a counterpart of financial flows (operations of the financial account of the balance of payments). In the early literature on dollarization, the expression of the liquidity risk linked to foreign currency intermediation was the problem of the absence of a lender of last resort in dollarized economies (Ize,

Kiguel, and Levy-Yeyati (2005), Levy-Yeyati (2006)). This systemic liquidity risk was at the center of the Argentine 2001-2002 convertibility crisis, which led to the famous forced pesofication. It is also at the center of the recent crisis of Lebanon's monetary system, where banks suspended the withdrawal and the international transfer of customers' dollar denominated deposits.

Table 26: Foreign currency credit and liquidity

Bank A		Int. Bank		Domestic Central Bank	
1. FC Deposit at Int. Bank = $X.(1-2r)$	4. FC Deposit of Client a = X	1. Loan to Int. nonbank sector = X	2. FC Deposit of Bank A = $X.(1-2r)$	1. FC Deposit at Int. Bank = $X.2r$	2. FC Reserves of Bank A = $X.2r$
2. FC Reserves at CB = $X.2r$	5. FC Deposit of Client a' = X		3. FC Deposit of CB = $X.2r$		
3. FC Loan to Client a' = X					
Total = $2.X$	Total = $2.X$	Total = X	Total = X	Total = $X.2r$	Total = $X.2r$

Foreign currency intermediation and FX systemic risk – FX systemic risk is linked to the currency mismatch of balance sheets and income flows of economic agents. We will start by briefly explaining the shortcomings of previous currency mismatch indicators that have been used in the literature before retaining the definition that we deem the most appropriate for the analysis of FX systemic risk. As discussed in detail in Tobal (2018), the literature has constructed different classes of currency mismatch indicators. The earliest measures known as original sin indicators⁴⁶; see Eichengreen, Hausmann, and Panizza (2003) - have been criticized for ignoring the asset side of balance sheets that constitute a hedge of the foreign currency risk. In response to this defect,

⁴⁶Barry Eichengreen, Ricardo Hausmann, and Ugo Panizza defined original sin in 2002 as a situation in which most countries cannot borrow abroad in their own currency. They showed that almost all countries (except the US, the Euro area, Japan, the UK, and Switzerland) have suffered from original sin over time. They found that weaknesses of national macroeconomic policies and institutions are not statistically related with original sin and that the only statistically robust determinant of original sin was country size. They argued that international transaction costs, network externalities, and global capital market imperfections were the main reasons for the original sin.

measures that look at both sides of the balance sheet were used, such as external vulnerability indicators; see Goldstein and Turner (2004). However, these indicators have the problem of being based on the residence criteria and are frequently not disaggregated by currency of denomination. The measure developed by Lane and Shambaugh (2010) represents an improvement relative to both the original sin and the external vulnerability indicators in that it considers both sides of a country's international balance sheet and uses data disaggregated by currency of denomination. However, the problem with this approach is that it is aggregated at the country level. The use of country-level data is even more inappropriate in cases where residents establish foreign currency relationships among themselves, as in the case of financially dollarized economies.

We retain in our chapter the definition of currency mismatch given by Chui, Kuruc, and Turner (2016): A currency mismatch between domestic and foreign currencies arises whenever an entity's balance sheet or income flows (or both) is sensitive to changes in the exchange rate. The "stock" aspect of a currency mismatch is given by the sensitivity of the balance sheet to changes in the exchange rate, and the "flow" aspect is given by the sensitivity of the income statement (net income) to changes in the exchange rate. The greater the degree of sensitivity to exchange rate changes, the greater the extent of the currency mismatch. Currency mismatch and the resulting FX risk should be assessed at the entity level and must encompass both stock and flow mismatches.

Foreign currency intermediation entails a direct systemic FX risk if it results in currency mismatches on the balance sheets of domestic banks. An indirect FX-related credit risk also exists if banks provide foreign currency loans to borrowers whose incomes are perceived in the domestic currency⁴⁷, who would default on their loans in the event of a sharp depreciation of the domestic currency. Ranciere, Tornell, and Vamvakidis (2010) suggest a measure of currency mismatch for the banking sector that captures the indirect systemic risk linked to the credit risk resulting from foreign currency lending to unhedged borrowers. Their measure is the ratio of banks' net foreign currency liabilities, computed after subtracting from the assets side the foreign currency loans to households and firms without foreign currency income, to total assets of banks. We do not favor this approach as a measure of currency mismatch, as it mixes two different risks characterized by different probability distributions. While direct currency risk is uniformly distributed, indirect currency risk only materializes above certain depreciation thresholds. The reason is that the direct currency risk of banks starts affecting their capital as soon as the exchange rate moves, while the nonlinearity of indirect currency risk for banks reflects that losses resulting from unhedged borrowers' currency mismatch start affecting lending banks' capital only after they erode the borrowers' equity. This equity "cushion" constitutes the threshold above which losses start to be incurred by banks (and

⁴⁷Brown, Ongena, and Yesin (2011) find that foreign currency borrowing by small firms in transitioning European economies is related more strongly to their foreign currency revenue than to interest rate differentials. Their results suggest that retail clients that take foreign currency loans are better equipped to bear the corresponding currency risks than is commonly thought.

other lenders). However, although we do not favor this approach as a measure of banks' currency mismatch, it could still be a good indicator of systemic risk as it accounts for extreme events. Yesin (2013) uses this measure to assess the exchange rate-induced systemic risk of European banking sectors, which is due to foreign currency loans to the unhedged nonbanking sector in Eastern Europe in the period 2007-2011.

5.2.3 The rationale behind macroprudential regulation

Following the 2008-2009 global financial crisis, macroprudential regulation gained ground as a tool to ensure financial stability. Claessens (2015) states that the fundamental rationale behind macroprudential policies is to deal with the externalities and market failures associated with activities of financial intermediaries and markets that can lead to excessive procyclicality and the buildup of systemic risk. He notes that advanced countries prefer the credit-related maximum loan-to-value (LTV) and maximum debt-to-income (DTI) tools out of concern for excessive leverage, while emerging markets tend to favor foreign exchange and liquidity-related policies due to their concerns with large and volatile capital flows and related systemic risks. The IMF's Annual Macroprudential Policy Survey (2018) reports that tools to manage liquidity and currency mismatches in the banking system are the most frequently used macroprudential policy tools, with a wide variety of designs. A large number of countries (75 countries, about half of respondents) reported that they maintain a net FX position limit for banks to limit systemic risk. In addition, many countries, especially in Central and South America, differentiate liquidity macroprudential measures by currency.

Claessens (2015) points to the fact that, with actual experiences still being limited, evidence on the effectiveness of specific macroprudential tools is only slowly accumulating and comes with many economic and econometric caveats, making it difficult to determine which policies to use and when to tighten or loosen them. Tools may not be able to reach some activities that can lead to systemic risks, and tighter regulations create stronger incentives for circumvention, risking vulnerabilities building up outside of the regulatory perimeter and policy makers' sight. Moreno (2011) notes that authorities appear to behave pragmatically when applying macroprudential tools, reflecting uncertainties about their effects. In particular, they appear to assess the effectiveness of adopted measures and adjust the rates and/or the coverage if it appears to be necessary. In some cases, however, the settings for what are increasingly recognized as possible macroprudential tools are still based on microprudential norms. Moreno (2011) stresses that it will be difficult to change this reality until theoretical and empirical research clarifies how these settings should be adjusted to take into account macroprudential risks.

5.2.4 FX-related macroprudential regulation

De Crescenzo, Golin, and Ott (2015) define currency based measures (CBMs) as regulations imposing a different treatment between bank operations denominated by domestic and foreign currencies. CBMs encompass a broad category of measures: a limit on the net FX position of banks; differentiated reserve requirements for domestic and foreign currency deposits; rules on foreign currency accounts; measures limiting lending in foreign currencies; rules on trading in FX derivatives; liquidity and maturity matching requirements differentiated by currency; and regulation of lending in domestic currency to nonresidents or of domestic currency accounts operated by nonresidents. They review the use of CBMs in the pre- and post-crisis period in a sample of 49 countries. In general, emerging economies have been the most active users of CBMs. While advanced economies generally had few CBMs in place at the starting point of their analysis in 2005, only a few of them gradually tightened their CBM stance over time, mainly over the period 2009-2011. The authors point out that a common understanding and agreement need to be reached on which types of CBMs are desirable macroprudential measures and which types have the nature of capital flow management measures and may have an effect on the overall openness of the financial system. De Crescenzo, Golin, and Molteni (2017) find that the increased use and tightening of CB-CFMs (currency-based capital flows management; a subset of CBMs that relate to operations with nonresidents and fall in a grey area between macroprudential measures and capital control measures) has resulted in the decrease of the total external debt of banks - and especially its short-term component that most of the CB-CFM tightening actions targeted - one quarter after their implementation. Ahnert, Forbes, Friedrich, and Reinhardt (2018), using a data set on 132 changes in FX-related macroprudential regulations in 48 countries (both advanced and emerging) over the period 1995-2014, find that these measures are successful in accomplishing their direct goals of reducing the foreign currency exposure of banks and the sensitivity of banks to currency movements. However, FX-related regulations also appear to have the unintended consequence of causing companies to partially shift their foreign currency funding toward international debt issuance, thereby mitigating the reduction in the economy's aggregate exposure to FX risk.

5.2.5 The trade-off posed by FX-related macroprudential regulation

Borrowers can behave irrationally and prefer cheaper foreign currency loans as they ignore, underestimate, or excessively discount the FX risk associated with them. Alternatively, borrowers may be involved in a moral hazard behavior if they understand the higher risks of foreign currency borrowing but reckon that they will not be forced to repay in full in the event of a depreciation-related insolvency, because of their limited liability or the expectation of government support in the event of a devaluation.

Dell'Ariccia, Laeven, and Marquez (2018) argue that foreign currency borrowing reduces the interest borrowers pay on their loans and has been associated

with faster credit and economic growth. However, foreign currency borrowing also increases systemic risk: should a country experience a sharp currency depreciation, firms with unhedged foreign currency denominated debt would find it difficult to honor their liabilities, resulting in widespread bankruptcies. The same authors highlight the link between liability dollarization and the frequency of crises, particularly in the banking sector. Their results support the view that government intervention to curb foreign currency borrowing and the contagion risks associated with it may be beneficial in certain circumstances. Such government intervention can come in the form of capital controls or prudential regulation or some combination of both.

Ranciere, Tornell, and Vamvakidis (2010) deem that the risk premium on foreign currency debt does not fully reflect the extent of insolvency risk, because agents expect the government to grant a bailout in the event of a severe financial crisis resulting from a sharp depreciation of the domestic currency⁴⁸. Using their measure of currency mismatch in the banking sector that accounts for indirect FX risk, they find that across transitioning European economies, increases in currency mismatch are associated with higher growth in tranquil times but also with more severe crises. Overall, after taking into account the crisis period, they find a positive link between currency mismatch and growth. They also ascertain that currency mismatch relaxes borrowing constraints and enhances growth across small firms in non-tradable sectors, which are arguably the most credit-constrained, but not across large firms.

5.3 FX-related macroprudential policies country experiences

In this section, we review a representative group of country experiences with FX-related macroprudential regulations. We include countries for which we could find reliable narrative or econometric studies documenting their experiences.

Poland: Kabza and Kostrzewa (2016) document that in the run up to the financial crisis of 2007-2009, capital flows from western European banks through loans, deposits, and capital provided to their local subsidiaries were a main driver of the credit and demand boom in Poland. The expansion of foreign currency lending was seen as a source of systemic risk because it increased the liquidity risk linked to the foreign funding of the Polish banking system and led to a real estate market bubble. It also generated macroeconomic risks due to the lower effectiveness of monetary policy. To eradicate foreign currency mortgage lending, Polish supervisory authorities resorted to a series of new macroprudential regulations. In 2005, the Polish Commission for Banking Supervision introduced Recommendation S that induced banks to enhance their risk man-

⁴⁸Along the same lines, Brown, Ongena, and Yesin (2014) show in a theoretical model that, under imperfect information about their revenues, firms whose income is earned in local currency choose foreign currency loans as they do not bear the full cost of their credit risk. Yesin (2013) documents that foreign currency loans to the unhedged nonbank sector were remarkably prevalent in Eastern Europe in the period 2007-2011, which created a significant exchange rate-induced systemic risk to European banking sectors.

agement related to foreign currency lending (by inter alia, including depreciation buffers in the assessment of borrower creditworthiness and setting internal limits for particular exposures secured by mortgages) and to inform customers of the related risks. Then a resolution raising the risk weight of residential mortgage loans denominated in foreign currency was introduced in April 2007. To reduce the flow of foreign currency loans further between the end of 2008 and early 2011, the authorities introduced more stringent debt-to-income ratios for foreign-currency-denominated loans to unhedged borrowers (Recommendation T and amendments to Recommendation S). Furthermore, the regulator used strong moral persuasion, coordinated with home authorities where necessary, to persuade banks to end foreign currency mortgage lending. Recommendation S was again amended in June 2013, recommending limitations on the borrower's exposure to foreign currency risk by ensuring conformity of the currency of exposure with the currency of income used for repayment. Consequently, the share of foreign currency mortgage credit in total mortgages fell from 60% in 2008 to 48% in May 2014.

Croatia: Dimova, Kongsamut, and Vandebussche (2016) document that in Croatia, as banks' foreign borrowing was increasing rapidly and the share of their liabilities to non-residents was trending upward, marginal reserve requirements on those liabilities with a rate of 24% were imposed for the first time in Q3 2004. The strength of this measure was gradually increased as the share of non-resident liabilities did not fall at first. The trend only reversed when marginal reserve requirements reached the level of 55%. In addition, the share of Croatia's foreign currency and foreign-currency-indexed bank loans started declining following an increase of risk weights on foreign currency loans to unhedged borrowers by 25% in Q2 2006. The implementation of a second increase in risk weights by a further 25% in Q1 2008 was also followed by a further decline in the share of foreign currency bank lending. The continued decline in the share of foreign currency lending following those measures did not last because, in reaction to uncertainties about the stability of the kuna in late 2008 and early 2009, households and companies shifted deposits into foreign currency and banks shifted lending into foreign currency again. Consequently, the share of banks' foreign currency credit rose again to close to 75% by early 2010, and it remained at this level even after the risk weight differentiation across currencies was dropped.

Serbia: In Serbia, reserve requirements on banks' foreign liabilities with a maturity shorter than 4 years were imposed at a rate of 21% in Q1 2005. However, the share of banks' nonresident liabilities kept increasing, perhaps as a result of the simultaneous increase in the effective reserve requirements rate on domestic liabilities. This trend was reversed when the reserve requirements rate on banks' foreign borrowing reached 60% on short-term liabilities and 40% on long-term liabilities. Dimova, Kongsamut, and Vandebussche (2016) also document Serbia's imposition of a 125% risk weight (an increase of 25% or more, depending on loan type) on unhedged foreign currency and foreign-currency-indexed bank loans larger than 10 million dinars in Q4 2006. This measure was implemented together with a reduction in the reserve requirements rate on local

currency bank deposits from 18% to 15%. Those measures led to the halt of the upward trend in the share of foreign currency and foreign-currency-indexed bank lending. In addition, an increase of risk weights by 25% on unhedged foreign currency bank loans to households in Q3 2008 happened just before the onset of the global financial crisis, making its effectiveness difficult to assess.

Romania: Dimova, Kongsamut, and Vandebussche (2016) document that the introduction in Romania of an exposure limit on foreign currency bank lending to unhedged borrowers in Q3 2005 was followed by an abrupt decrease in the share of foreign currency bank lending. This measure was taken together with an extension of the reserve requirements base to include all foreign currency bank liabilities regardless of maturity. Upon Romania's accession to the EU in January 2007, the exposure limit was abolished, and the trend in the share of foreign currency bank lending, which had been upward again since Q2 2006, continued.

Korea: Bank of Korea's Governor Kim (2013) explains that as capital inflows resumed in 2009, two FX-related macroprudential policy measures were imposed on banks: (1) leverage caps on banks' FX derivatives positions, which requires banks to limit their FX derivatives positions at or below a targeted level (specified in a percentage of bank equity capital of the previous month), and (2) a macroprudential stability levy on non-core foreign currency liabilities of banks. As a consequence of these measures, foreign banks' branches have resorted more to long-term inter-office borrowings in order to reduce their macroprudential stability levy and to increase their forward-buying capacity in response to a tightening of leverage caps on FX derivatives positions. This led to the unintended (but desirable) result of reducing the share of short-term borrowing in total external borrowing from 93% to 58% during 2010–2012.

Peru: By increasing reserve requirements in foreign currency during periods of intense capital inflows, the central bank of Peru aimed at reducing banks' incentives to lend in dollars. In addition, Peru's prudential authority (SBS) increased the capital requirement for dollar lending by raising the risk weight for dollar credit from 102.5% to 108% in November 2012. Between 2013 and 2016, the central bank implemented a dedollarization program through additional reserve requirements, to achieve a faster reduction in credit dollarization. Castillo, Vega, Serrano, and Burga (2016) find that high reserve requirements on foreign currency deposits used counter-cyclically since 2010, as well as the dedollarization program put in place by the central bank of Peru since 2013, reduced credit dollarization in a statistically significant manner. Contreras, Gondo, Ore, and Perez Forero (2018), using granular credit register data, confirm the effectiveness of these policy measures in speeding up the pace of credit dedollarization, especially after the announcement of the policy measures of 2015. They document that the aggregate ratio of credit dollarization in Peru fell from 69.3% to 49.3% between 2011 and 2017. Dollarization fell sharply in credit to households (especially mortgages and car loans), whereas the reduction in credit dollarization for firms was more moderate.

Brazil: Following the global financial crisis, low interest rates in advanced economies and returning risk appetite triggered a surge in capital inflows to

Brazil and to other emerging markets. Terrier, Valdés, Tovar, Chan-Lau, Fernández-Valdovinos, García-Escribano, Medeiros, Tang, Vera Martin, and Walker (2011) document that foreigners, who wanted to have exposure to the Brazilian real, took a short US dollar position in the futures market. Local banks usually took the opposite long position buying US dollar forwards. To hedge their exposures, local banks used the underlying cash market and took external credit. They went on to sell their foreign currency proceeds to the central bank and invest the funds in onshore Brazilian real assets. At the end of October 2010, local banks' external liabilities had increased by 24 bn dollars year-on-year. While part of this increase was used to lend domestically, a large part of the external borrowing was used for hedging purposes. These hedging transactions ultimately resulted in the same exchange rate market pressures that would arise when carry trades are conducted directly in the cash market. This external borrowing was not constrained by existing regulatory limits on net open FX positions because existing regulations in Brazil stated that a bank's net open position, encompassing spot and derivative transactions, should equal at most 30% of the bank's capital. Since the transactions supporting the carry trade involved assuming both a long and a short FX position, they canceled out in terms of net open positions. The net open position limits were clearly not binding in this context.

Bolivia: In Bolivia, a Tobin-type tax was imposed on financial transactions, exclusively levied on foreign-currency-denominated bank accounts. Moreover, the official foreign exchange bid-ask spread was increased for dollar sales to discourage the dollarization of labor income. This spread was increased from one to two Bolivian cents per dollar in January 1999, to four then to six in July 2005, and to ten in April 2006. An econometric study by Rivera and Kuscevic (2014) concluded that the tax on financial transactions and the gradual increase in the exchange rate spread by the central bank have contributed to the dedollarization of financial liabilities. Moreover, in December 2009, the limit on long foreign currency positions of Bolivia's banks was reduced from 70% to 60% of their accounting patrimony. This measure was aimed at further promoting the remonetizing process of the Bolivian economy - Bolivianization. Using two different indicators, Tobal (2018) finds that the aggregate currency mismatch at the bank level was reduced as a result of this measure.

Paraguay: Paraguay has a long tradition of financial dollarization. The limits on banks' foreign currency positions were changed several times from 1992 to 2012. In October 2008, the central bank reduced the limit on long foreign currency positions from 50% to 30% of banks' accounting patrimony. This measure had three main goals: reducing the volatility of the exchange rate, reducing potential maturity mismatches on foreign currency positions, and reducing banks' exposure to foreign currency risk by decreasing currency mismatches. Tobal (2018) shows that currency mismatch at the aggregate bank level was reduced because of this measure.

Colombia: Faced with heavy capital inflows and rapid currency appreciation, Terrier, Valdés, Tovar, Chan-Lau, Fernández-Valdovinos, García-Escribano, Medeiros, Tang, Vera Martin, and Walker (2011) document that Colombia's

central bank imposed a restriction on banks' long and short gross currency derivatives positions in May 2007, limiting them to 500% of their capital. At the same time, unremunerated reserve requirements on banks' external borrowing were also imposed. The two measures combined did not appear to have the intended effect and were unsuccessful in limiting exchange rate appreciation.

The general conclusion we can derive from these countries' experiences is that the use of various indirect price-related macroprudential tools partially managed to reduce intermediation in foreign currency. In addition, their effect on foreign currency credit and FX risk exposure has only been partial and proportional to the cost imposed by the measures. Their calibration has followed a trial and error process, and the final outcome could not be precisely anticipated at the implementation of the measures. These measures have also affected other variables than their intended targets.

5.4 FX-related macroprudential regulation and dedollarization

Past literature has linked the reduction of the systemic risk implied by foreign currency intermediation to the reduction of its share in domestic banking systems⁴⁹. In this section, we discuss the optimal design of FX-related macroprudential regulation building on the comparative experiences of Latin America and transitioning European economies and we argue that neutralizing the systemic risks linked to foreign currency intermediation is possible through macroprudential regulation, without aiming at directly limiting or banning foreign currency intermediation (i.e., dedollarizing). We argue that dedollarization is a different and more ambitious target that must be justified by the other inconveniences of foreign currency intermediation.

5.4.1 Which regulations should deal with the systemic risks implied by foreign currency intermediation?

There are two diverging experiences with foreign currency intermediation. Transition European economies have mainly seen the benefits of foreign currency intermediation in terms of capital inflows, credit availability, and economic growth. Latin American economies were mostly marked by the crisis amplification mechanisms linked to foreign currency intermediation. Therefore, it is not surprising to see diverging views between economists of both regions when it comes to the trade-off posed by foreign currency intermediation. The main difference between the two experiences is the more stable institutional environment that prevailed in the period leading to EU accession, as well as existing regulations imposing limits on banks' FX positions in transition countries (see, e.g., Zettelmeyer, Nagy, and Jeffery, 2010).

As shown by recent contributions, the trade-off when it comes to foreign currency intermediation is between its positive effect on growth in tranquil times

⁴⁹See, for example, Zettelmeyer, Nagy, and Jeffrey (2010) and Vidahazy and Yesin (2020).

and its negative effect in terms of financial fragility, which increases the probability of crises as well as their severity. Foreign currency intermediation can have a positive effect on economic performance by providing an alternative stable currency to the economy and by facilitating the inflow of capital that can be much needed for the country's economic growth. The effect of foreign currency intermediation on financial fragility goes through the liquidity and FX systemic risks it induces, as discussed in the first section of this chapter.

The comparative experience of Latin American and transition European countries suggests that balance sheet currency matching (including off balance sheet FX positions) should be imposed as a regulatory requirement for banks. We favor imposing a strict currency matching because this measure directly targets the source of the FX systemic risk (i.e., currency mismatch). This measure would neutralize banks' direct FX risk and protect them from potential capital losses resulting from exchange rate movements.

The best way to deal with the indirect FX risk resulting from lending to unhedged borrowers (i.e., whose incomes are not perceived in the foreign currency) would be to implement a macroprudential regulation requiring banks to assess the situation of each borrower applying for a foreign currency loan, and to limit the amount loaned to the present value of the borrower's future expected incomes that are perceived in that currency. However, this regulation provides an imperfect cover because it is dependent on banks' assessment and therefore less strict than regulations imposing limits on directly observable aggregates. This regulation would result in the decrease of loan dollarization in the economy, because non-eligible borrowers would no longer have access to foreign currency loans. According to the results of Ranciere, Tornell, and Vamvakidis (2010), this reduction in the indirect FX exposure of borrowers would result in credit constraints, leading to a possible slowdown in economic activity.

As regards the systemic liquidity risk linked to foreign currency intermediation, the ultimate regulatory measure is to submit foreign currency bank deposits to 100% reserve requirements, either in low risk liquid foreign assets held by the depository bank or in the form of reserve deposits at the domestic central bank. In the latter case, the central bank must strictly hold those assets in the form of low-risk liquid foreign assets and refrain from using them for FX interventions as did the central bank of Lebanon. Reserve requirements held in the form of deposits at the central bank come with a cost for bank intermediation if the central bank remunerates them at an interest rate lower than the one prevailing in the money market (their opportunity cost). In order to make this 100% foreign currency reserve coverage costless for banks, the central bank should remunerate them at an interest rate close to the one banks can obtain on the international money market for this currency. This regulation would make foreign currency creation impossible within the domestic banking system as we have shown in the first section of this chapter, and consequently, the size of foreign currency intermediation would be reduced.

The main characteristic of those three measures is that they directly target the sources of the systemic risk, without constraining other aspects of banks' operations. They leave banks free to choose the composition of both sides of

their balance sheets, as long as they abide by the established rules. The indirect measures that are used by regulators and central banks to reduce the share of foreign currency assets and/or liabilities of banks, in order to contain systemic risk, uselessly constrain banks' operations without fully achieving their intended macroprudential target.

Implementing strict currency matching of banks' balance sheets to deal with direct FX systemic risk, limiting foreign currency credit to hedged borrowers to deal with indirect FX systemic risk, and imposing 100% reserve requirements to deal with foreign currency liquidity systemic risk are the ultimate regulations allowing neutralization of the three risks. Those measures do not forbid or directly limit the use of foreign currency, but they put constraints on the latter, and consequently, on foreign currency credit availability and cost. If the domestic economy needs a higher level of foreign currency intermediation, then those regulations could be eased in the form of limits on banks' net FX positions (as opposed to a strict currency matching of banks' balance sheets), less strict regulation on foreign currency credit to unhedged borrowers, and a reserve requirements rate lower than 100% on foreign currency deposits (partial coverage). However, regulators need to bear in mind that this greater flexibility would necessarily come at the cost of a higher systemic risk exposure.

A last observation we would like to make in this section is that we favor the implementation of those macroprudential measures in any market condition and under any exchange rate regime. Tobal (2017) argues that policies that constrain FX positions and/or modify incentives to take them restrict banks' purchases and sales of FX assets, and consequently, affect FX market conditions and enhance exchange rate stability. In that sense, those regulations can replace FX market interventions in the pursuit of exchange rate stability. He finds that those policies were more frequently used in Latin America under intermediate and floating exchange regimes than under fixed exchange regimes. The reasons behind this observed pattern might be that policymakers have a stronger tendency to substitute FX market interventions⁵⁰ with FX regulation in flexible exchange rate regimes, or that in flexible regimes, exchange rates are naturally more volatile, inducing higher FX risks. Our view in that regard is that those measures should rather be seen as preventive prudential measures that must be applied in any economic context, independently from the exchange rate regime in place.

5.4.2 Dedollarization

Most countries have taken steps to reduce the degree of dollarization in their banking systems. However, as we have shown in the previous section, systemic FX and liquidity risks linked to foreign currency intermediation can be neutralized without directly having to forbid or limit the use of foreign currencies in domestic banks. Therefore, dedollarization should be an answer to the other

⁵⁰Short-run and long-run effectiveness of FX interventions is a highly debated matter in the literature. On FX intervention patterns, see Gomez-Gonzalez and Garcia-Suaza (2012) and Basu (2012).

inconveniences linked to foreign currency intermediation; namely, the loss of monetary policy as a macroeconomic management tool, the loss of monetary sovereignty (i.e., the economy being dependent on the availability of the currency of another country), and the seignorage paid to the foreign country.

Dollarization is commonly accused of impairing the effectiveness of domestic monetary policy because it limits the use of the domestic currency, and as a consequence, the influence of domestic interest rates on the economy's growth and inflation. However, independently from the dollarization issue, monetary policy's countercyclical function in emerging markets has been questioned. Spillovers from US monetary policy, the weakness of its transmission channels, and the observed procyclical behavior of interest rates in emerging economies place monetary policy in a secondary position relative to other macroeconomic management tools.

Money, although not a public good in the strict economic definition of the latter, is by essence a "sovereign good" because it is a strategic asset allowing payments, thus, the functioning of the entire national economic system. If a nation becomes dependent on the availability of another nation's currency for the functioning of its economy, it loses part of its economic independence. Marshall (2008) argues that despite the pesofication that followed the Argentine banking crisis of 2001–2002, the fact that the group of foreign banks operating in Argentina could propose and encourage the adoption of dollarization shows the political strength that foreign banks can attain when controlling a local market. The Argentine economy's absolute dependence on foreign currency, as well as the depth of its social, political, and economic crisis, allowed foreign banks to play an intrusive role in the country's economic policy.

The seignorage cost of dollarization could be calculated in different ways: It could be seen as the interest cost of foreign currency liquid assets held by the economy, the amounts of those assets, or the seignorage revenue forgone by domestic monetary authorities as a result of the use of the foreign currency in domestic intermediation.

A number of economists do not favor measures directed at limiting foreign currency intermediation, as long as monetary management is still not completely sound. Their position relies mainly on their empirical findings on European transition economies. Brown and De Haas (2012) use a dataset containing detailed information on the loan and deposit structure of nearly 200 banks in 20 transition European economies over 2001–2004. They show that foreign currency customer deposits rather than foreign currency wholesale funding from foreign banks have been the key driver of foreign currency lending in the region. They argue that credible macroeconomic policies that encourage customers to save in local currency may be more important than regulatory proposals to limit foreign banks' foreign currency funding of domestic banks. They conclude that in countries with weak monetary and fiscal institutions, a strong regulatory response to reduce foreign currency lending may be counterproductive, because lending in the domestic currency is not a realistic alternative in the short term. Brown and Stix (2015) provide a comprehensive household-level analysis of deposit euroization in Central, Eastern, and Southeastern Europe, based on survey data

covering households in ten countries in 2011 and 2012. Their results suggest that deposit euroization can be, at least partly, tackled by sound monetary policy. However, sound monetary policy may not be sufficient to achieve deeuroization because the holding of foreign currency deposits has become a habit in the region, following the financial crises of the 1990s. They argue that supply side measures are unlikely to affect the euroization of savings because the use of foreign currency deposits is largely demand driven.

Dedollarization has proven to be counterproductive in countries with poor monetary management (e.g., Bolivia in 1982, Peru in 1985; see Ize and Levy-Yeyati (2005), Fernandez-Arias, Levy-Yeyati and Moron (2006)), because it led to capital outflows and had a negative effect on output growth. In contrast, Marshall (2008) argues that Argentina's forced pesofication following the 2001-2002 crisis is now widely acknowledged to promote greater macroeconomic robustness as well as healthy profits for the banking sector. Damill, Frenkel, and Rapetti (2015) document that Argentina's GDP was 21% lower by mid-2002 than it was during its previous peak of mid-1998 because of the convertibility crisis, then the economy began a rapid and strong recovery that turned into rapid and strong economic growth. Those contradicting experiences show that the same policy measure can have different results if applied in different contexts.

Two categories of measures are used to achieve dedollarization: (1) administrative (or legal) measures that forbid certain transactions, assets, or liabilities (e.g., forbidding loans to unhedged borrowers and forbidding certain foreign currency deposits types); and (2) price-related measures aiming at increasing the cost of foreign currency intermediation relative to domestic currency intermediation, to favor the use of the domestic currency (e.g., higher loan provisioning, higher capital requirement, and higher reserve requirements). Price-related measures have shown some efficiency and helped partially dedollarize domestic banking systems in some cases; however, they could not eliminate foreign currency intermediation completely.

Administrative measures can be seen mathematically as price-related measures where the additional cost is set in a way that no agent would be willing to engage in the targeted transaction. Administrative measures have the advantage of being simple to apply, easily understandable by the public, not easily circumvented, and not easily manipulable from a political economy point of view. It could be argued that well-connected special interest groups can profit from administrative regulations and manipulate them to their advantage; however, those groups can also manipulate the implementation and calibration of price-related measures.

Administrative measures produce direct and total results, whereas price-related measures produce gradual and partial results (proportional to the cost level imposed by the regulation). In addition, price-related measures increase the transaction cost for agents who are willing to engage, and might induce excessive risk-taking behaviors. For example, any measure increasing the interest cost of foreign currency credit overburdens borrowers and shifts foreign currency credit towards riskier borrowers. The claim that price-related tools are more "market friendly" than administrative measures is misplaced in this

context. Increasing the cost of the use of foreign funds for agents who need them, namely export-oriented companies whose incomes are perceived in hard currencies, and for international businesses whose competitors are financed at lower interest rates, is economically counterproductive. Moreover, price-related tools that have been used in some countries (e.g., reserve requirements, capital requirement, or tax levies) are difficult to calibrate and their effect on the final target might vary over time if their transmission mechanisms are unstable. In addition, they affect and/or constrain variables other than the target variable, which might result in undesirable welfare costs.

Price-related measures have the apparent advantage of leaving loopholes for agents who find benefit in engaging in the transaction, despite the increased cost imposed by the regulation. However, well-designed administrative measures are able to leave those loopholes, too, but in a more price-efficient manner. For example, allowing foreign currency bank loans for export-oriented companies whose incomes are perceived in foreign currency, while forbidding these loans to producers of non-tradables, is an administrative/legal measure that leaves an economically justified “loophole”.

In sum, if domestic monetary management is unsound, making domestic agents unwilling to use the domestic currency, then macroprudential measures aiming at banning or limiting the use of foreign currencies will be counterproductive. In this case, as monetary control is far from being reached, the foreign currency takes the role that the domestic currency is not able to fulfill. If domestic monetary management is sound but its full credibility is not established yet, then the use of a foreign currency in intermediation might still be needed. Measures to gradually curbe the use of foreign currency can be useful in that case. If domestic monetary management is sound and fully credible, the optimal regulation would be an implicit or even a legal ban of bank intermediation in foreign currency, except for international trade purposes. This is the policy that prevails in advanced economies with longstanding sound macroeconomic management. Price-related measures can be useful as temporary tools to induce agents to switch gradually towards the use of the domestic currency. However, when monetary management becomes sound and gains credibility, administrative measures must be implemented to restrict the use of foreign currency to transactions related to international trade exclusively. Our views are in line with the position of Eduardo Levy-Yeyati (Levy-Yeyati, 2021), one of the most prominent specialists of dollarization, who argues that quantitative restrictions or limits to complement the battery of market incentives must be added, in what he describes as a “head-on assault” on dollarization.

5.5 Concluding remarks

In this chapter, we showed that views with regards to the trade-off posed by foreign currency intermediation differ according to regional and country experiences. Empirical studies performed on transition European countries favor its positive influence on economic growth, whereas studies on Latin American countries emphasize its implications in terms of systemic risk and crises amplifi-

cation. This shows the importance of the context in which a study is performed (i.e., the structural and institutional frameworks, as well as the cyclical context). Our analysis suggests that over-reliance on empirics to derive policy recommendations can therefore be misleading, if not combined with analytical and normative considerations. Institutional and macroeconomic contexts, as well as legal and regulatory frameworks that define the rules of the game, can shape agents' behavior. Econometric studies reveal patterns that are linked to the context in which they are performed, and therefore their results should not be taken as universal truths that apply in any context. Relying solely on some empirical patterns found in a specific case can therefore be misleading for policy design in a different context or country.

The comparison between the two regions' experiences suggests that some degree of macroprudential regulation is needed to counter the systemic FX and liquidity risks related to foreign currency intermediation. We analyzed those systemic risks and the ways to minimize them. We argued that neutralizing those systemic risks is possible, without aiming at limiting or banning foreign currency intermediation. However, we stressed that by neutralizing or reducing those systemic risks, foreign currency intermediation would be constrained and its positive effect on growth would be diminished.

We see dedollarization as a different and more ambitious target. Limiting the use of the foreign currency in the domestic economy must be justified by its other inconveniences (i.e., the loss of monetary policy independence, the loss of monetary sovereignty, and seignorage costs). The dedollarization decision should reflect the trade-off between the need for dollarization (i.e. the need for an alternative currency and the need for more capital inflows) and those inconveniences. We argued that the use of administrative measures to achieve dedollarization can be more efficient than the use of price-related measures in many instances. We stressed that it would be counterproductive to aim for dedollarization as long as the country's macroeconomic management is unsound.

The lack of comprehensive, systematically compiled, internationally harmonized and granular data on the currency of denomination of assets and liabilities, as well as that of financial and real flows in the different economic sectors, hinders the advancement of research on foreign currency intermediation and financial dollarization and the risks linked to them. Tobal (2018) made a tremendous data collection effort to gather and harmonize data on the banking sector currency mismatch in Latin America and the Caribbean, which is supposed to be the economic sector where data are produced in the most regular, complete, and accurate way⁵¹. In our current financially globalized world, central banks and national statistics should make further efforts to compile harmonized stock and flow aggregates and to classify them by currency of denomination. Some initiatives are underway in that regards⁵².

⁵¹Tobal (2018) develops two currency mismatch indicators. The first indicator measures the average level of currency mismatches in a country during a given time period, and the second indicator informs on whether foreign currency positions have been long or short on average.

⁵²Gencay (2017) documents that a new system that collects net FX and hedging positions of the non-financial sector companies is being established at the central bank of Turkey.

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This project aims at identifying risky firms and sectors with unhedged open FX positions. This system will allow introducing regulations that penalize unhedged open FX positions and promote hedging with financial instruments.

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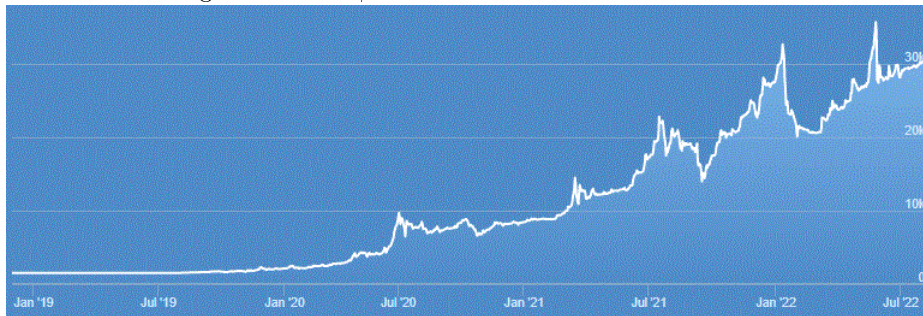
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6 General Conclusion

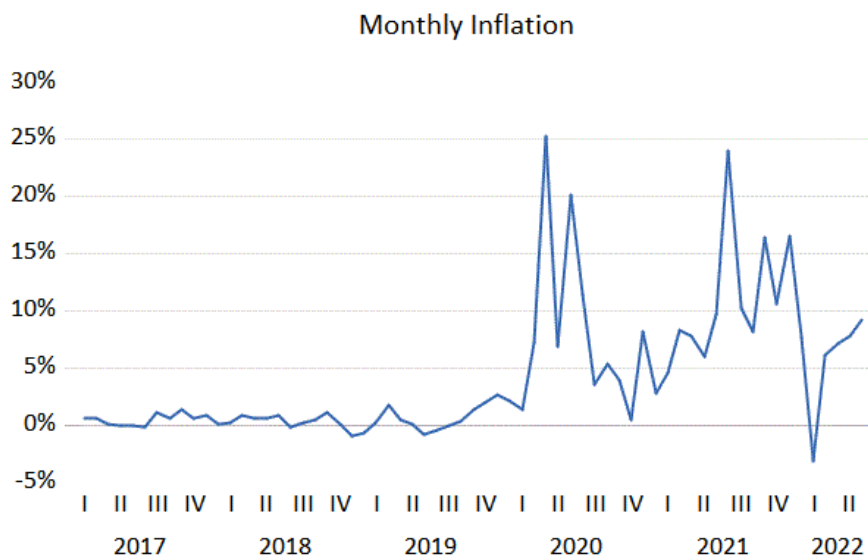
Lebanon's experience with dollarization highlighted the utmost importance of foreign liquidity in dollarized monetary systems. The liquidity analyses we performed in the first two chapters of the thesis helped explain the mechanisms of the ongoing monetary crisis that we analyzed in the third chapter. The recommendation of forced conversion of the USD denominated share of banks balance sheets to LBP that we made at the end of the third chapter was unfortunately not implemented by Lebanon's monetary authorities. The monetary disorder and the conversion of dollar denominated bank deposits at rates way above the fixed rate that prevailed since 1997 till just before the start of the crisis, exploded the LBP money supply, resulting in a circa 1900% depreciation of the domestic currency at the end of July 2022, and in a cumulative inflation of 1082% between September 2019 and June 2022 as shown in the below two graphs. What is needed at this stage is mainly a robust institutional and political order in Lebanon, which is a prerequisite for sound and ethical monetary management.

Figure 39: USD/LBP black market rate evolution



Graph Source: lirarate.com website

Figure 40: Monthly CPI inflation (in %)



Data Source: Lebanon’s Central Administration of Statistics Website

The direct implication of our liquidity analysis on the choice of the exchange rate regime under partial dollarization, contradicts the commonly accepted recommendation of fixed exchange rate regime, aiming at limiting the FX risk in the presence of dollarization. The liquidity risk is incompatible with an overvalued fixed exchange regime as it deteriorates the country’s foreign liquidity position through recurring current account deficits. That said, we need to bear in mind that in a lot of cases the structural external deficit results mainly from the weakness of the export sector, and is only partially related to the overvaluation of the country’s exchange rate, as was the case in Lebanon. Our result helps explain the choice made by the majority of emerging economies of intermediate exchange rate regimes like the “managed float” that helps in limiting the FX risk while avoiding the overvaluation of the country’s exchange rate.

Studying Lebanon’s monetary policy under dollarization allowed us to uncover a number of monetary mechanisms that were overlooked by the academic literature so far. One main characteristic of the thesis is that it fully adopts the financing model of bank intermediation (i.e., credits make deposits), as opposed to the incorrect loanable fund model of banking that dominates mainstream economics.

The main analytical and conceptual contributions of this thesis are:

- Formalizing monetary mechanisms in dollarized economies. To our knowledge, no formalization of monetary mechanisms in dual currency systems has

been done previously.

- Developing an in-depth understanding of dollar liquidity in dollarized economies, and the direct link between balance of payments operations and money in partially dollarized monetary systems.
- Defining the main liquidity aggregate in dollarized monetary systems as the Gross Foreign Assets of the Locational Bank Sector, equal to the sum of the central bank's gross foreign liquid assets (gross international reserves) and the locational domestic banks gross foreign liquid assets.
- Analyzing the liquidity crises of partially dollarized monetary systems, and the "moneyness" of dollar deposits in dollarized banking systems.
- Making a thorough analysis of central banks' reserve requirements, under the financing model of bank intermediation, in order to correct some misconceptions with regards to this tool resulting from its previous analyses under the loanable funds model.
- Suggesting a normative macroprudential framework to deal with the liquidity and FX systemic risks linked to financial dollarization, reflecting the findings of our liquidity analysis, and accounting for past experiences in partially dollarized banking systems.

Our results have shown that liquidity issues under dollarization are far more complex than currency mismatch issues. Thus, previous macroeconomic modeling that approached dollarization solely from the angle of its currency mismatch implications fails to account for the complexity of dollarized monetary systems. A new generation of macroeconomic modeling of dollarized economies is needed to cope with this fact. Also, our analyses have revealed some shortcomings in the way the international finance literature deals with the questions related to international reserves.

As dollarization has taken different forms in different countries (dollarization of deposits, assets, liabilities, transactions, foreign financing of banks and corporate etc), the institutional, legal, macroeconomic and behavioral context is key in each specific case. Similar works are needed for other countries with other forms of dollarization, in order to better understand the micro and macro mechanisms at play.

We hope to be able to contribute towards the improvement of small open economies macroeconomic modeling by integrating the results of our analyses in future works. Two promising research projects are underway with co-authors: a Stock-Flow Coherent modeling of the Lebanese economy stressing the international liquidity dimension, and an extension of the international liquidity analyses performed in this thesis to the cases of full/official dollarization and currency boards.

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