Financial instability in Lebanon: do the liquidity creation and performance of banks matter?*

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Abstract:

This paper examines the interrelations between banks' liquidity creation, their profitability, and systemic financial instability in politically unstable developing countries, with a focus on the Lebanese banking sector. Using original, annual observations of Lebanese bank data for the period 1997 – 2019 and employing fixed effect OLS regressions and system GMM to account for the dynamic aspect of our data, we show that liquidity creation is significantly associated with lower financial stability and thus higher instability. Banks' profitability is positively linked to their systemic stability. The results vary slightly from one estimate to another, but they stand up to robustness tests. Our empirical results could have a substantial impact on the functioning of the Lebanese banking sector and on the determinants of banking and economic instability.

JEL classification

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Keywords

Bank liquidity creation

Bank performance

Bank stability

Financial crises

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1. Introduction

Banks bridge the gap between the diverging needs of lenders and borrowers by assuming a transformation task in terms of size, maturity and risk. Casu *et al.* (2015) argue that banks can easily provide better services with lower transaction costs, thus smoothing liquidity and enabling risk sharing, by seizing opportunities to make economies of scale and increasing scope, and by reducing the problems of moral hazard and adverse selection generated by the asymmetric information phenomenon. They identify five theories to explain the need for financial intermediation and therefore banks, which are delegated monitoring, information production, liquidity transformation, consumption smoothing, and commitment mechanics. Allen and Carletti (2012) identify the crucial role of banks in economic growth through effective allocation of resources, risk diversification, liquidity formation, consumption smoothing, and by providing means to overcome the asymmetric information problems hindering the financial system in general. However, they also highlight the controversial role played by banks in financial crises in contributing to the fragility of the financial system.

Likewise, several studies examine the relationship between banks' liquidity creation and profitability, with divergent findings (Duan & Niu, 2020; Tran, Lin, & Nguyen, 2016; Sahyouni & Wang, 2018). For instance, when creating liquidity, banks may jeopardize financial stability (Acharya & Thakor, 2016; Berger, Boubakri, Guedhami, & Li, 2019; Berger & Bouwman, 2017). Nevertheless, to maximize their profits, banks may be tempted to adopt loose and predatory credit policies, thus creating excessive liquidity, which promotes crisis-nurturing bubbles, increases risks,and augments the probability of failure (Fungacova, Turk Ariss, & Weill, 2013).

Given the importance of liquidity creation as the main measure of banks' output, and in the absence of an empirically proven method to measure the risk transformation function (Berger and Sedunov, 2017; Jayasekara *et al.*, 2020), empirical studies have been conducted to examine the relationship between bank liquidity creation and different financial and economic variables (Berger *et al.*, 2019; Sahyouni & Wang, 2018, 2019; Acharya & Thakor, 2014; Berger & Bouwman, 2017; Berger *et al.*, 2017; Berger & Sedunov, 2017; Fungacova et al., 2013; Gupta & Kashiramka, 2020). Transforming mainly short-term, liquid, relatively safe deposits into long-term, illiquid, risky loans is the essence of financial intermediation (Diamond and Dybvig, 1983). The output of this transformation is measured by Deep and Schaefer (2004) using a single unit: the liquidity transformation gap (LT Gap) and more recently by Berger and Bouwman (2009), who present a comprehensive approach to measure such liquidity creation.

However, most of these studies focus on developed countries with advanced financial and banking systems, thus overlooking developing countries that rely heavily on banks as their sole financing channel. In times of crisis or instability, particularly in developing countries, the role (or more precisely the roles) of banks can be called into question. During these turbulent periods, the interrelations between the creation of liquidity and the profitability of banks can vary, and even cancel each other out.

The relation of banks' output with financial instabilities and crises is a key concern for researchers and policy makers (Kim, 2018; Rajan, 2006; Soedarmono, Machrouh, & Tarazi, 2011;Vogel & Winkler, 2010; Diamond & Rajan, 2005). Both developed and developing economies havelong suffered from the economic and social costs of these instabilities. For example, Bhattacharya*et al.* (1998) examine the need to regulate banks by analyzing contemporary banking theories, and then discuss the main roles and functions fulfilled by banks as financial intermediaries. They particularly suggest that banks become intrinsically unstable by providing liquidity, hence creating a need for regulatory intervention. However, developing countries are additionally prone to political and security shocks that make financial crises extremely pricey. An understanding of the interactions between banks' output and financial instabilities, in the context of politically contentious developing countries, is crucial to develop realistic approaches and models for bank regulations and monetary policies in these countries.

Financial instability is best defined as periods of absence of financial stability (The World Bank, 2021). During these periods, the financial system does not work efficiently to maximize resources allocation and other aspects of the economy in order to optimize the performance of economic agents. Financial stability is mainly defined by its role in the efficient functioning of the real economy (Schinasi, 2004; The World Bank, 2021); Vo *et al.*, (2019) highlight the importance of understanding financial instability from both macroeconomic and banking sector performance perspectives. Gadanecz & Jayaram (2009) argue that financial stability should be broadlydefined to include macroeconomic dimensions and capture the interrelations between the real sector and the financial sector. Consequently, a financial system is stable when it ensures the smooth functioning of interactions in a broad micro- and macro-economic context while remaining resilient to shocks (The World Bank, 2021).

Several studies (Čihák *et al.*, 2013; Dhiman, 2018; Gadanecz & Jayaram, 2009; Gersl & Hermanek, 2010; Vo *et al.*, 2019) examine different financial (in)stability indicators, trying to determine an aggregate indicator or the best available proxy. The z-score is a commonly used measure of financial stability; however, it is overly dependent on banks' accounting data and it ignores the interrelations between individual banks (Čihák *et al.*, 2013). Another indicator, highlighted by Čihák *et al.* (2013) is excessive credit growth, although "excessive" levels are hard to determine. Gadanecz & Jayaram, (2009) compile a list of commonly used variables to measure financial stability, covering different levels of economic sectors. Based on Worrell (2004), the author indicates that an analysis of financial stability and consequently instability should be based on the difference across periods and changing trends, and combined with monitoring shocks and sudden breaks in patterns between normal and abnormal situations.

By analyzing the financial stability reports (FSRs) of a number of both developing and developed countries, Gadanecz & Jayaram (2009) observe that, in general, emerging countries focus on capital inflows, exchange rate fluctuations, and balance of payments, while industrial economies examine the exposure of their banks to emerging markets. However, performance and risk analyses of the banking and financial system are common practice in both types of reports. The authors conclude that the FSRs of different central banks rely on "partial composite

indicators" due to the inexistence of aggregate indicators. Such indicators may be related to banking sector stability and market liquidity. Nevertheless, they stress the fact that all financial stability analyses should take into consideration indicators from the following three sectors: the real sector, the financial and banking sector, and the external sector. Gersl & Hermanek (2010) analyze the use and adequacy of different financial stability indicators employed by the IMF and the ECB. However, financial stability is considered in its narrow sense as banking sector stability and soundness. Given the nonexistence of optimal values for most of the indicators, theauthors recommend analyzing them based on the evolution of their values and by comparing them with those of other countries to assess the financial situation. In addition, Davydov *et al.* (2021) use a new method to account for systemic risk, which enables a distinction between the bank's specific risk from one side and its systemic connection to financial system shocks from the other side (Van Oordt & Zhou, 2019), to study the relationship between banks' liquidity creation and systemic risk.

Some aspects of the Lebanese banking sector and its outputs have been studied previously. However, to our knowledge, no study conducted in Lebanon analyzes the triptych - bank liquidity creation, bank profitability, and systemic financial instability. For instance, El Khoury (2015) analyzes the liquidity determinants of the Lebanese banks before, during, and after the global financial crisis. Awdeh (2016) studies the evolution of Lebanese banks' fragility and its determinants over two decades from 1990 to 2013. Naimy & Karayan (2015) examine the impact of the global financial crisis on the performance of Lebanese banks using the Chow modelto test for structural breaks in profitability, liquidity, credit quality and capitalization. Peters, Raad, & Sinkey (2004) evaluate the performance and financial soundness of banks in Lebanon between 1993 and 2000. Over an eight-year period from 2008 to 2015. Khoury (2018) discusses the impact of Lebanese banks' liquidity on their risk appetite. Lebanese liquidity creation and its relationship with banks' performance is considered by Sahyouni & Wang (2019) as part of a broad regional study. However, the relationship between liquidity creation and financial instability has not been tackled in the Lebanese context.

We add to this literature by studying the relationship between banks' liquidity creation, their financial performance, and financial instability in Lebanon from 1997 to 2020, employing an unpublished, original database. The dire economic, social, and political impacts of the current Lebanese financial crisis have raised important questions about the role of the Lebanese banking sector in cultivating a very high level of instability that was unthinkable two years earlier.

To estimate the interrelations between banks' liquidity creation, their financial performance, and financial instability, we use the ordinary least squares (OLS) estimator. In addition, to address the problem of possible endogeneity and to check for a possible no serial autocorrelation of theerror terms, we employ the two-step system Generalized Methods of Moments (GMM) model (Davydov, Fungáčová, & Weill, 2018; Davydov et al., 2018; Gupta & Kashiramka, 2020a; Hou, Li, Li, & Wang, 2018; Kim, 2018; Otero González, Ashour, Redondo-López, & Rodríguez Gil, 2018;

Soedarmono et al., 2011; Tran et al., 2016) using measurements and data inspired by the existing literature.

We follow the three-step procedure developed by Berger & Bouwman (2009) to calculate liquidity creation using two measures, i.e. the *cat.fat* method, which is the preferred method of these authors, taking into consideration the liquidity created by the off-balance sheet items of banks; and the *cat.nonfat* method which accounts only for the assets, liabilities, and equity. The financial performance of banks is captured using the return on average assets (ROAA) and the return on average equity (ROAE), two measures commonly used in the previous literature (Jayasekara et al., 2020), in addition to the net interest margin (NIM) as a third measure (Sahyouni & Wang, 2018). We aim to capture financial instability through its broad macroeconomic impact? by using different indicators based on the economy's different sectors: the instability of the financial sector is measured by the banks' Z score, while the real sector indicators are captured through the main indicators stated above.

Our contribution to the literature is summarized below:

First, to the best of our knowledge, no previous analysis of the impact on banks' liquidity creation, performance, and financial instability has been conducted in the Lebanese context. In fact, the Lebanese banking system has been long admired for its resilience, soundness, and ability to attract foreign flows of capital (Banque du Liban, 2016; Desquilbet, 2012; Jad, 2011; World Economic Forum, 2013-2014). This is mainly due to its outstanding reputation and to the Lebanese banking secrecy laws, despite the fact that Lebanon has been marked by continuous periods of war, political crises, and security shocks. Surprisingly, Lebanese banks are currently facing an unprecedented crisis coupled with record low confidence in banks, banking and financial authorities, and policymakers.

Second, our study presents a newly compiled dataset for Lebanese banks that will help future research in this context. To construct our relatively comprehensive dataset consisting of annual observations for 57 Lebanese banks for the years 1997 to 2019, we collected banks' financial figures from four different sources, i.e., (1) the Orbis Bankfocus database, (2) Bureau Vandijk's Bankscope, (3) the banks' annual reports, and (4) the annual reports in Bilanbanques (local database for Lebanese banks).

Third, the usefulness of the current study lies in its potential to uncover the possible relationship between Lebanese banks' function as liquidity creators and the current financial crisis and to suggest possible solutions. This is crucial for regulatory bodies, policymakers, international donors, and banking authorities to formulate preventive policies and early warning signals for the future and to plan corrective ex-post and ex-ante interventions. In the absence of a direct financial system, active liquid and deep financial markets, and an adequate regulatory framework, Lebanese banks are the sole providers of financial and liquidity services for the Lebanese economy. The size of the financial services sector, which is dominated by commercial banks, measured by total assets, represented 433% of total Lebanese GDP in 2017 (McKensie, 2018). Critically, the Lebanese banking sector acts as the main government creditor, financing up

to 60% (Naimy & Karayan, 2015)of the Lebanese public gross debt.

Fourth, the results and conclusions of this study resist robustness tests, based on different estimation methodologies (OLS and GMM) and different variables of interest and control from one model to another.

Finally, our paper adds to the literature on liquidity creation and financial instabilities in developing countries with political uncertainty. Doubtlessly, understanding the current Lebanese crisis, its indicators, and its interrelatedness with the banking sector will pave the way to a better understanding of the instability indicators hidden behind the ostensibly strong banking systems of developing countries.

The remainder of the paper is organized as follows. Section 2 presents the literature review. Section 3 depicts the data and the variables. Section 4 introduces the methodology and the models. Section 5 discusses the empirical results, while Section 6 discusses the empirical findings. Section 7 concludes and draws policy implications.

2. Literature review

Several studies examine the relationship between the banking sector and financial stability from different angles. For instance, Rajan (2006), finds that deregulation leads to increased competition among banks, which nurtures an aggressive risk appetite and jeopardizes banks'role as liquidity providers in times of crisis. The author argues that banks' illiquidity may accentuate the impact of downturns by slowing down the allocation of financial losses that will eventually spill over into the real economy. Furthermore, Rajan argues that diminishing credibility of both banks and regulators precedes full-blown financial crises. He specifically maintains that emerging economies are prone to economic downturns originated by financial crises and exacerbated by a potential illiquidity in the financial system. This may be triggered by an interruption in hot money flows and easy capital fleeing the system after a negative economic outlook. We consider that the recent financial collapse in Lebanon may provide valuable support to this assumption. In actual fact, right before the financial meltdown, Moody's downgraded Lebanon's rating (Moody's, 2019). This was shortly after a Lebanese bank was sanctioned by the Office of Foreign Assets Control (OFAC) of the U.S. Department of the Treasury (U.S. DEPARTMENT OF THE TREASURY, 2019).

Moreover, Weill et al. (2018) observe that bank liquidity creation may intensify the volatility of economic activity. Besides, Acharya & Naqvi (2012) conclude that increasing macroeconomic risks leads to an increase in banks' deposits that are considered safe. This excessive liquidity motivates banks to lower the lending conditions, thus fostering credit booms, and preparing the ground for a financial crisis. Moreover, Gao et al. (2020) conclude that a country's internal conflict

risk has an adverse effect on banks' liquidity creation, reporting the case where one standard deviation increase in the country's internal conflict risk resulted in a 3.66 percentage point decrease in bank liquidity creation.

In relation to the above, Kim (2018) explore the relationship between bank competition, liquidity risk, and financial stability. He shows that large banks with higher market power create more liquidity and therefore become more prone to liquidity risk than smaller ones which tend tohold more liquid assets and foster their financial stability in times of crisis. In addition, according to the author, large banks seem to take advantage of bail-out likelihood and thus jeopardize their financial stability relative to smaller banks. Even though Lebanese banks are relatively small,they may have enjoyed a similar advantage of bail-out inevitability and thus ignored the risks of a financial collapse.

We add to this literature by analyzing the role of banks in transforming uncertainties, whether political or financial, into financial and monetary instabilities in developing countries by focusing on the exemplary case of Lebanon. We suggest that the financial systems of these economies, seemingly very robust, may fuel real crises in the case of a sudden economic slowdown due to political or security shocks.

Other studies analyze the connections between financial stability and banks' function as liquidity creators.

Berger & Sedunov (2017) suggest that liquidity creation could be used as a tool to measure the total output of banks covering their two main functions: liquidity creation and risk transformation. They base their argument on the high correlation between the mentioned functions on one side and the absence of empirical measures of risk transformation on the other. The authors prove the significant positive relationship between bank liquidity creation and real economic output on a per capita basis while emphasizing the importance of small bank liquidity creation on a per dollar basis. Furthermore, they find that liquidity creation is higher than other output indicators such as total assets and gross total assets. However, they suggest that excessive liquidity creation should be avoided to prevent possible liquidity problems for banks and to reduce the chances of creating bubbles leading to financial crises.

Likewise, Berger & Bouwman (2017) use de-seasonalized, detrended, inflation-adjusted financial and banking data from Q1 1984 to Q4 2008 to analyze the relationship between bank liquidity creation, monetary policy, and financial crises. They describe the importance and risksof bank liquidity creation for the economy and highlight the lack of studies considering this as a crisis indicator. They empirically show that relatively high liquidity creation, mainly generated by off-balance activities, is usually followed by financial crises. Additionally, the authors find that monetary policy has statistical significance but little economic impact on small banks' liquidity creation during normal times, and that this impact becomes even less significant during financial crises.

Dang and Huynh (2022) examines the bank liquidity creation's response to monetary policy changes in Vietnam from 2007 to 2019. banks may expand the liquidity creation more aggressively after the central bank relaxes its monetary policy by lowering policy interest rates or supplying more money to the market.

Moreover, Berger *et al.* (2019) use data from 4,871 bank-year observations including 690 banks across 24 countries between 2000 and 2014 to estimate the effect of commercial and Islamic banks' liquidity creation, measured by Berger and Bouwman's three-step "cat.fat" procedure (Berger & Bouwman, 2009), on the financial stability of developed and developing countries. The authors conclude that liquidity created by commercial banks negatively affects the national financial stability of high income countries but that this impact is not substantial in low-income countries.

Nonetheless, Gupta & Kashiramka (2020) examine the impact of bank liquidity creation on banks' financial stability in India by analyzing 1,046 bank-year observations of 91 Indian commercial banks between 2007 and 2019. They find a positive relationship between banks' liquidity creation and their stability in contrast with previous studies. According to the authors, the different levels of banking system development in developed and developing countries may have led to these diverging results. However, their findings are only statistically significant for nonfat liquidity creation measures excluding off-balance sheet items. Considering bank size, the findings suggest that small and large bank liquidity creation is associated with less financial stability for these banks when compared to medium-sized banks. The authors argue that the "competition-fragility hypothesis" may explain the case of the former, while the moral hazard generated form their too-big-to-fail positions may be the reason for the latter. We build on this idea to hypothesize that Lebanese banks may have benefited from a similar condition being, by far, the ultimate liquidity providers to the Lebanese economy.

Additionally, while investigating the role of banks' leverage as a liquidity creation tool, Acharya & Thakor (2016) shows that high bank leverage (i.e., more deposits) may lead to higher systemic risk driven by bank run contagion, which may jeopardize the entire financial and payment systems and thus necessitate regulatory rescue of distressed banks. Consequently, regulators may impose higher capital requirements to strengthen banks' position in the game and avoid such interventions. The authors also predict the effect of systemic leverage on individual banks; for instance, a bank may face the risk of liquidation because similar banks are highly leveraged. Furthermore, banks are inclined to increase the leverage when creditors are aware of the shocks, yet they perceived these shocks as improbable. This may have important implications in developing countries, more specifically in Lebanon where shocks are always lurking, but their materializationis doubtful.

In addition, Davydov *et al.* (2021) surprisingly find a negative association between liquidity creation and individual banks' systemic risk levels. However, the results show that increasing liquidity creation may reinforce the connection between individual banks and systemic shocks, suggesting that a high level of liquidity creation may magnify the vulnerability of financial institutions in general during times of market instability.

Moreover, Otero González *et al.* (2018) argue that a higher country risk, which combines economic, political, and social risks, led to increased economic instability in five Middle Eastern countries. They tested a sample consisting of 595 observations over a five-year period from 2005 to 2010 for 105 banks in five Middle Eastern countries including Palestine and its surrounding area. The authors found a significant negative relation between environmental (country) risk and bank liquidity transformation. In addition, they suggest that bank liquidity creation is positively related to banks' cash margins, but negatively associated with their capitalization. Subsequently, the authors suggest that a regulatory policy aiming to increase liquidity requirements for banks would work better than high capital requirements to face the risk of uncertainty and ensure better liquidity creation and credit granting (Otero González et al., 2018).

Furthermore, Gao *et al.* (2020) examine the data for 14,453 bank-year observations between 2000 and 2014 from 32 countries within the Belt and Road initiative. They show that a country's internal conflict risk, proxied by the International Country Risk Guide (ICRG), has an adverse effect on the bank liquidity creation measured by a modified version of Berger and Bouwman's three-step "cat.fat" liquidity creation measure (Berger & Bouwman, 2009).

Dietrich & Vollmer (2012) attempt to establish a relationship between universal banks and financial stability by studying the German banking system during the global financial crisis. The authors document a financially stabilizing effect of German universal banks when operating in a financial system enabling them to fulfill this role.

We add to this literature by examining the impact of the function of bank liquidity creation on financial stability in Lebanon, a developing country with a relatively developed banking system, during a period of alternating political uncertainties. We aim to emphasize the role of regulators in monitoring the liquidity creation function of banks rather than focusing on capital requirements in similar developing countries.

Some studies examine the interconnection between banks' profitability and their financial stability. For instance, The relationship between the bank liquidity creation function and their profitability, in developing countries, is tackled by Sahyouni & Wang (2018) who investigate data on 2,117 bank-year observations including 422 commercial banks and 69 Islamic banks from 18 MENA counties between 2011 and 2016. The authors find that liquidity creation, measured by Berger and Bouwman's three-step "cat.fat" procedure (Berger & Bouwman, 2009) has no significant effect on the Return On Average Assets (ROAA) profitability measure, but that it negatively affects the Return On Average Equity (ROAE) measure. According to Sahyouni & Wang, these results are in line with the bankruptcy cost hypothesis stating that more liquidity creation leads to an increased illiquidity risk and therefore higher capital costs. The authors recommend studying the impact of a country's instability on bank liquidity creation.

Gupta & Kashiramka (2020) show that banks' stability is negatively related to income diversification but positively associated with profitability. Likewise, VO *et al.* (2019) argue that

policymakers in developing countries should prioritize maintaining a continuously well-functioning banking sector to secure fundamental financial stability. The authors show the positive impact of the profitability of the banking sector, measured by the Return on Equity, on financial instability, proxied by the credit growth in seventeen emerging economies between 2000 and 2017.

The Lebanese banking sector's performance, resilience, and other determinants have constituted the subject of several analyses. Awdeh (2016) study the determinants of Lebanese banks' fragility, proxied by the Z-score, by analyzing data on thirty-eight Lebanese commercial banks between 1990 and 2013. The author finds that market concentration and shocks, whether economic or political, decrease the fragility of these banks. However, higher profitability, measured by the net interest margin (NIM) ratio, and deposit growth result in greater fragility.In addition, by examining the annual data on 23 commercial banks operating in Lebanon between 2005and 2013, El Khoury (2015) concludes that bank size and lower loan growth are associated with increased liquidity. Additionally, the partial impact of inflation and liquidity premiums supports Lebanese banks' credit rationing practice. Furthermore, the observed effect of the interbank rate on Lebanese banks' liquidity shows a possible monetary policy impact, mainly in times of crisis. While the author aims to identify the determinants of Lebanese commercial banks' liquidity without looking into the role of liquidity creation, we find it useful to adopt an interbank rate determinant as a control variable in our analysis.

Furthermore, Naimy & Karayan (2015) find that during the 2008 global financial crisis, Lebanese banks showed no signs of weakness, with surprisingly positive breaks in ratios capturing profitability, liquidity, credit quality and capitalization. In the same study, the American banks used as benchmarks showed structural breaks and instabilities during the crisis. The authors believe that Lebanese banks' conservatism and high liquidity requirements coupled with bank mergers provide a possible explanation of the apparent resilience. However, according to the authors, the Lebanese banking system may be extremely fragile and incapable of standing a single adverse shock.

We build on this last remark, in conjunction with the recent Lebanese financial collapse, to reinforce our approach of examining the role of the banking sector output on financial stability as measured by liquidity creation and profitability, rather than by analyzing performance independently.

3. Data and variables

3.1. Data

The sample used in our empirical analysis consists of annual observations of 57 Lebanese commercial, private, and Islamic banks between 1997 and 2019. We obtained related data on these banks from four different sources: first we used the Orbis Bankfocus database, second, we used the old Bureau Vandijk's Bankscope database for the years from 1997 to 2005 and 2007 for some banks, then we used the banks' annual reports and the Bilanbanques base to fillin the missing information where needed. For instance, Bankfocus data is available from 2005 for some banks but shows figures for only 2 or 3 years for others.

Due to some differences in classification, aggregation, and reporting between the different sources used to complete our database, we paid special attention to detect any discrepancies or flaws by making comparisons and sometimes checking annual reports and notes. The main objective was to avoid major data misrepresentations that could affect our analysis.

In addition, data concerning financial stability indicators, political stability, regulatory and environment, transparency and other possible control variables for the same periods were collected form the World Bank and IMF databases, such as World Development Indicators (WDI) Worldwide Governance Indicators (WGI), Global Financial Development (GFD), and the Global Economic Monitor (GEM), International Financial Statistics (IFS), World Economic Outlook (WEO), and the Central Bank of Lebanon (Banque du Liban).

This compilation and standardization work made it possible to create an original, unpublished database for Lebanon from 1997 to 2019. The amount of data varies from one variable to another due to unavailable temporal observations for some banks. We have a minimum of 712 observations and a maximum of 1,311 observations.

3.2. Variables

This section includes the description of the variables used in the model.

3.2.1. Financial Instability

Our main dependent variable is the Z-score, a measure commonly used in the literature to capture banks' solvency and stability (Gupta & Kashiramka, 2020; Soedarmono et al., 2011; Čihák et al., 2013; Detragiache et al., 2008; Fu, Lin, & Molyneux, 2014; Lepetit & Strobel, 2013; Uhde & Heimeshoff, 2009). These studies use the bank level Z-score rather than aggregate country or regional scores. However, Strobel, (2011) indicates that aggregate Z-score levels are usually used to measure the level of financial soundness.

We obtained our aggregate Z-score data from the world bank Global Financial Development Database.

3.2.2. Liquidity creation

To calculate the amount of liquidity created by Lebanese banks, following prior literature (Berger & Bouwman, 2010, 2017; Berger et al., 2017; Berger & Sedunov, 2017; Davydov et al., 2018; Fungacova et al., 2013; Lei & Song, 2013; Tran et al., 2016) we apply Berger & Bouwman's (2009) three-step procedure, which suggests four measures of liquidity: *mat.nonfat, mat.fat, cat.nonfat, and cat.fat* where "*mat*" and "*cat*" indicate classification according to maturity and category respectively, while "*fat*" and "*nonfat*" designate the inclusion or exclusion of off-balancesheet activities. In our calculations, we opt for two measures: the *cat.fat* which is the preferred and most comprehensive measure according to Berger & Bouwman, 2009, and the *cat.nonfat* because some studies show varying results in developing countries (Gupta & Kashiramka, 2020a).

Deep & Schaefer (2004) propose an alternative model to assess bank liquidity creation based on the Liquidity Transformation Gap (LT gap) model. The value of this LT Gap varies between -1 and +1, where banks with values close to +1/-1 are transforming/destroying liquidity. Nevertheless, the comprehensive nature of Berger and Bouwman's liquidity creation measure encompassing assets, liabilities, and off-balance sheet activities makes it our preferred approach.

Based on Berger et al., 2019 and following the classification of Lei & Song, 2013, we start by classifying assets, liabilities, equity, and off-balance sheet activities as liquid, semi-liquid, and illiquid.

Concerning assets, liquidity classification depends on the cost, time, and effort employed by the banks to settle their obligations and respond to their clients' needs. As for the liabilities and equity, the same criteria are considered from the customers' perspective to obtain liquid money from their banks. Off-balance sheet guarantees and commitments are treated like their on-balance sheet equivalents. Following (Berger et al., 2019; Gupta & Kashiramka, 2020a), we depart from the initial classification of Berger & Bouwman (2009) to adapt to the less-developed Lebanese banking and financial systems. For instance, Lebanese banks cannot securitize or sell their mortgage or consumer loans and consequently they should be considered to be illiquid as opposed to semi-liquid in the initial classification.

Table A1 (in the appendix) includes the detailed classification of the assets, liabilities & equity, and off-balance activities in our model (**Step one**).

The **second step** of the procedure consists in assigning weights to the classified on- and off-balance sheet items based on the liquidity creation theory. Since banks create liquidity by transforming illiquid assets (e.g., loans) into liquid liabilities (e.g., deposits), negative weights are assigned to liquid assets and illiquid liabilities, while positive weights are assigned to illiquid assets and liquid liabilities. Table A2 (in appendix) contains the details of the weights assigned to the classified items.

The **third step** consists in calculating the liquidity created by multiplying the classified items by their respective weights. The details of our calculations are presented in Table A3 (in the appendix).

Additionally, to remove the impact of the bank's size, following (Berger & Bouwman, 2009), we calculate the liquidity created by one dollar of total gross assets. Table A4 (in the appendix) shows the details of these calculations.

3.2.3. Performance

The existing literature uses the Return on Assets (ROA) and Return on Equity (ROE) to measure banks' profitability. Consequently, following (Jayasekara et al., 2020) we utilize the Return on Average Equity (ROAE), which is equal to the net income per dollar of equity, to capture the profitability of Lebanese banks.

3.2.4. Control variables

Following the existing literature, we use the Equity to Assets (EA) ratio to capture an individual bank's capitalization accounting for the bank's specific characteristics; we also use the five banks' assets concentration (BK) to account for the concentration of Lebanese banking activities on the aggregate level. Furthermore, we use the GDP per capita growth (GDP_CAP_GRWTH) to control for macroeconomic cyclicality, the change in foreign reserves (RES_CHNG) to control for the impact of the external sector, and the change in total government expenditure (GOVEXP_CHNG) to control for the change in policy and consequently policy uncertainty. Finally, we used one dummy variable (GFC) to account for the global financial crisis, where 1 is used to indicate a crisis for the years 2007 to 2009 (Berger *et al*., 2019).

4. Methodology and models

To test the effects of banks' liquidity creation and performance on financial stability, following (Berger *et al.*, 2019; Berger & Bouwman, 2017; Berger & Sedunov, 2017; Gao *et al.*, 2020) we adopt a two-step analysis.

The general form of our equation is finally:

$$Bank\ stability = f(Liquidity\ creation, bank\ controls, macro\ and\ institutional\ controls\ variables)$$

We begin by estimating the following fixed effects ordinary least squares regressions:

$$\begin{aligned} Z-Score_{i,t} = {} & \alpha_0 + \beta_1 LC_{i,t-1} + \beta_2 ROAE_{i,t-1} + \beta_3 EA_{i,t-1} + \beta_4 BK_{i,t-1} \\ & + \beta_5 \text{GDP CAP GROWTH}_{i,t-1} + \beta_6 \text{RES CHNG}_{i,t-1} + \beta_7 \text{GOVEXP CHNG}_{i,t-1} \\ & + \beta_8 GFC_{i,t-1} + \gamma_i + \delta_t + \varepsilon_{i,t} \end{aligned}$$

where $Z-Score$ is the $Z-Score$ of the banks; *LC* is the measure of liquidity creation; *ROAE* represents the return on average equity; *X* is a vector of controls with *EA* (equity to total assets), BK(banks' activity concentration), GDP CAP GROWTH (gross domestic product per capita growth), RES CHNG (total central bank reserves excluding gold), GOVEXP CHNG (change in general government total expenditure) and GFC (Global Financial Crisis expressed as a dummy variable); β are the estimated parameters of interest; γ is a bank-fixed effect, δ is a time-fixed effect and $\varepsilon_{i,t}$ is a noise. The subscript *i* and *t* represent the banks and time period, respectively.

However, to mitigate the risk of potential endogeneity (due to reverse causality and omitted variables) in our analysis, we lag all control variables by one year and we include time and bank fixed effects following (like Berger *et al.*, 2019).

As a robustness check, and in line with the existing literature, to address the problem of possible endogeneity and reverse causality, we use the two-step Generalized Method of Moments (GMM) model, like Davydov, Fungáčová, & Weill, 2018; Gupta & Kashiramka, 2020; Hou, Li, Li, & Wang, 2018; Kim, 2018; Otero González, Ashour, Redondo-López, & Rodríguez Gil, 2018; Soedarmono et al., 2011;Tran et al., 2016; Weill, Davydov, & Fungác, 2018. We conduct estimations using lagged values of the regressors as instruments in a GMM dynamic framework similar to Arellano and Bover (1995).,

With the GMM method, the process may be dynamic, with current realizations of the dependent variable influenced by past ones, and some regressors may be endogenous. Using lagged values of the regressors as instruments can help deal with the problem of reverse causality, which may exist between bank performance/stability and LC. Indeed, for example, Zheng et al. (2019) show that banks that are already in trouble could modify their LC in response to this.

We employ the GMM system estimator in the study. System-GMM combines the regression in differences with the regression in levels using a system of equations. Blundell and Bond (1998)

have shown that this estimator is very powerful (relative to the GMM difference estimator) in short sample periods and when the variables are persistent over time; particularly with a two-step system GMM procedure (Baltagi, 2008; Roodman, 2009).

To check the suitability of the models, two conditions are required for estimators to be consistent. The first one is a test of second-order serial correlation. By construction, the residuals in the first differences (AR(1)) should be correlated, but there should not be serial correlation in the second differences (AR(2)). Second, the validity of the additional instruments can be tested using the standard test developed by Sargan (1958) and Hansen (1982) for over-identifying restrictions. This test checks the validity of the additional instruments. In addition, like Gupta and Kashiramka (2020), we restrict the number of lags used as instrumented. One-year lagged values of all controlvariables are used in the equation to treat them as strictly exogenous. To check different assumptions and provide robust estimates, we use the several tests proposed by Roodman (2009).

To test the impact of banks' liquidity creation and profitability on financial instability we use the banks' Z score to capture systematic financial stability, where a higher score means higher stability. We use the bank's level Z-score and the country level aggregate Z-score in separate experiments for robustness.

5. Empirical Results

The results of the study are presented in this section. First, we present the descriptive statistics and the correlation matrix of the variables considered in our analysis. In the second part we discuss the results of the panel model. The robustness test results are presented in the third part.

4.1. Descriptive statistics

Summary statistics are shown in Table 1. The mean value of the country-level aggregate Z-score is 32.08 with a standard deviation of 3.439, indicating a relatively high level of systematic stability. However, the bank's level Z score in our sample shows a lower mean value of 19.88 with a considerably higher standard deviation of 22.783, implying a lower stability of the sample. The absence of aggregate Z-score data for the years 2018 and 2019, which marked the beginning of thecurrent crisis, may provide a possible explanation of the above.

The mean values of both *cat.fat* and *cat.nonfat* liquidity creation measures are 3.5% and -1.7% respectively. The negative value observed for the *cat.nonfat* measure indicates that, in our sample, banks destroy liquidity when the liquidity created by off-balance sheet items is ignored. The standard deviation values imply that the liquidity created varies greatly between the banks in the sample, which is also depicted in the minimum and maximum values of these measures.

The mean return on average equity (*ROAE*) is 8.8%, indicating a relatively high bank profitability. However, the standard deviation, the minimum value, and maximum value of 12.8%, -155.4%, and 76.9% respectively, signal diverging profitability between banks and support the use of a

specific bank control variable in our model.

Looking at the control variables, Lebanese banks seem to be well capitalized, with a 11.7% mean of equity to total assets (E/A). Concerning the banks' aggregate level, 66.44% of the bank assets are controlled by the largest five banks, which indicates a certain amount of activity concentration in the Lebanese banking sector.

Table CORR provides the correlation coefficient matrix of the variables. Multicollinearity does not seem to pose a problem in our study; the correlation values are all lower than 0.8. Notably, the high correlation between the two liquidity measures is not a cause for concern as they are considered separately in our model.

Systematic stability, as measured by the aggregate and the bank's level Z score, is negatively correlated with both liquidity creation measures but positively correlated with banks' profitability. Moreover, both stability measures are positively correlated with banks' capitalization (EA), banks' activity concentration (BK), gross domestic product per capita growth (GDP_CAP_GRWTH), and with the change in general government total expenditure (GOVEXP_CHNG), but negatively correlated with the total central bank reserves excluding gold (RES_CHNG).

Table 1

Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	Skew.	Kurt.
Z score O	1197	32.08	3.439	24.95	37.271	-.614	2.278
Z I	783	19.884	22.783	-2.574	355.43	9.643	129.268
LC T GTA CatFat	802	.035	.248	-.998	.762	-.585	4.32
LC T GTA Cat NonFat	802	-.017	.245	-.998	.739	-.531	3.958
ROAE	712	.088	.128	-1.554	.769	-3.981	54.848
EA	802	.119	.11	.003	.997	3.739	21.875
BK	1140	66.44	5.767	57.618	76.83	.488	1.876
GDP CAP GRWTH	1311	.111	4.236	-6.65	9.137	.998	3.19
RES CHNG	1254	.109	.231	-.236	.728	1.189	3.798
GOVEXP CHNG	1254	1.047	.082	.925	1.194	.18	1.859

Note(s): The amount of data varies from one variable to another due to unavailable temporal observations for some banks.

Table 2

Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Z_AGG	1.00000									
(2) Z_I	0.10157	1.00000								
(3) LC_CatFat	-0.23855	-0.06146	1.00000							
(4) LC_Cat_NonFat	-0.26684	-0.06882	0.96894	1.00000						
(5) ROAE	0.06426	0.15509	-0.11423	-0.10939	1.00000					
(6) EA	0.15294	0.24385	-0.31367	-0.33615	-0.13489	1.00000				
(7) BK	0.61116	0.00980	-0.15212	-0.17566	0.09198	0.00602	1.00000			
(8) GDP_GRW	0.16936	0.01770	0.00658	-0.03542	0.04511	-0.06588	0.04213	1.00000		
(9) RES_CHG	-0.04743	-0.09911	-0.02977	-0.04542	0.02266	-0.05925	0.04665	0.24018	1.00000	
(10) GOVEX_CHG	0.33287	0.10267	-0.02023	-0.03588	-0.02640	0.05856	-0.05167	0.21849	0.06427	1.00000

4.2. Results of the panel model

The results of the fixed effect OLS regressions are presented in Table 3, where extended models (3) and (4) show an R-squared of 33%. The results of OLS regressions show a strong negative association between both liquidity measures and banks' financial stability. These results are in line with the previous literature (Berger et al., 2019; Fungacova et al., 2013; Berger & Bouwman, 2017) analyzing the negative impact of liquidity creation on financial stability. However, our results do not support (Davydov et al., 2021), who show that liquidity creation decreases individual U.S. bank's systematic risk and are opposed to (Gupta & Kashiramka, 2020b), who document a positive relationship between liquidity creation and Indian bank stability. Moreover, our findings contradict (Zheng, et al, 2019), who find a positive relationship between banks' liquidity creation and a lower risk shown by higher Z scores.

Concerning the control variables, our OLS results show a strong positive relationship between banks' capitalization and financial stability in line with previous studies (Zheng, *et al.,* 2019). In addition, banks' concentration shows a strong positive association with financial stability in line with previous research (Fungacova et al., 2013). As expected, an increase in government expenditures is positively correlated with systematic financial stability. However, an increase in foreign reserves shows a negative association with the stability of the financial system.

Lastly, it is worth noting that the Global Financial Crisis (GFC) has a surprisingly significant positive impact on the Lebanese banks' stability.

Table 3

OLS regressions

VARIABLES	(1) Cat.Fat (OLS_Reduced) Z_I	(2) Cat.NonFat (OLS_Reduced) Z_I	(3) Cat.Fat (OLS_Extended) Z_I	(4) Cat.NonFat (OLS_Extended) Z_I
LC_T_GTA_CatFat	-7.339***		-5.095***	
	(2.063)		(1.173)	
LC_T_GTA_Cat_NonFat		-8.987***		-5.267***
		(2.318)		(1.253)
ROAE	1.173	0.980	3.273*	3.539*
	(3.162)	(3.151)	(1.980)	(1.981)
L.EA			61.037***	61.280***
			(4.820)	(4.821)
L.BK			0.115***	0.111***
			(0.031)	(0.031)
L.GDP_CAP_GRWTH			-0.089	-0.087
			(0.087)	(0.087)
L.RES_CHNG			-1.897***	-1.860**
			(0.725)	(0.726)
L.GOVEXP_CHNG			2.230	2.136
			(2.289)	(2.293)
L.GFC	1.743	1.556	2.257**	2.149*
	(1.062)	(1.063)	(1.126)	(1.127)
Constant	19.391***	19.015***	1.101	1.156
	(0.453)	(0.454)	(3.369)	(3.374)
Observations	709	709	566	566
R-squared	0.024	0.027	0.337	0.335
Number of ID	55	55	46	46
r2_o	3.84e-06	3.02e-05	0.0561	0.0579

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.3. Robustness check

We undertake the following robustness tests to check the validity and sensitivity of the results obtained in alternative settings:

i. Including a two-step system GMM estimations of our reduced model comprising a different proxy for financial stability: the aggregate country-level Z score (table 4).

ii. Including a new different proxy for financial stability: the aggregate country-level Z score (Tables 5).

iii. Testing each independent variable on a standalone basis (Table 6).

iv. Including a bank's liquidity measure (LIQ_A_TA) as an additional control variable. The variable stands for the liquid assets total assets ratio (Table 7).

v. Including a bank's assets quality measure (PLL_LN) as a control variable. PLL_LN represents the percentage of provision for loan losses to gross loans of a given bank (Table 8).

vi. Including a new measure for bank's profitability: the Net Interest Margin (NIM) (Tables 9).

Since we are measuring the relationship between banks' function as liquidity creators and their profitability on one side, and financial stability at the country level on the other side, it seemed useful to run the model using a national banking system stability measure: the aggregateZ score as the dependent variable. The test confirmed our results for all our dependent variables. However, as opposed to our original model, the results are highly significant for both liquidity creation measures but not significant for banks' profitability.

To summarize, to avoid possible interdependence, we tested our extended model for each dependent variable separately. Our findings also held after we added two control variables, in separate tests, to account for bank liquidity and bank asset quality.

As for our robustness GMM tests presented in table Table 4, the results of the two-step system GMM estimations of our model. For all four models presented, the AR(2) tests are not significant at 5%, indicating the absence of second order autocorrelation. Additionally, the p-values of the Hansen test do not reject the null hypothesis and consequently validate the used instruments.

In line with our main findings, the negative relationship between liquidity creation and financial stability on both individual and aggregate levels is significant in our reduced GMM models.

The use of the GMM estimation, which considers the dynamic nature of the data, is further confirmed by the continuance of the dependent variables. for instance, the Z score lagged value is significant at 1% in all models. Precisely, a 1% increase in the previous year's Z score leads to an increase of between 81.3% and 82.6% in the current Z score.

Our GMM models show a statistically significant positive association between bank profitability and a higher Z score depicting lower instability. These results are consistent with previous studies

(Gupta & Kashiramka, 2020; VO et al., 2019).

In the another tables (tables 5 at 9), our regression results are highly robust to changes in liquidity creation measures and multiple controls variables (financial stability, bank's assets quality and bank's profitability).

Table 4

GMM system regressions

	(1) Cat.Fat (GMM_Reduced)	(2) Cat.NonFat (GMM_Reduced)	(3) Cat.Fat (GMM_Reduced)	(4) Cat.NonFat (GMM_Reduced)
VARIABLES	Z_I	Z_I	Z_score_O	Z_score_O
L.Z	0.826***	0.813***	0.949***	0.927***
	(0.0239)	(0.0293)	(0.0590)	(0.0673)
LC_T_GTA_CATFAT	-7.306*		-5.141***	
	(4.622)		(1.959)	
LC_T_GTA_CAT_NONFAT		-9.944*		-6.601***
		(5.972)		(2.379)
ROAE	5.831*	5.962*	-1.736	-1.561
	(3.767)	(3.936)	(2.962)	(2.759)
GFC	0.573	0.968	0.951***	0.773**
	(0.459)	(0.660)	(0.313)	(0.377)
Constant	2.248***	2.039**	1.806	2.259
	(0.707)	(0.885)	(1.798)	(2.037)
Observations	700	700	658	658
Number of id	55	55	56	56
Sargan statistic	233.3	237.6	223.4	223.4
Prob > Sargan	0	0	0	0
Hansen statistic	25.59	17.43	36.21	36.21
Prob > Hansen	0.0292	0.0653	0.000299	0.000299
AR(2)	0.296	0.321	3.61e-06	3.61e-06

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5

OLS regressions with aggregate country-level Z score

VARIABLES	(1) Cat.Fat (OLS_Extended) Z_score_O	(2) Cat.NonFat (OLS_Extended) Z_score_O
LC_T_GTA_CatFat	-3.821***	
	(0.881)	
LC_T_GTA_Cat_NonFat		-4.799***
		(0.927)
ROAE	0.669	0.905
	(2.240)	(2.214)
L.EA	8.548**	8.574**
	(3.657)	(3.624)
L.BK	0.271***	0.266***
	(0.022)	(0.022)
L.GDP_CAP_GRWTH	0.071	0.071
	(0.062)	(0.062)
L.RES_CHNG	-3.105***	-3.077***
	(0.517)	(0.513)
L.GOVEXP_CHNG	4.998***	4.938***
	(1.668)	(1.655)
L.GFC	2.720***	2.644***
	(0.804)	(0.797)
Constant	7.740***	7.909***
	(2.400)	(2.381)
Observations	512	512
R-squared	0.475	0.483
Number of ID	46	46
r2_o	0.455	0.442

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6

OLS regressions - Testing each independent variable on a standalone basis

	(1)	(2)	(3)
	OLS_Mod_CF _fe	OLS_Mod_CNF_fe	OLS_Mod_ROAE_fe
VARIABLES	Z_I	Z_I	Z_I
LC_T_GTA_CatFat	-7.647***		
	(1.966)		
LC_T_GTA_Cat_NonFat		-9.412***	
		(2.222)	
ROAE			0.132
			(3.177)
L.GFC	1.618	1.420	1.903*
	(1.022)	(1.022)	(1.071)
Constant	19.329***	18.910***	19.238***
	(0.352)	(0.351)	(0.455)
Observations	735	735	709
R-squared	0.026	0.030	0.005
Number of ID	55	55	55
r2_o	1.40e-07	2.33e-05	1.24e-05

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7

Including a bank's liquidity measure (LIQ_A_TA) as an additional controlvariable

	(1) Cat.Fat (OLS_Extended)	(2) Cat.NonFat (OLS_Extended)
VARIABLES	Z_I	Z_I
LC_T_GTA_CatFat	-6.322***	
	(1.259)	
LC_T_GTA_Cat_NonFat		-6.507***
		(1.342)
ROAE	3.659*	3.973**
	(1.975)	(1.979)
L.EA	61.810***	62.076***
	(4.802)	(4.807)
L.LIQ_A_TA	*-6.210****	*-5.982***
	(2.399)	*(2.397)*
L.BK	0.109***	0.105***
	(0.031)	(0.031)
L.GDP_CAP_GRWTH	-0.063	-0.062
	(0.087)	(0.087)
L.RES_CHNG	-1.686**	-1.647**
	(0.725)	(0.727)
L.GOVEXP_CHNG	1.729	1.630
	(2.285)	(2.290)
L.GFC	2.030*	1.906*
	(1.123)	(1.125)
Constant	6.072	5.961
	(3.862)	(3.870)
Observations	566	566
R-squared	0.345	0.343
Number of ID	46	46
r2_o	0.0519	0.0543

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8

OLS regressions - Including a bank's asset quality measure (PLL_LN) as a control variable

VARIABLES	(1) Cat.Fat (OLS_Extended) Z_I	(2) Cat.NonFat (OLS_Extended) Z_I
LC_T_GTA_CatFat	-5.287***	
	(1.179)	
LC_T_GTA_Cat_NonFat		-5.378***
		(1.263)
ROAE	3.459*	3.728*
	(1.971)	(1.973)
L.EA	65.416***	65.455***
	(5.044)	(5.054)
L.PLL_LN	*-6.576***	*-6.176***
	(2.407)	*(2.413)*
L.BK	0.101***	0.098***
	(0.031)	(0.031)
L.GDP_CAP_GRWTH	-0.066	-0.066
	(0.088)	(0.089)
L.RES_CHNG	-1.703**	-1.678**
	(0.725)	(0.726)
L.GOVEXP_CHNG	2.396	2.297
	(2.278)	(2.284)
L.GFC	2.134*	2.033*
	(1.134)	(1.136)
Constant	2.098	2.096
	(3.367)	(3.374)
Observations	562	562
R-squared	0.348	0.346
Number of ID	45	45
r2_o	0.0694	0.0712

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9

Including a new measure for bank's profitability: the Net Interest Margin (NIM)

VARIABLES	(1) ols_E_ROB31_lfe Z_I	(2) ols_E_ROB32_lfe Z_I
LC_T_GTA_CatFat	-5.401***	
	(1.169)	
LC_T_GTA_Cat_NonFat		-5.716***
		(1.255)
NIM	*42.422*	*48.494*
	(29.319)	*(29.478)*
L.EA	59.311***	59.291***
	(4.854)	(4.858)
L.BK	0.131***	0.129***
	(0.031)	(0.031)
L.GDP_CAP_GRWTH	-0.077	-0.074
	(0.086)	(0.086)
L.RES_CHNG	-1.912***	-1.860***
	(0.719)	(0.719)
L.GOVEXP_CHNG	2.271	2.170
	(2.271)	(2.273)
L.GFC	2.148*	2.020*
	(1.118)	(1.118)
Constant	-0.405	-0.514
	(3.485)	(3.486)
Observations	564	564
R-squared	0.345	0.344
Number of ID	46	46
r2_o	0.0532	0.0548

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Discussion and key findings

Our findings demonstrate that bank stability is consistent from one year to another which is line with previous studies (Gupta & Kashiramka, 2020b). In fact, we found that the systematic financial stability of one year is significantly positively associated with the year that follows.

Our results on liquidity creation show a strong negative association between on- and off-balance sheet liquidity creation and financial stability in Lebanon. Our analysis showed that liquidity created by Lebanese banks leads to a decrease in the banks' financial stability. These results are supported by existing literature; particularly, Berger *et al.*, (2019) find that liquiditycreated by commercial banks is associated with reduced financial stability, furthermore, Fungacova *et al.*, (2013) show that a higher probability of Russian banks' failure is associated with excessive liquidity creation between 2000 and 2007. Moreover, Berger & Bouwman (2017)suggest that high levels of liquidity creation may serve as a financial crisis predictor. Nevertheless,Davydov *et al.*, (2021) demonstrate that liquidity creation is negatively associated with banks' risk on an individual level but magnifies their exposure to severe shocks, which supports our findings on the national aggregate level. Our results are contrary to Zheng, et al, 2019 who find that increasing liquidity creation by U.S. banks between 2003 and 2014 led to a higher Z score and therefore increased stability.

Our results show a persisting positive association between banks' profitability and systematic financial stability. Particularly, our model depicts a significant positive association between banks' return on average assets (ROAE) and their stability proxied by an individual bank's Z score. Still, we found that Lebanese banks' profitability is insignificant in our alternative model including the aggregate Z score, which points to an interestingly inexistent effect of profitability on liquidity creation; similar results are reported by Sahyouni & Wang (2019) for MENA countries.

Considering our control variables, the alternative aggregate Z score level model show that banks' concentration is significant and positively associated with stability, which leads us to conclude that relatively high concentration among Lebanese banks brings higher stability to the financial system, similar to the main findings of Saif-Alyousfi, Saha, & Md-Rus (2020) for GCC countries, who find that lower bank competition led to more stability during the 2008 crisis and provide supporting evidence for the competition-stability hypothesis. These results are similar to the findings of Fungacova et al. (2013), who show that higher concentration reduces the probability of bank failure in Russia, but contrary to Tabak, Fazio, & Cajueiro (2013) and Fiordelisi & Mare (2014), who show that bank concentration, mainly in terms of assets, decreases the stability of the whole financial system.

Furthermore, our results show that an increase in GDP growth per capita is associated with lower stability. Differing findings are reported by Yin (2019) and by VO et al. (2019) for developing countries. Additionally, in line with Davydov et al. (2018), who highlight the procyclicality of banks' liquidity creation behavior, our findings reflect an increasing risk appetite in banks during

economic expansions and thus more liquidity creation which is also in line with Berger & Sedunov (2017), who find a strong positive relationship between banks' liquidity creation and real economic output.

An interesting finding in our study is the positive association between government expenditure and country-level financial stability in Lebanon, which sheds some light on the type of fiscal policy to be adopted in such contexts and may hinder the effectiveness of a potential contractionary policy to deal with the current crisis. In fact, Berger et al. (2017) show that economic policy uncertainty can harm the economy by decreasing bank liquidity creation, whichmay explain the acceleration of the crisis channeled by banks during the 2019 – 2021 period in Lebanon; this period is characterized by a sudden drop in government expenditure and an abruptchange in monetary interventions by the Banque du Liban (Lebanese central bank).

The above results also lead to a paradoxical situation for a potential policy intervention. While liquidity creation may serve as a trigger to increase economic output Berger & Sedunov (2017), Acharya & Thakor, (2016) report an interesting implication where banks are inclined to decrease their liquidity creation when an unconditional bail-out is probable.

The additional robustness tests including alternative stability measures and simple OLS regressions reinforce the key findings of our initial model. Moreover, the results hold when different samples of control variables are used. Consequently, our tests present additional proof that liquidity creation by Lebanese banks reduces their stability on both aggregate and individual levels.

6. Conclusion

This paper studies the relationship between banks' liquidity creation, their profitability, and national financial stability in Lebanon. The function of banks as liquidity creators is inherently risky; in fact, banks transform liquid and relatively safe deposits into illiquid risk-bearing assets. However, this transformation is at the center of banks' operations and revenues. Therefore, banks may increasetheir profitability by creating more liquidity. Nevertheless, several studies have linked excessive liquidity creation to periods of financial instability, mainly in developed countries. The current financial collapse in Lebanon highlighted the importance of analyzing the performance of Lebanese banks from a different angle to understand the link between their outcome and systematic stability. Our paper questions the role that these apparently sound and resilient banks played in the crisis by examining, for the first time, the relationship between Lebanese banks' liquidity creation, their profitability, and financial stability.

In our empirical study we used data for Lebanese banks over the period 1997 – 2019. To calculate the amount of liquidity created, we adopted the Berger and Bouwman (2009) three-step procedure. Following the existing literature, we used aggregate and bank-level Z scores to capture the financial (in)stability and the return on average equity (ROAE) to account for bank profitability.

Our findings, supported by robustness tests, suggest a strong negative relationship between banks' liquidity creation and financial stability in Lebanon for the observed period. In addition, profitability seems to affect financial stability positively but insignificantly for the same period.

Our paper may have significant policy implications for the expected recovery plan of the Lebanese banking sector and the Lebanese economy in general. We might deduce that stricter regulations in terms of liquidity creation could be applied (Zheng et al., 2019). The resulting suggestion is that political decision makers and regulators should supervise the creation of liquidity, and limit the degree of diversification of banks, by determining optimal levels. This would limit the negative influence of liquidity creation on financial stability in Lebanon.

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Appendix

Table A1

Detailed classification of assets, liabilities & equity, and off-balance activities

Assets		
Liquid Assets	**Remarks / Notes**	**Explanation**
Cash & balances with central banks		These assets can be easily, economically (minimal loss), and rapidly turned into cash.
Net loans & advances to banks		
Total financial assets: securities	The change in classification dummy variable denotes the possible omission of other securities from this account prior to 2003. However, the amounts and therefore the impact are minimal.	
Semi Liquid Assets		
No semi-liquid assets		Due to underdeveloped financial markets, Lebanese banks cannot securitize or sell their mortgages or consumer loans and consequently they should be considered illiquid and not semi-liquid as inthe initial classification
Illiquid Assets		
All other assets		These assets cannot be easily and rapidly withdrawn without incurring substantial costs turned into cash

Liabilities and Equity		
Liquid Liabilities		**Remarks**
Demand deposits		These liabilities can be easily, economically (minimal or no penalty), and rapidly withdrawn by the bank's customers
Savings deposits		
Derivative financial instruments	The change in classification dummy variable denotes the omission of this account mainly prior to 2007. However, the amounts and therefore the impact are minimal	
Trading liabilities	The change in classification dummy variable denotes the omission of this account mainly prior to 2007.However, the amounts and therefore theimpact are minimal	
Semi-liquid Liabilities		
Time deposits		These liabilities can be less easily withdrawn by the bank'scustomers, although incurring a penalty
Other customer deposits		
Bank deposits		
Other wholesale deposits		
Short-term borrowings and debt securities at historical cost < 1 year	The change in classification dummy variable denotes the omission of this account mainly prior to 2007.However, the amounts and therefore the impact are minimal	
Illiquid Liabilities and Equity		
All other liabilities and equity		These liabilities cannot be withdrawn without involving substantial losses and time. Equity components are illiquid since they are residual claims by nature.

Off-balance Sheet Activities / Guarantees		
Liquid Guarantees		**Remarks**
Non-liquid Guarantees		
Semi-liquid Guarantees		
Non-liquid and semi-liquid guarantees		Off-balance sheet derivatives, when available, are reported at par book value and consequently they are not considered in our calculation. Berger and Bouwman consider gross fair values in their analysis.
Illiquid Guarantees		
All other off-balance sheet liabilities		Off-balance sheet guarantees and commitments are treated like their similar on-balance sheet equivalents

Table A2

Weights assigned to the classified items

Assets	
	Weight
Liquid Assets	-0.5
Semi-liquid Assets	0
Illiquid Assets	+0.5
Liabilities and Equity	
Liquid Liabilities	+0.5
Semi-liquid Liabilities	0
Illiquid Liabilities and Equity	-0.5
Off-balance Sheet Activities / Guarantees	
Liquid Guarantees	-0.5
Semi-liquid Guarantees	0
Illiquid Guarantees	+0.5

Table A3

Liquidity created by multiplying the classified items by their respective weights

Variable	Description	Calculation
LC_A	Liquidity created by assets	liquid assets * (- 0.5) + semi-liquid assets * 0 + illiquid assets * 0.5
LC_L&E	Liquidity created by liabilities and equity	liquid L&E * 0.5 + semi-liquid L&E * 0 + illiquid L&E * (- 0.5)
LC_OBS	Liquidity created by off-balance sheet activities	liquid OBS * (- 0.5) + semi-liquid OBS * 0 + illiquid OBS * 0.5
LC_ CAT.FAT	Total liquidity created including off-balance sheet activities	LC_A + LC_L&E + LC_OBS
LC_ CAT.NONFAT	Total liquidity created excluding off-balance sheet activities	LC_A + LC_L&E + LC_OBS

Table A4

Liquidity created per dollar of total gross assets

Variable	Description	Calculation
GTA	Gross total assets	Total assets + Provision for loan losses
LC_A / GTA	Liquidity created by assets for one dollar of GTA	LC_A / GTA
LC_L&E / GTA	Liquidity created by liabilities and equity for one dollar of GTA	LC_L&E / GTA
LC_OBS / GTA	Liquidity created by off-balance sheet activities for one dollar of GTA	LC_OBS / GTA
LC_ CAT.FAT / GTA	Total liquidity created including off-balance sheet activities for one dollar of GTA	LC_ CAT.FAT / GTA
LC_ CAT.NONFAT / GTA	Total liquidity created excluding off-balance sheet activities for one dollar of GTA	LC_ CAT.NONFAT / GTA