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WP/19/02

Bank Capital, Liquidity Creation, Profitability, and Financial Stability: Evidence Across Countries

December 2019

Abstract

This paper represents the first broad, cross-country examination of the interrelationships between regulatory capital, liquidity creation, bank profitability, and financial stability. From a sample of 558 commercial banks across 84 countries over the 2011-2017 time span, our empirical results show a negative two-way relationship between regulatory capital and liquidity creation, which holds for all banks and supports the financial fragility-crowding out hypothesis. Furthermore, we find that liquidity creation leads to lower bank profitability and higher financial instability. Further analysis reveals that the impact of ROA and regulatory capital is negative for bank-based financial structure, but positive for market-based economy. Finally, banks in higher growth countries exhibit higher liquidity creation, while higher financial freedom results in lower riskiness and better profitability. Our findings are robust after estimated using alternative measures for regulatory capital and liquidity creation.

JEL Codes: G21, G28

Keywords: regulatory capital, liquidity creation, bank profitability, financial stability

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1. Introduction

Responding to the global financial crisis of 2007-2008, many countries have introduced additional standards for higher capital measurements and liquidity with the aim to promote a more resilient banking sector. Hence, banks are met with higher capital requirements to ensure their ability to cover solvency risks. Furthermore, banks are exposed with liquidity risk, particularly when liquidity is created by mismatching long-term assets with short-term liabilities. These new requirements for additional capital and liquidity coverage will most likely affect bank's performance. Banking industry believes that tighter capital reserve will increase funding cost and lower liquidity creation, which result in lower lending and investment activities in the economy. As a consequence, banks tend to maintain lower profitability since higher capital requirements will shift funding from liquid deposits to less liquid capital, which may cause bank's inability to create liquidity. Goodard et al. (2010) support this argument that an increase in capital requirements will negatively impact bank profitability.

In contrast, Admati et al. (2013) argue that banks with higher capital would tend to avoid excessive risk taking activities. Consequently, banks have better performance from lower distortion in lending decisions and moral hazard. To support the importance of capital regulation, Demirgüç-Kunt and Huizinga (2000), Iannotta et al. (2007), and Lee and Hsieh (2013) have illustrated that bank capital ratio has positive relationship with profitability. In terms of bank's illiquidity, only a few studies have directly investigated the relationship between liquidity creation and bank profitability. Molyneux and Thornton (1992) and Goddard et al. (2013) both report a negative impact of liquidity on bank performance in European countries in 1986–1989 and the mid-1990s, respectively. Tran et al. (2016) also shows negative relationship between liquidity creation and bank performance in the United States from 1996 to 2013.

This paper aims to extend previous work on the interrelationships between capital, liquidity creation, and profitability with their impacts on financial stability across various countries. We use a sample of global commercial banks to specifically assess the impact on financial stability of higher regulatory capital and liquidity, and whether such an impact depends on bank-specific and country-specific factors. To the best of our knowledge, only Tran et al. (2016) and Fu et al. (2016) have examined the connection between regulatory capital, liquidity creation, and bank profitability in the United States and Asia Pacific, correspondingly. However, none has relate the corresponding relationships with the stability of the banking sector. In the case of illiquidity, excessive liquidity creation can be an antecedent for crisis because an increase in the bank balance sheet can result in asset bubble that in the future may burst and lead to bank failures (Acharya and Naqvi, 2012). Thus, this paper serves to produce empirical evidence of the critical nexus between bank performance and financial stability. By investigating the linkages between bank performance and stability across banks around the world, this paper presents a benchmark for policy makers as to how to promote banking growth without exacerbating bank riskiness.

The rest of the paper is organized as follows. Section 2 provides a brief literature review on the interrelationships between regulatory capital, liquidity creation, profitability, and financial stability. Section 3 desbribes our data, variables and methodology to assess the issues raised in the paper. Section 4 provides empirical results, robustness check, and related discussions. Section 5 concludes the paper.

2. Brief literature review

There are numbers of existing studies on the linkage between regulatory capital and liquidity creation, which can be partitioned into two opposing views. The first view follows Berger and Bouwman (2009) who propose that regulatory capital can be related to liquidity creation in two ways. The first is financial fragility-crowding out hypothesis, which stipulates negative relationship between regulatory capital and liquidity creation. Diamond and Rajan (2001) conclude that banks are typically fragile since their primary source of fund come from depositors. Banks have informational advantage in monitoring borrowers; therefore, they have incentive to raise deposits rate for higher share of loan income at the expense of their depositors. In addition, the lack of full deposit insurance leads banks to have the tendency to adopt a fragile financial structure with a large share of liquid deposits to acquire depositors' confidence and decreasing the probability of bank run. In summary, banks are likely to raise deposits for issuing loans in maximizing liquidity creation. While higher capital standards aim to prevent financial fragility, they crowds out deposits in an unsegmented capital market and therefore limiting liquidity creation (Gorton and Winton, 2000). As a consequence, banks with higher regulatory capital may be exposed to lower liquidity creation.

On the contrary, risk absorption hypothesis stipulates that regulatory capital has positive relation with respect to liquidity creation. Liquidity creation tends to increase a bank's illiquidity risk in the event of forcibly disposing illiquid assets to meet deposits, as argued by Allen and Santomero (1998) and Allen and Gale (2004). Furthermore, Bhattacharya and Thakor (1993) and Repullo (2004) argue that liquidity creation encourages banks to strengthen the capital base. In contrast, well-capitalized banks with greater risk capacity have a forceful position to build more liquidity. The adjustment between capital and the level of illiquidity risk becomes the underlying argument of this hypothesis. As a result, the relationship between regulatory capital and liquidity creation is positive and bi-causal.

Nevertheless, the result of these competing hypotheses is still mixed over existing empirical evidence. Berger and Bouwman (2009) find out that when off-balance sheet items are included in the measurement of liquidity creation, the relationship between liquidity creation and capital is positive for large banks but negative for small banks. Horváth et al. (2014) study the two-way causal of liquidity and capital requirements in a sample of the Czech bank and conclude that liquidity creation granger-causes decrease in capital. In addition, they reveal that capital has negative impact on liquidity creation on small banks. This finding is supported by Distinguin et al. (2013), which conclude that Basel III's illiquidity measure and liquidity creation are simultaneous and negatively related to Tier-1 and Tier-2 capital ratios. Nonetheless, when stable deposits are replaced with core deposits for measuring liquidity, the capital seems to be positively related to liquidity creation of small bank.

Furthermore, banks with greater capital and therefore lower equity multiplier produce lower return on equity. If corporate tax is considered, an increase in equity with corresponding decrease in debt likely reduces tax-shield savings, which lead to lower after-tax earning. Hence, a higher capital ratio results in lower bank profitability. This negative relationship appears to hold with the assumption that markets are largely frictionless (without taxes). Another imperfection in the market possibly affects the relationship between capital and bank profitability. Berger (1995) reports that expected bankruptcy costs and asymmetric information may reverse the impact of capital on bank profitability. In static trade-off theory,

the optimal capital structure can be obtained if the total benefits (including tax shields) are equal to the total costs of debt (including bankruptcy costs). As a result, banks with capital ratio lower than its optimal level may get an advantage from additional capital. Moreover, well-capitalized banks may deliver positive signal to the market, lowering their cost of capital and increasing its profitability in an environment of information asymmetry between banks and investors.

Consequently, there seems to be no consensus on the relationship between regulatory capital and bank profitability. Bourke (1989) argues that regulatory capital can affect bank profitability positively in different countries. Banks with high capital likely to have better access to financing sources with lower cost and risk, as well as better access to higher quality assets markets compared to low capitalized banks. Similarly, Berger (1995) reveals that regulatory capital tends to positively granger-cause earnings because it is more likely to fall below its optimal level. On the contrary, Altunbas et al. (2007) report that highly-capitalized banks in Europe are found to be inefficient.

In managing liquidity, banks will hold more liquid assets to prevent liquidity risk from maturity mismatch between assets and liabilities. Dymski (1988) examines the way in which illiquidity risk is maintained by forecasting the level of future deposits available to the bank. Another approach is for banks to control their illiquidity risk by managing their assets and liabilities. Le Héron (2002) proposes that the preference of banks' liquidity is indicated by their intention to decrease uncertainty and set their balance sheet in specific composition.

Since liquid assets generate lower return than illiquid assets, the holding of liquid assets may lower bank profitability. Nonetheless, Bordelau and Graham (2010) illustrates that holding more liquid assets can reduce bank's illiquidity risk, and consequently its default probability. Hence, the financing costs can be reduced, which lead to higher profit. The benefit of lower default risk by holding more liquid assets may also offset the cost of lower return.

In this paper, we build on the work of Tran et al. (2016) in order to assess the connection between liquidity creation, regulatory capital, and profitability across countries. We examine the the impact of the connection on financial stability, so as to highlight whether the link between performance and stability in banking is affected by the degree of bank capital and liquidity.

As a further contribution, we extend the analysis to whether strengthening bank capital and liquidity base that may result in higher performance is beneficial for financial stability taking into account the influence of bank-specific and country-specific factors. Specifically, we focus on analyzing whether bank-specific characteristic related to the size of the bank matter in influencing the impact of regulatory capital and liquidity creation on stability of the banking sector. Additionally, we examine whether market-based or bank-based structure in the economy differ substantially that may aggregate financial instability.

3. Data and methodology

3.1 Data

We employ an unbalanced yearly panel data focusing on commercial banks in 84 countries globally between 2011 and 2017. A detailed bank-level dataset is compiled on

balance sheet, income statement, banking sector concentration ratios, macroeconomic indicators, and financial freedom index from various sources (see Appendix A for detail).

From the seven-year period dataset, we identify 1211 banks with 8477 observations as our initial sample, but subsequently, we exclude banks with missing values on dependent variables used in the analysis. Furthermore, bank are excluded from observation if (1) missing values for on- and off-balance-sheet items, (2) missing values for the total capital ratio (TCR) and Tier-1 capital to risk-weighted assets (T1CR), or (3) bank's total capital ratio is lower than the regulatory minimum requirements. To reduce the impact of potential outliers, we winsorize the top 1% and bottom 1% of dependent variables data to give the final sample of 558 banks with 3005 observations.

Table 1 presents the summary statistics of regulatory capital, liquidity creation, profitability, financial stability, bank-specific and country-specific variables over the full sample and sub-samples (See Appendix for variable definitions). We sort the data by bank size, financial system, and country classification. Following Berger et al. (2014), small and large banks are classified as banks with total assets below and above the median. The median bank size in our sample is $5,890 billion of assets. To categorize the financial system, we follow Levine (2002) that classifies countries as bank-based and market-based. We use the Structure-Size measurement to calculate the size of stock markets relative to that of banks. Structure-Size is obtained from the logarithm of the market capitalization ratio divided by the bank credit ratio. A larger value of Structure-Size indicates a more market-based financial system. Hence, countries with below-median values of Structure-Size are classified into bank-based, while countries with above-median values are categorized as market-based. Finally, we distinguish the sample according to the International Monetary Fund's World Economic Outlook (WEO) that classifies the countries into advanced and developing economies.

Table 1. Summary Statistics of Regulatory Capital, Liquidity Creation, Profitability and Financial Stability

	Obs.	CET1 (%)	T1CR (%)	TCR (%)	LC1	LC2	ROAA	Z-Score
Panel A: Mean for all sample banks								
All	3005	14.533	14.957	17.059	0.169	0.092	0.935	16.348
Panel B: Mean by year								
2011	229	13.763	14.075	16.398	0.123	0.061	0.874	16.279
2012	325	14.796	15.117	17.291	0.158	0.081	0.994	16.528
2013	429	13.763	14.128	16.257	0.164	0.086	0.964	16.491
2014	465	14.001	14.342	16.394	0.165	0.090	0.954	16.279
2015	481	14.366	14.743	16.824	0.171	0.095	0.868	16.297
2016	518	14.886	15.410	17.496	0.181	0.102	0.956	16.350
2017	558	15.549	16.137	18.168	0.187	0.108	0.930	16.261
Panel C: Mean by size								
Large	1503	12.710	13.322	15.698	0.168	0.083	0.801	16.237
Small	1502	14.533	14.957	17.059	0.169	0.093	0.936	16.348
Panel D: Mean by country classification								
Advanced	1285	15.584	16.149	17.930	0.168	0.104	0.487	16.214
Developing	1720	13.748	14.066	16.409	0.169	0.084	1.271	16.448
Panel E: Mean by financial system								

Bank-based	1502	14.739	15.208	17.153	0.143	0.081	0.782	16.226
Market-based	1503	14.327	14.706	16.967	0.194	0.105	1.089	16.469

Panel A demonstrates that the average CET1, T1CR, and TCR are 14.53%, 14.96%, and 17.06%. These percentages are much higher than the required minimum capital ratio imposed by Basel I and Basel II (4% for CET1 and T1CR) as well as the stricter Basel III (4.5% for CET1 and 6% for T1CR) while the total regulatory capital is left unchanged at 8%. From these figures, we conclude that banks on average seem to have adequate capital to secure them from financial risk throughout the sample period. As expected, due to their nature of transaction are more complex, banks in advanced countries have more capital cushions than those in developing countries as shown in Panel D. Similarly, banks in the bank-based countries tend to have higher capital ratio than banks in the market-based country, as demonstrated in Panel E.

Panel A also shows different values for liquidity creation, which depends on whether off-balance sheet items are included in the calculation. On average, a ratio of fat liquidity creation (LC1) to total assets is 16.9% for all sample banks, while the average nonfat liquidity creation (LC2) ratio is 9.2%, which indicates that almost half of liquidity source of banks are off balance sheet items. Panel B displays increasing pattern of liquidity creation every year, driven by banks in market-based countries. This result implies that banks in a market-based economy tends to be more aggressive in creating liquidity than banks in a bank-based economy.

Return on Asset (ROA) as a proxy for bank profitability measure averages 93.5% over the sample period. There is a huge gap ROA in panel D, ROA of advanced economies banks are only one-third ROA of developing economies. This huge gap might be driven by higher capital structure banks in advanced economies made them less profitable. Over the sample period, Banks in all panel shows same level of financial stability, indicate with Z-Scores on average 16.35%.

3.2 Methodology

We examine the relationship among regulatory capital, liquidity creation, bank profitability, and financial stability by employing bank-level datasets from 84 countries. The relationships among these variables pose potential endogeneity and serial correlation problems in dynamic panel models. According to Arellano and Honoré (2001), ordinary least square (OLS), instrumental variables estimators, and panel data estimators such as least square dummy variables (LSDV) may not sufficiently perform as consistent estimators to address bias. Arellano and Bond (1991) and Blundell and Bond (1998) argue that the dynamic panel GMM is better than conventional estimators due to its ability to corrects potential endogeneity, heteroscedasticity, and autocorrelation in panel data. Thus, lagged values of dependent variables and exogenous variables as valid instruments can be used to address simultaneity. The need for external instruments is eliminated because the set of "internal" instruments are already available in the panel. Finally, potential correlations between the dependent variables are captured by the GMM estimators.

We apply the one-step system GMM dynamic panel estimators of Arellano and Bover (1995) and Blundell and Bond (2000) in our estimation. Since the system GMM uses both regressions in levels and differences, it is more efficient than the difference GMM by

Arellano and Bond (1991). To overcome potential downward bias of the estimator, we use robust standard error by Windmeijer (2005). We estimate our panel data by employing the equations as follow:

(1) Liquidity = *f* (Capital, Profitability, Bank Control, Macro Control)
(2) Capital = *f* (Liquidity, Profitability, Bank Control, Macro Control)
(3) Profitability = *f* (Capital, Liquidity, Bank Control, Macro Control)
(4) Stability = *f* (Capital, Liquidity, Profitability, Bank Control, Macro Control)

3.3 Variables

3.3.1 Regulatory Capital

Following Distinguin et al. (2013), two alternative regulatory capital ratios have been defined by Basel Committee Banks Supervision (BCBS) to measure bank capital. The first measurement is the total regulatory capital ratio (TCR), which is the ratio of Tier 1 and Tier 2 capital to risk-weighted assets. The second measurement is the Tier 1 capital ratio, computed as the ratio of Tier 1 capital to risk-weighted assets (T1CR). For further insight, we consider Common Equity Tier 1 (CET1) as an alternative measure of the regulatory capital ratio to measure bank's core equity capital to total risk-weighted assets.

3.3.2 Liquidity Creation

There are two measures of liquidity creation following Berger and Bouwman (2009). First, we classify bank's assets, liabilities, and off-balance sheet activities to liquid, semiliquid, or illiquid items (See Appendix B for the balance sheet and off-balance sheet items for each of three categories). Then all of these items are assigned different weights according to liquidity intuition. The first measurement of liquidity creation is fat liquidity creation (LC1) that incorporates off-balance sheet items, such as derivatives, letter of credit, and loan commitment (Kashyap et al. 2002). Then we calculate as follows:

(5) Fat Liquidity Creation = 0.5 (illiquid assets + liquid liabilities + illiquid guarantees) + 0 (semiliquid assets + semiliquid liabilities + semiliquid guarantees) - 0.5 (liquid assets + illiquid liabilities + equity + liquid guarantees + liquid derivatives)

The alternative measurement for liquidity creation is non-fat liquidity creation (LC2), which excludes off-balance sheet items and estimated as follows:

(6) Non- Fat Liquidity Creations = 0.5 (illiquid assets + liquid liabilities) + 0 (semiliquid assets + semiliquid liabilities) - 0.5 (liquid assets + illiquid liabilities + equity)

We classify bank loans based on category following Berger and Bouwman (2009). Furthermore, the classification by category is preferred than based on maturity because the

ease, cost, and time for banks to adjust their obligation to acquire liquid funds are more substantial than the time to create self-liquidating.

3.3.3 Profitability

Bank profitability is measured by two indicators. The first measure is the return on average assets (ROA), which is the ratio of net income over average total assets. ROA shows the banks' effectiveness in managing assets to generate profits and considers the performance of both conventional and non-conventional banking activities. The second measure is the return on equity (ROE), which is the ratio of net income over average total equity and disregards the financial leverage and the risk correlated with it.

3.3.4 Financial Stability

To measure financial stability in a particular country, we use Z-Score as the sum of the return on assets and equity to assets ratio, divided by the standard deviation of the return on assets. Z-score is generally used to analyze financial system characteristics. Previous banking literature also uses similar measure to examine individual bank risk (e.g., Berger et al. 2018; Berger et al. 2017; Laeven and Levine, 2009).

3.3.5 Bank Specific Control Variables

We use bank size (Size), bank risk (Risk), productivity growth (Productv) for bank specific control variables. Size, calculated as the natural log of total assets, is used to accommodate too-big-to-fail exposure associated with larger bank as they receive implicit assurance. Hence, the correlation among liquidity creation, regulatory capital, profitability, and financial stability may different across bank size. Following Berger and Bowman (2013), we measure Risk by the ratio of risk-weighted assets as defined in Basel regulation over gross total assets. As a control variable, bank risk can separate bank's regulatory capital and profitability from the bank's risk transformation function. Finally, Productv ratio measures bank efficiency, which is calculated as the ratio of gross total revenues over personnel costs. There are two arguments regarding the relationship between productivity and regulatory capital. Athanasoglou et al. (2008) argues that a rise in productivity can promote bank profitability. However, Fiordelisi et al. (2011) finds that bank efficiency results in negative consequences on regulatory capital because highly efficient banks provide a buffer to form capital subsequently.

3.3.6 Country Specific Variables

Annual growth rate of real gross domestic product (GGDP) is used to measure the macroeconomic environment of each country, while inflation is used to represent general price level increase in the economy. Perry (1992) argues that the impact of inflation in bank performance relies on whether banks already anticipate inflation or not. Positive effects on profitability will be achieved if inflation is completely anticipated. Following Santoso et al. (2019), we use financial freedom (FinFree) to measure efficiency in the banking industry in terms of its independence from government control and intervention in the financial sector. High scores of financial freedom indicate more ease and effective financing opportunities in the economy. Hence, financial freedom results in a positive impact on bank performance. Finally, we use financial structure (Structure) as defined by Levine (2002) to classify

countries into market-based and bank-based. In this paper, we measure the financial structure of the economy by size, which is calculated as the size of the stock market in corresponding to bank size.

4. Results

To examine the relationship among regulatory capital, liquidity, profitability and financial stability, we employ system GMM estimator to mitigate potential endogeneity between variables. Our indicators for regulatory capital are T1CR and TCR as defined by the Basel Committee, while fat liquidity creation (LC1) is used as an indicator for liquidity creation. For profitability and stability, we employ ROA and Z-Score, respectively.

4.1 Main Result

Table 2 exhibits the main results of the relationships among liquidity creation, regulatory capital, profitability, and financial stability in 84 countries. The results reveal that the two-way relationship between liquidity creation and regulatory capital is negative and significant. The result is robust across two measurements of regulatory capital. The results are consistent with the finding of Fu et al. (2016) that suggest banks in 14 Asia Pacific countries tend to decrease liquidity creation when they oblige higher regulatory capital, and otherwise. Finding by Distinguin et al. (2013) also show that liquidity creation has a significant and negative impact on regulatory capital. The result indicates that the bank does not enhance their solvency when they suffer liquidity constraint; instead, bank tends to lower their capital when they exposed to higher illiquidity. It is a signal that bank is more confidence to their strong depositor base than capital market. Once bank under liquidity constraint condition, they prefer to find liquidity from depositor than the capital market.

Moreover, the negative and significant impact of regulatory capital on liquidity creation is consistent with the "financial fragility-crowding out" hypothesis and provide less support for the "risk absorption" hypothesis. Banks must maintain depositors' trust by carrying out a fragile financial structure with a large portion of the liquid deposit. Consequently, higher capital ratios will crowd out deposits which mean shifting investors' fund from relatively liquid deposits to relatively illiquid bank capital. Therefore, the more banks' capital ratios increase, the lower is their liquidity creation.

Columns 5-7 in Table 2 present the effects of regulatory capital and liquidity creation on bank profitability as measured by ROA. It appears that regulatory capital has a positive impact on banks' profitability across countries. This result supports the findings by Berger (1995), Iannotta et al. (2007), and Lee and Heish (2013). Comparing to low capitalized banks, the banks with high capital likely to have better access to higher-quality assets markets with lower cost as their financing sources. Consistently, bank profitability also positively impacts regulatory capital because higher profitable banks have capability to retain more earnings.

Conversely, we find that liquidity creation negatively and significantly affects profitability; the negative sign also appears on the impact of profitability on LC1. Our findings consistent with the bankruptcy cost hypothesis, as higher illiquidity risk which is indicated by an increase in liquidity creation, might raise the default risk and lowering bank performance. It can be concluded that creating more liquidity may cost bank profitability. Column 8 shows that liquidity creation brings negative consequences on financial stability, while regulatory capital has an insignificant negative impact on financial stability. This

finding confirmed Berger et al. (2018) finding on liquidity creation by commercial banks results in financial instability.

Moreover, the negative coefficient of bank size on regulatory capital indicates that small banks tend to maintain a higher regulatory capital ratio to create more capital cushions; indeed, the result shows that a larger bank generates more profit. Additionally, results on control variables are mixed. Bank risk shows significant value in liquidity creation, regulatory capital, and profitability. Other control variables, the coefficient of financial freedom and financial structure display significant values for liquidity creation and regulatory capital; banks' growth significantly affects the regulatory capital and profitability, while the coefficient of real GDP growth is significant for stability and inflation has a significant impact on liquidity creation, regulatory capital, and financial stability.

4.2 Size Effect

Table 3 and Table 4 shows regression results for large and small banks, respectively. The regression on large and small banks shows similar results to regression on all banks. For both Size, we find that the two-way relationship between liquidity creation and regulatory capital is significantly negative, demonstrate the support for the "financial fragility-crowding out" and liquidity substitution hypothesis. We concluded that bank does not adjust their TCR and T1CR when facing higher illiquidity, regardless bank size. Instead, the capital is decreased when banks create liquidity. This finding is in line with Berger and Bouwman (2009), Fungacova et al. (2010), Distinguin et al. (2013), Horvath et al. (2014) and Fu et al. (2016). Moreover, the relationship between liquidity creation and profitability is negative and significant. The result is consistent with expected bankruptcy cost hypothesis which assume that an increase in liquidity creation may lead to higher illiquidity risk, therefore reducing banks' profitability and subsequently increasing the probability of having bankruptcy as supported by Molyneux and Thornton (1992), Goddard et al. (2010) and Tran et al. (2016).

In contrast, regulatory capital results in positive consequences on profitability, consistent with Berger and Bouwman (2013), this result demonstrate that higher capital promotes small bank to gain more profit. Another finding, liquidity creation is observed to have an adverse influence on financial stability, indicates that liquidity creation by any bank size affects financial instability. Conversely, banks' profitability displays a positive and significant coefficient on regulatory capital.

4.3 Market-Based vs. Bank-Based

Table 5 and 6 shows the regression result for countries in the market-based system and bank-based system. Results shows that all the regulatory capital measurement display adverse effects on liquidity creation for both, vice versa. Similar findings also find for all bank regressions and bank size regressions. This reveals that both the "financial fragility-crowding out" and the "liquidity substitution" hypothesis work on all banks, any bank size, and both market-based and bank-based system. The findings on the relationships between liquidity creation and financial stability are also similar for both and in line with findings from all banks and any bank size.

In contrast, different results of the interrelationships between regulatory capital and profitability exist for market-based and bank-based system. Regulatory capital is reported to be positively related to profitability for market-based system, whereas the relationships found

negative for bank-based system. This indicates that a higher capital ratio can boost bank profitability in the market-based country, while it has adverse effect in the bank-based system. Capital is inexpensive source of fund for banks, thus bank in the market-based system will have high access to inexpensive source of fund to capital market, consequently, the bank generates more profit that bank in bank-based system.

Interestingly, liquidity creation is not significant to affect bank profitability and bank profitability does not associate with financial stability in the market-based system. In particular, the coefficient of our control variables Productv, GGDP, Inflation and FinFree are positive, as displayed in Table 5. For banks in the market-based country, as the bank that more efficient, high GDP Productv, increase in inflation and more dynamic banking industry create more liquidity, while large banks and the more risky bank maintain high regulatory capital. Regarding the result for the country in the bank-based system, the two –way relationship between regulatory capital and liquidity creation is negative significant.

In contrast with the bank in the market-based system, liquidity creation for banks in the bank-based country is proven to be negative and significant affects profitability. This evidence is supporting the bankruptcy cost hypothesis, as higher illiquidity risk which is indicated by an increase in liquidity creation, might raise the default risk, therefore, lowering bank performance. Furthermore, bank profitability negatively associated with liquidity creation, which suggesting that bank with high profit creates less liquidity and liquidity creation affect financial instability. Respect to the control variables in the bank-based country, the relationship between bank risk, inflation and financial freedom is significantly positive. This result indicates that banks in this system with higher risk, raise in country inflation, and high financial freedom can create more liquidity. The coefficient of Size is significantly negative for regulatory capital, suggesting that smaller bank maintain high regulatory capital in the bank-based country.

4.4 Developed Countries vs. Emerging Countries

To understand the relationship between liquidity creation, regulatory capital, profitability and financial stability, we separate the sample into an emerging country and developed country to estimate the models. The results are demonstrated in tables 7-8, respectively. There is evidence that the two-way relationship between regulatory capital and liquidity creation is negative and significant, therefore supporting both the "financial fragility-crowding out" and the "liquidity substitution" hypothesis. Diamond and Rajan (2001) argue that higher capital possibly to reduce banks' liquidity and transaction services because it leads to higher agency costs and less efficient in contracting resolutions. In an emerging country, regulatory capital is found to affect profitability positively but has a negative association with financial stability. This result shows that higher bank capital leads to higher profitability but has an impact on financial instability. Calem and Rob (1999) and Hellman et al. (2000) assume that excessive equity may encourage the bank to take higher risk, hence threaten financial stability. Besides, bank profitability positively correlated with liquidity creation and regulatory capital but has no effects on the financial stability of the emerging country.

Similarly, the result of a two-way relationship between liquidity creation and regulatory capital in the developed country also shows a negative and significant coefficient. In contrast with evidence from an emerging country, regulatory capital has no impact on profitability. Instead, liquidity creation negatively influences profitability which supports the bankruptcy

cost hypothesis. The positive and significant coefficient between regulatory capital and financial stability implied that maintaining high capital ratio affects in stable financial condition, along with high profitability that associated with high financial stability in a developed country. Focusing on the control variables, a smaller bank in the emerging country create more liquidity and maintain high capital. Conversely, a larger bank in the developed country manages high regulatory capital. Control variable bank Productv only significantly affects regulatory capital in an emerging country, and financial freedom has an impact on regulatory capital, profitability and financial stability in an emerging country, while in developed country financial freedom only affect bank profitability.

4.5 Robustness Test

For robustness check, we follow Berger and Bouwman (2009) to replace the fat liquidity creation measurement by using nonfat liquidity creation that excludes off-balance sheet items (LC2) to examine the two-way relationship between liquidity creation and regulatory capital. Furthermore, we employ CET1 as the alternative measure for regulatory capital according to Basel III requirements. As displayed in Panel A of Table 9, the coefficient of TCR, T1CR, and CET1 as a measure of regulatory capital remains negative and significant effect on liquidity creation that proxy by LC2. Regulatory capital (CET1) also continues to associate with profitability and liquidity creation (LC2) positively, but negatively impact on profitability and financial stability. Therefore, the results reported in previous are robust.

The result in Panel B shows that the alternative measurement of profitability (ROE) only robust for liquidity creation, the interrelationship between profitability and liquidity creation remain negative and significant across two measurements of profitability.

5. Conclusion

This paper examines the interrelationships between regulatory capital, liquidity creation, profitability and the impacts on financial stability from bank-level data over the 2011-2017 period. The empirical results from a dynamic panel data analysis reveal that the financial fragility-crowding out hypothesis holds across all banks and countries. Our findings suggest that there is an adverse two-way relationship between regulatory capital and liquidity creation, and the results are robust using alternative capital measurement.

Meanwhile, the resulting negative association between liquidity creation and bank profitability follows the bankruptcy cost hypothesis. Our finding also shows that liquidity creation results in negative impact on financial stability. In terms of capital, bank profitability has positive association, particularly for lower capitalized banks. However, at certain high level of capital, profitability will decrease, which indicates that an optimal capital structure exists for maximum performance.

Specifically, our findings show a trade-off between increased regulatory capital and liquidity creation. Increase level of capital ratio from Basel III requirements may reduce liquidity creation, which may subsequently lead to economic slowdown from lower available financing. Conversely, if bank maintains higher liquidity, then the regulatory capital will decrease and induce bank to become insolvent because of its inability to meet the capital adequacy requirement.

Table 2. Liquidity Creation, Regulatory Capital, Profitability, and Financial Stability for All Banks

	Liquidity Creation		Regulatory Capital		Profitability			Stability
	LC1		TCR	T1CR	ROA			Z-Score
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TCR	-0.00567***				0.0220**			-0.0140
	(0.000380)				(0.00871)			(0.00960)
T1CR		-0.00564***				0.0247***		
		(0.000350)				(0.00951)		
LC1			-7.909***	-9.182***			-0.875***	-2.179***
			(1.513)	(1.159)			(0.210)	(0.307)
ROA	-0.0176***	-0.0166***	0.634***	0.841***				0.0426
	(0.00453)	(0.00462)	(0.230)	(0.253)				(0.0313)
Risk	0.00179***	0.00175***	-0.104***	-0.135***	0.0150***	0.0155***	0.0141***	0.00702
	(0.000241)	(0.000254)	(0.0138)	(0.0138)	(0.00185)	(0.00175)	(0.00222)	(0.00650)
Size	-0.000294	-0.00150	-1.225***	-1.716***	0.0302	0.0392**	0.00357	-0.0546
	(0.00156)	(0.00155)	(0.129)	(0.132)	(0.0186)	(0.0199)	(0.0160)	(0.0504)
Productv	-0.00310	-0.00331	0.177*	0.112	0.0851***	0.0843***	0.0874***	0.00478
	(0.00209)	(0.00215)	(0.0990)	(0.0955)	(0.0269)	(0.0266)	(0.0270)	(0.0134)
GGDP	-0.00136	-0.00167	0.0383	0.0837	0.00625	0.00638	0.0172	-3.540***
	(0.00283)	(0.00291)	(0.113)	(0.123)	(0.0314)	(0.0313)	(0.0293)	(1.276)
Inflation	0.0294***	0.0292***	-0.279***	-0.388***	-0.0110	-0.00775	0.00383	-0.0596**
	(0.00204)	(0.00199)	(0.0743)	(0.0658)	(0.00960)	(0.0107)	(0.0158)	(0.0248)
FinFree	0.00116***	0.00120***	0.0561***	0.0747***	-0.00257	-0.00295	-0.000442	0.103**
	(0.000287)	(0.000289)	(0.00893)	(0.0141)	(0.00206)	(0.00208)	(0.00191)	(0.0513)
Structure	-0.00293*	-0.00241	0.118	0.293***	-0.00162	-0.00435	-0.00155	0.00181
	(0.00159)	(0.00172)	(0.0913)	(0.0607)	(0.00896)	(0.00827)	(0.00894)	(0.00490)
Constant	-0.176***	-0.164***	45.45***	53.47***	-1.092**	-1.277**	-0.378	18.20***
	(0.0448)	(0.0456)	(3.417)	(3.036)	(0.500)	(0.527)	(0.394)	(2.666)
N	1,600							

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3. Liquidity Creation, Regulatory Capital, Profitability, and Financial Stability for Small Banks

	Liquidity Creation		Regulatory Capital		Profitability			Stability
	LC1		TCR	T1CR	ROA			Z-Score
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TCR	-0.00516***				0.0168***			-0.00555
	(0.000593)				(0.00541)			(0.0112)
T1CR		-0.00527***				0.0161***		
		(0.000634)				(0.00523)		
LC1			-14.62***	-15.46***			-1.190***	-4.873***
			(2.640)	(2.705)			(0.365)	(1.066)
ROA	-0.0201***	-0.0201***	0.961***	1.062***				-0.171***
	(0.00677)	(0.00676)	(0.371)	(0.407)				(0.0321)
Risk	0.00116**	0.00114**	-0.148***	-0.186***	0.0129**	0.0126**	0.0115**	0.0182***
	(0.000528)	(0.000552)	(0.0428)	(0.0470)	(0.00504)	(0.00500)	(0.00461)	(0.00686)
Size	0.00327	0.00177	-1.933***	-2.565***	0.170**	0.170**	0.128*	0.404
	(0.00932)	(0.00946)	(0.285)	(0.218)	(0.0735)	(0.0724)	(0.0776)	(0.317)
Productv	0.00250*	0.00239*	0.0533	0.00918	0.0750*	0.0755*	0.0770*	-0.00309
	(0.00140)	(0.00140)	(0.0397)	(0.0282)	(0.0444)	(0.0444)	(0.0445)	(0.0124)
GGDP	0.00278	0.00288	0.329	0.555*	-0.0545	-0.0528	-0.0277	-5.099**
	(0.00620)	(0.00623)	(0.249)	(0.308)	(0.0631)	(0.0623)	(0.0607)	(2.285)
Inflation	0.0339***	0.0332***	-0.220	-0.469**	-0.00107	0.000642	0.0358	-0.160***
	(0.00390)	(0.00384)	(0.167)	(0.183)	(0.0215)	(0.0220)	(0.0317)	(0.0429)
FinFree	0.00149***	0.00166***	0.0889***	0.175***	-0.0144**	-0.0145**	-0.0111*	0.385***
	(0.000534)	(0.000531)	(0.0255)	(0.0316)	(0.00650)	(0.00646)	(0.00630)	(0.0873)
Structure	-0.0115***	-0.0114***	-0.209	-0.223	-0.00289	-0.00535	-0.0249*	0.0105
	(0.00211)	(0.00207)	(0.191)	(0.179)	(0.0151)	(0.0142)	(0.0131)	(0.0174)
Constant	-0.310**	-0.295*	57.01***	64.17***	-2.064**	-2.024**	-1.488	9.377
	(0.154)	(0.155)	(3.528)	(4.300)	(0.860)	(0.840)	(1.096)	(5.716)
N	611							

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Liquidity Creation, Regulatory Capital, Profitability, and Financial Stability for Large Banks

	Liquidity Creation		Regulatory Capital		Profitability			Stability
	LC1		TCR	T1CR	ROA			ZScore
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TCR	-0.00467***				0.0667***			0.0108
	(0.00169)				(0.00822)			(0.0116)
T1CR		-0.00835***				0.0683***		
		(0.00217)				(0.00752)		
LC1			-0.771**	-1.486***			-0.310***	-0.995**
			(0.390)	(0.382)			(0.0692)	(0.387)
ROA	-0.0400***	-0.0335***	1.325***	1.510***				0.103
	(0.0103)	(0.0110)	(0.210)	(0.160)				(0.0703)
Risk	0.00257***	0.00222***	-0.0324***	-0.0475***	0.0116***	0.0131***	0.0109***	0.0135**
	(0.000474)	(0.000471)	(0.00386)	(0.00909)	(0.00137)	(0.00150)	(0.00129)	(0.00544)
Size	0.00423	0.00195	-0.204**	-0.304***	0.00458	0.0134	-0.0168	0.0172
	(0.00593)	(0.00598)	(0.0897)	(0.118)	(0.0196)	(0.0199)	(0.0204)	(0.0359)
Productv	-0.0170***	-0.0163***	0.252***	0.231***	0.115***	0.116***	0.140***	0.105***
	(0.00352)	(0.00370)	(0.0426)	(0.0429)	(0.0110)	(0.0108)	(0.0147)	(0.0404)
GGDP	0.00318**	0.00283	-0.0751	0.00381	-0.0159	-0.0187	-0.0212	-5.783***
	(0.00161)	(0.00173)	(0.0602)	(0.0670)	(0.0208)	(0.0205)	(0.0198)	(2.033)
Inflation	0.0241***	0.0236***	-0.00850	-0.0935**	-0.0334***	-0.0318***	-0.0328***	-0.0441
	(0.00377)	(0.00368)	(0.0384)	(0.0444)	(0.00569)	(0.00592)	(0.00587)	(0.0403)
FinFree	0.00112***	0.00134***	0.0421***	0.0602***	-0.00174	-0.00197	0.00302***	-0.0654*
	(0.000365)	(0.000314)	(0.00456)	(0.00625)	(0.00122)	(0.00134)	(0.00113)	(0.0380)
Structure	0.0141***	0.0142***	-0.0429	0.0499	0.0447***	0.0392**	0.0535***	-0.00244
	(0.00407)	(0.00390)	(0.0571)	(0.0775)	(0.0171)	(0.0162)	(0.0133)	(0.00433)
Constant	-0.196	-0.115	13.96***	14.88***	-1.294***	-1.413***	-0.196	17.20***
	(0.123)	(0.127)	(1.924)	(2.415)	(0.272)	(0.296)	(0.280)	(1.568)
N	655							

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Liquidity Creation, Regulatory Capital, Profitability, and Financial Stability in Market-Based Countries

	Liquidity Creation		Regulatory Capital		Profitability			Stability
	LC1		TCR	T1CR	ROA			ZScore
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TCR	-0.00724***				0.0568**			-0.0469
	(0.000748)				(0.0252)			(0.0447)
T1CR		-0.00716***				0.0621**		
		(0.000755)				(0.0254)		
LC1			-6.406***	-7.410***			-0.0938	-2.984***
			(0.947)	(0.950)			(0.240)	(0.619)
ROA	0.00503*	0.00752**	0.955***	1.235***				-0.0133
	(0.00277)	(0.00310)	(0.283)	(0.309)				(0.0689)
Risk	0.000378**	0.000299*	-0.0635***	-0.0736***	0.0212***	0.0218***	0.0185***	0.0166**
	(0.000185)	(0.000171)	(0.0131)	(0.0169)	(0.00232)	(0.00244)	(0.00163)	(0.00813)
Size	-0.00498	-0.00648*	-0.823***	-1.015***	0.0625	0.0786	0.0143	-0.0426
	(0.00413)	(0.00394)	(0.0722)	(0.0522)	(0.0439)	(0.0509)	(0.0217)	(0.0870)
Productv	0.000720	0.000500	0.262**	0.266**	0.00638	0.00518	0.0241	0.0231
	(0.00131)	(0.00136)	(0.129)	(0.115)	(0.0189)	(0.0182)	(0.0193)	(0.0146)
GGDP	0.000759	0.00104	0.0407	0.0843	-0.0806***	-0.0800***	-0.0746***	-0.228**
	(0.00325)	(0.00329)	(0.129)	(0.154)	(0.0212)	(0.0203)	(0.0202)	(0.102)
Inflation	0.0224***	0.0225***	-0.417***	-0.418***	-0.0177***	-0.0134*	-0.0563***	0.138**
	(0.00527)	(0.00526)	(0.140)	(0.149)	(0.00620)	(0.00694)	(0.00737)	(0.0666)
FinFree	0.000891**	0.00100**	0.0517*	0.0791***	-0.00724***	-0.00861***	-0.00303	-0.00826**
	(0.000402)	(0.000395)	(0.0269)	(0.0279)	(0.00230)	(0.00240)	(0.00186)	(0.00395)
Structure	-0.00728***	-0.00721**	-0.142***	-0.141**	0.0291**	0.0273**	0.0248*	-0.0819
	(0.00257)	(0.00287)	(0.0486)	(0.0596)	(0.0133)	(0.0117)	(0.0145)	(0.0684)
Constant	-0.00728***	-0.00721**	-0.142***	-0.141**	0.0291**	0.0273**	0.0248*	-0.0819
	(0.00257)	(0.00287)	(0.0486)	(0.0596)	(0.0133)	(0.0117)	(0.0145)	(0.0684)
Observations	765							

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Liquidity Creation, Regulatory Capital, Profitability, and Financial Stability in Bank-Based Countries

	Liquidity Creation		Regulatory Capital		Profitability			Stability
	LC1		TCR	T1CR	ROA			ZScore
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TCR	-0.00529***				0.00134			-0.00453
	(0.000596)				(0.00533)			(0.00689)
T1CR		-0.00555***				0.00109		
		(0.000639)				(0.00562)		
LC1			-12.73***	-12.58***			-1.300***	-1.070**
			(1.953)	(1.961)			(0.236)	(0.529)
ROA	-0.0405***	-0.0411***	-0.0344	-0.105				0.175**
	(0.00954)	(0.00943)	(0.351)	(0.396)				(0.0826)
Risk	0.00290***	0.00284***	-0.162***	-0.197***	0.0000384	-0.0000268	0.00454	-0.00898*
	(0.000369)	(0.000362)	(0.0306)	(0.0319)	(0.00329)	(0.00321)	(0.00312)	(0.00527)
Size	-0.00172	-0.00344**	-1.906***	-2.421***	-0.0568***	-0.0572***	-0.0477*	-0.0902
	(0.00161)	(0.00166)	(0.214)	(0.222)	(0.0193)	(0.0175)	(0.0269)	(0.0568)
Productv	-0.0117***	-0.0115***	-0.0772	-0.0726	0.322***	0.322***	0.290***	-0.0561*
	(0.00245)	(0.00251)	(0.124)	(0.0980)	(0.0341)	(0.0340)	(0.0368)	(0.0308)
GGDP	-0.000520	-0.000504	0.267	0.443*	0.0404**	0.0405**	0.0437***	0.0998
	(0.00302)	(0.00311)	(0.274)	(0.255)	(0.0181)	(0.0184)	(0.0161)	(0.0661)
Inflation	0.0342***	0.0337***	-0.0572	-0.214*	0.00912	0.00910	0.0616***	0.0280
	(0.00176)	(0.00185)	(0.124)	(0.117)	(0.0208)	(0.0214)	(0.0220)	(0.0636)
FinFree	0.000980**	0.00106**	0.0356*	0.0765***	-0.000533	-0.000535	0.00108	0.00602
	(0.000465)	(0.000467)	(0.0189)	(0.0196)	(0.00349)	(0.00354)	(0.00340)	(0.00976)
Structure	-0.00362	-0.00245	0.304	0.527**	-0.0378	-0.0380	-0.0437	0.0849
	(0.00526)	(0.00521)	(0.247)	(0.265)	(0.0311)	(0.0307)	(0.0325)	(0.0581)
Constant	-0.221***	-0.193***	62.84***	70.20***	0.162	0.176	-0.490	18.25***
	(0.0544)	(0.0533)	(5.523)	(5.217)	(0.377)	(0.338)	(0.587)	(1.977)
Observations	763							

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0

Table 7. Liquidity Creation, Regulatory Capital, Profitability, and Financial Stability in Developing Countries

	Liquidity Creation		Regulatory Capital		Profitability			Stability
	LC1		TCR	T1CR	ROA			ZScore
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TCR	-0.00585***				0.0603**			-0.0897*
	(0.00109)				(0.0263)			(0.0517)
T1CR		-0.00620***				0.0636**		
		(0.00115)				(0.0272)		
LC1			-5.419***	-11.23***			0.430	-4.028***
			(0.578)	(2.076)			(0.281)	(0.767)
ROA	0.00895***	0.0109***	0.999***	1.249***				0.0144
	(0.00262)	(0.00259)	(0.279)	(0.326)				(0.0703)
Risk	0.00120***	0.00114***	-0.0259	-0.0415**	0.0115***	0.0118***	0.00777***	0.0190
	(0.000276)	(0.000260)	(0.0179)	(0.0200)	(0.00283)	(0.00275)	(0.00278)	(0.0156)
Size	-0.00614**	-0.00760***	-0.941***	-1.258***	0.0639	0.0760	-0.000874	-0.0911
	(0.00310)	(0.00280)	(0.129)	(0.139)	(0.0631)	(0.0686)	(0.0353)	(0.124)
Productv	-0.00403	-0.00448	0.847***	0.618**	0.0829	0.0829	0.149***	0.0631
	(0.00258)	(0.00284)	(0.152)	(0.250)	(0.0581)	(0.0575)	(0.0304)	(0.0559)
GGDP	0.0111**	0.0120**	0.382***	0.680***	-0.0885***	-0.0899***	-0.0720*	-0.146*
	(0.00493)	(0.00491)	(0.126)	(0.173)	(0.0257)	(0.0239)	(0.0373)	(0.0818)
Inflation	0.0230***	0.0225***	-0.440***	-0.452**	0.0313**	0.0349***	-0.0179	0.252**
	(0.00376)	(0.00355)	(0.157)	(0.190)	(0.0134)	(0.0129)	(0.0215)	(0.102)
FinFree	0.000543	0.000720	0.154***	0.146***	-0.00747**	-0.00929**	0.00536*	0.0648**
	(0.000528)	(0.000553)	(0.0403)	(0.0417)	(0.00332)	(0.00372)	(0.00310)	(0.0261)
Structure	-0.00195	-0.00146	0.0745	0.295**	-0.0151	-0.0204**	-0.0239**	0.00773
	(0.00137)	(0.00143)	(0.118)	(0.139)	(0.0100)	(0.00962)	(0.0102)	(0.0436)
Constant	-0.0679	-0.0536	23.27***	27.83***	-1.632	-1.731	0.0592	16.42***
	(0.0666)	(0.0600)	(2.580)	(2.602)	(1.127)	(1.178)	(0.604)	(3.230)
Observations	806							

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8. Liquidity Creation, Regulatory Capital, Profitability, and Financial Stability in Advanced Countries

	Liquidity Creation		Regulatory Capital		Profitability			Stability
	LC1		TCR	T1CR	ROA			ZScore
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TCR	-0.00548***				0.00192			0.00703**
	(0.000682)				(0.00792)			(0.00303)
T1CR		-0.00560***				0.00333		
		(0.000738)				(0.00822)		
LC1			-9.985***	-10.40***			-1.345***	-0.496
			(2.375)	(2.576)			(0.178)	(0.646)
ROA	-0.0584***	-0.0579***	-0.304	-0.123				0.129***
	(0.00654)	(0.00639)	(0.456)	(0.529)				(0.0495)
Risk	0.00321***	0.00320***	-0.173***	-0.201***	0.00693	0.00728	0.0121***	-0.00626**
	(0.000262)	(0.000277)	(0.0245)	(0.0303)	(0.00531)	(0.00539)	(0.00459)	(0.00286)
Size	0.00638**	0.00484*	-1.935***	-2.533***	-0.0220	-0.0181	0.00170	-0.0189
	(0.00259)	(0.00282)	(0.208)	(0.233)	(0.0152)	(0.0145)	(0.0201)	(0.0555)
Productv	0.000567	0.000594	-0.0586	-0.0734	0.0641**	0.0640*	0.0607**	-0.00462
	(0.00108)	(0.00107)	(0.0876)	(0.0665)	(0.0326)	(0.0327)	(0.0296)	(0.00870)
GGDP	0.0114***	0.0112***	0.0199	0.285	0.0234	0.0233	0.0373	0.0219
	(0.00403)	(0.00416)	(0.181)	(0.260)	(0.0365)	(0.0366)	(0.0349)	(0.0734)
Inflation	0.0314***	0.0311***	-0.133**	-0.291***	-0.0288	-0.0277	0.0193	-0.0273
	(0.00216)	(0.00213)	(0.0611)	(0.0851)	(0.0188)	(0.0189)	(0.0237)	(0.0628)
FinFree	0.0000988	0.0000802	-0.00537	0.0233	0.00812*	0.00806*	0.00641	0.00883
	(0.000754)	(0.000723)	(0.0233)	(0.0208)	(0.00452)	(0.00448)	(0.00461)	(0.0138)
Structure	-0.0215***	-0.0216***	0.897***	-0.173	0.133***	0.133***	0.100*	-0.0700
	(0.00748)	(0.00788)	(0.286)	(0.373)	(0.0476)	(0.0474)	(0.0548)	(0.121)
Constant	-0.302***	-0.278***	69.19***	77.27***	0.0732	-0.0336	-0.664	17.58***
	(0.0596)	(0.0665)	(6.281)	(6.252)	(0.576)	(0.586)	(0.496)	(0.948)
Observations	744							

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.

Table 9 Liquidity Creation, Regulatory Capital, Profitability, and Financial Stability with Alternative Measures

	Liquidity Creation			Regulatory Capital			Profitability				Stability	
	LC2			TCR	T1CR	CET1	ROA				Z-Score	
Panel A	(1a)	(2a)	(3a)	(1b)	(2b)	(3b)	(1c)	(2c)	(3c)	(4c)	(1d)	(2d)
TCR	-0.00590***						0.0220**				-0.0164	
	(0.000547)						(0.00871)				(0.0106)	
T1CR		-0.00576***						0.0247***				
		(0.000459)						(0.00951)				
CET1			-0.00557***						0.0252***			-0.0153
			(0.000445)						(0.00906)			(0.00945)
LC2				-11.14***	-12.95***	-13.13***				-1.229***	-2.410***	-2.403***
				(1.754)	(1.374)	(1.431)				(0.250)	(0.467)	(0.476)
ROA	-0.0174***	-0.0163***	-0.0163***	0.542***	0.740***	0.831***					0.0226	0.0251
	(0.00411)	(0.00423)	(0.00428)	(0.207)	(0.237)	(0.235)					(0.0336)	(0.0351)
Observation	1,600											

Panel B	Liquidity Creation			Regulatory Capital			Profitability				Stability	
	LC1			TCR	T1CR	CET1	ROE				ZScore	
	(1a)	(2a)	(3a)	(1b)	(2b)	(3b)	(1c)	(2c)	(3c)	(4c)	(1d)	(2d)
TCR	-0.00588***						0.0448				-0.0141	
	(0.000527)						(0.111)				(0.00995)	
T1CR		-0.00587***						0.0614				
		(0.000527)						(0.129)				
CET1			-0.00562***						0.0604			-0.0128
			(0.000492)						(0.125)			(0.00806)
LC1				-8.495***	-9.761***	-9.975***				-8.319**	-2.188***	-2.179***
				(1.387)	(1.010)	(1.159)				(3.798)	(0.351)	(0.342)
ROE	-0.00133**	-0.00129**	-0.00130**	0.00544	0.0232**	0.0162					-0.00103	-0.000987
	(0.000579)	(0.000591)	(0.000592)	(0.0114)	(0.00948)	(0.0129)					(0.00478)	(0.00477)
Observation	1,600											

Robust standard errors in parentheses

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

Appendix A. Variable Definition and Data Source

Variables	Acronym	Definition	Source
Main variables			
Regulatory capital	TCR	Total regulatory capital ratio, which is the ratio of Tier 1 and Tier 2 capital to risk-weighted assets	BankFocus
	T1CR	Tier 1 capital ratio, which is Tier 1 capital divided by risk-weighted assets	BankFocus
	CET1	Common equity tier 1 ratio, which is common equity tier 1 capital divided by risk-weighted assets	BankFocus
Liquidity creation	LC1	A measure of "cat fat" liquidity creation normalised by gross total assets	BankFocus
	LC2	A measure of "cat nonfat" liquidity creation normalised by gross total assets	BankFocus
Profitability	ROA	Return on assets as the ratio of net income to total average assets	BankFocus
	ROE	Return on equity as the ratio of net income to total average equity	BankFocus
Financial stability	ZScore	Probability of default of a country's banking system that compares the buffer of a country banking system which consist of capital and return with the volatility of bank return.	Global Financial Development Database
Bank specific variables			
Risk	Risk	Measuring the bank risk-taking as the ratio of the bank's risk-weighted asset to gross total assets	BankFocus
Size	Size	The logarithm of total assets	BankFocus
Productivity	Productv	The ratio of gross total revenue to personnel costs	BankFocus
Country specific			
Real GDP growth	GGDP	The annual rate of change in real GDP	World Bank
Inflation	Inflation	Annual inflation rate	World Bank
Financial Freedom	FinFree	Efficiency in the banking industry	The Heritage Foundation
Financial structure	Structure	Country classification as bank and market-based system. The classification based on market capitalisation ratio, which is the value of domestic equities listed on domestic exchanges divided by GDP.	World Bank, CEIC

Appendix B. Liquidity Category of Bank Activities

Illiquid assets (weight = ½)	Semiliquid assets (weight = 0)	Liquid assets (weight = - ½)
Assets		
Corporate and commercial loans	Residential mortgage loans	Cash and due from banks
Other loans	Other mortgage loans	Trading securities and at future value through income
Investments in property	Other consumers/retail loans	Derivatives
Insurance assets	Loans and advances to banks	Available for sale securities
Foreclosed real estate	Reverse repos and cash collateral	Held to maturity securities
Fixed assets		At-equity investments in associates
Goodwill		Other securities
Other intangibles		
Current tax assets		
Deferred tax assets		
Other assets		

Liquid liabilities (weight= ½)	Semiliquid liabilities (weight=0)	Illiquid liabilities plus equity (weight= − ½)
Liabilities plus equity		
Customer deposits—Current	Customer deposits—Term	Senior debt maturing after 1 year
Customer deposits—Savings	Deposits from banks	Subordinated borrowing
Derivatives	Repos and cash collateral	Other funding
Trading liabilities	Other deposits and short-term borrowings	Credit impairment reserves
Insurance liabilities	Fair value portion of debt	Reserves for pensions and other
		Current tax liabilities
		Deferred tax liabilities
		Other deferred liabilities
		Other liabilities
		Total equity

Illiquid OBS (weight= ½)	Semiliquid OBS (weight=0)	Liquid OBS (weight= − ½)
Off-balance-sheet activities		
Acceptances and documentary credits reported OBS	Managed securitised assets reported OBS	
Committed credit lines	Other OBS exposure to securitisations	
Other contingent liabilities	Guarantees	

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