Chapter 9

CROSS BORDER INTERBANK CONTAGION RISK FROM VIETNAM’S BANKING SYSTEM

By
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1. Introduction

Opening one country’s financial market brings both opportunities and challenges to its development. While some papers focus on the benefits of financial integration in an open economy, our research studies cross-border interbank contagion exposure for Vietnam’s case, using the data from 2011-2017. Our research uncovers little evidence for contagion risk through the linkages of banks in the Asian region.

Vietnam is a developing country for which the banking system has been growing rapidly in terms of the asset volumes and the diversity of its services. At this point in time, Vietnam’s banking system has become increasingly connected to the world’s financial system, with the proliferation of overseas transactions between Vietnam’s banks and foreign banks, the opening of foreign bank branches or investments in local banks and vice versa. Thus, the linkage between Vietnam’s banks and foreign banks has been clear over time. While the Asian financial crisis of 1997 did not have too much effect on the financial sector in Vietnam, the global financial crisis in 2008 had a stronger impact on the Vietnamese banking system. However, up to now, there has been no research on the cross-border interbank contagion risk between the banking systems in Vietnam, the region or more broadly, the world. Meanwhile, while financial contagion is a rare phenomenon, nonetheless its repercussions are great but when it happens. As such, this research gap is important to be investigated.

Contagion means the spillover process of one issue onto others through some connections and interactions (European Central Bank, 2016). Interbank contagion refers to a situation in which the problem of one bank is transferred to other banks through some common channels. In interbank markets, contagion could occur when the liquidity assets of a bank are insufficient to absorb unexpected deposit outflows. As a result, market expectations can cause a spillover effect like a domino effect which can lead to a single bank’s collapse which subsequently impacts other banks in the system. Freixas et al. (2000) study the correlation between depositors’ behavior and/or a bank’s characteristics. An illustration of this is a liquidity crisis happening when a depositor knows other depositors are withdrawing their money from a bank in a particular region. He/she may start withdrawing his/her money without any plausible reason from his/her own non-problem bank, which may or may not be in the same area. The similarities in banks’ credit concentration, investment portfolios, macroeconomic policies, capital base, may be other sources of correlation. Theory indicates that the extent to which a crisis spill-overs to the system depends a lot on the structure of the interbank linkages. Allen and Gale (2000) find that 3 structures, namely, (i) the “complete structure” that banks are linked to other banks symmetrically, (ii) the “incomplete market

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1. Authors are from the Banking Strategy Institute, Banking Supervisory Agency and Monetary-Financial Stability Department of the State Bank of Vietnam, respectively.
structure” that banks are only linked to neighboring banks, and (iii) the “disconnected incomplete market structure” that two disconnected markets coexist. The researchers prove that the “complete structure” is less prone to contagion as compared to the “incomplete market structure”, because with the former structure, the effect of a financial crisis on one bank is absorbed by a number of banks.

To estimate interbank contagion risk, Muller (2003) combines a network and a simulation approach in order to assess contagion risk in the Swiss interbank market, taking credit and liquidity effects into account. Elsinger et al. (2006) simulates the joint effect of exchange rate shocks, interest rate shocks and stock market movements on interbank payment flows in Austrian banks. The researchers distinguish between insolvency caused by correlated exposures and by domino effects. Their simulation result shows that though the possibility of contagious default is lower than the total default possibility, there are situations where up to 75% of the defaults are caused by contagion.

In terms of this research, we find the following issues are important for investigation: Vietnam’s SIBs clarification, assessment of their sensitiveness to potential domestic economic shocks, then extending the scope to external shocks. To elaborate further, we identify SIBs of Vietnam via simple financial ratios and their market share in terms of deposits, loans and/or other indicators. Subsequently, we determine the SIBs’ main activities which can cover consumer loans, business loans, mortgages, derivatives, off balance sheet activities as well as the sources of funds for such business activities. Then we evaluate their sensitivity to potential internal economic shocks, including market risk and macroeconomic variables. The study then is extended to the external shocks.

This paper aims to contribute to the literature by investigating empirically the cross-border interbank contagion risk using BIS data on international interbank exposure. Our research combines qualitative and quantitative analysis by modelling the simulation of cross-border interbank contagion risk in Vietnam. Our main goal is to inform policy makers of the alternative scenarios of potential risk triggers of cross-border interbank contagion. Also, we highlight some recommendations to the regulators to mitigate contagion risk, firstly in Vietnam and secondly, in the South-East Asian region.

Our research includes four parts as follows: the first section focuses on and maps the interconnectedness of domestic SIBs with the key cross-border SIBs. Section 2 comprises an overview of the financial market – banking system in Vietnam. Section 3 discusses data and methodology. Section 4 elaborates the empirical research work already done on this topic, while Section 5 concludes.

2.1 Overview on the Structure of the Banking System

Vietnam’s financial system includes credit institutions, securities companies and insurance companies. The banking system dominates with total assets accounting for more than 95% of the total assets of the whole financial system. In 2017, Vietnam’s credit institutions (excluding people’s credit funds) comprise of 7 State owned banks (SOBs), 28 Joint stock (private) commercial banks (JCBs), 7 foreign banks, 2 joint venture banks, 47 branches of foreign banks, 1 cooperative bank, 1 social policy bank, 18 non-bank credit institutions (including financial companies and finance leasing companies) and 3 microfinance institutions, established and operating under the Law on Credit Institutions 2010.

The total assets of credit institutions have increased, with total assets at the end of December 2017 reaching 10,001.8 trillion VND, up by 17.6% from the end of 2016, thanks to the development of Vietnam’s economy, with the strongest increase recorded in the State Owned Banks (+ 18.4%) and Joint stock (private) commercial banks (+ 17.7%). Total assets of State owned banks and Joint stock banks in 2017 were 4,570 trillion dong and 5,431 trillion dong, respectively. By 2017, total assets reached over 10 trillion dong, up by 17.6% from 2016, equivalent to 200% of GDP in 2017.

In terms of total asset structure, 7 SOBs accounted for 45.7% of the total assets of the credit system, while the remaining 54.3% belonged to JCBs and other credit institutions. It can be seen that while the proportion of assets of JCBs is on the rise, the SOBs still play the leading role in the banking sector.

Total equity of the system at the end of December 2017 reached 660.1 trillion dong, increasing by 65.2 trillion dong (+ 11%) compared to the end of 2016. This is the highest rise since 2013.

2.2 Main Challenges

2.2.1 Capital Adequacy

The banks are under pressure to raise capital to meet Basel II’s minimum capital adequacy ratio. In 2017, the chartered capital and equity capital have improved, thanks to positive business outcomes of the system. Most credit institutions were able to meet the minimum capital adequacy ratio. However, if fully calculating the amount of specific provisions to be made when the debt is not restructured and retaining the group of debts under Decision 780 and Circular 09, some credit institutions may have lower CARs. In addition, raising capital is currently difficult because business outcomes of the system have not been very stable, making it difficult to mobilize capital from the existing shareholders as well as finding new partners. For smaller banks, the ability to raise capital will be more difficult due to the less attractive earnings of shares while profit is mainly allocated to restructuring activities and dealing with bad debt activities.

2.2.2 Asset Quality

In 2017, the process of dealing with bad debts of the financial institutions was accelerated, especially in the last months of the year, thanks to the impact of Resolution 42/2017/QH14 resolving bad debts of credit institutions. Resolution 42/2017/QH14 solves a number of obstacles for the effective disposal of bad debts including measures to improve the lender’s ability to enforce collateral in order to facilitate credit institutions to revoke mortgages and release bad debts and at the same time, create favorable conditions for bad debt transactions in the secondary market. From August 2017 to December 2017, the total bad debts handled by Resolution 42/2017/QH14 was around 83.46 trillion dong. This outcome was made possible by the State Bank of Vietnam’s (SBV) initiation of the VAMC – an agency responsible for creating the market for trading bad debts. The SBV also forced some commercial banks to restructure so that they could resolve their bad debt problems. Accordingly, the Governor of the State Bank issued Directive 02 on dealing with bad debts and restructuring credit institutions. At the same time, the Strategy for Banking Development of Vietnam also identifies the target that by the end of 2020, the bad debt ratio of the whole banking system should be kept under 3%.

2.3 Performance Indicators

2.3.1 Profitability

Business outcomes reached the highest level since 2012, with many banks posting a sharp increase in profit compared to the end of 2016. The total revenue of the whole system in 2017 rose by 52% compared to 2016 in the context of macroeconomic stability and positive economic growth. The income structure was improved at some CIs due to the trend of increasing the proportion of services. The profitability of the credit system in 2017 was higher than that of 2016 as the difference in revenue and expenditure of the credit institutions has increased significantly (52%) while total assets and equity have increased more gradually (up by 17.6% and 11.5% compared to the end of 2016). ROA and ROE in 2016 were 0.74% and 10.25% (2016 were 0.56% and 8.6%) respectively, with the highest rise in JCBs.

While business results at many banks improved, some banks had disappointing financial results because the owners of these banks violated some regulations and were involved in some risky investments. In addition, although the profit targets including ROA, ROE of CIs were quite high and stable compared to the previous year, they were still lower compared to other countries in the region. The risk associated with decreasing profit of CIs is still high and so is the size of bad debts and potential bad debts in the banking system.

2.3.2 Capital Adequacy Ratio

The capital adequacy ratio (CAR) for CIs in 2017 was 12.23%, down from 12.84% at the end of 2016, lower than the average of 12.9% for the period 2011-2017. By the end of December 2017, most of the CIs had complied with the safety ratios in their operations. Violators among CIs were troubled commercial banks and weak financial leasing companies and financial companies. In addition, if calculating the full amount of specific provisions is to be deducted when the debt is not restructured to keep the group of debts under Decision 780 and Circular 09, there will be a number

4. Source: SBV.
of credit institutions with lower CAR ratio. Even though the CAR ratio of the system by the end of December 2017 was still higher than the SBV’s minimum requirement (9%) and at many CIs, the CAR was much higher than the average, the CAR has nonetheless been declining recently. In addition, many commercial banks have met the minimum requirement of capital adequacy under Circular 36 (over 9%), but is still relatively low, at less than 10%.

### 2.3.3 Growth of Credit

Credit growth has been stable in the past two years, mainly due to the continued recovery of the economy and stable interest rates. By the end of 2017, outstanding loans reached 6,509 trillion dong, an increase of 18.24% over 2016. Credits increased at all banks and commercial banks which currently have a dominant market share (49.9%) compared to the whole system. The ratio of credit/GDP has increased rapidly in recent years and by the end of 2017, it reached 130%, indicating that total credit has continued to support positive economic growth.

### 2.3.4 Liquidity

The LDR ratio increased from 87.74% in 2016 to 90.23% in 2017, of which the LDR of the SOBs was 94.02% and the LDR of the JCBs was 84.17%. These are higher than the ceiling level set by the SBV because the CIs boosted lending activity at the beginning of the year. However, the liquidity of the system was maintained, thanks to the SBV’s increase in money supply through the purchase of more than 7.5 billion USD in 2017. In 2017, although credit growth was faster than capital mobilization, the interest rate remained relatively stable. Interest rates on long-term deposits fluctuated slightly, increasing only at a few small and medium sized banks, in order to improve the capital structure to meet the requirements of Circular 06/2016/TT-NHNN on the ratio of short-term funds to medium and long-term loans. However, the regulation on the ratio of short-term capital used for medium and long-term lending applicable to the CIs in 2018 was set at 45% as stipulated in Circular 19/2017/TT-NHNN dated 28/12/2017. The amendment of Circular 36/2014/TT-NHNN will reduce the long-term capital of CIs, thus reducing the pressure on capital costs of some banks, especially banks with high ratios.

### 2.3.5 NPLs

Credit quality improved as bad debt decreased significantly compared to 2016. However, the bad debt ratio remained high and the debt of group 5 (the potential capital loss) still accounts for a large proportion. In 2017, the bad debt process of credit institutions was accelerated, especially in the last months of the year. However, if the calculation had been more circumspect, the data for bad debts could even be higher because bad debts trading at market price is limited and the process of restructuring weak banks is slow. Credit institutions mainly deal with bad debts through various forms such as debt sale, collateral settlement, credit risk provision.
3. Data and Methodology

3.1 Description of the Applied Methods

Stress-testing (ST) is a commonly used method by banking supervision agencies around the world. The biggest advantage of this method is that it provides forecasts and tests the banking/banking system’s resilience under unfavorable economic conditions. The hypothetical events (scenarios) are attached to the model to analyze their impacts on the financial situation of the bank/banking system, especially impacts on bank profits and capital due to asset depreciation.

<table>
<thead>
<tr>
<th>Country</th>
<th>Assumptions (Scenarios)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong</td>
<td>Scenario from basic to stress level is based on: (1) GDP growth rate; (2) China’s GDP growth rate; (3) Interest rate; (4) Real estate prices.</td>
</tr>
<tr>
<td>Indonesia</td>
<td>(1) A shift in debt collection capacity to less than 20%; (2) Interest rate increased by 100 basis points; (3) Rupiah depreciates 20% on forward contracts less than 3 months; (4) Government bond yield down by 20%; (5) Real GDP growth declines.</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Macroeconomic indicators are comparable to the worst levels in history such as the 1997 East Asian financial crisis; the 2001 dot-com bubble and the SARS outbreak in 2003; External factors such as prolonged recession on global and regional scale.</td>
</tr>
<tr>
<td>Philippines</td>
<td>Scenario from basic to stress level based on: (1) National GDP growth rate; (2) Interest rate; (3) Inflation rate (4) Deposit growth rate; (5) Exchange rates (to USD).</td>
</tr>
<tr>
<td>Singapore</td>
<td>Various macroeconomic shocks; shocks to the world economy; Estimation of income and dividend payments during stress horizon.</td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td>(1) Declining revenue of corporate borrowers (2) Declining real income of household borrowers (3) Declining collateral value of real estate.</td>
</tr>
<tr>
<td>Thailand</td>
<td>Scenario from the basic to the stress level is based on: (1) National GDP growth rate and its components; (2) Interest rate; (3) Inflation rate (core and headline) (4) Exchange rate (to US dollar) (5) Crude oil price (6) GDP growth rate of trading partners.</td>
</tr>
</tbody>
</table>
There are currently two approaches to conducting stress testing: the top-down approach and the bottom-up approach. The “top-down” approach is implemented by regulators, while the “bottom-up” approach is implemented by the individual bank. The advantage of a top-down approach is that it is easier to implement than a bottom-up approach as the regulator simply synthesizes the data and consistently applies the scenario parameters. Therefore, it allows the regulator to compare bank’s results with one another. However, according to Cihak (2007), the downside of a top-down approach is that the application of aggregate data may underestimate risk concentration and ignore interlinks between banks. Depending on the specific characteristics of the banking system, central banks may choose a top-down or bottom-up approach or a combination of both.

**Bank’s Stress Test - Bottom-up Approach**

Stress testing is recognized as one of the international practices for risk management. The Basel Capital Accord II requires financial institutions, especially banks, to periodically test banks’ resilience in different adverse situations. The Basel Committee also issued the minimum criteria that banks should meet under a stress test.

International experience shows that supervisory agencies often require banks to conduct periodic (6 month or 1 year) stress tests, especially for banks which may pose contagion risk. Banks are now required to conduct annual stress tests. On the side of regulatory agencies such as central banks and financial supervision agencies, they will be responsible for issuing regulations on ST and evaluating the performance of ST in banks.

**Bank’s Stress Test - A Top-down Approach**

Most supervisory agencies also conduct ST at a systematic level to predict the vulnerability of the whole system as well for each bank group, for timely and effective intervention. The Fed and Bank of England perform ST and publish ST results to classify various banking groups based on their financial soundness.

<table>
<thead>
<tr>
<th>Top-Down</th>
<th>Bottom-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject</strong></td>
<td>Central bank/Supervision agencies</td>
</tr>
<tr>
<td><strong>Data</strong></td>
<td>Use aggregate data of each bank or system-wide data</td>
</tr>
<tr>
<td><strong>Impact analysis</strong></td>
<td>Evaluate the impact of each scenario on the portfolio of the whole system or individuals, assess capital quality</td>
</tr>
<tr>
<td><strong>Advantage</strong></td>
<td>Use effectively when assessing credit risk. Allows bank comparison and assess spillover effects.</td>
</tr>
<tr>
<td><strong>Disadvantage</strong></td>
<td>It does not clearly reflect risk status of each bank</td>
</tr>
</tbody>
</table>

Application of the Stress Test in Assessing the Ability of Risk Resilience of Commercial Banks

The top-down stress test approach is being applied to some developing countries (including Vietnam) by the FSAP Team of the World Bank (WB) and the International Monetary Fund (IMF). This model is based on the model of Cihak (2007) and Li Lian Ong et al. (2010). The model does not require data that is too detailed and or accumulated over a long range of time. It is therefore easy to implement and in accordance with the real conditions of data and technology of developing countries.

The WB/IMF Stress Test model uses balance sheet data, statistical reports and aggregated information from the Credit Information Center (CIC) with a sample of all commercial banks (excluding foreign bank branches, non-bank credit institutions) with total assets accounting for nearly 90% of total assets of the whole system. Different stress scenarios are used in the model to assess the ability to withstand credit, market, interbank, and liquidity risks as follows:

- **Credit Risk**: adjust the data by transferring the debt group with the assumption that banks did not classify debt properly, the value of the collateral is not properly assessed; analyze impact of macroeconomic factors (with variables: output gap, real interest rate and real effective exchange rate (REER)) on bad debt and thereby on capital by the Vector Auto Regression (VAR) model.

- **Market Risk**: analyze the impact of interest rate shocks and the VND depreciation on the capital through futures gap analysis and foreign currency performance based on the worst scenario determined by unfavorable movement of exchange rate and interest rates statistics in the past;

- **Interbank Risk**: analyze the impact of a bank in the event of a bank being unable to pay for loans/deposits from other banks;

- **Liquidity Risk**: analyze liquidity after five days of bank-run with assumed rates of withdrawal, asset utilization (high liquidity and high liquid assets).

In addition, through the impact assessment of shocks to capital, the model is able to determine the size of capital that needs to be injected into the banking system in the event of a crisis to ensure that all banks in the system meet the minimum capital adequacy requirement.

3.2 The Suitability of the Chosen Specific Methods

Stress tests consist of an assessment of a bank’s resilience, measured by the sufficiency of its capital or liquidity in the face of shocks to risk factors. The tests can be based on single factor shocks (e.g., changes in CAR resulting from a large increase in NPLs or interest rates) or scenario analysis, including macroeconomic stress scenarios (e.g., increases in NPLs and decreases in CAR following severe, but plausible changes in macroeconomic variables). Stress tests normally cover the main risks to financial stability, namely: credit risk, market risk (e.g., interest rate risk, exchange rate risk), concentration risk, (interbank) contagion risk, and liquidity risk. The scope, depth and accuracy of the analysis of such risks are usually driven by data availability, capacity constraints (e.g., existing model-ware, know-how) and the complexity of the banking sector itself. In this study, we conducted a top-down test to assess the impact of D-SIBs on the performance of the banking system in Vietnam.

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5. The model is applied under the framework of Financial Sector Assessment Program (FSAP) in Vietnam in 2013 to assess the resilience of the banking system to adverse shocks.
The stress test uses data from 2017 audited consolidated financial statements of 15 banks identified as D-SIBs and hypothetical scenarios based on the real market and bank system conditions in Vietnam such as bad debt, cross ownership rate, exchange rate, interest rate, real estate price, etc.

4. Empirical Part

4.1 Identification of D-SIBs

4.1.1 D-SIBs Identification Methodology

Circular 08/2017/TT-NHNN dated 1 August 2017 on the submission and the procedures for banking supervision of the State Bank of Vietnam defines D-SIBs as credit institutions, branches of foreign banks that have systemic importance; providing the objectives of banking supervision by the degree of impact of various institutions on the system. Accordingly, credit institutions and branches of foreign banks are identified as systemically important when they have the ability to cause a negative impact on the entire system of credit institutions, foreign bank branches and/or when systemic risks disrupt the operation of the system of credit institutions, branches of foreign bank and the whole economy in case of insolvency.

We apply the approach developed by FSB, IMF, BIS (2009), BCBS 2011 and Zlatuse Komarkova et al. (2012), using static quantitative indicators for identifying D-SIBs in Vietnam with the aim of officially providing more stringent requirements for regulating and supervising CIs recognized in this category (D-SIBs) compared to other CIs in the future, thus addressing the systemic risks arising from the structure of “too big to fail”, and “orderly exit of small weak banks” that are not systemically important. Based on the current level of development of the Vietnamese banking sector, we provide simpler quantitative indicators compared to the original studies. However, it still maintains the suitability and reliability for identifying D-SIBs in Vietnam.

Principle

The systematic importance of banks is assessed in two steps. Firstly, define quantitative scores using a set of indicators of scale, degree of alignment, and substitutability. And secondly, use qualitative assessments, monitoring information to supplement the quantitative assessment in the first step. Banks can be removed from or added to the list identified in step one.

Quantitative Assessment

The systematic importance of the banks in the sample was assessed according to the index-based measurement method, based on the scores of the indicator groups: size, interconnectedness, substitutability.

i) Size. This is a primary measure of systemic importance. The larger the bank, the more likely it is that the sudden stopping of a service will be widespread and therefore the more likely it will be for the bank to disrupt the financial market and the banking system, and to the broader functioning of the economy. This measure looks at the overall size of banking activity in the system and economy and provides a precise measure of potential systemic impacts in the event of a bank collapse. The extent of loss from a bank’s insolvency to the stability of its entire financial system and economy depends largely on the size of its assets and the amount of its
services and the financing that the bank provides. A large-scale bank usually comes with a high degree of alignment, complexity and low replacement.

ii)  **Interconnectedness.** This indicator represents the degree of association of a bank with other financial institutions that may give rise to external factors affecting the financial system and the domestic economy in Vietnam. Systemic risk can occur through the insolvency of a bank that has a significant impact on the financial system.

iii) **Substitutability.** This indicator assesses the systematic importance of the banks in its operation as a provider of infrastructure services. The bigger the bank, the harder it is to replace it, and the more likely it is that the risk will cause a disruption in the event of a bank failure. The level of importance of a bank’s system increases as other credit institutions are less likely to provide similar services in the event that the bank ceases to operate.

The weighting and scores of the indicator groups for the whole sample are as follows:

<table>
<thead>
<tr>
<th>Indicate</th>
<th>Individual Indicate</th>
<th>Weight</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Total Assets</td>
<td>50%</td>
<td>2</td>
</tr>
</tbody>
</table>
| Interconnectedness | Total assets in the financial system Include:  
- Deposits at the SBV;  
- Loans and deposits at other credit institutions;  
- Securities issued by other credit institutions;  
- Contribution of capital, long-term investment to other CIs | 12.5% | 0.5 |
|                 | Total debt assets in the financial system Include:  
- Debts owed by the Government and the SBV;  
- Borrowing and receiving deposits from other credit institutions. | 12.5% | 0.5 |
| Substitutability | Deposits of customers | 12.5% | 0.5 |
|                 | Loans to customers  | 12.5% | 0.5 |
| Total           |                     | 100%   | 4     |

**Qualitative Assessment**

Based on the results of the quantitative scores, the State Bank will combine these with the qualitative assessment from the results of the inspection and supervision of D-SIB, taking into account the complexity of the bank, the number and size of branches, the number and size of subsidiaries, the level of complexity in the operation, the derivative transactions and the role and importance of the financial infrastructure, which includes the role of the payment system.
4.1.2 Identification of D-SIBs in Vietnam

Based on the static quantification methodology with 3 categories: size, interconnectedness and replacement, we use the annual financial statement audited data of credit institutions as well as consider the complexity of banks through the number and size of branches, the number and size of subsidiaries, the complexity in operations and derivatives transactions of banks. We then calculate the systemic importance and identify the 15 D-SIBs in Vietnam.

Table 3 below represents the results obtained from the above methodology of identifying the 15 CIs as D-SIBs for Vietnam in 2017. The ranking and key system scores of each bank are shown below:

<table>
<thead>
<tr>
<th>Rank</th>
<th>CIs</th>
<th>Score of the Indicator Group</th>
<th>Total Scores</th>
<th>Total Scores (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Size</td>
<td>Interconnectedness</td>
<td>Substitutability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Assets</td>
<td>Total Assets to the System</td>
<td>Total Liability to the System</td>
</tr>
<tr>
<td>1</td>
<td>Bank 1</td>
<td>0.22</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>2</td>
<td>Bank 2</td>
<td>0.23</td>
<td>0.04</td>
<td>0.02</td>
</tr>
<tr>
<td>3</td>
<td>Bank 3</td>
<td>0.23</td>
<td>0.04</td>
<td>0.07</td>
</tr>
<tr>
<td>4</td>
<td>Bank 4</td>
<td>0.18</td>
<td>0.07</td>
<td>0.06</td>
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<tr>
<td>5</td>
<td>Bank 5</td>
<td>0.08</td>
<td>0.00</td>
<td>0.01</td>
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<tr>
<td>6</td>
<td>Bank 6</td>
<td>0.03</td>
<td>0.01</td>
<td>0.00</td>
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<td>7</td>
<td>Bank 7</td>
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<td>Bank 8</td>
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<td>Bank 9</td>
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<td>10</td>
<td>Bank 10</td>
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<td>0.01</td>
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<td>11</td>
<td>Bank 11</td>
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<td>12</td>
<td>Bank 12</td>
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<td>0.01</td>
<td>0.02</td>
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<tr>
<td>13</td>
<td>Bank 13</td>
<td>0.08</td>
<td>0.01</td>
<td>0.02</td>
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<tr>
<td>14</td>
<td>Bank 14</td>
<td>0.05</td>
<td>0.01</td>
<td>0.02</td>
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<tr>
<td>15</td>
<td>Bank 15</td>
<td>0.03</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td><strong>1.39</strong></td>
<td><strong>0.31</strong></td>
<td><strong>0.31</strong></td>
</tr>
</tbody>
</table>
4.2 Stress Testing D-SIBs

4.2.1 Data Adjustments

Reported values of capital, collateral and loans by classification were adjusted to reflect the economic reality of the banking system before ST. The adjustments include:

Adjustment 1: An initial X% haircut on regulatory capital is applied to all D-SIBs, reflecting indirect cross-ownership among banks, leading to “double-counting” of capital (Capital 1).

Adjustment 2: This adjustment relates to the re-classification of loans.

Adjustment 3: This adjustment relates to the treatment of collateral: first the implied value of collateral for each loan category is estimated based on the reported loan amount and the corresponding provision using the statutory provision rates of that loan category. Subsequently, a Y% average haircut is applied to the implied collateral value of each bank, to account for collateral (mostly real estates) valuation deficiencies.

Finally, following these adjustments, the resulting “starting point” capital (Capital-2) is computed by deducting from the Capital-1 the additional provisions that would be obtained by applying the corresponding provisioning rates to the re-classified loan amounts, net of adjusted collateral, in each of the five loan categories.

4.2.2 Results

The following stress tests were carried out under the static balance sheet assumption to deal with credit risk, market (mainly interest rate and exchange rate) risks, concentration risks and liquidity risk.

For the group of 15 D-SIBs, borrowing and deposit-taking from the interbank in 2017 were in relatively small amounts in proportion to total assets for most of the banks. Contagion risks were assessed based on the interbank matrix which includes the net lending between banks in the system.

Scenario: This scenario assumes the default of each bank at a time for all of its interbank obligations and the impact on other banks. If the default of any bank for its interbank obligations implies the default of another bank within the system, then the second iteration should be calculated to assess the impact of the bank default on all other banks.

Through the assessment, it is found that the contagion risks are at a very low level. The impact of a bank default on its interbank obligations from other banks will stop from the first iteration without the contagion of insolvency on other banks in the interbank system.

We also use Bank for International Settlements (BIS) locational statistical data which covers individual countries and the amount outstanding of cross-border bank exposures between Vietnam and other countries. The reporting countries are required to report the credit exposures of their domestic banks to other countries in the country list and the amount outstanding of credit exposure from each reporting country to the other countries. From the list of countries reporting, there are only 12 countries out of 31 countries with reporting data. Based on this available data, we assessed that there is no impact from reporting countries on Vietnam.
The following figures show the relationship between Vietnam and other reporting countries based on the data from BIS.

**Figure 1**  
Total Claim - Loan and Deposit - Banks

**Figure 2**  
Total Claim – Non-conventional Bank
Figure 3
Total Claim - Loan and Deposit - Non-bank

Figure 4
Total Claim – Non-conventional Non-banks
Figure 5
Total Liability - Loan and Deposit Banks

Figure 6
Total Liability – Non-conventional Banks
Figure 7
Total Liability - Loan and Deposit Non-banks

Figure 8
Cross-border Bank Exposure Network
The figures are the network maps between Vietnam and other reporting countries based on the data from BIS. Figure 1 shows the total claim-loan and deposit-banks between Vietnam and reporting countries (Austria, Australia, Belgium, Brazil, Canada, Switzerland, Chile, Germany, Denmark, Spain, Finland, France, United Kingdom, Guernsey, Greece, Hong Kong, Ireland, Isle of Man, Italy, Jersey, Japan, Korea, Luxembourg, Macao SAR, Mexico, Netherlands, Philippines, Sweden, Chinese Taipei, United States, and South Africa). The connections between Vietnam and other countries are illustrated by the arrows. However, some countries are reporting with empty data. Also, with the data provided, the map indicates a one-way relationship between Vietnam with reporting countries and also between reporting countries.

5. Conclusions

In this paper, we examined the systemic risk for the Vietnam interbank market associated with the cross-border linkages between Vietnam and other countries. The empirical results from the contagion risk assessment for the 15 D-SIBs in Vietnam, show that there is very low level of contagion risk of one bank’s default on its obligation with other banks from interbank linkages. Also, the impact from other countries on Vietnam with linkages are low and do not have any impact.

We also find that the network has low connectivity between Vietnam and other countries for banking activities. In this sense, the empirical analysis examines the relationship between cross-border links among banking systems and financial stability, taking the network structure into account. The result suggests that the effect of integration in international interbank markets on stability is unclear. The analysis has relevant policy implications as it reveals that the resilience of the banking system is affected both positively and negatively by interdependencies in the banking network. The main objective of policymakers should thus be to keep the benefits of international risk-sharing as well as geographical diversification gains while limiting fragility costs (Tonzer, 2013).
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