Article

Operational Efficiency of Bank Loans and Deposits: A Case Study of Vietnamese Banking System

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Abstract: This paper examines whether there is a causal relationship between bank loans and deposits in the Vietnamese banking system and the efficiency of the use of loans and deposits by the Vietnamese banks. In a country such as Vietnam, where inter-bank money markets are relatively underdeveloped, one would expect a reasonably strong relationship between deposits and loans. A pooled cross-sectional sample of financial ratios is collected from annual reports of 44 Vietnamese banks covering the period 2008–2015. The explanatory power of instrumental variables in relation to the endogenous variables is tested. A deterministic frontier model based on corrected ordinary least squares, estimated by three-stage least squares on a simultaneous equations model, is employed to derive the frontiers for the sampled banks as well as to estimate the causality between bank loans and deposits. Our findings suggest that, in an underdeveloped banking system such as Vietnam, bank deposits have a positive and significant impact on bank loans, but the reverse relationship is not significant. It is further suggested that in deposit-taking and loan-creating activities, Vietnamese banks performed moderately well over the period examined; however, in the near future, they should start to focus more on deposit-taking activities.

Keywords: simultaneous equations model (SEM); corrected ordinary least squares (COLS); three-stage least squares (3SLS); causality; loans; deposits; Vietnamese banks

JEL Classification: C01; C30; G21

1. Introduction

The activities of an intermediary credit institution such as a commercial bank primarily focus on receiving deposits and providing loans, which are two aspects of credit operations. Among other things, receiving deposits (or fund mobilisation) is considered as an 'input' activity of the bank[1], while lending (or fund utilisation) is considered an 'output' activity. On one hand, since more deposits allow for more loans, banks want to mobilise more funds but also minimize their interest payments. On the other hand, since more loans contribute to economic development, increase revenues, and create more (potential) deposits, banks also want to utilise more funds while maintaining low leverage and low risks. Concurrently, the efficiency of fund mobilisation and utilisation at banks should have causal impacts on each other.

The interdependent relationship between bank loans and deposits has long been acknowledged in the banking literature. Revisiting the argument of Klein (1971) and Monti (1972) that the decisions about

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[1] It is arguable that deposits can also be seen as an output of the bank (Berger and Humphrey 1997); however, the more common view is to see them as inputs, as opposed to loans, which are outputs.

loans and deposits are independent, Dermine (1986) found that the two decisions are interdependent if the bank faces very plausible situations such as a positive probability of default. Using data from Italian banks, Corradi et al. (1990) showed that there was cointegration among bank free reserves, loans, and deposits and thus provided evidence in favour of the hypothesis that there is a causal nexus running from bank deposits to loans. Kashyap et al. (2002) also found synergies between the two activities of deposit-taking and lending and further argued that they are the two manifestations of one primitive function of the bank, that is the provision of liquidity on demand or the intermediary role of the banks. These relationships have also been highlighted by Berger and Bouwman (2009) in their exploration of bank liquidity creation.

Bank efficiency studies mainly treat banks as intermediaries[2] between savers and borrowers. In this sense, according to Sealey and Lindley (1977), loans and other assets serve as outputs, while deposits and other liabilities are considered inputs of the banks. Consequently, bank efficiency studies focus on minimizing the deposits used (input-oriented), on maximizing the loans provided (output oriented), or on both (non-oriented). For example, Berger et al. (1993) examined the input technical efficiency of US banks over the 1984–1989 period using the funds (both deposits and non-deposit funds) and number of employees as input variables; while Assaf et al. (2011) used total deposits (alongside labour and physical capital) to evaluate the input efficiency of Shinkin banks (i.e., credit associations in Japan) during the period 2000–2006. In contrast, Fujii et al. (2014) studied the output-oriented efficiency of Indian banks in producing customer loans (alongside other earning assets as well as bad loans); while Nguyen and Simioni (2015) used total loans (alongside securities and total operating income) to analyse the output-oriented total factor productivity change over time of Vietnamese banks from 2008 to 2012.

We thus find that traditional banking studies acknowledge the causal relationship between bank loans and deposits but do not examine it from the efficiency perspective. The bank efficiency literature examines the efficiency of either fund mobilisation or fund utilisation activities and thus does not explore the causality issue. In this paper, we investigate the efficiency of deposit-taking and loan-making in a simultaneous framework in order to determine the causality between the operational efficiency of bank loans and deposits. Specifically, we apply corrected ordinary least squared (COLS) to estimate the deterministic frontier of Vietnamese banks for the period of 2008–2015 in mobilizing and utilizing funds. The efficiency of deposit-taking and loan-making activities will then be simultaneously examined under a simultaneous equations model (SEM) using three-stage least squares (3SLS). In this sense, we combine the two above approaches of traditional banking studies and banking efficiency studies into a novel approach. We expected this approach to provide an overall view on the operational efficiency of the two basic activities of commercial banks without the problem of simultaneity bias (Wooldridge 2016).

Empirically, we found that, for Vietnamese banks, deposits have a positive and significant impact on loans, whereas loans have a positive but insignificant impact on deposits. Moreover, the (median) operational efficiency of deposit-taking activities is higher than that of loan-making activities, suggesting that Vietnamese banks will need to focus more on their output side. One can see that, in the past few years, Vietnamese banks were not only having problems creating more loans but also had problems with the quality of the loans, as nonperforming loans increased over time (Ngo and Tripe 2017).

The remainder of this paper is as follows. Section 2 provides some background information regarding the Vietnamese banking system and its efficiency. Section 3 clarifies the methodology

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[2] There is also a 'production approach' where banks are seen as a production unit which primarily producing services for account holders (Berger and Humphrey 1997), but it is less common than the 'intermediation approach' used in this paper, since banks are commonly seen as the intermediaries in the process by which the economy chooses its activities and the way those activities are financed (Fama 1980). Readers interested in alternative approaches are encouraged to check the study of Favero and Papi (1995), among others.

aspect of the research as well as the sample data. Section 4 reveals the results and discussions, and Section 5 concludes.

2. The Vietnamese Banking System and Its Efficiency

Since the transformation from a one-tier into two-tier system in 1990, the Vietnamese banking system has developed rapidly in terms of the number of banks, the size of the banking sector, the amount of banking activities, and transactions (Ngo 2012). However, impacts of the Asian Financial Crisis (AFC) of 1997 and the Global Financial Crisis (GFC) of 2008 put pressure on the Vietnamese banking system and thus required further renewals of banking operations.

Since 2011, the State Bank of Vietnam (SBV) has introduced many policies that have brought about fundamental changes and achieved positive results. In particular, the Credit Institution System Restructuring Plan was approved in March 2012 (Vietnamese Government 2012) to deal with bad debt and weak performance of the banking system. One important impact of this decision was the merger and acquisition of some joint stock commercial banks in the recent years, which caused concern about the efficiency of the operation of the banking system in Vietnam.

Figure 1 shows the changes in the number of commercial banks in Vietnam over the past 25 years. One can see that many banks were established in the first decade[3], the restructure of the banking system after the AFC and the GFC.[4]
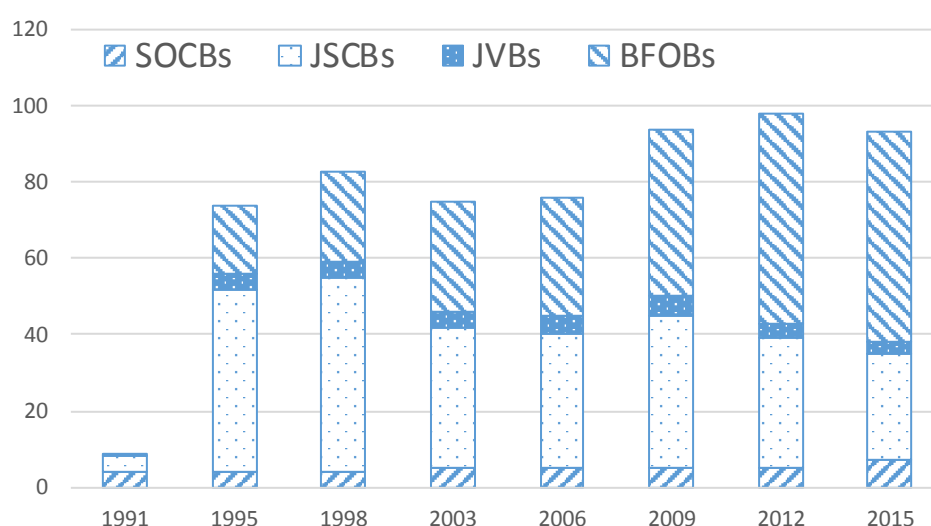

Figure 1. Number of Vietnamese banks over time. **Notes:** SOCBs: State-Owned Commercial Banks; JSCBs: Joint Stock Commercial Banks; JVBs: Joint Venture Banks; BFOBs: Branches of Foreign-Owned Banks (also include Fully Owned Foreign Banks after 2007). *Source: SBV*.

Figure 2 shows both fund mobilisation and utilisation (as a percentage of GDP), two basic activities of Vietnamese banks during the period 2008–2015. Both activities show downward trends overall, especially around 2011–2012, where Moody's downgraded eight large banks in Vietnam (Global Credit Research 2012), although there was a gradual recovery at the end of the period with respect to credit activity. The fund mobilisation rates in Vietnamese banks rose from 22.84% in 2008 to 36.24% in 2010. This then plunged to a low of 12.4% in 2011, followed by moderate growth to 19.9% in 2013.

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3 After the Vietnam War, Vietnam re-joined IMF, WB and ADB in October 1993. In February 1994, the US removed its sanctions on Vietnam.
4 It is argued that effects of regional and global crisis on the Vietnamese banks were lagged due to the lack of cross-border linkages between the domestic banking system and the regional/global counterpart (Ngo 2015), which is also found in other developing countries (IMF 2009).

Later, the rate of fund mobilisation declined progressively to 16.2% during the last two years of the 2008–2015 period. Meanwhile, the rate of bank credit for industry was almost equal to that of fund mobilisation in 2008 (23.38%). The figure hit a peak of 37.53% in 2009, followed by a sequential decrease, reaching its lowest point, at 8.75%, in 2012, when banks were reluctant to lend as a result of high NPLs (Tran et al. 2015) as well as the restrictive credit policies of the SBV (OECD 2013). The following three years saw a moderate recovery, reaching 18.8% in 2015.
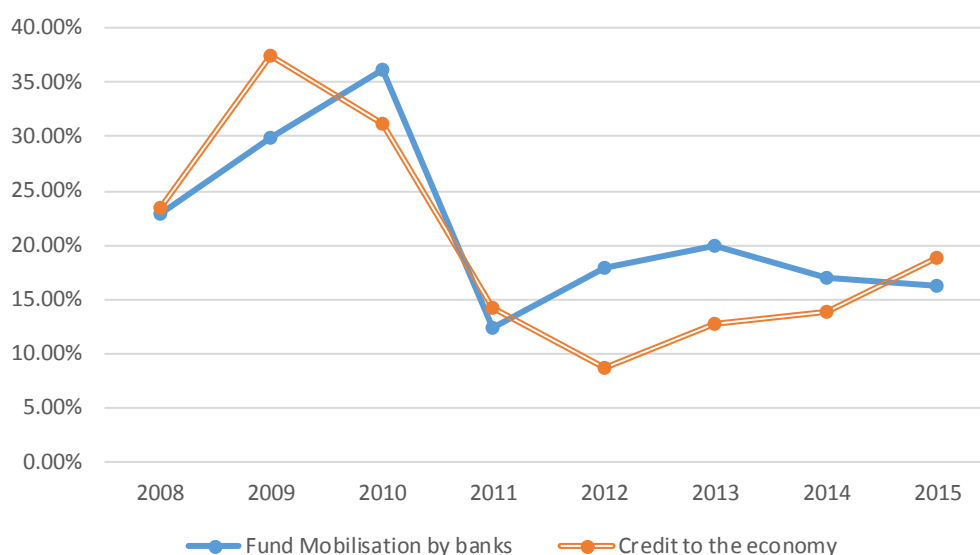
Figure 2. Fund mobilisation and utilisation of Vietnamese banks, 2008–2015. *Source: SBV.*

The development of the Vietnamese banking industry and its performance has been examined by many studies, including market reports from international financial institutions (e.g., WB or IMF) as well as individual researchers (Ngo 2012; Ngo and Tripe 2017; Nguyen and Simioni 2015; Nguyen et al. 2016; Stewart et al. 2016). In particular, Stewart et al. (2016) revealed that, in Vietnam, small and medium-sized banks were less efficient than large and very large banks, and the small banks had the lowest efficiency ratings. This was supported by Ngo and Tripe (2017) and Nguyen et al. (2016) where they both found that SOCBs (which are large in size) were more (cost)-efficient than JSCBs (which are generally smaller). In terms of profit efficiency, findings from Vu and Nahm (2013) argued that Vietnamese banks operated well below the frontier in the 2000–2006 period mainly due to allocative inefficiency (of using labour, fixed assets, and deposits and other borrowed funds) rather than technical inefficiency. However, none of these studies has focused on the banks' efficiency under the causal relationship between loans and deposits. Our study is therefore expected to be the very first empirical study on the particular relationship between the operational efficiency of bank loans and deposits, especially in the Vietnamese context.

3. Technical Aspects of the Study

3.1. Methodology

According to Berger and Mester (1997) and Liu et al. (2013), data envelopment analysis (DEA), a nonparametric approach, and stochastic frontier analysis (SFA), a parametric approach, are the two most popular approaches for efficiency evaluation in the banking sector. Those two actually belong to the frontier analysis, where the firms that operate on the frontier are treated as efficient and the others are treated as inefficient, inspired by the idea of the production possibility frontier. The basic difference between DEA and SFA is that the former does not distinguish noise or errors from efficiency. In this sense, DEA is similar to the deterministic frontier model (DFM) of the parametric approach (Forsund

and Hjalmarsson 1987), where one can use corrected ordinary least squares (COLS) to estimate the frontier and all deviations from the frontier will be classed as inefficient.

According to Greene (2008) and Kumbhakar et al. (2015), among others, output-oriented efficiency estimation of COLS starts by first obtaining the OLS frontier, and then shifts this frontier upward (or inward if input-oriented) to the extent that the function after the adjustment bounds all the observations below (or above, if input-oriented).[5] Figure 3 below, adapted from Greene (2008), shows the difference between OLS and COLS frontiers for the output-oriented situation, whereas the COLS frontier envelops the sample at the best-practice observation (i.e., Point C), similar to DEA (under the constant-returns-to-scale (CRS) assumption). The only differences between CRS DEA and COLS are the intercepts (and thus the slope of the frontiers), which usually reveal nothing more than the units of measurement (Greene 2008).
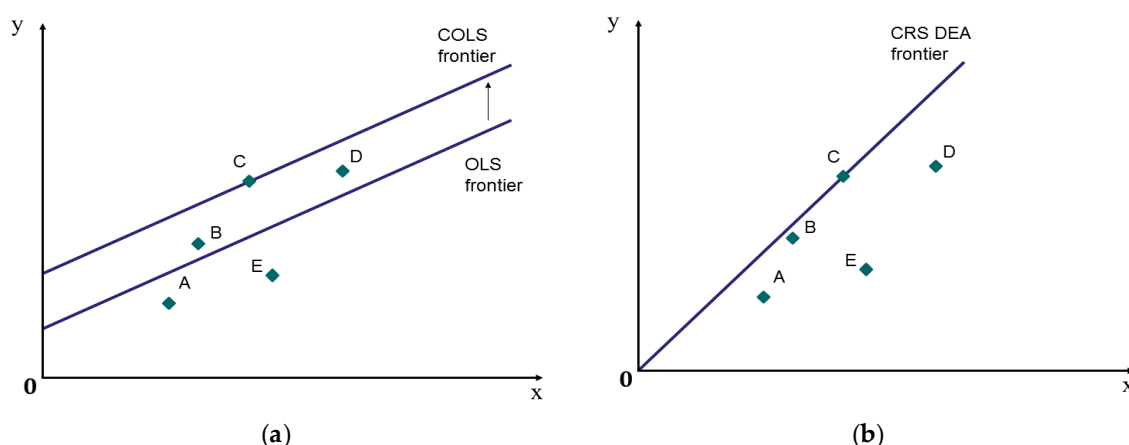
Figure 3. Similarity between COLS and CRS DEA. (**a**) COLS frontier; (**b**) DEA frontier. **Source:** Adapt from Greene (2008, Figure 2.3, p. 106).

Amsler et al. (2016) suggest that one needs to consider endogeneity when estimating the (OLS) frontier. This is in line with our discussion so far, as we expect to see a causal relationship between banks activities of fund mobilisation and utilisation. Consequently, we use a simultaneous equations model (SEM) to examine this issue for Vietnamese banks, because an SEM is able to provide a set of interrelated questions in a single, systematic, and comprehensive analysis (Gefen et al. 2000). We can thus model the relationship between the operational efficiency of bank loans and deposits simultaneously. To date, SEM has been applied in a great number of economic fields, particularly marketing and management, but not in efficiency analysis. Therefore, with the application of SEM to banking data, the authors offer a new approach to banking research.

Specifically, our SEM is constituted by the two following equations, each has a *ceteris paribus* interpretation.[6] Three-stage least squares (3SLS) will be used to solve that SEM, as it can be more efficient than the two-stage least squares (2SLS) in terms of explaining interrelations among the error terms (Belsley 1988).

$$LOAN = \alpha_0 + \alpha_1 DEPOSIT + \beta_1 Z_1 + \varepsilon_1 \tag{1}$$

$$DEPOSIT = \alpha_2 + \alpha_3 LOAN + \beta_2 Z_2 + \varepsilon_2 \tag{2}$$

where:

LOAN: the logarithmic value of the loans utilised by the bank;

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5   The idea of shifting the OLS frontier upward or inward is to match it with the production possibility frontier.
6   For simplicity, we omit the subscript "i" for bank and "t" for year.

DEPOSIT: the logarithmic value of the deposits mobilised by the bank;

Z_1: a set of exogenous instrumental variables in Equation (1);

Z_2: a set of exogenous instrumental variables in Equation (2);

ε_1 and ε_2: the residuals, which then will be used to estimate the inefficiency of the two activities in the next step.

At this stage, we can obtain the estimated zero-mean OLS residuals as

$$\hat{\varepsilon}_1 = LOAN - [\alpha_0 + \alpha_1 DEPOSIT + \beta_1 Z_1] \tag{3}$$

$$\hat{\varepsilon}_2 = DEPOSIT - [\alpha_2 + \alpha_3 LOAN + \beta_2 Z_2]. \tag{4}$$

Here, the value of $\hat{\varepsilon}_1$ and $\hat{\varepsilon}_2$ can be less than, equal to, or greater than zero.

After the efficient frontiers for the two activities are estimated, COLS will adjust them upward (as we follow an output-oriented approach).[7] Accordingly, the residuals are also adjusted to be

$$u_1 = \hat{\varepsilon}_1 - max\{\hat{\varepsilon}_1\} \le 0 \tag{5}$$

$$u_2 = \hat{\varepsilon}_2 - max\{\hat{\varepsilon}_2\} \le 0 \tag{6}$$

and

$$EF_1 = \exp(u_1) \tag{7}$$

$$EF_2 = \exp(u_2) \tag{8}$$

where EF_1 is the technical efficiency of fund utilisation activities, and EF_2 is the technical efficiency of fund mobilisation activities.

3.2. Data

Our research employs the pooled cross-sectional sample data of 43 banks domiciled and operated in Vietnam (please see Appendix A for a listing of those banks) during the 2008–2015 period (totaling 289 observations), extracted from the Vietnamese banking database (Ngo and Le 2017). All data is calculated in VND and deflated using the Consumer Price Index (CPI) extracted from the World Bank Database, where 2010 is chosen as the base year. There might be differences between the accounting principles and standards of the banks, namely the Vietnamese Accounting Standards (VASs) and the International Financial Reporting Standards (IFRSs), but those differences are not important to our analysis, especially as VASs had begun to adopt IFRSs since 2001 (Ngo and Tripe 2017). A summary on the number and types of banks covered in this research is presented in Table 1 below, where the number of banks varied from 23 to 43 each year, supporting the use of a pooled cross-sectional analysis. Overall, our sample covers a set of up to seven SOCBs and up to another 33 JSCBs.[8]

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[7] In this sense, we argue that the aim of Vietnamese banks is to maximize the amount of funds mobilized from savers as well as the amount of funds utilized for borrowers.

[8] The total assets of the seven state-owned commercial banks, as of September 2016, were VND 3,690,463 billion, and accounted for 45% of the total assets of the Vietnamese banking sector (SBV 2017). Although our panel is not perfectly balanced, the gaps in our observations are relatively few, hence we consider it valid to compare performance between years (even though the composition of the cross sections are not exactly identical).

Table 1. Number of banks tested every year during the period 2008–2015.

Year	Number of Banks	SOCBs	SPBs	JSCBs	JVBs	BFOBs
2008	40	6	1	32	1	0
2009	43	7	1	33	1	1
2010	43	7	1	33	1	1
2011	38	6	0	30	1	1
2012	35	5	0	28	1	1
2013	33	5	0	27	1	0
2014	30	4	0	25	1	0
2015	27	3	0	23	1	0

Notes: SOCBs: State-Owned Commercial Banks; SPBs: State Policy Banks; JSCBs: Joint Stock Commercial Banks; JVBs: Joint Venture Banks; and BFOBs: Branches of Foreign-Owned Banks (also includes Fully Owned Foreign Banks after 2007). ***Source***: *Authors' calculation.*

As discussed in the previous section, besides the two variables LOAN and DEPOSIT, we also examine the effect of some instrumental variables (IVs) on the efficiency of the two basic activities as Z_1 and Z_2 in our SEM. Accordingly, we control for total assets (TA), the ratio of loans to customers to total assets (LOA), the ratio of deposits from customers to total liabilities (DOL), the number of branches a bank has (BRANCH), the ratio of deposits and borrowings from other credit institutions to total liabilities (ILL), the lending rate (LR), the unemployment rate (UNEMP), and the type of the bank (TYPE, a dummy variable that is 1 if the bank is an SOCB; otherwise, it is zero). The descriptive statistics are presented in Table 2 below. The correlation between the variables are low, except for LOAN, DEPOSIT, and TA. This is common in the banking literature and further emphasises the endogeneity issue that needs to be avoided by using SEM.

Table 2. Descriptive statistics of the variables.

Variable	Obs	Mean	Median	Maximum	Minimum	Std. Dev.
LOAN	289	12.3388	12.1801	15.7777	8.0742	1.3631
DEPOSIT	289	12.3889	12.4489	15.5139	8.6800	1.4466
TA	289	13.0661	13.1061	16.2169	9.7549	1.2915
LR	289	12.1845	13.1353	16.9538	7.1175	3.1409
DOL	289	0.6410	0.6701	0.9829	0.0138	0.1835
UNEMP	289	2.2739	2.3000	2.6000	1.8000	0.2704
ILL	289	0.2193	0.2113	0.7608	0.0000	0.1409
BRANCH	289	1639	88	199689	0	16258
LOA	289	0.5172	0.5110	0.9773	0.0116	0.1605
TYPE	289	0.1246	0	1	0	0.3308

Notes: LOAN, DEPOSIT, and TA are in logarithm; BRANCH is in number; LR is in percentage; the rest are ratios. *Source: Authors' calculation.*

4. Results and Discussions

4.1. SEM Analysis

The estimation of the SEM in Equations (1) and (2) above requires some endogenous variables. We argue that, because DOL appears only in Equation (2) and LOA enters only in Equation (1), the only two equations of our SEM are identified. In this sense, DOL and LOA are instrumental variables (IVs) for DEPOSIT and LOAN, respectively; the rest of the variables in Z_1 and Z_2 can be used as control variables. We first report OLS results for the reduced forms of the above equations to detect strong IVs for the two endogenous variables LOAN and DEPOSIT. In particular, we used the Cragg–Donald test to check if DOL is truly an IV for DEPOSIT, and if LOA is truly an IV for LOAN. The tests generated F-statistics of 563.301 and 635.596, respectively, and since these are greater than 10, we can argue that they are appropriately identified as endogenous variables in our SEM.

In addition, we also employed the Durbin–Wu–Hausman test for the exogenous characteristics of the other explanatory variables (e.g., TA, BRANCH, or UNEMP). All tests ended up with J-statistics smaller than zero: thus, we cannot reject the null hypothesis that those variables are exogenous to the dependent ones, i.e., LOAN and DEPOSIT. Consequently, we argue that our SEM is justified, and its results are consistent and unbiased.

Our SEM in Equations (1) and (2) were consequently estimated by 3SLS, and the results are presented in Table 3. As discussed, we argue that our SEM results have accounted for the causal relationship between bank loans and deposits and that the findings reveal the operational efficiency of Vietnamese banks' fund mobilisation and utilisation activities simultaneously.

Table 3. Results of SEM analysis.

Variable	Coefficient	Standard Error	t-Statistic	
Panel A. Results of Equation (9)—Dependent Variable: LOAN				
Variable	*Coefficient*	*Standard Error*	*t-Statistic*	
DEPOSIT	0.208	0.022	9.294	***
LOA	2.440	0.073	33.480	***
TA	0.765	0.025	30.462	**
LR	0.008	0.005	1.797	***
BRANCH	0.000	0.000	2.543	***
TYPE	−0.022	0.041	−0.535	
UNEMP	0.063	0.199	0.315	
Constant	−1.466	0.191	−7.678	***
Panel B. Results of Equation (10)—Dependent Variable: DEPOSIT				
Variable	*Coefficient*	*Standard Error*	*t-Statistic*	
LOAN	−0.029	0.048	−0.614	
DOL	2.686	0.108	24.893	***
TA	1.072	0.046	23.362	***
LR	0.037	0.007	5.042	***
BRANCH	0.000	0.000	−9.220	***
TYPE	−0.136	0.064	−2.121	**
UNEMP	−1.071	0.319	−3.357	***
Constant	−3.532	0.286	−12.328	***

Notes: ** represents 5% level of significance and *** represents 1% level of significance.

In particular, by examining this causality, we identify the positive and significant impact that DEPOSIT has on LOAN (see Panel A of Table 3), whereas the impact of LOAN on DEPOSIT is negative (and small) but insignificant (Panel B of Table 3). Theoretically, one can argue that, on a system-wide basis, loans come back to the banking system as deposits. What we do not know, however, is how this affects the loans and deposits of individual banks. In the Vietnamese context, we assume that the flow of loans back to the banks is asymmetric between individual banks (i.e., large banks may get more of the loans back in as deposits, compared to smaller banks)—as can be seen with the variable TA in Table 3. We also argue that in Vietnam savers put money in banks not only because the banks are efficient but due to other factors such as safety or their beliefs (e.g., that the SOCBs will not be merged or bankrupted), hence the negative impact of TYPE on LOAN is not significant. It thus suggests that further studies with larger or different datasets (e.g., for other advanced economies) are needed to examine this situation.

In terms of the impacts of IVs on fund utilisation activities of the banks, i.e., Panel A of Table 3, we can see that except for TYPE and UNEMP, other independent variables of this equation are positive and statistically significant. This suggests that increasing those factors can help Vietnamese banks provide more loans to the market. For example, adding one more point of deposit or one more point of assets can increase the amount of loans by 0.208 and 0.765 percentage points, respectively. In contrast, the second part of Table 3 suggests that all independent variables have a significant impact on bank deposits, except for bank loans. Interestingly, in this part, TYPE and UNEMP negatively affect

deposit at a 1% level of significance, indicating a different story about the fund mobilisation activities of Vietnamese banks. In particular, SOCBs tend to attract less deposits compared to other types of banks, which confirms the argument that private banks are more flexible and more competitive than state-owned banks (Ariff and Luc 2008; Bonin et al. 2005a, 2005b). They can therefore be more attractive to savers. In addition, the unemployment rate has an explanatory power for deposits, but not for loans, because an individual who has lost his job would reduce his/her deposits into a bank.

4.2. Efficiency Analysis Using COLS

In this section, we first report the overall view on operational efficiency of 289 Vietnamese bank-observations in terms of mobilizing and utilizing funds in the 2008–2015 period. Figure 4 suggests that Vietnamese banks are more competitive in lending activities than in deposit-taking activities, as observations on EF_1 are more concentrated than those of EF_2. Additionally, the median score for EF_1 is 0.789, higher than for EF_2 (0.720). Accordingly, we conclude that, over the 2008–2015 period, Vietnamese banks performed moderately well in terms of the two activities, with the lending activities focused more than deposit-taking activities. We argue that this might result from the Credit Institution System Restructuring Plan and the establishment of VAMC, since banks were required to manage their credit risks. Nevertheless, there is still room for those banks to improve their efficiency.
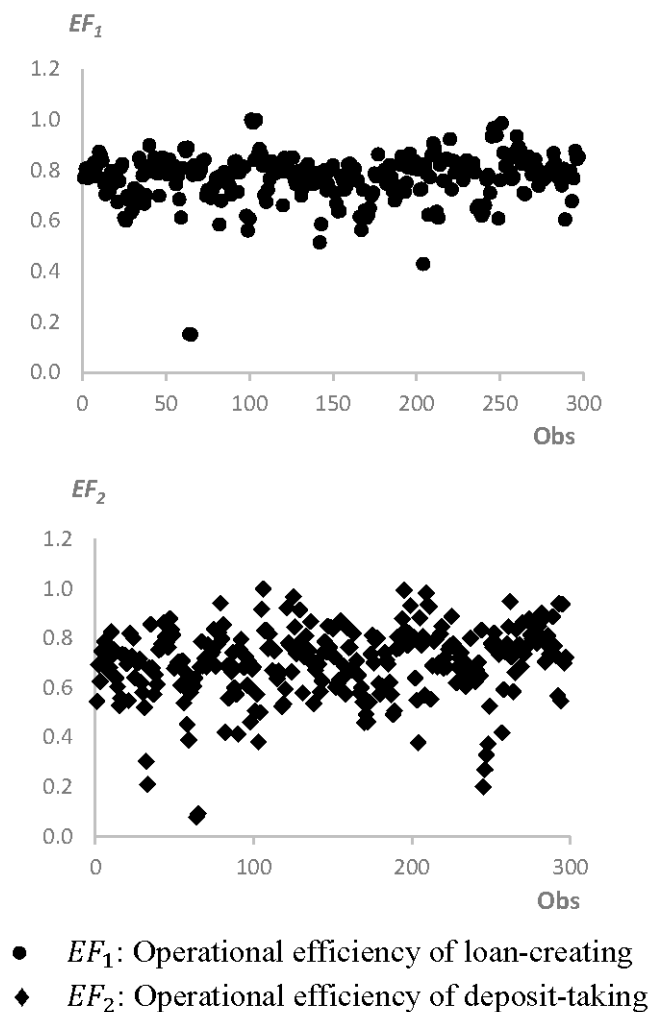

EF_1: Operational efficiency of loan-creating

EF_2: Operational efficiency of deposit-taking

Figure 4. Results of SEM: overview.

When examined over time, the picture on operational efficiency of Vietnamese banks is clearer. Particularly, we can see that the yearly-average efficiency of loan-creating activities of Vietnamese banks increased during the period examined (the dotted trend line in Figure 5); whereas the yearly-average efficiency of deposit-taking activities decreased (the dashed trend line in Figure 5). While the former shows a good signal, the latter reveals an issue for the Vietnamese banking system. Specifically, as discussed in the previous section, in the Vietnamese banking system, deposits have a positive impact on loans, while the impact of loans on deposits is not significant. In other words, the contribution of the higher efficiency of loan-creating activities to the banks is not clear, but the decrease in efficiency of deposit-taking activities will hinder the banks' lending and thus negatively impact the whole banking system. Therefore, we suggest that, while trying to maintain the positive trend on loan-creating activities, Vietnamese banks should start to focus more on deposit-taking activities.
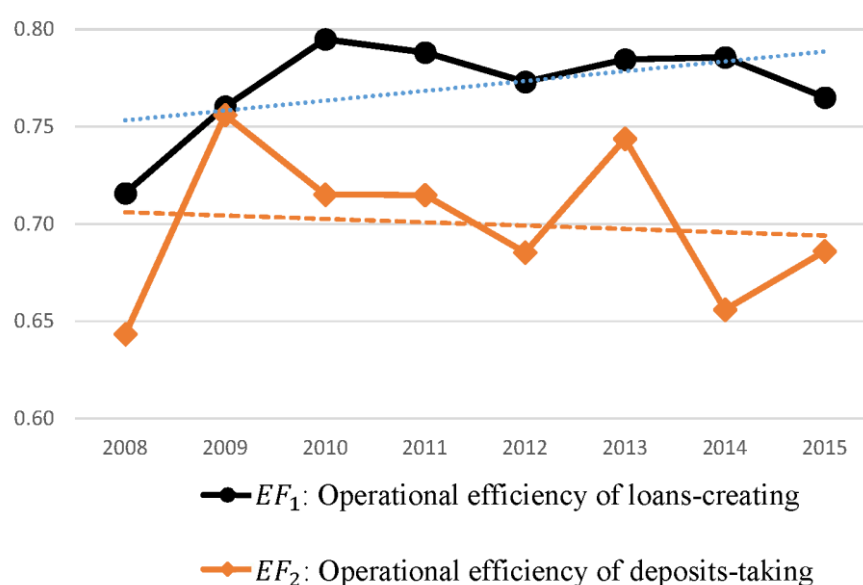

Figure 5. Results of SEM: average operational efficiency over time.

5. Conclusions

In this paper, we examine the causal relationship between bank loans and deposits in the Vietnamese banking system. Data collected from the annual reports of 44 Vietnamese banks over an eight-year period from 2008 to 2015 is utilised to examine the hypotheses developed in the study. The relationship between bank loans and deposits is significant in the one-way relationship, indicating that deposits have an impact on loans. This also highlights that, in terms of limited funding sources for loans as in Vietnam, banks deposits are crucial. The reverse effect of loans on deposits is not significant, which could be because customers make deposits with a bank in Vietnam not because of the bank's efficiency but due to other factors such as safety or particular beliefs (e.g., that the SOCBs will not be merged or bankrupted). Thus, further studies with a larger dataset or with different datasets (e.g., of other advanced economies) are needed to confirm this finding. Subject to the availability of suitable data, it would also be interesting to apply the liquidity creation measures pioneered by Berger and Bouwman (2009) to the Vietnamese market.

We also investigated the efficiency in the use of loans and deposits by those Vietnamese banks. Employing the COLS approach, we found Vietnamese banks performed moderately well in terms of deposit-taking and loan-creating activities, although there is still room for those banks to improve. Combined with an assessment of efficiency changes over time, we suggest that, though Vietnamese banks are trying to keep a good trend in loans-creating activities, they should start to focus more on deposit-taking activities.

As a first study on the relationship between loans and deposits, as well as on the efficiency of using loans and deposits in the Vietnamese banking system, this study, however, still experienced certain difficulties that limit its research scope. These limitations include the challenges in collecting data from banks with foreign ownership, which led to the small data sample (only 297 observations). The short sample period, from 2008 to 2015 only, does not allow us to examine the impact of the global financial crisis on Vietnamese banks. Future research on this topic, specifically through increasing the sample data in respect to both size and time period covered is, therefore, recommended. In addition, more in-depth study on the efficiency of using loans and deposits based upon other factors such as customer behaviour is also suggested.

Author Contributions: This paper based on Tram Nguyen's master thesis at the School of Economics & Finance, Massey University. Thanh Ngo updated the data, revised the empirical model as well as the accordance discussions. David Tripe provided important suggestions and tidy up the work.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Vietnamese banks included in the study.

No.	Bank's Name	No.	Bank's Name
1	An Binh Commercial Joint Stock Bank	23	Orient Commercial Joint Stock Bank
2	Asia Commercial Joint Stock Bank	24	Petrolimex Group Commercial Joint Stock Bank
3	Bao Viet Joint Stock Commercial Bank	25	Saigon—Hanoi Commercial Joint Stock Bank
4	Construction Bank (former name: Trustbank)	26	Saigon Bank for Industry & Trade
5	DongA Joint Stock Commercial Bank	27	Saigon Commercial Bank
6	First Joint Stock Commercial Bank	28	Saigon Thuong Tin Commercial Joint Stock Bank
7	Global Petro Commercial Joint Stock Bank	29	South East Asia Joint Stock Commercial Bank
8	Great Asia Commercial Joint Stock Bank	30	Southern Commercial Joint Stock Bank
9	Hanoi Building Commercial Joint Stock Bank	31	TienPhong Commercial Joint Stock Bank
10	Ho Chi Minh City Development Joint Stock Commercial Bank	32	Viet A Joint Stock Commercial Bank
11	HSBC Bank (Vietnam) Limited	33	Viet Capital Commercial Joint Stock Bank
12	Indovina Bank Ltd.	34	Viet Nam Technological and Commercial Joint Stock Bank
13	Joint Stock Commercial Bank for Foreign Trade of Vietnam	35	Vietnam Bank for Agriculture and Rural Development
14	Joint Stock Commercial Bank for Investment and Development of Vietnam	36	Vietnam Bank for Social Policies
15	Kienlong Commercial Joint Stock Bank	37	Vietnam Commercial Joint Stock Bank for Private Enterprise
16	Lien Viet Post Joint Stock Commercial Bank	38	Vietnam Export Import Commercial Joint Stock Bank
17	Mekong Development Joint Stock Commercial Bank	39	Vietnam International Commercial Joint Stock Bank
18	Mekong Housing Bank	40	Vietnam Joint Stock Commercial Bank of Industry and Trade
19	Military Commercial Joint Stock Bank	41	Vietnam Maritime Commercial Joint Stock Bank
20	Nam A Commercial Joint Stock Bank	42	VietNam Tin Nghia Commercial Joint Stock Bank
21	National Citizen Bank	43	Western Commercial Joint Stock Bank
22	Ocean Commercial One Member Limited Liability Bank	44	Vietnam Public Joint Stock Commercial Bank

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