A productivity analysis of the Vietnamese banking sector using non-performing loans as a bad output

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Abstract: Using non-performing loans as a bad output, this study will measure and analyse the productivity of Vietnam's banks during the period from 2007−2014. The Malmquist-Luenberger index is utilised to measure the productivity of Vietnamese banking system. The results show an outperformance of publicly owned banks over their private counterparts and a deterioration of bank productivity due to technical regress.
Keywords: Data Envelopment Analysis, banking, productivity, non-performing loans, Vietnam

INTRODUCTION

Over the last decade, studies on banking efficiency and productivity in Vietnam have attracted a substantial attention from academics and practitioners [13,16,14,12,9]. These studies focus on different periods and cover important events relating to the evolution of Vietnamese banks including the transformation from a mono-tier to a two-tier banking system in 1988, the East Asian Financial Crisis in 1997, the WTO accession in December 2006 and the Global Financial Crisis in 2008. Despite extensive and numerous works, there is a gap in the relevant research on banking efficiency and productivity in Vietnam. In particular, these studies have ignored the impact of non-performing loans (NPLs) on bank performance, despite the fact that many authors have proven the importance of including NPLs in examinations of banking operations. According to Assaf et al., [1], NPLs need to be included in a mixed-production process to ensure unbiased results. Exclusion of bad loans in efficiency measuring processes lead to biased outcomes because the more efficient banks can produce a higher proportion of undesirable outputs. Some may argue that profitability and risk are two edges of banking activities; thus, if only good outputs are considered when measuring banking efficiency then it would be difficult to assess the capability of risk management [6].

NPLs are a persistent and serious problem in Vietnam due to a number of factors including: an inadequate and inconsistent framework of regulation and supervision; the overwhelming participation of the state in the banking sector; the low quality of management; and out-dated standards for loan-loss classifications and provisioning [7]. This reality requires academics to take bad loans into account in any research on Vietnamese banking operations.

To measure the performance of the Vietnamese banking sector under the impact of NPLs, this paper employs the Malmquist-Luenberger index to identify changes in bank productivity. This indicator is based on the directional distance function that allows accounting for the impact of bad outputs in a mixed-production process.

This paper is organised as follows. Section 2 overviews the development of Vietnamese banking system since the WTO entry event in December 2006. Section 3 describes the methodology used to carry out the analyses and the data covering the expansionary versus contractionary periods of monetary policy (2007−2010 versus 2011−2014). A description of this data is provided in Section 4. Section 5 provides interpretations and explanations of results. Finally, Section 6 provides concluding remarks.

An overview of Vietnamese banking sector since the WTO entry

The entry of Vietnam into the WTO in December 2006 marked an important point in the banking sector's liberalisation; accordingly, a number of policy measures were conducted to improve bank performance and competitiveness. As part of the commitments to the WTO, overseas banks are allowed to open 100% foreign-invested banks that are recognised for their advanced technology and high quality of governance. Foreign investors are also allowed to take part in domestic banks as minority shares holders. Rural banks are permitted to transform to urban banks, although under inadequate selection processes. Four of five state-owned banks were privatised and strategic foreign investors were invited to participate. The pre- and post-WTO entry period

experienced rapid credit growth at an average rate of 35% annually. In a financial system still in its infancy and with a weak regulatory and supervisory framework like Vietnam's, this booming credit leads to mounting NPLs. Quantitative assessments of bad loans in Vietnam are inconsistent. According to a report conducted by the National Assembly Economic Commission [11], the rate of NPLs over the entire banking sector was between 10 to 12% at the end of 2011. This rate was estimated by credit rating agencies such as Fitch as being even higher at 13 to 15%. The State Bank of Vietnam (SBV)[1] data indicated that it was 3.1% at the end of 2011; however, it increased to 4.8% by September 2012.

Rapid but risky credit growth combined with macroeconomic instability during the 2008−2011 period raised questions about the quality and sustainability of the Vietnamese economy. These challenges forced the government to issue and implement quick but appropriate measures. Resolution No. 11 issued in February 2011 by the government identified immediate measures to curb the high inflation rate and the extreme expansion of banking credit. It limited the growth rate of credit to less than 20% and significantly reduced the fraction of lending to financial markets. The priority in credit allocation was to be focused on agriculture, small and medium enterprises and supportive industries. Moreover, in the banking sector, a long-run restructuring plan, ruled under Decision 254, was issued in March 2012 by the Prime Minister. The overall objective of this was to comprehensively restructure the banking system with a 2020 vision of modern, safe, efficient and sustainable banks capable of competing with foreign banks. In particular, in the 2011-2015 period, emphasis was placed on improving financial conditions, improving the safety, legal compliance and efficiency of banks and consolidating operational capabilities. One of the most important objectives of Decision 254 was to reduce the rate of NPLs to less than 3% by the end of 2015. Accordingly, a number of specific measures have been conducted. First, the system of laws relevant to the banking sector was reviewed and renewed to make it more effective and appropriate, including regulations on loan classification and loan-loss provisioning, and on the definition of related parties and capital adequacy. Second, the banking inspection and supervisory authority was reorganised such that this agency is more centralised, independent and covers all supervisory functions including awarding of bank licenses, building banking regulations, supervising banking activities and processing infringements. Third, the Vietnam Asset Management Company was established to purchase,

manage and resell bad loans from credit institutions. Fourth, small, illiquid private banks were encouraged to merge with big, financially sound banks. Insolvent banks, in which the provisioning cost for bad loans exceeds their equity, were nationalised and the State Bank of Vietnam appointed new high-ranking management positions in these banks.

Up to the present day, the impact of Decision 254 on banking operations is still unclear as no study has been conducted to shed light on it. This research is the first to investigate the banking system in the 2011-2014 period, influenced by Decision 254, and its results will help the government, academics and practitioners answer the question as to whether the performance of the banking sector has been improved.

METHODOLOGY

The measurement of efficiency and productivity should focus on both marketable outputs (good outputs) and by-products (bad or undesirable outputs) such as pollution in industry or non-performing loans in banking sector [5, 15]. Chung *et al.,* [4] proposes the Directional Distance Function (DDF) to measure efficiency that includes both types of outputs. The objective of DDF models is to increase good outputs in parallel with reducing the bad outputs. The DDF is defined as follows:

$$\vec{D}(x, y, b; g_y, g_b) = max\{\beta: (y + \beta g_y, b - \beta g_b) \in P(x)\}$$
$$and \ P(x) = \{(y, b): x \ can \ produce \ (y, b)\}$$

where inputs be denoted by $x \in R_+^M$, desirable outputs by $y \in R_+^S$ and undesirable outputs by $b \in R_+^P$; g_y and g_b are the direction vectors of good and bad outputs.

The value of DDF can be calculated by using linear programming as below:

$$max \ \beta$$

Subject to
$$X\lambda + \beta g_x \leq x_o$$
$$Y\lambda - \beta g_y \geq y_o$$
$$B\lambda - \beta g_b = b_o$$
$$\lambda \geq 0; g_x \geq 0; g_y \geq 0; g_b \leq 0$$

For analysing changes of efficiency over time, aggregate indices such as the Malmquist index have been developed. They are derived from the efficiency scores of production frontier models. These productivity measures are used to scale total factor productivity (TFP) which includes all categories of productivity changes and can be decomposed further to allow a better understanding of the relative importance of various components, including technical and efficiency change. Technical change measures the shift of production frontier over time while efficiency change

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[1] The State Bank of Vietnam plays a role as a central bank.

measures how close a bank is to the frontier between two compared periods.

In this paper, we employ the Malmquist-Luenberger index (ML index) as a TFP measure because it is believed to be more robust than the Malmquist index [3]. Chung *et al.,* [4] proposes the ML index and this index can be used to measure the productivity of systems that generate bad outputs. Change in the ML index is further broken down into technical change and efficiency change. The ML index and its components are computed as below:

$$ML_t^{t+1} = \left[\frac{\left(1 + \vec{D}^t(x_k^t, y_k^t, b_k^t)\right)}{(1 + \vec{D}^t(x_k^{t+1}, y_k^{t+1}, b_k^{t+1}))} \frac{\left(1 + \vec{D}^{t+1}(x_k^t, y_k^t, b_k^t)\right)}{\left(1 + \vec{D}^{t+1}(x_k^{t+1}, y_k^{t+1}, b_k^{t+1})\right)} \right]^{\frac{1}{2}}$$

$$MLTC_t^{t+1} = \left[\frac{\left(1 + \vec{D}^{t+1}(x_k^t, y_k^t, b_k^t)\right) \left(1 + \vec{D}^{t+1}(x_k^{t+1}, y_k^{t+1}, b_k^{t+1})\right)}{\left(1 + \vec{D}^t(x_k^t, y_k^t, b_k^t)\right) \left(1 + \vec{D}^t(x_k^{t+1}, y_k^{t+1}, b_k^{t+1})\right)} \right]^{1/2}$$

$$MLTEC_t^{t+1} = \frac{\left(1 + \vec{D}^t(x_k^t, y_k^t, b_k^t)\right)}{\left(1 + \vec{D}^{t+1}(x_k^{t+1}, y_k^{t+1}, b_k^{t+1})\right)}$$

$$ML_t^{t+1} = MLTEC_t^{t+1}.MLTC_t^{t+1}$$

where: x_t represents the input for year t;
x_{t+1} is the input for year $t + 1$;
y_t is the desirable output for year t;
y_{t+1} is the desirable output for year $t + 1$;
b_t is the undesirable output for year t; and
b_{t+1} is the undesirable output for year $t + 1$.

$\vec{D}^t(x_k^t, y_k^t, b_k^t)$ is the inefficiency score of year t based on the frontier of year t.

Similarly, $\vec{D}^t(x_k^{t+1}, y_k^{t+1}, b_k^{t+1})$ is the inefficiency score of year $t + 1$ based on the frontier of year t. The ML index can be decomposed into technical change ($MLTC$) and efficiency change ($MLTEC$).

If the values of ML, MLTEC and MLTC are bigger than one suggesting a positive change and in a contrary, a negative change is recorded if the values are less than one.

Data

The sample consists of four SOCBs (State-Owned Commercial Banks) representing public banks and 19 JSBs (Joint Stock Banks) representing private banks in Vietnam (see Table 1). The panel data are collected from the financial statements of the commercial banks from 2007 to 2014, including their balance sheets and income reports. These statements are compiled under Vietnamese Accounting Standards (VAS), which are regarded as being less rigorous than International Accounting Standards (IAS). With a two-digit inflation rate on average covering the period 2007−2012 (about 11-12%), the balance sheets of the banks have significantly deteriorated. It is appropriate and essential to convert this data into real terms. The year 2007 is taken as the benchmark base, and the data from 2007 forward is discounted using the Consumer Price Index (CPI).

It is widely accepted that, despite substantial research efforts, there is still a lack of agreement in identifying the output and input of banks in similar studies [2, 8]. Two input/output approaches including the intermediation approach and the operating approach have been commonly utilised in the literature. The intermediation approach views banks as intermediating funds between savers and investors and relies on labour costs and fixed assets as inputs; and total lending volume and/or other assets such as investments, securities as the outputs. The operating approach is a profit-oriented approach in which banks maximise revenues from their operations. Interest income and non-interest income are used as outputs, while interest expenses and non-interest expenses are used as inputs. In this paper, we use the intermediation approach.

Under the intermediation approach, the inputs include fixed assets, labour expenses and deposits. Meanwhile, desirable outputs are loans and non-traditional assets including securities and investments. The undesirable output is bad loans and in this paper we use loan-loss provisioning cost as its proxy. A statistical description of these variables is shown in Table 2.

Table-1: List of Vietnamese domestic banks in the sample from 2007 to 2014

Bank name	Type of ownership	Abbreviation
Joint Stock Commercial Bank for Foreign Trade of Vietnam	SOCB	VCB
Vietnam Bank for Industry and Trade	SOCB	ICB
Bank for Investment and Development of Vietnam	SOCB	BIDV
Vietnam Bank for Agriculture and Rural Development	SOCB	Agribank
The Maritime Commercial Joint Stock Bank	Private bank	MRB
East Asia Commercial Joint Stock Bank	Private bank	EAB
Saigon Commercial Bank	Private bank	SGB
Asia Commercial Joint Stock Bank	Private bank	ACB
Vietnam Export and Import Commercial Bank	Private bank	EXIM
Saigon Thuong Tin Commercial Joint Stock Bank	Private bank	SACB
Housing Development Commercial Joint Stock Bank City, Ho Chi Minh	Private bank	HDB
Nam A Commercial Joint Stock Bank	Private bank	NAMA
Kien Long Commercial Joint Stock Bank	Private bank	KLB
Southeast Asia Commercial Joint Stock Bank	Private bank	SEA
Viet Nam Technological and Commercial Joint Stock Bank	Private bank	TCB
Vietnam International Commercial Joint Stock Bank	Private bank	VIB
Vietnam Prosperity Commercial Joint Stock Bank	Private bank	VPB
An Binh Commercial Joint Stock Bank	Private bank	ABB
Nam Viet Commercial Joint Stock Bank	Private bank	NVB
Petrolimex Group Commercial Joint Stock Bank	Private bank	PGB
Saigon-Hanoi Commercial Joint Stock Bank	Private bank	SHB
Southern Commercial Joint Stock Bank	Private bank	PNA
Military Commercial Joint Stock Bank	Private bank	MB

Table-2: Statistical description of the variables

Indicators	Min	Max	Mean	SD
Inputs (in million VND)				
Labour expenses	16,801	14,502,145	1,279,603	2,129,241
Fixed assets	23,060	8,872,165	1,441,136	1,688,750
Deposits	952,246	621,132,821	84,637,030	113,675,615
Outputs (in million VND)				
Loans	1,351,742	518,108,254	76,063,405	112,085,194
Non-traditional assets	110,550	142,195,350	20,576,972	23,859,489
Loan-loss provisioning cost	1,737	9,288,127	969,693	1,802,597

RESULT DISCUSSIONS
Bank efficiency

Technical efficiency of Vietnamese banks is estimated using the DDF model. Each year, the production frontier is identified and accordingly, bank efficiency of a particular year is estimated. Table 3 describes the results of bank efficiency from 2007 to 2014. Overall, the value of efficiency is minimal at 0.9021 in 2007 and maximal at 0.9822 in 2011.

In addition, if the banking sector is classified into private and state-owned banks, the results reveal an outperformance of SOCBs over private banks (JSBs). These results are consistent over the years from 2007 to 2014. For example, in 2007, the mean efficiency value of SOCBs is 1.000 while it is 0.8042 in the case of JSBs. SOCB efficiency is unity in most cases except in the case of the VCB in 2013. This outcome shows that state-owned banks are playing an important role as leaders of the banking system and shaping the production frontier.

Table-3: Technical efficiency of Vietnamese banks from 2007 to 2014

DMU	Eff (2007)	Eff (2008)	Eff (2009)	Eff (2010)	Eff (2011)	Eff (2012)	Eff (2013)	Eff (2014)	Mean
Joint Stock Bank (JSB)									
ABB	1.0000	1.0000	0.8076	0.7400	0.7728	0.7372	0.7738	0.8294	0.8269
ACB	0.6601	1.0000	1.0000	1.0000	1.0000	0.9004	0.8087	0.8312	0.8916
EAB	0.9709	1.0000	1.0000	1.0000	0.9344	0.9977	0.7364	0.8176	0.9269
EXIM	0.8476	0.8744	0.9372	1.0000	1.0000	0.9372	0.9350	0.8936	0.9267
HDB	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
KLB	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9496	0.9196	0.9832
MB	0.6186	1.0000	0.8945	0.8130	1.0000	1.0000	1.0000	1.0000	0.9050
MRB	0.6569	0.8365	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9279
NAMA	0.3995	0.8030	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.8675
NVB	0.5312	0.8788	1.0000	1.0000	1.0000	1.0000	0.7742	0.9300	0.8726
PGB	1.0000	1.0000	1.0000	0.9972	1.0000	1.0000	1.0000	1.0000	0.9996
PNA	0.5658	0.9811	1.0000	1.0000	1.0000	1.0000	0.6328	0.6602	0.8330
SACB	0.9858	0.8046	0.8058	0.8732	0.8123	0.7836	0.7424	0.7769	0.8202
SEA	1.0000	1.0000	0.7976	1.0000	0.9773	1.0000	1.0000	1.0000	0.9693
SGB	0.6884	0.8704	0.9260	1.0000	1.0000	0.9581	1.0000	1.0000	0.9240
SHB	0.7682	0.8383	1.0000	0.8557	0.8265	0.8766	0.9021	1.0000	0.8801
TCB	0.8449	0.8542	0.8293	0.7973	1.0000	1.0000	1.0000	1.0000	0.9117
VIB	0.9683	0.9007	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9830
VPB	0.7745	0.8094	0.8468	1.0000	1.0000	1.0000	1.0000	1.0000	0.9239
JSB mean	*0.8042*	*0.9185*	*0.9392*	*0.9514*	*0.9644*	*0.9574*	*0.9082*	*0.9294*	*0.9144*
State-owned Commercial banks (SOCB)									
Agribank	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
BIDV	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ICB	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
VCB	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9846	1.0000	0.9981
SOCB mean	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*1.0000*	*0.9961*	*1.0000*	*0.9995*
All mean	**0.9021**	**0.9592**	**0.9696**	**0.9757**	**0.9822**	**0.9787**	**0.9521**	**0.9647**	**0.9570**

Bank productivity

In general, when viewed with the intermediation approach, banking sector productivity has slightly regressed during the 2007−2014 (see Table 5). This is because the average Malmquist-Luenberger index of this period is 0.9797 indicating that productivity has decreased. This decreasing trend can be observed in both the contradicting themes of monetary policy (expansionary versus contractionary) represented by 2007−2010 (the value of ML is 0.9965) versus 2011−2014 (the ML value is 0.9673).

This trend of productivity movement diverges when using an ownership criterion. The productivity of SOCBs has improved through the overall 2007−2014 period and as well as in the two sub-periods (2007−2010 and 2011−2014). This sustainable trend has not been impacted by the changes in monetary policy. In contrast, private bank productivity has suffered a continuous decrease from 2007 to 2014.

The reasons for these above-mentioned trends can be found by analysing changes in the productivity components including efficiency changes and technical changes.

Table 4: Productivity growth, efficiency change, and technical change of 23 banks over the period 2007−2014

	2008/07			2009/08			2010/09			2011/10			2012/11			2013/12			2014/13		
	ML	MLTEC	MLTC	ML	MLTEC	MLTC	ML	MLTEC	MLTC	ML	MLTEC	MLTC	ML	MLTEC	MLTC	ML	MLTEC	MLTC	ML	MLTEC	MLTC
Joint Stock Bank																					
ABB	0.33	1.00	0.33	0.64	0.81	0.79	0.92	0.92	1.01	0.96	1.04	0.92	0.71	0.95	0.74	1.15	1.05	1.10	1.00	1.07	0.93
ACB	1.49	1.51	0.98	1.06	1.00	1.06	1.31	1.00	1.31	0.77	1.00	0.77	0.85	0.90	0.94	0.96	0.90	1.07	1.01	1.03	0.98
EAB	0.94	1.03	0.91	1.07	1.00	1.07	0.98	1.00	0.98	0.90	0.93	0.96	0.97	1.07	0.91	0.81	0.74	1.10	1.00	1.11	0.90
Exim	0.86	1.03	0.83	1.18	1.07	1.10	1.21	1.07	1.13	0.98	1.00	0.98	0.74	0.94	0.79	1.02	1.00	1.02	0.89	0.96	0.93
HDB	0.30	1.00	0.30	0.95	1.00	0.95	1.27	1.00	1.27	0.96	1.00	0.96	0.79	1.00	0.79	1.14	1.00	1.14	0.80	1.00	0.80
KLB	0.74	1.00	0.74	1.31	1.00	1.31	1.10	1.00	1.10	0.99	1.00	0.99	0.90	1.00	0.90	0.95	0.95	1.00	0.88	0.97	0.91
MB	1.32	1.62	0.82	0.94	0.89	1.05	1.06	0.91	1.17	0.98	1.23	0.80	0.98	1.00	0.98	1.16	1.00	1.16	1.12	1.00	1.12
MRB	0.96	1.27	0.76	1.29	1.20	1.08	1.22	1.00	1.22	0.92	1.00	0.92	0.78	1.00	0.78	1.26	1.00	1.26	1.14	1.00	1.14
NAMA	1.07	2.01	0.53	1.06	1.25	0.85	1.38	1.00	1.38	1.11	1.00	1.11	0.93	1.00	0.93	1.32	1.00	1.32	1.01	1.00	1.01
NVB	0.89	1.65	0.54	1.31	1.14	1.15	1.02	1.00	1.02	0.93	1.00	0.93	1.00	1.00	1.00	0.86	0.77	1.11	0.86	1.20	0.72
PGB	0.97	1.00	0.97	1.03	1.00	1.03	0.97	1.00	0.98	1.02	1.00	1.02	1.02	1.00	1.02	1.00	1.00	1.00	1.00	1.00	1.00
PNA	1.23	1.73	0.71	1.12	1.02	1.10	1.05	1.00	1.05	0.73	1.00	0.73	0.92	1.00	0.92	0.65	0.63	1.03	1.00	1.04	0.96
SACB	0.74	0.82	0.91	1.09	1.00	1.08	1.16	1.08	1.07	1.08	0.93	1.16	0.80	0.96	0.83	0.92	0.95	0.97	0.98	1.05	0.94
SEA	0.91	1.00	0.91	0.46	0.80	0.57	1.83	1.25	1.46	0.55	0.98	0.57	0.79	1.02	0.77	1.44	1.00	1.44	0.89	1.00	0.89
SGB	0.70	1.26	0.55	1.03	1.06	0.97	0.94	1.08	0.87	1.04	1.00	1.04	0.86	0.96	0.90	1.01	1.04	0.97	0.99	1.00	0.99
SHB	0.87	1.09	0.80	0.89	1.19	0.75	0.93	0.86	1.09	0.88	0.97	0.91	0.94	1.06	0.89	1.27	1.03	1.23	1.09	1.11	0.98
TCB	0.85	1.01	0.84	1.02	0.97	1.05	1.13	0.96	1.18	1.19	1.25	0.95	0.93	1.00	0.93	1.10	1.00	1.10	1.08	1.00	1.08
VIB	0.76	0.93	0.82	1.25	1.11	1.13	1.53	1.00	1.53	0.83	1.00	0.83	0.78	1.00	0.78	1.02	1.00	1.02	1.05	1.00	1.05
VPB	0.84	1.05	0.80	1.08	1.05	1.03	1.45	1.18	1.23	0.76	1.00	0.76	0.80	1.00	0.80	1.46	1.00	1.46	1.01	1.00	1.01
State-owed Commercial Bank																					
Agri_bank	1.03	1.00	1.03	1.06	1.00	1.06	1.02	1.00	1.02	0.99	1.00	0.99	1.04	1.00	1.04	1.05	1.00	1.05	1.28	1.00	1.28
BIDV	0.97	1.00	0.97	1.01	1.00	1.01	1.00	1.00	1.00	1.03	1.00	1.03	1.08	1.00	1.08	1.07	1.00	1.07	1.08	1.00	1.08
ICB	1.00	1.00	1.00	0.99	1.00	0.99	1.27	1.00	1.27	1.07	1.00	1.07	1.01	1.00	1.01	1.01	1.00	1.01	1.08	1.00	1.08
VCB	0.81	1.00	0.81	0.96	1.00	0.96	1.11	1.00	1.11	0.82	1.00	0.82	1.13	1.00	1.13	0.89	0.98	0.90	1.12	1.02	1.10

Notes: ML _ Malmquist - Luenberger productivity index; MLTEC _ Technical Efficiency Change; MLTC _ Technical Change

Table-5: Productivity change, efficiency change and technical change in the Vietnamese banking sector over the 2007-2014 period

	Productivity changes			Efficiency changes			Technical changes		
	JSBs	SOCBs	All	JSBs	SOCBs	All	JSBs	SOCBs	All
2007/08	0.8302	0.9454	0.8492	1.1742	1.0000	1.1419	0.7070	0.9454	0.7437
2008/09	1.0142	1.0042	1.0125	1.0226	1.0000	1.0186	0.9918	1.0042	0.9940
2009/10	1.1623	1.0973	1.1507	1.0124	1.0000	1.0102	1.1481	1.0973	1.1391
2007-10	*0.9928*	*1.0138*	*0.9965*	*1.0672*	*1.0000*	*1.0552*	*0.9303*	*1.0138*	*0.9442*
2010/11	0.9128	0.9738	0.9232	1.0149	1.0000	1.0123	0.8994	0.9738	0.9119
2011/12	0.8624	1.0630	0.8944	0.9922	1.0000	0.9936	0.8692	1.0630	0.9002
2012/13	1.0594	1.0010	1.0490	0.9431	0.9961	0.9521	1.1233	1.0049	1.1017
2013/14	0.9863	1.1366	1.0110	1.0266	1.0039	1.0026	0.9608	1.1322	0.9886
2011-14	*0.9524*	*1.0417*	*0.9673*	*0.9937*	*1.0000*	*0.9948*	*0.9584*	*1.0417*	*0.9724*
2007-14	***0.9695***	***1.0296***	***0.9797***	***1.0246***	***1.0000***	***1.0203***	***0.9463***	***1.0296***	***0.9603***

Efficiency change

The indicator of efficiency change over the years 2007−2014 is 1.0203 and this is close to unity, suggesting that the efficiency of the banking sector has slightly increased. While the increasing trend can be seen in the 2007-2010 sub-period, the later sub-period (2011−2014), with an efficiency indicator of 0.9948 witnessed a decrease.

We see an unchanged level of efficiency in SOCBs during the studied duration. The efficiency indicators of this group are one in most cases, suggesting that most SOCBs are on the production frontier and are playing a role as leaders in the banking industry.

The above results show a slight increase in efficiency while the period witnessed a decreasing trend of productivity in the banking sector. Thus, a deterioration of technical factor is forecasted and this factor would mostly explain the decline of productivity.

Technical change

Overall, a regress of technical change has been recorded during 2007−2014 with the technical change index 0.9630, but it varies between the two bank groups. While 2007−2014 witnessed technical progress made by SOCBs, their private rivals experienced a technical regression. These conflicting results can be clarified by the fact that state-owned banks have to innovate themselves through a strict privatisation process. Under this procedure, SOCBs have had to implement a number of reform measures in order to strengthen financial capability, risk management and quality of human resources. Meanwhile, bad loans have been the most challenging issue for private banks due to cross-ownership between banks and business groups and the low quality of risk management. From 2011 onward, the Vietnamese banking system has introduced many measures to stabilise the system through a five-year restructuring plan [2] (2011-2015). Accordingly, regulations on classification of NPLs and provisioning for loan-loss have been stringently revised; hence, a large portion of these banks' total cost has been dedicated to resolving the loan losses. Furthermore, the contractionary monetary policy also imposed limits on the lending activities of this group.

This finding of technical regression is in line with a study by Nguyen and Simioni [12] when they used the Färe-Primont index to measure Vietnamese banking productivity during the 2008−2012 period. They attribute the technical regression to changes occurring in the business environment of banks with two particular major challenges. First, Vietnam has faced macroeconomic instability since 2007 with a double-digit inflation rate, large trade and fiscal deficits and substantial volatility in exchange and interest rates [7] [3]. These uncertainties increase the market risk relevant costs which cannot be avoided and all banks, including the best practice ones, suffer. Second, the high level of non-performing loans has deteriorated banks' capacity to provide intermediation services. Increasing the proportion of bad debts in total bank assets leads to a decline of credit that could otherwise be utilised for new projects.

CONCLUSION

Using the DDF model, this paper measures the efficiency and productivity of Vietnamese banks from 2007 to 2014. The results show that SOCBs outperform their private rivals and that they play an important role as leaders of the banking industry, being located on the production frontiers. In general, a decreasing trend in productivity has been recorded; however, this trend diverges between private and public banks. While SOCBs had an increase, JSBs had a decrease in productivity during the period. Due to the fact that efficiency has slightly improved, the decline of the TFP index can be explained by the technical regression in general. However, a progression in technical change has been recorded in the case of SOCBs. We see a similarity when comparing the productivity changes and its components between the two sub-periods, suggesting that the impact of the restructuring measures is insignificant and they have not brought about a positive impact on the banking performance during the 2011−2014 period.

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[2] The objective of this plan is to reduce the NPL rate to below 3% by the end of 2015.

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[3] The negative real interest rate due to high inflation discouraged depositors from keeping their money in banks. Instead, they withdrew their deposits and invested in more profitable assets such as property or gold [11].

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