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Article

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MANAGEMENT | RESEARCH ARTICLE

Intellectual capital and bank profitability: New evidence from Vietnam

Tu D. Q. Le^{1,2*} and Dat T. Nguyen³

Abstract: This study empirically examines the impact of intellectual capital on bank risk-adjusted returns in Vietnam between 2007 and 2019 using the system generalized method of moments (GMM). The findings show the positive impacts of value-added intellectual coefficient (VAIC) and its components (human capital efficiency (HCE), capital employed efficiency (CEE), and structural capital efficiency (SCE)) on bank profitability. However, the results show an inverted U-shaped relationship may exist in the case of VAIC, HCE, and CEE. Also, the positive impacts of VAIC and HCE on bank profitability are true to the case of state-owned commercial banks while for foreign-owned banks the positive effect is more with HCE. Therefore, this study provides significant implications for policy-makers, management, and academics.

Subjects: Econometrics; Banking; Credit & Credit Institutions

Keywords: intellectual capital; risk-adjusted returns; Vietnam; system GMM

Jel: G21; G28; G30

1. Introduction

Intellectual capital (IC) plays an essential role in a firm's performance and creating value. It represents distinctive characteristics that, *ceteris paribus*, can determine the success or failure of

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PUBLIC INTEREST STATEMENT

Healthy and sustainable profitability is one of the main predictors of financial distress and a bank crisis. This also reflects the quality of management, shareholder's behavior, bank's competitive strategies, efficiency, and risk management capacity. Under the pressure of an increasingly competitive environment, banks should look at a different way to maintain their profitability stable. Intellectual capital is one of the solutions. The higher quality of products and/services offered to customers depends on the bank's investments associated with intellectual capital such as human resources, brand building, systems, and processes. However, making substantial investments into intellectual capital is costly, too. Therefore, the cost may outweigh its benefits. Therefore, it is crucial to investigate whether intellectual capital has any effect on bank profitability in an emerging market like Vietnam. Given the diversified structure of the Vietnamese banking system, the impact of intellectual capital on bank profitability may differ among bank ownership.

a firm compared to its peers (El-Bannany, 2008). In the knowledge-based socio-economic period where IC is considered as one of the production factors, it is not surprising that IC has been much-received attention from many researchers from different disciplines, especially management, accounting, and finance. While several studies have attempted to define IC from a theoretical perspective (Bontis, 1998; Wu & Tsai, 2005), others have developed effective measures of IC-based performance (Pulic, 2000) or explored the relationship between IC efficiency and some key characteristics of firms, industries, and regions (El-Bannany, 2008; Liang et al., 2011). The last strand focuses on empirically examining the effect of IC efficiency on financial performance. Despite many studies on this strand, there are a limited number of studies that attempt to test this link in the banking sector. It is acknowledged that the banking industry is one of the most knowledge-intensive industries (Firer & Mitchell Williams, 2003; Mavridis & Kyrmizoglou, 2005) and represents an ideal setting for research on IC. One may argue that banks may gain valuable competitive advantages by tightening their relationship with their customers and making valuable investments in soft information production (Boot, 2000). Other studies however emphasize that an efficient IC is more important for achieving success in banking than other industries since the higher quality of products and/services offered to customers depends on the bank's investments associated with IC such as human resources, brand building, systems, and processes. Hence, banks should manage their IC as efficiently as possible.

Nonetheless, empirical studies provide mixed findings. Several studies found a positive impact of IC on bank profitability (Meles et al., 2016) or bank productivity (Alhassan & Asare, 2016). Others however suggest an inverted U-shaped relationship between them (Haris et al., 2019) or non-existence of a relationship between IC and market value or financial performance (Tran & Vo, 2018). Because there is inconsistency in the effect of IC efficiency on bank performance, this study revisits this issue by examining this relationship in the context of Vietnam.

The Association of Southeast Asian Nations (ASEAN) has emerged as one of the fastest-growing economies in the world, with an average annual economic growth of approximately 5.3% between 2007 and 2019. In which Vietnam is one of the leaders in economic performance¹ and considered as Asia's next dragon. Under this stellar performance, the banking system is the backbone of the Vietnamese economy since the stock market is relatively underdeveloped. Healthy and sustainable profitability is one of the main predictors of financial distress and a bank crisis (Demirgüç-Kunt & Detragiache, 2000). This also reflects the quality of management, shareholder's behavior, bank's competitive strategies, efficiency, and risk management capacity. As IC is one of the increasingly important factors contributing to the success of banks, it is crucial to investigate whether IC has any effect on bank profitability in Vietnam. Since entering to World Trade Organization in 2007, the presence of foreign banks in the market has increased. Two forms of foreign participation are a green-field investment and the acquisitions of a minority share.² The presence of foreign-owned banks resulted in fierce competition for deposits and loans, thereby may affect domestic banks' profitability. In response, along with shifting towards non-traditional activities, domestic banks should further improve their IC efficiency. Furthermore, the market also has witnessed the increasing competition between state-owned commercial banks and privately owned commercial banks (Le et al., 2019). This competitiveness puts further pressure on banks to maintain a stable source of income. These banks should consider IC efficiency as their long-term goal. Given the diversified structure of the Vietnamese banking system, this necessitates conducting empirical research to investigate whether IC could enhance bank profitability in Vietnam.

This study contributes to the literature in several ways. First, the evidence of intellectual capital on bank profitability is limited, especially in the Asia-Pacific region [Tran and Vo (2018) may be one of the exceptions]. This study provides more comprehensive evidence of intellectual capital to the extant literature by examining the impacts of VAIC and its components on risk-adjusted returns in the Vietnamese banking system. Second, we contend that the benefits of intellectual capital investment may exist up to a certain threshold because it is not easy to control the efficient utilization of intangible assets over time. Consequently, we further examine whether the U-shaped

relationship between IC measures (VAIC and its components) and bank risk-adjusted returns may exist. Third, by using a unique dataset this is the first study to examine whether the relationship between IC and bank risk-adjusted returns may differ among different types of bank ownership (SOCBs versus POCBs, listed versus non-listed banks, foreign-owned versus domestic banks). Last, to the best of our knowledge, this study is the first attempt to investigate the impact of IC on bank risk-adjusted return in Vietnam.

The findings show that there appear positive relationships between IC measures (VAIC and its components—human capital efficiency (HCE), capital employed efficiency (CEE), and structural capital efficiency (SCE)) and bank risk-adjusted returns in Vietnam. However, we find that the non-linear relationships between IC measures (VAIC, HCE, and CEE) and bank profitability may exist. Also, higher profitability is associated with well-capitalized banks, those with lower liquidity risk, those with lending specialization, and small-sized ones. Furthermore, SOCBs tend to utilize intangible resources and human capital more efficiently than POCBs, thus earning higher profitability. The same is true for the case of foreign-owned banks with greater human capital efficiency.

The remainder of our paper is organized as follows: Section 2 presents a literature review on the relationship between intellectual capital and bank profitability. Section 3 discusses the methodology and data. Section 4 reports empirical findings while Section 5 concludes.

2. Literature review

Although there appear many studies that have investigated whether intellectual capital (IC) has a significant contribution to firms' value creation, the concept of IC is still a subject of ongoing debate (Marr & Moustaghfir, 2005). There several different definitions of IC across various disciplines and from different perspectives, including economics, strategy, finance, accounting, human resources, reporting and disclosure, marketing, and communication. Due to the various definitions and the availability of data, several measures thus have been developed and used in different industries.³ In this study, we do not focus on discussing the different methods of measuring the IC and its components across different fields. Instead, the literature on the relationship between intellectual capital and bank performance where IC is measured by the VAIC method as proposed by Pulic (2004) is presented. Surprisingly, the empirical evidence of VAIC in the financial sector is relatively scanty while the relationship between the IC and the firm's performance is widely tested in different industries. Nonetheless, empirical evidence provides mixed findings.

Most studies found a positive correlation between VAIC and financial outcomes. Meles et al. (2016) using the US data show a positive impact of VAIC on bank profitability and human capital plays the most significant role in explaining bank performance. For developing countries, similar results are also obtained. Ting and Lean (2009) using Malaysian data indicate that VAIC affects ROA positively and variance in VAIC components helps to explain 71.6% of the variance in ROA. Alhassan and Asare (2016) also indicate that VAIC has a positive effect on the productivity of banks in Ghana and human capital efficiency and capital employed efficiency are the main drivers of productivity growth in the banking industry. Moreover, Joshi et al. (2013) suggest that the performance of VAIC and its components differ across all subsectors in Australian financial sectors. Their results further demonstrate that investment firms more concentrate on human capital to increase VAIC level whereas physical capital is focused by insurance companies. Kamath (2007) also shows that foreign banks are top performers in HCE and value creation efficiency while public banks are the best performers in CEE. In short, these studies highlight that the impact of VAIC on bank profitability may vary according to different types of bank ownership.

In contrast, other studies show the opposite findings when observing the impact of VAIC and its components (HCE, CEE, SCE) on bank performance. Tran and Vo (2018) show no relationship between VAIC and bank profitability in Thailand. This confirms the early findings of Joshi et al. (2013) in Australia and Ozkan et al. (2017) in Turkish and Singh et al. (2016) in India. Their findings

also demonstrate that bank profitability is mainly driven by CEE while is marginally reduced by HCE. Besides, Haris et al. (2019) confirm an inverted U-shaped relationship between VAIC and bank profitability in Pakistan. HCE and CEE are found to have a positive impact on bank profitability while there appears a negative relationship between SCE and bank profitability. Joshi et al. (2010) however point out that the value creation capability of Australian banks is directly attributable to the HCE while CEE and SCE performance have little or no impact on the overall efficiency of the banks and their value creation. This is consistent with studies by Goh (2005) in Malaysia, Kamath (2007) in India, Mavridis (2004) in Japan, and where the best performing banks are those who mainly have very good results in the usage of their IC or HCE and less in the usage of their CEE.

Moreover, a study by Poh et al. (2018) shows that a positive effect of VAIC may depend on different measures of bank profitability and a different examined period. During the period 2011–2016, CEE and HCE impact ROA and ROE positively, respectively while SCE has a significant effect on ROE, and the positive effect of CEE on ROA remains from 2007 to 2016. Mondal and Ghosh (2012) using Indian data suggest that the relationship between IC and financial performance indicators is varied. Their study show HCE affects ROA and ROE positively and concludes that SCE does not play an important role in banks' profitability. Nonetheless, their findings demonstrate that banks' intellectual capital is crucial for their competitive advantage.

In the context of the Vietnamese banking system, several banking reforms have been implemented for domestic banks. One of the key objectives of these programs is (1) recapitalize banks and enhance bank capital efficiency (2) replace and re-organize the work of their management boards (3) improve employee skills.⁴ Accordingly, most banks made significant investments in banking technology in terms of upgrading the application of banking software to computerize transactions, the development of internet and electronic banking services to serve their customers better. All in all, these would help banks gain more sustainable competitive advantages and improve their market value. It is anticipated that investment in IC will have a positive effect on bank profitability. Therefore, the following hypotheses are proposed:

H1: There is no impact of intellectual capital on bank profitability.

Furthermore, Haris et al. (2019) suggest that the non-linear relationship between IC and bank performance may exist because a positive effect may depend upon a certain degree of the efficient utilization of intangible resources which is difficult to manage. Therefore, it is anticipated that there may exist a U-shaped relationship between IC and bank profitability in the Vietnamese banking system.

H2: There is no existence of the non-linear relationship between intellectual capital and bank profitability.

3. Methodology and data

3.1. Methodology

Due to the structure of panel data used in this study, a GMM estimator suggested by Arellano and Bover (1995) is used.⁵ The objective of GMM is to control for two basic problems that include unobserved heterogeneity and endogeneity problems (Arellano, 2002). The GMM estimator accounts for unobserved heterogeneity and the persistence of the dependent variable.⁶ Hence, this estimator yields consistent estimations of the parameters. The estimated coefficients are more efficient since an ample set of instruments is employed.

For the endogeneity problems,⁷ the system GMM estimator uses lagged values of the dependent variables (in levels and differences) and lagged values of other regressors which potentially suffer

from endogeneity as instruments. Following Bond (2002), we use the lagged values of the variables that are treated as endogenous as instruments as shown in italics in the result table. Our approach uses instruments for all regressors except for those which are considered exogenous.⁸ Besides, the number of lags is determined by Arellano-Bond autocorrelation (AR) tests and the test for over-identifying restrictions (Hansen, 1982). If the null hypothesis of the Hansen test is rejected, the instruments do not meet the required orthogonality conditions. Additionally, the moment conditions are valid only if there is no serial correlation in the idiosyncratic errors. If the null hypothesis at second-order autocorrelation (AR2) cannot be rejected, the moment conditions are still valid.

The above arguments suggest the application of a dynamic model of bank profitability that takes the following form:

$$\pi_{i,t} = \alpha_{i,t} + \beta_1 \pi_{i,t-1} + \beta_2 \text{VAIC}_{i,t} + \beta_3 \text{CAP}_{i,t} + \beta_4 \text{LATA}_{i,t} + \beta_5 \text{LOAN}_{i,t} + \beta_6 \text{LNNTA}_{i,t} + \beta_7 \text{OWNER}_{i,t} + \beta_8 \text{LISTED}_{i,t} + \beta_9 \text{FOREIGN}_{i,t} + \beta_{10} \text{HHI}_t + \beta_{11} \text{GDP}_t + \beta_{12} \text{INF}_t + \mu_i + \varepsilon_{i,t} \quad (1)$$

Following Le (2017b), Le et al. (2019), and Le (2020b), two performance measures based on accounting ratios as described in Table 1 include risk-adjusted returns on equity (RAR_{ROE}) and risk-adjusted returns on assets (RAR_{ROA}) are used. $\text{RAR}_{ROE_{i,t}} = \frac{ROE_{i,t}}{\sigma_{ROE_i}}$ where ROE is the returns (profits before tax) on equity, σ_{ROE} is the standard deviation of returns on equity over the examined period. $\text{RAR}_{ROA_{i,t}} = \frac{ROA_{i,t}}{\sigma_{ROA_i}}$ where ROA is the returns (profits before tax) on total assets, σ_{ROA} is the standard deviation of returns on assets over the examined period.⁹ π_{t-1} , the lagged bank profitability, is used to measure the persistence of profits, for instance, the extent to which a bank remains in the same profit distribution.

CAP , the ratio of total equity to total assets, is used to control for bank capitalization due to the lack of risk-weighted measures for most of the banks in the sample. The signaling hypothesis suggests that banks may disclose information to the market about their prospects and capacity to generate profits. Thus, a signaling equilibrium may exist where banks that expect to have better future performance will exhibit a greater level of capital (Saona, 2016). Several studies, however, emphasize that a bank with an excessively high capital ratio is operating over-cautiously and ignoring opportunities for profitable growth (Berger, 1995; Sharma et al., 2013). $LATA$, the ratio of liquid assets to total assets, is used to control for liquidity risk (Le, 2017b; Sharma et al., 2013). Several studies claim banks that hold more liquid assets tend to have a lower profit (Sharma et al., 2013). Other studies, however, argue that an increase in the relative liquid assets holdings of banks decreases its probability of default—thus, improving bank profits (Bordeleau & Graham, 2010; Bourke, 1989). $LOAN$, the ratio of total loans to total assets, is used to control for the effect of lending specialization. Several studies show a positive impact of bank loans on bank profitability (Ben Naceur & Goaid, 2008; Saona, 2016), suggesting that risk-averse shareholders seek higher earnings to compensate for higher risk because loans have higher operational costs as they need to be originated, serviced and monitored. However, Demirgüç-Kunt and Huizinga (1999) highlight a negative relationship between bank loans and earnings before taxes. $LNNTA$, the natural logarithm of total assets, is used to control for bank size. As larger operations bear higher risk, the large banks may charge higher margins, thus improve their performance (Maudos & Solis, 2009). Other studies, however, suggest that smaller banks can reduce the asymmetric information problems, thus improving their profitability (Dietrich & Wanzenried, 2014).

Table 1. The results of the Breusch-Pagan test

	RAR_{ROA}		RAR_{ROE}	
	VAIC	VAIC Components	VAIC	VAIC Components
Chi-square (χ^2)	25.19	33.66	114.55	152.3
P-value	0.000	0.000	0.000	0.000

The property structure of a bank is also considered in three ways. *OWNER*, a dummy variable that takes a value of 1 for a state-owned commercial bank and 0 otherwise, is used to control for the effect of bank ownership. Besides, the increasing role of privatization, and in particular diffused ownership, is investigated by incorporating *LISTED* in the model, a dummy variable that takes a value of 1 for a listed bank in the stock market and 0 otherwise. Last, we also examine foreign ownership in a way that takes account of the interesting characteristics of the Vietnamese banking system. *FOREIGN*, the actual percentage of foreign ownership over the capital of a local bank, is used to control for the effect of foreign ownership. To extend the role of bank ownership in explaining the relationship between IC performance and bank risk-adjusted returns, we include the interaction terms between IC measures (VAIC and its components) and bank ownership.

For macroeconomic variables, the Herfindahl-Hirschman index (*HHI*) as measured by the sum of the squared market shares of each bank's assets for a given year, is used to control for the effects of market concentration¹⁰ (García-Herrero et al., 2009). Accordingly, *HHI* is just greater than 0 for a perfectly competitive market and equals the value of 1 in the case of a monopoly. *GDP*, the annual GDP growth rate, is used to control for the effects of economic growth (Haris et al., 2019). *INF*, the annual inflation rate, is used to control for the effects of inflation (Perry, 1992).

Prior to the estimation, we test the variables for the presence of non-stationarity using the Panel Unit Root tests proposed by Choi (2001), and Im et al. (2003). The results of significance at the 1% significance level generally imply that the tested series does not contain a unit root. The series is thus estimated in levels.

Before choosing our model, we test for heteroscedasticity when one or more regressors are endogenous. Breusch and Pagan/Cook-Weisberg test is used to test the null hypothesis of homoscedasticity. We perform Breusch-Pagan/Cook-Weisberg heteroskedasticity tests χ in two steps. First, the equations with pooled OLS with robust standard errors for VAIC and its components are run. Then, we run the Breusch-Pagan/Cook-Weisberg tests. The regression Chi-square (χ^2) results and their *p-values* are indicated in Table 2 (here only the results of χ^2 and *p-values* are presented¹¹). Table 2 shows that the low *p-values* demonstrating high heteroscedasticity, suggesting that the GMM method is preferable to deal with this issue.¹²

Table 2. Descriptive statistics of variables used in the system GMM estimator

Variables	OBS	Mean	SD	Min	Max
RAR _{ROA}	377	1.814	1.497	-2.797	7.389
RAR _{ROE}	377	1.995	1.711	-2.989	9.071
VAIC	377	4.783	2.278	-2.452	19.784
CCE	377	0.298	0.138	-0.046	0.826
HCE	377	3.775	2.147	-0.737	18.636
SCE	377	0.668	0.279	-2.767	2.356
CAP	377	0.105	0.072	0.029	0.808
LATA	377	0.323	0.128	0.061	0.815
LOAN	377	0.547	0.137	0.113	0.851
LNTA	377	31.975	1.346	27.520	34.937
OWNER	377	0.133	0.340	0	1
LISTED	377	0.279	0.449	0	1
FOREIGN	377	0.066	0.093	0	0.3
HHI	377	0.087	0.014	0.072	0.119
GDP	377	0.062	0.006	0.052	0.071
INF	377	0.075	0.062	0.006	0.231

The VAIC literature suggests several alternative approaches to measure IC.¹³ Due to the unavailability of data used to measure IC, we use the conventional VAIC methodology since it provides a standardized and consistent measure (Shiu, 2006) and considered innovative both theoretically and methodologically (Iazzolino & Laise, 2013). Following prior studies such as Pulic (2004), Ozkan et al. (2017), and Tran and Vo (2018), and others, VAIC is calculated as $VAIC_{i,t} = CEE_{i,t} + HCE_{i,t} + SCE_{i,t}$ where $VAIC_{i,t}$ represents the value added intellectual coefficient; $CEE_{i,t}$ is the capital employed efficiency; $HCE_{i,t}$ is the human capital efficiency; and $SCE_{i,t}$ represents the structural capital efficiency. To estimate these VAIC components, it is necessary to calculate the total value added (VA) as follows: $VA_{i,t} = OP_{i,t} + PC_{i,t} + A_{i,t}$ where $OP_{i,t}$ is operating profit of a bank; $PC_{i,t}$ represents personnel expenses (salaries, wages, and other benefits); $A_{i,t}$ refers to the amortization and depreciation of the bank. Then, these components of VAIC are estimated as follows $CEE_{i,t} = VA_{i,t}/CE_{i,t}$ where $CE_{i,t}$ is capital employed by a bank and is measured as the book value of equity. $HCE_{i,t} = VA_{i,t}/HC_{i,t}$ where $HC_{i,t}$ refers to personnel expenses. $SCE_{i,t} = SC_{i,t}/VA_{i,t}$ where $SC_{i,t}$ represents structural capital and is measured as $SC_{i,t} = VA_{i,t} - HC_{i,t}$.

The literature proposes that increasing the efficiency of intellectual capital is the cheapest and safest way to ensure the sustainable functioning of banks, thus improving bank profitability. We, however, argue that it may be difficult to utilize intangible resources efficiently. Also, the higher investment in human capital and structural capital could reduce profitability if the management fails to generate higher efficiency. Therefore, we include the quadratic terms of VAIC ($VAIC^2$) and its components (SCE^2 , HCE^2 , and CEE^2) to investigate whether the U-shaped relationship between them and bank profitability may exist. The second model is formed as follows:

$$\begin{aligned} \pi_{i,t} = & \alpha_{i,t} + \beta_1 \pi_{i,t-1} + \beta_2 VAIC_{i,t} + \beta_3 VAIC^2_{i,t} + \beta_4 CAP_{i,t} + \beta_5 LATA_{i,t} + \beta_6 LOAN_{i,t} + \beta_7 LNTA_{i,t} \\ & + \beta_8 OWNER_{i,t} + \beta_9 LISTED_{i,t} + \beta_{10} FOREIGN_{i,t} + \beta_{11} HHI_t + \beta_{12} GDP_t + \beta_{13} INF_t + \mu_i + \varepsilon_{i,t} \end{aligned} \quad (2)$$

3.2. Data

Our sample covers the period 2007–2019 for 30 Vietnamese commercial banks on a consolidated basis which together accounted for more than 80% of total assets in the industry. Bank-specific information was mainly obtained from banks' financial statements as well as the Vietdata database according to Vietnamese accounting standards. To examine the impact of intellectual capital, banks with less than five consecutive years of data are excluded. The data for macroeconomic variables are collected from the World Bank. Because foreign bank affiliates and joint-venture banks are somewhat limited to operate in the Vietnamese market, only commercial banks are selected as they are mainly active players. Hence, this arrives at an unbalanced panel data with 377 observations since there were several bank mergers during the examined period.¹⁴

Overall, the average VAIC in the Vietnamese banking system is estimated at 4.783. Among the three components of VAIC, HCE accounts for the highest proportion of VAIC. This is consistent with those of Ozkan et al. (2017) in Turkey and Tran and Vo (2018) in Thailand. There also appear some negative VAIC values due to negative HCE values. Negative HCE value is explained by the fact that banks make a loss while still paying salaries. The same explanation is also applied to negative CEE and SCE values.

4. Results

4.1. The results of baseline models

For ease of exploration, we only focus on interpreting our main interest variables. At first glance, Table 3 indicates the positive impacts of VAIC and its components on two measures of bank profitability. There also appears no high correlation between independent variables, thus multicollinearity is not a concern.

Table 4 indicates the results of the impact of intellectual capital on bank profitability in the Vietnamese banking system between 2007 and 2019 using the system GMM.¹⁵ As can be seen, the

Table 3. Correlation matrix

	RAR _{ROA}	RAR _{ROE}	VAIC	HCE	CEE	SCE	CAP	LATA	LOAN	LNTA	HHIA	GDP	INF
RAR _{ROA}	1												
RAR _{ROE}		1											
VAIC	0.373*** (7.777)	0.365*** (7.583)	1										
HCE	0.341*** (7.021)	0.323*** (6.616)	0.991*** (143.095)	1									
CEE	0.491*** (10.902)	0.577*** (13.667)	0.155*** (3.029)	0.076 (1.481)	1								
SCE	0.208*** (4.121)	0.234*** (4.654)	0.549*** (12.713)	0.445*** (9.623)	0.190*** (3.746)	1							
CAP	-0.014 (-0.264)	-0.177*** (-3.480)	0.035 (0.681)	0.113** (2.203)	-0.478*** (-10.525)	-0.337*** (-6.939)	1						
LATA	0.061 (1.185)	0.012 (0.234)	0.096* (1.873)	0.109** (2.130)	-0.09* (-1.743)	-0.002 (-0.034)	0.128** (2.5)	1					
LOAN	0.158*** (3.1)	0.225*** (4.479)	-0.129** (-2.523)	-0.167*** (-3.283)	0.324*** (6.622)	0.058 (1.118)	-0.231*** (-4.605)	-0.807*** (-26.446)	1				
LNTA	0.24*** (4.781)	0.343*** (7.082)	-0.023 (-0.453)	-0.086* (-1.669)	0.616*** (15.155)	0.159*** (3.121)	-0.683*** (-18.098)	-0.176*** (-3.469)	0.289*** (5.845)	1			
HHIA	0.35*** (7.236)	0.392*** (8.247)	0.000 (0.006)	-0.032 (-0.614)	0.459*** (10.004)	0.018 (0.347)	-0.256*** (-5.135)	-0.174*** (-3.417)	0.346*** (7.142)	0.546*** (12.614)	1		
GDP	0.045 (0.876)	0.086* (1.674)	-0.022 (-0.422)	-0.028 (-0.547)	0.154*** (3.026)	-0.039 (-0.751)	-0.164*** (-3.211)	-0.143*** (-2.807)	0.221*** (4.379)	0.186*** (3.664)	-0.006 (-0.115)	1	
INF	0.222*** (4.414)	0.112** (2.174)	0.198*** (3.917)	0.208*** (4.110)	-0.058 (-1.123)	0.068 (1.314)	0.333*** (6.847)	0.231*** (4.590)	-0.266*** (-5.339)	-0.341*** (-7.029)	0.047 (0.907)	-0.366*** (-7.618)	1

*, **, ***Significant at 10, 5, and 1 per cent levels, respectively.

Table 4. The relationship between VAIC and bank risk-adjusted returns

IT	RAR_{ROA}			RAR_{ROE}		
π_{t-1}	0.489*** (0.049)	0.421*** (0.064)	0.457*** (0.045)	0.371*** (0.086)	0.347*** (0.062)	0.176* (0.095)
VAIC	0.074* (0.041)	0.230** (0.084)	0.096** (0.043)	0.140** (0.052)	0.375*** (0.105)	0.418*** (0.095)
VAIC2		-0.007* (0.003)			-0.128*** (0.004)	
CAP	-0.345 (1.722)	2.356 (1.634)	-1.089 (1.217)	-1.754 (1.677)	0.556 (1.491)	1.167 (1.893)
LATA	6.853*** (1.150)	7.493*** (1.951)	3.900* (2.099)	4.869*** (1.582)	7.483*** (1.326)	3.146* (1.776)
LOAN	6.297*** (1.243)	6.023*** (1.498)	3.448* (1.833)	2.024 (1.853)	4.451*** (1.506)	1.431 (2.221)
LNTA	-0.231 (0.213)	-0.125 (0.200)	-0.065 (0.191)	-0.615** (0.226)	-0.205 (0.219)	0.637 (0.404)
OWNER	0.636 (1.905)	2.326 (3.046)	0.506 (0.863)	-0.757 (1.479)	-1.376 (2.128)	-2.817 (3.107)
LISTED	1.891*** (0.630)	2.253*** (0.714)	-0.227 (0.819)	3.264*** (0.799)	2.889*** (0.750)	-1.047 (1.986)
FOREIGN	-6.444*** (2.064)	-8.583*** (2.915)	-1.423 (3.841)	0.725 (5.668)	-4.483 (5.524)	-3.327 (14.852)
VAIC*OWNER			0.369** (0.186)			0.096 (0.272)
VAIC*LISTED			0.131 (0.128)			0.334 (0.296)
VAIC*FOREIGN			0.503 (0.818)			0.406 (2.726)
HHI	-8.590 (78.588)	-100.106 (132.827)	-74.233* (40.144)	84.326 (60.664)	79.710 (53.559)	81.434 (68.997)
GDP	17.396*** (5.337)	19.436*** (5.785)	1.457 (10.526)	19.975*** (4.391)	3.545 (11.815)	-2.532 (14.503)
INF	2.927*** (0.8822)	2.203** (0.879)	1.384 (1.272)	0.291 (0.958)	0.959 (0.625)	1.087 (1.630)
Constant	0.813 (7.034)	-3.217 (6.717)	-0.99 (6.453)	15.226 (7.933)	0.513 (7.284)	-22.608 (12.763)
No. of Obs	347	347	347	347	347	347
No. of Groups	30	30	30	30	30	30
AR1 (p-value)	0.001	0.001	0.001	0.000	0.000	0.015
AR2 (p-value)	0.213	0.289	0.082	0.104	0.103	0.344
Hansen test (p-value)	0.292	0.278	0.171	0.302	0.375	0.512

The table contains the results estimated using the system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, ***Significant at 10, 5, and 1 per cent levels, respectively.

p -value of the Hansen test is statistically not significant in any of the models, and therefore the null hypothesis cannot be rejected.¹⁶ This suggests that there is no evidence of over-identifying restrictions, which means that all conditions for the moments are satisfied and the instruments are accepted. Furthermore, the hypothesis of the non-existence of the first-order autocorrelation between the first residual differences is rejected. This, however, does not imply that estimates are inconsistent. Inconsistency would be concluded if the second-order autocorrelation is present (Arellano & Bond, 1991). Since p -values of AR2 in our all models are statistically not significant, this suggests that the moment conditions of the model are met.¹⁷ All in all, we conclude that the estimated model meets diagnostic tests.

A number of the regression models are run. The coefficient of Π_{t-1} is positive and significant in all models, suggesting that profits are persistent over time. This is consistent with the early findings of Goddard et al. (2004), and Le and Ngo (2020). The findings show that *CAP* affects bank profitability positively, suggesting that capitalized banks are more profitable than less capitalized counterparts. This somewhat supports the findings of Le and Nguyen (2020) in cross-country analysis. A positive relationship between *LOAN* and bank profitability measures implies that Vietnamese banks take advantage of scale economies to improve their profitability. This partly supports the early findings of Le (2020a) in Vietnam. *LATA* is in general positively and significantly related to both measures, thus supporting the opportunity costs hypothesis. A higher fraction of liquid assets improves bank profits, as banks compensate extra costs related to holding liquid assets by charging higher margins. This is comparable with Le (2017b) in Vietnam, Bourke (1989) in Europe, and Bordeleau and Graham (2010) in the US and Canada. The results also indicate a negative impact of bank size (*LNTA*) on profitability that demonstrates larger banks are less profitable than smaller counterparts. This is similar to the findings of Le (2020b). Regarding bank ownership, the coefficient of *OWNER* as shown in Tables 4 and 5 is positive and significant, suggesting that POCBs are less profitable than SOCBs due to the following reasons. Firstly, SOCBs have benefited from government subsidies. Second, due to their government ownership, SOCBs are usually considered safe in the banking system. As a result, depositors are willing to accept lower deposit interest rates offered by SOCBs, thus increasing their profitability (Le et al., 2019). A positive relationship between *LISTED* and bank profitability indicates that listed banks are more profitable than non-listed banks. Because shareholders have their capital at risk at the bank, they have more incentive to monitor its management to ensure the bank operates effectively. As a result, listed banks may have better asset quality which ultimately improves their profitability. The findings also indicate a negative impact of *FOREIGN* on bank profitability, emphasizing that foreign ownership seems to reduce bank profitability. Possibly, these banks may seek growth opportunities so they may invest higher-risk assets. Nonetheless, this supports the findings of Naaborg and Lensink (2008) in transition economies.

VAIC is positively and significantly associated with bank profitability, suggesting that an increasing ability of IC management enables banks to achieve sustainable operations and thereby improve profitability. The coefficient of *VAIC2* is negative and significant, indicating that a non-linear relationship between *VAIC* and bank profitability in Vietnam may exist. This suggests that a positive effect of *VAIC* well beyond depends on the efficient utilization of intangible resources, which are difficult to manage. Nonetheless, this supports the findings of Pitelli Britto et al. (2014) in Brazil and Haris et al. (2019) in Pakistan. When examining the effect of interaction between bank ownership and *VAIC*, the coefficient of *VAIC*OWNER* is positive and significant. This suggests that SOCBs tend to utilize intangible resources more efficiently than POCBs, thus generating higher profits.

When decomposing *VAIC* components, the positive effects of *SCE*, *HCE*, and *CEE* are also found in both measures as indicated in Table 5. However, we do find the inverted U-shaped relationship between two components (*HCE* and *CEE*) and RAR_{ROA} , demonstrating that higher investment in human capital and increasing equity could determine if the management fails to generate higher efficiency. When observing the interaction terms between these components and bank ownership,

Table 5. The relationship between VAIC's components and bank risk-adjusted returns

π	RAR _{ROA}						RAR _{ROE}					
	0.211*** (0.058)	0.258*** (0.050)	0.163*** (0.046)	0.222*** (0.471)	0.466*** (0.125)	0.253*** (0.093)	0.233* (0.121)	0.127** (0.046)	0.210*** (0.031)	0.495*** (0.125)		
π_{t-1}	0.271 (0.402)	-1.315 (0.786)	1.114* (0.680)	1.055** (0.451)	1.735* (1.021)	1.213*** (0.452)	1.093 (1.815)	0.818 (0.761)	0.612 (0.392)	0.405 (0.513)		
SCE		0.403 (0.245)					-0.819 (0.617)					
SCE2												
HCE	0.244*** (0.077)	0.723*** (0.125)	0.208** (0.092)	0.007 (0.039)	0.078 (0.110)	0.032 (0.052)	0.378 (0.226)	0.143* (0.078)	0.101* (0.052)	0.152*** (0.049)		
HCE2		-0.028*** (0.005)					-0.01 (0.009)					
CEE	6.805*** (0.803)	10.888*** (2.698)	6.224*** (0.951)	4.947*** (0.727)	2.923 (2.238)	6.638*** (1.248)	4.968* (2.581)	8.286*** (0.836)	7.909*** (0.983)	3.336** (1.591)		
CEE2		-9.572*** (3.398)					-0.604 (3.555)					
CAP	3.675** (1.557)	1.926 (2.678)	5.535*** (1.344)	6.400*** (2.312)	3.980 (6.058)	3.235 (2.603)	-4.336* (2.263)	1.632 (1.735)	2.326 (1.793)	0.089 (3.268)		
LATA	1.418 (1.129)	0.696 (0.897)	1.987 (1.302)	1.444 (1.540)	-1.297 (3.622)	4.768** (1.842)	2.121 (1.560)	3.978*** (1.184)	1.185 (1.159)	2.755 (2.093)		
LOAN	-0.259 (0.997)	0.405 (0.802)	-0.473 (0.928)	2.492* (1.337)	1.384 (2.820)	2.611 (1.791)	-0.542 (1.407)	-0.086 (1.041)	-1.412 (1.100)	1.471 (2.110)		
LNITA	-0.255 (0.201)	0.206 (0.156)	-0.007 (0.165)	0.137 (0.151)	-0.466 (0.264)	-0.235 (0.249)	-0.562** (0.219)	-0.228 (0.201)	-0.007 (0.220)	-0.609*** (0.132)		
OWNER	7.899*** (2.751)	3.025* (1.588)	1.367 (1.885)	1.362 (1.339)	4.760* (2.777)	5.713** (2.480)	1.942 (1.379)	3.182 (1.942)	0.360 (1.351)	1.584 (2.262)		
LISTED	0.484 (0.480)	-0.191 (0.518)	-0.156 (1.441)	-0.908 (0.908)	-2.907 (1.978)	1.507* (0.847)	0.912* (0.490)	1.014 (1.384)	0.876 (0.779)	0.722 (2.058)		
FOREIGN	-2.780 (1.863)	-1.981 (1.789)	5.923 (5.897)	-8.416** (3.337)	-5.069 (6.666)	-9.713*** (2.831)	0.913 (1.898)	2.444 (6.117)	-13.95*** (5.088)	0.299 (5.571)		
SCE*OWNER			-0.801 (1.939)					-2.663 (2.104)				

(Continued)

Table 5. (Continued)

IT	RAR_{ROA}				RAR_{ROE}				
SCE*LISTED	-213.105** (103.04)	-120.805** (60.309)	-4.331 (42.183)	0.789 (2.035)				-0.788 (1.985)	
SCE*FOREIGN				-7.004 (7.146)				-6.708 (6.949)	
HCE*OWNER				0.281** (0.142)				0.072 (0.098)	
HCE*LISTED				0.158 (0.157)				-0.231 (0.161)	
HCE*FOREIGN				1.688** (0.718)				2.929*** (1.037)	
CEO*OWNER					-7.568 (5.455)			-0.557 (4.675)	
CEE*LISTED					6.820 (4.707)			0.355 (5.113)	
CEE*FOREIGN					11.437 (16.290)			-1.564 (15.804)	
HHI				-113.354* (61.296)	-15.741 (54.380)	-176.941* (96.978)	28.667 (30.280)	3.554 (31.564)	-38.457 (39.566)
GDP	16.811** (7.034)	10.811* (6.199)	5.637 (6.798)	-0.121 (9.618)	24.626** (8.290)	-3.289 (12.271)	21.575*** (4.381)	22.824*** (6.792)	12.321 (13.189)
INF	0.185 (0.863)	1.775** (0.833)	0.451 (0.815)	1.466* (0.742)	0.828 (1.843)	0.130 (0.862)	-0.885 (0.802)	-1.014 (0.728)	-1.802 (1.328)
Constant	4.418 (6.846)	-10.412 (5.013)	-3.309 (5.241)	-7.555 (5.399)	12.001 (10.663)	3.125 (8.538)	14.654 (7.373)	2.630 (6.448)	-1.623 (7.298)
No. of Obs	347	347	347	347	347	347	347	347	347
No of groups	30	30	30	30	30	30	30	30	30
AR(1) (p-value)	0	0.004	0.012	0.006	0.002	0.021	0.013	0.008	0.011
AR(2) (p-value)	0.609	0.703	0.084	0.311	0.536	0.678	0.793	0.668	0.83
Hansen test (p-value)	0.24	0.223	0.328	0.607	0.341	0.262	0.276	0.365	0.54

The table contains the results estimated using the system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, ***Significant at 10, 5, and 1 per cent levels, respectively.

the findings show the coefficients of $HCE*OWNER$ are positive and significant, suggesting that SOCBs tend to utilize their human capital more efficiently than POCBs, thus generating higher profitability. This reflects the fact that the introduction of several reforms to transform banks into market functioning and profitability institutions has mainly focused on restructuring SOCBs.

More interestingly, the coefficient of $HCE*FOREIGN$ becomes positive and significant in both measures of bank risk-adjusted returns, implying that foreign-owned banks seem more efficient than their domestic counterparts in utilizing human capital, thus earning higher profits. Nonetheless, this somewhat reflects the ability of foreign banks to transfer superior managerial skills to the local banks.

Finally, bank profitability is also affected by macroeconomic factors. The findings show that a less concentrated banking system (HHI) is associated with higher profitability. This is comparable to earlier studies in the individual country such as García-Herrero et al. (2009) in China, Bolarinwa and Obembe (2017) in Nigeria, or the cross-country such as Mirzaei et al. (2013) and Le and Ngo (2020). GDP is positively and significantly associated with bank profitability, suggesting that economic growth fosters profitability as generally perceived. This is in line with the well-documented literature on the association between economic growth and financial sector performance (Le et al., 2020). The coefficients of INF are generally positive and significant in RAR_{ROA} models, implying that a higher inflation rate will result in greater interest rates on loans, thus greater bank profitability.

4.2. Robust checks

To provide additional empirical support to our findings, we first examine whether the impact of intellectual capital on bank profitability may differ between small and large banks. Following Le (2019) and Le et al. (2019), large and small banks are defined as those with total assets above and below the median, respectively. Then, $LARGE$, a dummy variable that takes a value of 1 for a large bank and 0 otherwise is used because the small sample size is employed in the system GMM estimator. Second, we investigate whether the relationship between intellectual capital and bank profitability may differ during the global financial crisis. We include the GFC , a dummy variable that takes a value of 1 for the period 2007–2009, and 0 otherwise.¹⁸

Table 6 shows that the coefficient of $LARGE*SCE$ is positive and significant, suggesting that large banks tend to more efficient in utilizing structural capital, thus having higher profitability. $LARGE*HCE$ is negatively and significantly related to both measures of bank risk-adjusted returns, implying that large banks may face difficulty to manage their branch employees efficiently, thus lowering their profitability. Nonetheless, the results of our main interest variables are robust.

Table 7 indicates that the coefficient of $GFC*HCE$ is negative and significant while $GFC*SCE$ is positively and significantly related to RAR_{ROE} . Although there is no significant impact of GFC on the Vietnamese banking system, banks with more structural capital efficiency during this period are more profitable. Banks with higher investment in human capital tend to have reduced profitability as the employee expenses increase while suffering more problem loans.

5. Conclusion

This study investigates the impacts of VAIC and its components on risk-adjusted returns in the Vietnamese banking system from 2007 to 2019 by using the system GMM. The findings show that bank risk-adjusted returns are positively associated with VAIC and its three components. However, there appear the inverted U-shaped relationships between VAIC and both measures of risk-adjusted returns while the non-linear relationship between HCE and CEE and risk-adjusted returns on assets. We do not find any evidence of the U-shaped impact of SCE on bank profitability. Several robust checks are run to confirm our main findings.

Table 6. The relationship between IC measures (VAIC and its components) and risk-adjusted returns in a subsample

π	RAR _{ROA}		RAR _{ROE}	
π_{t-1}	0.312***(0.096)	0.257***(0.074)	0.227***(0.068)	0.139***(0.042)
VAIC	0.298***(0.058)		0.377***(0.083)	
LARGE*VAIC	0.024(0.065)		-0.027(0.063)	
CEE		4.118***(1.050)		7.728***(0.948)
SCE		0.467(0.466)		0.052(0.396)
HCE		0.086***(0.035)		0.136***(0.031)
LARGE*CEE		-1.046(1.234)		0.642(1.610)
LARGE*SCE		5.339***(1.685)		1.944(1.418)
LARGE*HCE		-0.216*(0.107)		-0.092*(0.033)
LARGE	-1.040(0.650)	-3.127***(1.049)	-0.685(0.633)	-1.464(0.946)
CAP	1.943(2.302)	2.123(2.118)	-1.597(2.090)	-2.411(1.561)
LATA	3.042(1.686)	-0.080(2.360)	7.132***(1.206)	1.751*(1.020)
LOAN	0.858(1.394)	-0.993(2.414)	2.666*(1.307)	1.863(1.053)
LNTA	-0.178(0.342)	-0.355(0.261)	-0.193(0.297)	-0.614**(0.214)
OWNER	0.845(1.923)	3.401(2.061)	0.889(2.442)	3.028**(1.059)
LISTED	1.120(0.863)	1.563*(0.789)	2.867****(0.803)	1.225*(0.628)
FOREIGN	4.924*(2.753)	0.981(2.220)	4.609(5.017)	-0.839(2.422)
HHI	112.813*(64.125)	-32.827(44.567)	82.197(70.988)	-67.334(50.676)
GDP	21.496(15.668)	13.606(11.499)	9.028(14.956)	25.913*(13.777)
INF	1.064(1.021)	0.917(1.062)	-0.243(1.015)	-1.556*(0.56)
Constant	-9.716(10.721)	9.563(9.496)	0.540(9.187)	17.283(6.481)
No. of Obs	347	347	347	347
No. of Groups	30	30	30	30
AR1 (p-value)	0.001	0.001	0.001	0.005
AR2 (p-value)	0.284	0.295	0.087	0.569
Hansen test (p-value)	0.859	0.65	0.907	0.702

The table contains the results estimated using the system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, ***Significant at 10, 5, and 1 per cent levels, respectively.

The results indicate that bank profitability is also positively related to better capitalization, lower liquidity risk, lending specialization, and smaller size. Regarding bank ownership, SOCBs are more profitable than POCBs. The positive impact on bank profitability is further confirmed by SOCBs with greater HCE. Listed banks are also found to have greater profit than non-listed banks. Therefore, banks should be encouraged to list on the stock exchange to enhance the transparency of the banking system. The findings also point out that foreign-owned banks are generally less profitable than domestic banks. When observing the interaction effects between intellectual capital and foreign ownership, the findings however show that higher profitability is positively associated with foreign-owned banks with greater HCE. This emphasizes that foreign ownership may transfer better management skills to a local partner to utilize human capital more efficiently. The Vietnamese authorities thus may further remove restrictions on foreign investments in the banking system.

Although the above findings reveal the importance of IC to improve bank profitability, we suggest that the Vietnamese banks should be cautious to pursue IC investment aggressively, especially human capital and equity as the positive effects may exist to a certain extent.

Table 7. The relationship between IC measures (VAIC and its components) and risk-adjusted returns during the global financial crisis

IT	RARROA			RARROE		
π_{t-1}	0.524*** (0.067)	0.641*** (0.157)	0.483*** (0.119)	0.351*** (0.061)	0.354** (0.174)	0.350** (0.138)
VAIC	0.192*** (0.064)	0.142** (0.066)		0.331*** (0.059)	0.270*** (0.085)	
GFC*VAIC		0.106 (0.301)			-0.294 (0.367)	
CEE			6.359*** (1.589)			5.286*** (1.812)
SCE			1.471** (0.629)			-0.355 (0.566)
HCE			-0.002 (0.061)			0.146*** (0.047)
GFC*CEE			-1.022 (1.298)			0.057 (1.564)
GFC*SCE			1.279 (2.229)			4.709* (2.564)
GFC*HCE			0.071 (0.285)			-0.651** (0.287)
GFC	0.439 (0.263)	-0.043 (1.761)	-0.202 (1.191)	0.529 (0.515)	2.002 (2.164)	-0.062 (1.245)
CAP	-10.103** (4.068)	-10.663 (1.613)	3.371 (6.705)	-9.152 (7.435)	-0.799 (12.543)	14.242 (5.830)
LATA	-0.873 (1.319)	-1.434 (5.051)	-5.479** (2.500)	0.001 (1.423)	6.021 (6.566)	2.522 (2.784)
LOAN	0.101 (1.789)	1.496 (3.280)	-3.652* (1.881)	1.981 (1.706)	4.293 (4.310)	0.155 (1.795)
LNTA	-0.368 (0.321)	-0.292 (0.782)	-0.041 (0.502)	-0.272 (0.598)	-0.159 (0.827)	-0.328 (0.392)
OWNER	4.093** (1.762)	0.665 (2.908)	2.369 (2.435)	1.812 (1.821)	-0.510 (3.779)	1.297 (2.671)
LISTED	0.762** (0.362)	0.689 (0.681)	1.672** (0.717)	0.838 (0.710)	1.252 (0.901)	0.198 (0.936)
FOREIGN	2.061* (1.132)	-0.788 (7.336)	2.507 (3.453)	-0.475 (1.614)	-7.127 (8.979)	6.229 (2.773)
HHI	-76.807*** (25.219)	-27.586 (112.115)	-72.011 (106.192)	-28.975 (34.256)	-21.001 (148.807)	-7.967 (107.938)
GDP	27.396*** (4.786)	19.697** (8.394)	30.498*** (7.061)	20.744** (7.412)	24.093*** (9.432)	37.155*** (7.721)
INF	2.232** (1.005)	2.702 (1.684)	1.243 (1.262)	3.458** (1.441)	0.230 (1.758)	2.085 (0.711)
Constant	10.318 (10.170)	8.400 (28.550)	-1.568 (17.301)	6.312 (19.293)	-10.780 (30.709)	-15.309 (13.678)
No. of Obs	347	347	347	347	347	347
No. of Groups	30	30	30	30	30	30
AR1 (p-value)	0.001	0.009	0.019	0.003	0.004	0.007
AR2 (p-value)	0.685	0.657	0.879	0.767	0.304	0.248
Hansen test (p-value)	0.964	0.919	0.402	0.936	0.943	0.384

The table contains the results estimated using the system GMM estimator. Variables in italics are instrumented through the GMM procedure following Arellano and Bover (1995). Robust standard errors are in parentheses. *, **, *** Significant at 10, 5, and 1 per cent levels, respectively.

Therefore, banks should put a specific limit on investing in the intellectual capital to achieve and maintain desired profitability.

The study may suffer some following limitations. Future research may investigate how much intellectual capital banks should look to invest given the non-linear relation by using different methods (perhaps, the quantile regression). Also, our research only studies one country within a limited period, suggesting that future study needs to examine this link in other emerging markets that have an analogous banking structure for robust checks.

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Notes

1. An annual economic growth in Vietnam is averaged at 6.2% over the same period.
2. Compare to local banks, these banks can access cheaper funds to facilitate their assets.
3. For a comprehensive discussion on definitions of IC and its components, please see Abhayawansa and Guthrie (2010), and Bayraktaroglu et al. (2019).
4. Clarke et al. (2011) define IC as the inclusion of some common keywords such as accumulated knowledge, gained experience, intangible assets, maintaining good relationships, know-how, and innovations.
5. The dynamic nature of the bank profitability comprising a dynamic specification, estimators such as ordinary least square, fixed effects, or random effects (Ozkan et al., 2017; Tran & Vo, 2018) may become biased.
6. This persistence is related to market competition barriers, charter capital requirements, information opacity, and/or sensitivity to uncertainty, to the extent that there is a serial correlation between them.
7. For example, more profitable banks may increase their capital ratios by retaining earnings. They could also spend more on advertising campaigns and increase their size, which in turn may affect profitability. Furthermore, assuming profit as a measure of a firm's success, managers of successful firms will have more time to conduct beneficial activities for their firms, such as supporting innovation, compared with those of failing ones, which ultimately improves firms' profitability (El-Bannany, 2012).

8. It is assumed that strictly exogenous variables are not correlated to the individual effects while the endogenous variables are predetermined.
9. We also use the traditional measures of bank profitability such as average return on assets, the average return on equity, and pre-provision profit. Similar results are obtained although they cannot present here due to the length restrictions.
10. We are aware that there are alternative indicators of market concentration such as Lerner index or the Rosse-Panzar. However, these non-structure measures have some major limitations as discussed in Dietrich and Wanzenried (2014)'s study.
11. The full results of each equation can be provided upon request.
12. See Baum et al. (2003)
13. Please see Bayraktaroglu et al. (2019) for more discussion on different VAIC approaches.
14. For further discussion, please see Le (2017a).
15. We also conduct robustness checks with more rudimentary approaches for panel data using fixed effects. The results confirm our main findings and are available upon request.
16. Cameron and Pravin (2010) suggest that the value of Hansen test for over-identifying restrictions should exceed 0.05, thus the null hypothesis cannot be rejected. Alternatively, there is no correlation between the instrument variables and the residuals.
17. Arellano and Bond (1991) demonstrate p-values of AR2 above 0.05 that instruments are still valid.
18. Bank for International Settlements (2010) identifies the pre-crisis period as from 2003 to June 2007 and the acute crisis period as from July 2007 to March 2009. Since only yearly data are available, we consider years 2007-2009 as the crisis period.

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