How Does Intellectual Capital Fuel Non-Interest Incomes in Banks? New Case from an Emerging Country

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The aim of this study is to answer the straightforward question of whether the implementation of IC has fueled non-interest incomes of banks or not. By utilizing the data of 26 domestic banks in Vietnam and employing the value-added intellectual coefficient model (VAIC) as the measure of IC efficiency, our empirical evidence manifests that IC plays a vital role in fostering non-interest incomes of banks. When dividing VAIC into different components, we find that structure capital employed (SCE) is the most important component to enhance the expansion of these incomes compared with other components including capital employed efficiency (CEE), human capital efficiency (HCE). These findings remain unchanged through some robustness tests performed. While the main driver of IC and SCE, CEE component becomes a substantial advantage to increase non-interest incomes in large banks. Meanwhile, the degree of impact of SCE is higher in small banks compared with large ones. Overall, this study would provide a deep insight into the role of IC in the transformation into non-interest income activities of banks in an emerging

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country, and therefore our findings would be useful for both scholars and policy-makers in Vietnam, where has undergone the period of major reforms in banking system.

Keywords: Intellectual capital, Business strategy, Non-interest income, Banking system, Emerging market.

1. Introduction

The role of intellectual capital (IC) is widely recognized as the key engine for sustainable development and the main source of competitive advantages of most organizations these days (Suciu & Năsulea, 2019). It is not surprising that exploring the impact of IC on business operations in banking system has received much attention from scholars and policy-makers around the globe. However, while banking sector is considered one of the most knowledge-intensive spheres (Mavridis & Kyrmizoglou, 2005), in reality, empirical studies on this field in banking industry seem to be scarcity compared to others (Le & Nguyen, 2020). On the other hand, besides most of extant literature in the banking industry tends to focus on the productivity and profitability (Le & Nguyen, 2020; Ozkan, Cakan, & Kayacan, 2017; Yalama, 2013), risk-taking behavior (Nguyen, Le, & Ho, 2021), and the financial intermediation (Nguyen & Lu, 2023a, 2023b), the correlation between IC and non-interest incomes in banks seems to be relative dearth (Duho & Onumah, 2019). With that in mind, the main purpose of this study is to find out the role of implementing IC in transformation from traditional activities into non-traditional sources of income in banks by relying on the landscape of an emerging country.

In this vein, Vietnam may provide one of appropriate environments to reach the clear answer about whether IC has played a certain role in spurring non-interest incomes of banks or not. On one hand, along with becoming a member of the World Trade Organization in 2007, the banking system in this country has witnessed major reforms and changes in operations and regulations. In reality, to meet tighter requirements of The Guide of Implementing Basel I and Basel II, especially credit risk and capital adequacy, many constraints on banking operations have been constructed by The State Bank of Vietnam. As a result, these standards may raise substantial burdens on traditional business operations of domestic banks. Furthermore, the emergence of foreign banks, who are considered potential rivals and possess advanced capabilities, also leads banking market to be more competitive. In this scenario, local banks have to seek out alternative sources of income to ensure their profits and market shares, because a shift towards non-traditional incomes consisting of

commissions, fees, and trading incomes, is seen as the customer-oriented business strategy driving banking operations (Bian, Wang, & Sun, 2015), and assists banks to reduce risk and funding cost (Tran, 2020). However, this transformation process usually requires banks to hold necessary capacity such as technology, knowledge and human resources (Mostak Ahamed, 2017). Such this landscape may highlight the vital role of IC in helping banks to fill these preconditions. Indeed, a better IC means that an organization can possess neurodiverse talent, strong fabric, effective procedure, and close connection with end-users that in turn may assist managers to not only adapt to changing circumstances, but also tailor market-oriented policies and products to satisfy the changes in clients' demands. Therefore, it is expected that a shift towards non-traditional incomes of banks may be powered by IC-based management. On the other hand, while Vietnam has emerged as one of the fastest growing economies over the world, in which the average economic growth regularly stands at around 5.3% each year between 2007 and 2019 (Le & Nguyen, 2020), the sustainable development of economy mostly rests on the soundness and effectiveness of banking system due to undeveloped equity market (Phan, Lu, & Nguyen, 2022; Nguyen & Lu, 2023a, 2023b). Taken together, therefore, discovering the correlation between IC and non-interest incomes in banks would provide a deep insight into the expansion of non-traditional income activities and knowledge-based management of banks in Vietnam as well as other emerging markets as a whole.

Using the data of 26 domestic banks in Vietnam between 2006 and 2020, the study's regression analysis has demonstrated that IC could become one of the main drivers in fostering non-traditional income activities in banking system. By employing the value-added intellectual coefficient model (VAIC) created and developed by Pulic (2000, 2004) as the measure of IC and the key explanatory variable, the empirical evidence testifies a positive association between IC and non-interest incomes of banks. For three main components of VAIC including capital employed efficiency (CEE), human capital efficiency (HCE), and structure capital efficiency (SCE), the result indicates that SCE is the most important factor in enhancing non-interest incomes compared with other components. These findings remain survival through some robustness tests consisting of: (i) performing different econometric methods, (ii) the main independent variable being lagged one period, and (iii) adding variable into analysis model to eliminate issues related to omitted variables. Additionally, we also find that while large banks seem to harness IC more effectively for expanding into non-traditional incomes, the magnitude of SCE's positive impact is higher in small banks. At the same time, in large banks, capital employed efficiency may play a certain role in significant improvement in diversified incomes.

Through this paper, it is hoped that there are some contributions to the extant literature in various ways as follows. First of all, to the best of our knowledge, this study would provide one of the first empirical examinations to explore the impact of IC on one of the most important business strategies in banks, namely income diversity, in Vietnam. In fact, it is true that whilst most studies on this field in this country seem to focus on the aspects of profitability, bank risk, and financial intermediation (e.g., Le & Nguyen, 2020; Nguyen et al., 2021; Nguyen & Lu, 2023a, 2023b), the link between IC and non-interest incomes almost maintains an open question. Furthermore, these aspects are also paid much attention by academics in both developed and developing markets (e.g.,

Meles, Porzio, Sampagnaro, & Verdoliva, 2016; Ozkan et al., 2017; Poh, Kilicman, & Ibrahim, 2018; Yalama, 2013). Hence, by emphasis on non-traditional incomes, our study would make a difference in comparison with existing financial literature. Another contribution is that because relevant studies mostly rely on US and Chinese markets to evaluate the role of IC as the survey result of Alvino, Di Vaio, Hassan and Palladino (2020) has indicated, our study would improve the valuable understanding of the IC engine for boosting banking operations in an emerging country, where the smoothness and efficiency of banking system would ensure the growth and development of economy. In addition, as the research conducted by Poh et al. (2018) shows that different results when investigating the impact of IC in banking industry may come from different measures of banking performance and periods chosen. By selecting non-interest incomes as the main subject along with the period covering from 2006 to 2020, we would dig more into the impact of IC on various dimensions of business operations in banks and therefore we add more illumination to prior findings such as Le & Nguyen (2020); Nguyen et al. (2021); Nguyen & Lu (2023a, 2023b); Poh et al. (2018). Last but not least, because transformation from traditional incomes to non-traditional activities is seen as the necessary step in constructing business strategies, and implementation of IC may be the key to open up new road for domestic banks in coming future, our findings would provide certain implications for scholars and regulators in Vietnam and perhaps in other developing markets.

The remainder of our study is constructed as follows. The next section would analyze related studies in extant financial literature. Afterward, the methodology including the data, variables, and empirical method, would be elaborated in the third section. The main findings and a variety of robustness tests would be described in the fourth section, and the effect of bank size would be depicted in the fifth section. The conclusions and future directions would be stated in the final section.

2. Literature Review

Whilst there are certain differences depending on different disciplines and perspectives to conceptualize intellectual capital (Le & Nguyen, 2020), many studies consent that IC is one of the main drivers in strengthening competitive advantage, corporate value, and sustaining growth and development of most organizations in today's world (Jardon & Martínez-Cobas, 2019; Suciu & Năsulea, 2019). Existing theoretical literature also recognizes that IC is considered one of intangible assets that would fuel the wealth, propensity, and well-being of companies (Harris, 2000; Keong Choong, 2008). Although existing certain debate on the ingredients of IC (Keong Choong, 2008), in general, IC is mainly structured by three main dimensions consisting of: human capital, structural capital, and relational capital. Accordingly, human aspect is related to abilities such as skills, experiences, knowledge of individual and a group of individuals in a corporation or company. Meanwhile, the interpretation of structural capital usually obtains structures, strategies, and policies of an organization. By contrast, the last aspect, namely relation capital, also called capital employed, has the close involvement with extrinsic factors such as customers, suppliers, and multi-stakeholders.

As the vital role of IC in business operations, there are considerable efforts to measure IC in

financial literature. Some measures could be stated as Tobin's Q ratio, economic value-added indicator and IC index (see more: Bayraktaroglu, Calisir, & Baskak, 2019; Ozkan et al., 2017). However, the VAIC method proposed by Pulic (2000, 2004) is considered the suitable tool to evaluate the IC efficiency in the banking industry (Poh et al., 2018) and the quite simple method based on the available financial information publicized by banks (Adesina, 2019). Thus, it is easy to understand that why this approach is performed in large number of studies in this field, such as Le and Nguyen (2020); Nguyen and Lu (2023a,b); Ozkan et al. (2017). Accordingly, the VAIC would consist of three main components: capital employed efficiency (CEE), human capital efficiency (HCE), and structure capital efficiency (SCE). This indicator would mirror the degree of the value creation in one money invested by a company as well as the level of effectiveness resulting from employing IC. Hence, a rise in VAIC would reflect higher level of effectiveness in harnessing available resources of banks. Because of the recognition of this model in a huge number of relevant studies, this study would approach VAIC as the measure of IC efficiency in banks. The detailed calculations would be elaborated in the next section.

Besides VAIC is employed in many studies to evaluate the impact of IC on banking performance, the empirical findings seem to remain controversy. The reasons behind these contrary findings may result from certain differences in measures of banking performance, the periods selected, and perhaps macroconditions in each country (Nguyen & Lu, 2023a; Poh et al. 2018). On one hand, most of studies have illustrated the bright side of implementing IC, which becomes the key vehicle to support business operations of banks. For instance, by relying on the dataset of 17 banks in Turkey from 1995 to 2006, the empirical findings of Yalama (2013) indicate that the profitability, market value, and productivity in banks have a positive connection with VAIC, specifically in long run. Similarly, based on the data of 18 banks in Ghana between 2003 and 2011, the evidence of Alhassan and Asare (2016) demonstrates a positive association between VAIC and productivity of banks. Also, these authors find that HCE and SCE are the most important factors fueling banking productivity. Based on the data of 10 banks in Malaysia from 2007 to 2016, the regression analysis carried out by Poh et al. (2018) indicates that the components of IC would have different impacts on banking performance depending on choosing different measures of performance and periods. In particular, the findings of these authors show that between 2011 and 2016, both HCE and CEE components have a positive association with ROE and ROA respectively, while the similar results are found in the cases of SCE and CEE components during the period 2007-2016. The relevant studies in developed markets nearly find similar results. For example, by employing the large sample of banks in US and the period spanning from 2005 to 2012, the OLS estimation of Meles et al. (2016) finds that VAIC positively affect ROA and ROE in banking system, and HCE has a bigger impact on banking performance in comparison with the rest of components. In the relevant aspect, Adesina (2019) uses the database of 339 commercial banks in 31 African nations from 2005 to 2015 and performs the Tobit and one-system GMM methods to evaluate the impact of IC on bank technical, allocative, and cost efficiencies. The results show that VAIC has a positive

influence on technical, allocative, and cost efficiencies of banks, and HCE become a crucial catalyst for these efficiencies. In short, these empirical findings have demonstrated the main driver of IC in spurring the business operations of banks. For the firm industry, the prior studies also underline the positive side of IC. For instance, Khan et al. (2019) find that IC has influenced positively financial performance of SMEs in Pakistan, while the result of Hassan et al. (2019) indicates that IC will assist firms in the food industry to enhance the commitment, communication, and rules. Taken together, it is hoped that the implementation of IC would assist banks to enhance non-interest income activities. Therefore, the first hypothesis would be constructed as follows.

H1: VAIC and its components would contribute to improvement in non-interest incomes of banks.

By contrast, the extant literature in this field also indicates the reverse effect of VAIC and its components on performance of banks. One of the typical examples is that the empirical results conducted by Tran and Vo (2018). By using the dataset of 16 banks listed in Thailand, these authors do not find the relation between VAIC and profitability in banks. Also, the evidence shows that the slight reduction in profitability may result from the HCE component, besides the CEE component becomes a key factor to boost banking performance compared to others. These results seem to reaffirm the previous findings of Ozkan et al. (2017). Relying on the sample of 44 banks from 2005 to 2014 in Turkey, these authors find that CEE component has strongly positive effect on financial performance of banks in comparison with others. Thus, the authors believe that Turkish banks should focus on strengthening their financial as well as physical resources to gain higher profits. In addition, when investigating the correspondence between IC and banking performance of 26 banks from 2012 to 2016 in Pakistan, the finding of Haris, Yao, Tariq, Malik and Javaid (2019) demonstrates the inverted U-shaped connection between VAIC and profitability of banks. At the same time, the results of these authors indicate that SCE component has an adverse impact on banking performance, while CEE and HCE components help banks to enhance profits. Meanwhile, by using the unbalanced panel data of 32 Ghanaian banks from 2000 to 2015 and conducting the panel-corrected standard error regression, Duho and Onumah (2019) find that VAIC plays a vital role in fueling the asset diversification strategy in banks, but this factor does not drive income diversity.

For Vietnamese studies in this field, the earlier findings of Le and Nguyen (2020); Nguyen et al. (2021) have illustrated a debate on whether investment in IC would have brought advantages to banks or not. Indeed, by performing the system GMM method, the empirical results of Le and Nguyen (2020) have demonstrated that regardless of VAIC and its components have the positive connection with profitability of banks and the impact of both VAIC and HCE is profound in state-owned and foreign banks. Notwithstanding, these relations might be the inverse U-shaped, especially in the cases of VAIC, CEE, and HCE. Meanwhile, the empirical evidence carried out by Nguyen et al. (2021) has proved that investment in IC may have an adverse effect on the

stability of banks in the short term, however after reaching a certain threshold, it could improve the banking stability. At the same time, these authors also find that the banking instability may result from the considerable investment in SCE component compared to other components. What is more, in the recent studies, Nguyen and Lu (2023a) find that VAIC contributes to a significant improvement in the financial intermediation of banks and CEE is the most important factor assisting banks to expand this business operation. Similarly, the empirical analysis of Nguyen and Lu (2023b) suggests that a combination between technological and IC investments may improve the banks' deposit activities.

In short, even though many papers underline the bright side of IC in bolstering business function of banks, there are still the empirical results that do not support this point of view. Therefore, it is anticipated that IC may not foster non-interest income activities of banks. In this sense, the next hypothesis would be constructed as follows.

H2: VAIC and its components would not contribute to improvement in non-interest incomes of banks.

3. Methodology

3.1 Data and variables

3.1.1 Data and sample

To address our main concern about the correlation between IC and non-interest incomes of banks, we first collect the data of Vietnamese commercial banks from the audited financial statements. To calculate VAIC – the main explanatory variable – some detailed expenditures are manually gathered from the notes to the financial statements. Totally, our data obtains 26 domestic banks from 2006 to 2020. For the macro indicators, we select this information from the World Bank database during the same period. This period is selected because, to some extent, it has witnessed major changes such as regulations, structures, appearance of foreign banks, technology-based orientations, and customer-oriented business strategies in Vietnamese banking system (Phan, Lu, & Nguyen, 2022; Nguyen & Lu, 2023a). The period contains the first year of the Covid-19 outbreak – 2020 – because the Vietnamese government is seen as one of the best countries to control this pandemic infection at that time. In fact, the IMF report highlighted Vietnam only witnessed over 1,300 infected cases in total around 100 million population, and was one of the scarce nations having positive GDP growth in 2020 over the globe. In comparison with 35 domestic commercial banks in Vietnam, the total assets of 26 banks in the sample account for over 70%. Thus, the sample in our study would ensure the representative.

3.1.2 Key explanatory variable

Afterwards, we employ the value-added intellectual coefficient model (VAIC) as the measure of

IC in banks and the main explanatory variable throughout the analysis models. This method was built and developed by Pulic (2000, 2004), and it is also performed in many financial studies in banking industry, such as Le and Nguyen (2020); Nguyen & Lu (2023a); Ozkan et al. (2017); Poh et al. (2018). The VAIC is calculated as:

$$VAIC_{it} = CEE_{it} + HCE_{it} + SCE_{it} \qquad (1)$$

Where, Y_{it} represents NII of bank i at time t and VAIC is utilized as the key explanatory proxy in the model. $Control\ Bank_{it}$ is the vector of control variables consisting of SIZE, CAPITAL, EBLTA and LLR. $Control\ Macro_{it}$ is the vector of control variables including GDPR and IFL. The model obtains time-fixed effects, θ_t, to control for the macroeconomic conditions, common across banks. ε_{it} is the error term.

$$VA_{it} = OP_{it} + PC_{it} + A_{it} \qquad (2)$$

Where, OP_{it} is the operating profit of bank i at time t, PC_{it} is the personnel costs of bank i at time t, and A_{it} is the amortization and depreciation of bank i at time t. Accordingly, these components are calculated as:

$$CEE_{it} = VA_{it}/CE_{it} \qquad (3)$$

$$HCE_{it} = VA_{it}/HC_{it} \qquad (4)$$

$$SCE_{it} = SC_{it}/VA_{it} \qquad (5)$$

$$SC_{it} = VA_{it} - HC_{it} \qquad (6)$$

Where, CE_{it} is the book value of equity of bank i at time t, and HC_{it} is the personnel expenses of bank i at time t.

3.1.3 Dependent variable and control variables

For the dependent variable, we use the (natural logarithm of) total non-interest incomes (NII) of banks (Phan, Lu, Hoang, & Nguyen, 2022). For control variables, we control bank-specific variables consisting of: the (natural logarithm) total assets (SIZE), the ratio of capital over total assets (CAPITAL), the ratio of total income before taxes, provisions recognized in income over total gross assets (EBLTA) and the loan loss reserve ratio (LLR). At the same time, we also control country-level conditions including: the annual GDP growth (GDPR) and the inflation rate (IFL). We employ these control variables because they are performed in wide range of financial studies

(e.g., Le & Nguyen, 2020; Phan, Lu, Hoang, & Nguyen, 2022; Phan, Lu, & Nguyen, 2022; Tran, 2020).

3.2 Empirical method

To estimate the relation between intellectual capital and non-interest incomes of banks, we perform the following regression:

$$Y_{it} = \alpha + VAIC_{it} + Control\ Bank_{it} + Control\ Macro_{it} + \theta_t + \varepsilon_{it} \qquad (7)$$

Where, Y_{it} represents NII of bank i at time t and VAIC is utilized as the key explanatory proxy in the model. $Control\ Bank_{it}$ is the vector of control variables consisting of SIZE, CAPITAL, EBLTA and LLR. $Control\ Macro_{it}$ is the vector of control variables including GDPR and IFL. The model obtains time-fixed effects, θ_t, to control for the macroeconomic conditions, common across banks. ε_{it} is the error term.

The sample in this study contains about 380 observations for 26 domestic banks with the period spanning from 2006 to 2020. All variables are winsorized at 1% level on the top and bottom of their distribution to mitigate possible effects resulting from outliers. We observe that the value of HCE component in the sample is the highest compared to others and therefore this value is in line with some prior studies (Le & Nguyen, 2020; Ozkan et al., 2017). The definition of main variables is described in the table 1, and the descriptive statistics (Panel A) and the correlation matrix (Panel B) are illustrated in the table 2.

Table 1
Variables Definitions

Variables	Definitions
NII	The (natural logarithm of) total non-interest incomes
VAIC	The value-added intellectual coefficient model to measure the intellectual capital of banks
CEE	The measure of capital employed efficiency of banks
HCE	The measure of human capital efficiency of banks
SCE	The measure of structure capital efficiency of banks
SIZE	The natural logarithm of gross total assets
CAPITAL	Book value of equity over gross total assets

LLR	The loan loss reserve ratio
EBLTA	The ratio of total income before taxes, provisions recognized in income over gross total assets
STATE	A dummy variable equal one if the commercial bank is owned by the state and equal 0 otherwise
GDPR	The annual GDP growth of Vietnam
INFL	The annual inflation rate in Vietnam

Table 2
Panel A: Variables descriptive statistics

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	min	max
NII	355	18.67	2.086	12.69	22.18
VAIC	378	3.406	1.014	0.773	6.651
CEE	380	0.391	0.226	-0.330	0.946
HCE	378	2.463	0.785	1.001	5.467
SCE	380	0.554	0.148	0.000986	0.831
CAPITAL	380	0.110	0.0706	0.0416	0.462
SIZE	380	24.94	1.448	20.84	27.91
LLR	379	-0.00894	0.0425	-0.274	0.0315
EBLTA	380	0.0175	0.0102	4.84e-06	0.0602
GDPR	390	0.0623	0.0108	0.0294	0.0720
INFL	390	0.0731	0.0595	0.00631	0.231

Panel B: Correlation matrix (pairwise)

Variables	(NII)	(VAIC)	(SIZE)	(CAPITAL)	(EBLTA)	(LLR)	(GDPR)	(INFL)
NII	1.000							
VAIC	0.355*	1.000						
	(0.000)							
SIZE	0.872*	0.209*	1.000					
	(0.000)	(0.000)						
CAPITAL	-0.543*	0.011	-0.710*	1.000				
	(0.000)	(0.831)	(0.000)					
EBLTA	0.230*	0.707*	0.037	0.291*	1.000			
	(0.000)	(0.000)	(0.471)	(0.000)				
LLR	0.042	0.362*	-0.082	0.132*	0.287*	1.000		
	(0.432)	(0.000)	(0.110)	(0.010)	(0.000)			
GDPR	-0.112*	0.014	-0.086	-0.011	-0.044	-0.026	1.000	
	(0.035)	(0.786)	(0.092)	(0.825)	(0.389)	(0.614)		
INFL	-0.197*	0.061	-0.340*	0.325*	0.116*	0.302*	-0.112*	1.000
	(0.000)	(0.233)	(0.000)	(0.000)	(0.023)	(0.000)	(0.027)	

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

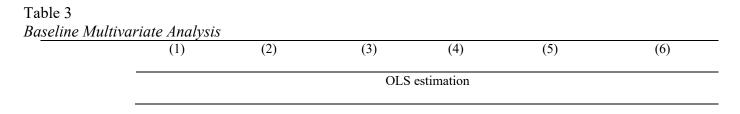## 4. How Intellectual Capital Affects Non-Interest Incomes of Banks

4.1 Main findings

The main results are illustrated in the table 3, in which the OLS regression method is employed in all models. At the beginning stage, we perform only the key explanatory variable (VAIC) in Model (1) and find that VAIC positive affect the dependent variable (NII) at the 1% level of statistical significance. Afterwards, the bank-specific and macro variables are employed in Model (2) and Model (3), respectively. We find a similar result in both models, although the coefficient of VAIC only has the statistical significance at the 10% level when controlling bank-specific variables. We next control both bank-specific and macro variables in Model (4), namely the baseline model. The result continues to indicate a positive relation between VAIC and NII, however this impact only stands at the 10% level of statistical significance.

Due to having some state-owned banks in the sample, we create the dummy variable named as STATE, which would equal one if the bank is state-owned bank and 0 otherwise. We then add this variable into the baseline model to evaluate possible effect of state-owned banks on our finding. The result in Model (5) shows that again the impact of VAIC nearly remains unchanged and possesses the statistical significance at the 1% level. At the same time, we observe that the STATE factor has a negative association with non-interest incomes at the 1% level of statistical significance.

To estimate the impact of different components of VAIC, we re-perform the baseline model in which VAIC is divided into three components consisting of: CEE, HCE, and SCE. The result in Model (6) indicates that structure capital employed have a considerable and positive connection with non-interest incomes at the 1% level of statistical significance, whereas the opposite impact is found in a case of human capital employed. Meanwhile, although the coefficient of capital employed efficiency is positive, it is not statistical significance.

In general, the empirical evidence demonstrates that non-interest incomes of banks have been fueled by the implementation of IC. In other words, IC has become one of main drivers that would enhance the transformation from traditional incomes to non-traditional ones in banking system. Some prior studies suggest that adopting new technologies and harnessing IC may advance the competitiveness and market share of banks (e.g., Singh, Chen, Del Giudice, & El-Kassar, 2019; Vătămănescu, Gorgos, Ghigiu, & Pătruț, 2019). In this sense, our evidence complements that the shift towards non-traditional incomes of banks has been strengthened by implementing IC. Additionally, when separating VAIC into different components, the empirical result reveals that structure capital employed is the most important component that assist banks to expand into non-interest income activities, while an increase in human capital employed may make banks decrease non-interest incomes.

Table 3
Baseline Multivariate Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS estimation					

VARIABLES	Reduced model	Control bank-specific	Control macro-specific	Baseline model	Addition Dummy variable	Different components of VAIC
VAIC	0.744***	0.155*	0.784***	0.158*	0.237***	
	(0.127)	(0.0842)	(0.119)	(0.0837)	(0.0915)	
CEE						0.477
						(0.478)
HCE						-0.313*
						(0.167)
SCE						3.174***
						(0.864)
SIZE		1.240***		1.253***	1.365***	1.215***
		(0.0646)		(0.0687)	(0.0790)	(0.0648)
CAPITAL		-1.677		-1.987	-1.015	-1.473
		(2.451)		(2.544)	(2.608)	(2.576)
EBLTA		31.72***		31.55***	23.97***	25.38***
		(7.988)		(7.940)	(8.564)	(8.459)
LLR		3.448*		2.570	2.826	0.894
		(1.890)		(2.005)	(1.853)	(1.683)
GDPR			-26.70***	-4.790	-3.434	-4.088
			(7.575)	(3.280)	(3.167)	(3.304)
INFL			-8.399***	2.006**	2.623**	2.611***
			(1.677)	(1.017)	(1.032)	(1.004)
STATE					-0.636***	
					(0.143)	

Constant	16.09***	-13.29***	18.21***	-13.44***	-16.53***	-13.17***
	(0.414)	(1.773)	(0.690)	(1.950)	(2.247)	(1.821)
Observations	353	352	353	352	352	352
R-squared	0.126	0.814	0.196	0.817	0.823	0.826

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

Notes. The table depicts regression estimations of the correlation between intellectual capital and non-interest incomes in banks. All variables are winsorized at the 1% and 99% levels. The asterisks ***, **, * denote significance at the 1%, 5%, and 10% level respectively. The period of sample spans from 2006 to 2020.

4.2. Robustness Tests

In this sub-section, we would provide some robustness tests to ensure our previous findings. The results are depicted in the table 4. To start, by using the fixed-effects estimator we re-perform the baseline model and this model with dividing VAIC into three components, in Model (1) and Mode (2) respectively. We approach this estimator as the alternative econometric method because it is seen as one of the vehicles that may address problems related to the possible influence of time on regression results (Phan, Lu, Hoang, et al., 2022; Phan, Lu, & Nguyen, 2022; Phan, Iyke, Sharma, & Affandi, 2021). Again, the impact of IC on NII maintains unaltered in which the coefficient of VAIC stands at the 5% level of statistical significance. For VAIC's components, whilst the effect of SCE is similar to the previous finding, that of HCE is not statistical significance. Meanwhile, the impact of CEE component is positive and statistical significance at 5% level.

To test further our previous results, we continue to re-run Model (1) and Mode (2) in which the key independent variables (VAIC and its components) are lagged one year. This approach not only helps to eliminate endogeneity issues (Huynh & Dang, 2021), but also is necessary because financial information on balance sheet of banks regularly needs a certain time before being absorbed by public (Tran, 2020). Accordingly, we employ OLS estimation and fixed-effects estimation in Model (3)-(4) and Model (5)-(6), respectively. The results illustrate that while the impact of both VAIC and SCE component is consistent, that of other components is not statistical significance. In brief, through a battery of robust tests, the empirical findings reaffirm the main role of both IC and structure capital employed in spurring non-interest incomes of banks.

Table 4
Robustness Tests

	(1)	(2)
	Fixed-effects estimation	
VARIABLES	Baseline model	Different components of VAIC
VAIC	0.183**	
	(0.0812)	
CEE		1.031**
		(0.496)
HCE		-0.318
		(0.214)
SCE		3.444***
		(1.303)
SIZE	1.230***	1.144***
	(0.0627)	(0.0643)
CAPITAL	-0.828	0.150
	(2.126)	(1.807)
EBLTA	15.00	4.911
	(9.858)	(8.205)
LLR	4.662	2.949
	(2.835)	(2.046)
GDPR	-6.236***	-6.031***
	(1.778)	(1.950)
INFL	1.023	1.585
	(1.351)	(1.162)
Constant	-12.62***	-11.39***

	(1.717)	(1.697)
Observations	352	352
R-squared	0.8128	0.8186

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

	(3)	(4)	(5)	(6)
	OLS estimation		Fixed-effects estimation	
VARIABLES	Baseline model	Different components of VAIC	Baseline model	Different components of VAIC
L.VAIC	0.158**		0.136**	
	(0.0620)		(0.0661)	
L.CEE		0.416		0.313
		(0.382)		(0.307)
L.HCE		-0.165		-0.160
		(0.150)		(0.137)
L.SCE		2.048**		1.916**
		(0.929)		(0.858)
SIZE	1.282***	1.241***	1.242***	1.203***
	(0.0665)	(0.0623)	(0.0950)	(0.0895)
CAPITAL	-2.314	-2.477	-2.200	-2.374
	(1.623)	(1.711)	(1.751)	(1.897)
EBLTA	38.73***	36.76***	27.57***	26.68***
	(5.635)	(6.169)	(7.338)	(7.407)
LLR	1.896	0.649	3.709	2.780
	(1.906)	(1.648)	(2.546)	(2.011)

GDPR	-5.758*	-5.635*	-6.695***	-6.628***
	(3.313)	(3.318)	(1.685)	(1.613)
INFL	2.079**	2.669***	1.237	1.636
	(0.910)	(0.978)	(1.056)	(1.029)
STATE				
Constant	-14.22***	-13.57***	-12.85***	-12.22***
	(1.768)	(1.638)	(2.473)	(2.321)
Observations	331	331	331	331
R-squared	0.830	0.834	0.8266	0.8307

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

Notes. The table illustrates regression estimations of our main concern. In Model (1)-(2), we first re-estimate our findings by employing fixed-effects estimation. We then perform both OLS and fixed-effects estimations in which the main explanatory variables are lagged one period from Model (3) to Model (5). All variables are winsorized at the 1% and 99% levels. The asterisks ***, **, * denote significance at the 1%, 5%, and 10% level respectively.

4.3. The System GMM Approach

To tackle some biased estimation coming from OLS method, many financial studies (e.g., Phan, Lu, Hoang, et al., 2022; Phan, Lu, & Nguyen, 2022; Phan et al., 2021) suggest that the dynamic panel of the system GMM method may become the best tool. Indeed, this approach could eliminate important issues related to potentially correct endogeneity, heteroscedasticity, autocorrelation and correlation between all independent variables (Arellano & Bond, 1991; Blundell & Bond, 1998). Hence, we employ this approach as the alternative econometric method to further test our findings in this sub-section. The results are described in the table 5.

We first re-perform the baseline model in Model (1), and we then re-run this model with dividing VAIC into its components in Model (2). Again, the evidence demonstrates that the coefficient of both VAIC and SCE is positive and statistical significance at the 1% level. Also, the impact of HCE is similar to the previous finding. In short, the chief role of both VAIC and SCE in boosting non-interest incomes of banks almost withstands through various robust tests employed.

Table 5
GMM Approach

VARIABLES	(1) Baseline model	(2) Different components of VAIC
L.NII	0.246**	0.274**
	(0.120)	(0.114)
VAIC	0.151***	
	(0.0421)	
CEE		-0.00150
		(0.433)
HCE		-0.256*
		(0.137)
SCE		2.834***
		(0.772)
SIZE	0.922***	0.872***
	(0.176)	(0.167)
CAPITAL	-1.180	-1.336
	(0.925)	(1.190)
EBLTA	19.24***	17.27**
	(6.200)	(7.060)
LLR	2.114	1.671
	(1.508)	(1.322)
GDPR	-2.794***	-1.995**
	(0.797)	(0.860)
INFL	0.767	1.016*
	(0.638)	(0.612)
Constant	-9.531***	-9.237***

	(2.422)	(2.308)
AR(2)	0.968	0.899
Wald chi2	240163.61	380287.53
Prob > chi2	0.000	0.000
Observations	322	322
Number of BANK	26	26

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Notes. The table shows our results in which we approach the dynamic panel of system GMM method to test further our previous finding. All variables are winsorized at the 1% and 99% levels. The asterisks ***, **, * denote significance at the 1%, 5%, and 10% level respectively.

5. The Effect of Bank Size

In this section, we would answer the question of whether the impact of VAIC and its component on non-interest incomes has varied in bank size or not. The results are presented in the table 6. Following Le and Nguyen (2020); Phan, Lu, Hoang, et al. (2022); Phan, Lu, & Nguyen (2022), the sample is divided into two groups including: large and small banks. Accordingly, large banks consist of banks with total assets above the median value in the sample. By contrast, small banks include banks with total asset below the median value in the sample. Afterwards, for large banks, we re-run the baseline model and this model with dividing VAIC into components, in Model (1) and Model (2) respectively. In similar way, we re-perform these models for small banks in Model (3) and Model (4).

The evidence reveals that while the impact of structure capital employed remains unchanged in both large and small banks, that of VAIC only has the statistical significance at the 1% level in large banks. At the same time, we observe that the impact of SCE component has higher magnitude in small banks compared with large ones. In addition, the positive impact of capital employed efficiency only appears in large banks. To some extent, these results mean that managers in large banks tend to harness effectively intellectual capital to increase non-interest incomes compared with small banks, whereas structure capital employed contributes to substantial improvement in non-interest income activities in small banks compared to large banks. Also, capital employed efficiency becomes the considerable advantage to assist large banks to rise non-interest incomes.

Table 6
The Role of Bank Size

VARIABLES	(1)	(2)	(3)	(4)
	Large banks		Small banks	
	Baseline model	Different components of VAIC	Baseline model	Different components of VAIC
VAIC	0.233***		0.241	
	(0.0873)		(0.153)	
CEE		1.694***		-0.194
		(0.476)		(0.799)
HCE		-0.108		-0.119
		(0.156)		(0.254)
SCE		1.759*		3.149**
		(0.947)		(1.468)
SIZE	1.257***	1.150***	0.952***	0.979***
	(0.0715)	(0.0586)	(0.174)	(0.169)
CAPITAL	7.215***	11.30***	-3.447	-2.997
	(2.601)	(3.351)	(2.843)	(2.850)
EBLTA	30.04***	15.57	6.450	-0.326
	(8.805)	(9.909)	(18.22)	(18.56)
LLR	0.533	-1.854	6.741***	4.492*
	(1.979)	(1.399)	(2.309)	(2.506)
GDPR	-0.0121	-1.262	-15.29*	-15.38*
	(3.345)	(3.010)	(8.038)	(8.016)
INFL	2.722***	3.362***	1.747	2.261
	(1.002)	(0.970)	(1.508)	(1.538)
Constant	-14.79***	-12.82***	-5.282	-6.507

	(1.873)	(1.556)	(4.420)	(4.255)
Observations	201	201	151	151
R-squared	0.780	0.810	0.480	0.492

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

Notes. The table illustrates the effect of bank size on the relation between intellectual capital and non-interest incomes. All variables are winsorized at the 1% and 99% levels. The asterisks ***, **, * denote significance at the 1%, 5%, and 10% level respectively.

6. Conclusion and Future Directions

To survive in the today's world that has become increasingly more competitive and uncertain, managers in banks have to find out the effective way to strengthen and develop business operations. In this backdrop, the knowledge-based management has appeared as one of the best keys to open up new road for sustainable development of banks. On the other hand, the transformation from traditional incomes to non-traditional sources of incomes, which is considered the market-oriented strategy, is seen as the viable step to contribute to expansion of incomes in banks. By exploring the connection between intellectual capital and non-interest incomes of banks, our study would illuminate some important issues in banking functions. Relying on the landscape of an emerging country in Asia Pacific region, the consistent evidence has manifested that IC would play a crucial role in fostering non-interest income activities of banks. When evaluating each component of IC, we find that structure capital employed has been the most important factor to enhance this transformation process in banks. These findings remain unaltered through various robustness tests performed. At the same time, our regression analysis has indicated that large banks seem to harness IC more effectively to improve non-interest incomes in comparison with small banks. Although structure capital employed has contributed to enhancement of non-traditional incomes in both large and small banks, the magnitude of this factor's impact tends to be higher in small banks. Also, these incomes seem to be strongly fueled by capital employed efficiency in large banks. Generally, our findings reaffirm the recent assertions of Singh et al. (2019); Vătămănescu et al. (2019) about the role of IC in business operations of banks these days, and complement a deeper insight into a unique aspect of IC's impact on banking operations in Vietnam that some previous studies have attempted to explore (e.g., Le & Nguyen, 2020; Nguyen & Lu, 2023a, 2023b; Nguyen et al., 2021).

These results may provide some productive implications for decision-makers in Vietnamese banks and perhaps, other emerging countries possessing similar financial fabric. For instance, to expand more into non-interest income activities, managers in large banks should pay special attention to consolidation of capital employed efficiency and enhancement of structure capital employed, such as policies related to financial products and services and promotion campaigns. Meanwhile, managers in small banks should emphasize structure capital employed when building business

strategies for transformation into non-traditional incomes. Because the study's evidence underscores that the more based on the knowledge-based management, the more improvement in non-traditional incomes, managers and directors in banks should take IC as the heart of income diversification strategy in the years to come. Last but not least, regulators and policy-makers should constitute adaptable regulations and frameworks to stimulate innovative environments and then sustain growth and development in the banking system in the coming time.

Regardless of reaping certain benefits from the empirical analysis, our study remains to exist some drawbacks that studies in coming time may build the bridge to fill up. The first drawback is that our paper almost relies on the domestic banks to evaluate the impact of IC, thus the finding may not bring a whole picture of banking system in Vietnam. In this regard, future studies could focus on foreign banks in Vietnam and find out the role of IC to make a comparison with our results. Furthermore, because Vietnam has suffered the outbreak of Covid-19 epidemic that mostly affects all of economic activities, separating the Covid-19 period should be taken into consideration when investigate the relation between IC and banking operations. This approach could dig more into the role of IC in a specifically uncertain period and provide valuable advice for decision-makers and practitioners. Additionally, other industries, especially Fintech firms who are seen as new potential rivals in the financial market with having higher ability of technology leading to directly affect non-traditional incomes of banks should be also paid much attention. This work may bring useful results to managers in the banking industry. It is anticipated that through this study, we would have a chance to open up new route for many studies carried out in coming future in this vital field.

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