

ISSN 2090-3359 (Print)
ISSN 2090-3367 (Online)



Advances in Decision Sciences

Volume 30
Issue 3
September 2026

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How Does Intellectual Capital Reduce Bank Opacity?

New Empirical Exploration from an Emerging Market

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Received: December 8, 2024; First Revision: September 25, 2025;

Last Revision: June 10, 2026; Accepted: June 14, 2026;

Published: July 7, 2026

Abstract

Purpose: The research aims to empirically investigate the linkage between intellectual capital (IC) and bank opacity in an emerging market.

Design/methodology/approach: The paper utilizes a sample of Vietnamese banks over the long period 2006-2020 and applies the extended value-added intellectual coefficient model rather than the conventional approach to measure IC.

Findings: The empirical evidence, with the strong support of various robust tests, demonstrates that IC-rich banks tend to be less opaque. Also, when decomposing IC into its components, the result indicates that structural capital serves as a vital factor in alleviating banks' opaqueness. Additionally, the relational capital, human capital, and capital employed components are associated with reducing opacity in large banks, but this is not true in the case of structural capital. Meanwhile, small banks seemingly leverage structural capital more effectively; nonetheless, quickening capital employed can take its toll on their opacity.

Originality/value: This study is a pioneering empirical exploration to demystify the impact of IC on bank opacity by using the extended value-added intellectual coefficient model based on an emerging market; thus, enriching the understanding of how IC influences bank opacity and offering both theoretical contributions and actionable insights for decision-making.

Implications: The study is limited to Vietnamese banks, which may restrict the generalizability of the findings. Future research could extend the analysis to other emerging and developed markets for broader comparison. The evidence informs decision-making processes for multiple stakeholders. Bank managers can strategically invest in IC to improve transparency, regulators can design more effective disclosure and oversight policies, and investors may incorporate IC considerations into their risk assessment and valuation decisions.

Keywords: Bank Opacity; Intellectual Capital; Banking Industry; Emerging Market

JEL Classifications: G21, G28, O31

1. Introduction

The existing literature asserts that most bank assets are more opaque than those of firms, leading outsiders to considerable difficulty in precisely scrutinizing the financial health of banks (Flannery et al., 2013; Fosu et al., 2017). In the aftermath of the global financial crisis 2007-2009, bank opacity has re-arrested the special attention of both academicians and regulators around the world (Zheng, 2020). On one side, it is witnessing numerous scientific endeavors to pin down how opaqueness exerts banking operations throughout the past two decades, and many of them have underscored the reverberations of opacity in the banking system (Cao & Juelsrud, 2020; Tran et al., 2022). On the other side, there are increasingly urgent calls for enhancement in financial information transparency in the banking industry based on the evidence-based belief that the more transparency, the higher stability (Bouvard et al., 2015; Flannery et al., 2013). This viewpoint is also supported by policy-makers, who desire to improve bank financial disclosure and then encourage market participants in monitoring and disciplining banks' risk behaviors, also known as Pillar III of Basel (Tran et al., 2022). Although a large body of literature has attempted to point out the consequences of opaque banks, there are sparse empirical studies on how to alleviate bank opacity. Against this backdrop, the present study aims to elucidate how intellectual capital (IC) can mitigate bank opacity and identify which elements of IC, such as human capital, structural capital, relational capital, and capital employed efficiency, banks should focus on.

Operating in a knowledge-driven economy, organizations could not neglect intellectual resources in building their business strategies if they desired to achieve sustainable competitive advantage (Alvino et al., 2020; Lu & Nguyen, 2024). Theoretically, IC is usually referred to intangible assets such as employees' knowledge, experiences, and skills (human capital); policies, Information Technology infrastructure, data, information (structural capital); and close relations with multi-stakeholders (relational capital) that are considered inimitable, sparse, and invaluable resources by which enterprises can advance their value-added creation and attain sustainable competitive advantage (Keong Choong, 2008; Stewart & Ruckdeschel, 1998). The central role of IC has also been empirically evidenced in the banking literature, from accelerating financial intermediation activities, improving financial performance, productivity, deposit growth, and cost-effectiveness, to fostering an income diversification strategy (Adesina, 2019; Asutay & Ubaidillah, 2024; Lu & Nguyen, 2023, 2024; Nazir et al., 2021; T. D. Nguyen & Lu, 2024). However, the important linkage between IC and bank opacity is seemingly not well explored. Considering the true fact that both IC and opacity have served as increasingly vital factors in bank operations, it is believed that quantifying the degree to which IC may exert bank opacity would bridge the research gap in the banking and IC literature.

To attain this target, the Vietnamese banking system offers a suitable environment to carry out an empirical analysis. First, the success and sustainability of the Vietnamese economy hinge virtually on how well banks obtain smoothness and sustainable development due to the immaturity of the capital market (Dang & Nguyen, 2023; V. T. Nguyen & Lu, 2024), however, the information transparency of the banking industry in this country is quite inferior to others (Batten & Vo, 2019; Dang & Nguyen, 2024). This assessment has been exemplified in the epitome of a well-known domestic bank (namely, Sai Gon Joint Stock Commercial Bank), in which the major controlling

shareholder was accused of financial manipulation for illegal profits.¹ Furthermore, although some practical approaches, such as requiring banks to apply international criteria in financial reports and listing on the stock exchange, have been undertaken to propel the degree of accessible informativeness in financial disclosure, regulatory capabilities in this nation remain insufficient, and the market discipline is not a priority of bank managers (Dang & Huynh, 2023; Dang & Nguyen, 2023). In addition, becoming a member of the World Trade Organization (WTO) in 2007 has led the Vietnamese banking sector to undergo remarkable reforms, such as lowering regulatory obstacles related to entering the domestic market of foreign banks, which, in turn, may increase competition and uncertainty in the banking market (Dang & Nguyen, 2023; T. V. Nguyen & Lu, 2023). Along with these transformative shifts, both macroeconomic conditions and banking operations have witnessed volatility and vulnerability triggered by some serious events like the global financial crisis of 2007-2009 and the period connected with bad debt and credit booming in Vietnam (Dang & Nguyen, 2023; Phan et al., 2022). Such a less predictable future, married with constant pressure on enhancing transparency, has accentuated a pressing need for discovering a sustainable development roadmap for Vietnamese banks. In this vein, a gradual shift towards an IC-focused orientation can be seen as the first-order necessity for domestic bank managers in the times ahead. Hence, delving deeply into the empirical IC-opacity link is expected to work out mounting problems in Vietnam.

Generally, the empirical result with the strong support from an array of robustness tests denotes that IC-rich banks tend to be less opaque than their counterparts. In other words, banks with higher IC will be less inclined to be involved in financial manipulation, hence, they become relatively more transparent. Among IC's components, structural capital serves as a driving factor for the attenuation of bank opacity. Furthermore, the impact of IC's elements in large banks tends to be markedly different from that in small ones. Specifically, relational capital, human capital, and capital employed efficiency have contributed to a significant reduction in large banks' opacity; however, the opposite is observed in the case of structural capital. Meanwhile, structural capital is leveraged more effectively by small banks, but this is not true in the case of the capital employed element.

The study brings several contributions to both banking and IC literature in the following ways. First, in the confines of the authors' knowledge, the research can be deemed the pioneering empirical analysis to pinpoint the IC-opacity relationship in the banking sector, especially based on the landscape of a bank-dependent economy. As stated earlier, although existing academicians have paid much attention to the impact of opacity on various facets of banking operations, such as bank-risk taking, financial instability, valuation, performance, deposit flows, and lending (Cao & Juelsrud, 2020; Chen et al., 2022; Fosu et al., 2017; Tran et al., 2022; Zheng, 2020), determining the IC-opacity linkage seems to be an important, ignored aspect. Because both theoretical and empirical views have demonstrated the essential role of IC in propelling banks' sustainability development in the dynamic world nowadays, filling this neglected dimension would provide a comprehensive understanding of the way in which IC can incentivize banks to disclose further their financial circumstance, and hence, become less opaque. The second contribution originates from the approach of IC and opacity measurements. For the former, even though many efforts to evaluate the impact of IC have been conducted in the Vietnamese banking sector in recent years, most studies have used the traditional method (the value-added intellectual coefficient (VAIC) model) to measure IC (Le et al., 2022; Lu & Nguyen, 2023; V. T. Nguyen & Lu, 2024), hence they do not yet examine all aspects of

¹ See more information: <https://www.scmp.com/news/asia/southeast-asia/article/3289105/vietnamese-tycoon-truong-my-lans-death-sentence-upheld-over-us12-billion-fraud>, and the discussion of Lu and Nguyen (2024).

IC, especially relational capital. This is also partially true in the banking literature because it is argued that applying the extended VAIC model is relatively sparse (Asutay & Ubaidillah, 2024). In this light, the current study can be seen as one of the rare empirical analyses employing the extended VAIC model in the Vietnamese context. For the latter, while the market-based measure seems to be relatively dominant in the previous studies, the accounting-based method in this research can help clarify specific balance sheet changes whereby banks create opaqueness (Cao & Juelsrud, 2020). Also, most empirical examinations associated with bank opacity in Vietnam tend to apply discretionary loan loss provisions as a proxy for measuring earnings manipulation (Dang & Huynh, 2023; Dang & Nguyen, 2023, 2024). Therefore, utilizing a balance-sheet-based measure makes this paper different from prior studies in the Vietnamese banking industry. The third contribution is that through demystifying the impact of IC and its ingredients on bank opacity as well as using the extended-VAIC model, the research is considered a direct response to prior studies that suggest the future researchers should unveil the role of IC in different aspects of bank operation and contend with the drawback of the original VAIC model, particularly in the landscape of an emerging country (Lu, 2024; Lu & Nguyen, 2023; V. T. Nguyen & Lu, 2024). Eventually, compared to advanced countries, the legal framework and market operation in bank-driven economies are seemingly insufficient (Dang & Huynh, 2023); hence, in addition to the theoretical contributions, our study also provides insights for decision-making processes across key stakeholders. For managers, the IC–opacity nexus offers guidance on strategic investment in intangible assets to improve transparency. Regulators can use this evidence to inform policy decisions on disclosure and supervisory practices, while investors may incorporate IC as a decision-making criterion when evaluating risk, governance quality, and long-term value.

In the next sections, the study will focus on some main points as follows. Section 2 presents the literature review, followed by the theoretical framework and hypothesis development in Section 3. Section 4 details the research methodology, and Section 5 presents the results and analysis. The discussions and conclusions will be presented in Section 6.

2. Literature Review

2.1. Opacity and Bank Operation

The view that banks' assets are inherently opaque compared to those of firms is widely advocated by many existing economists (Flannery et al., 2013; Fosu et al., 2017; Tran et al., 2019). The meaning of “bank opacity” is usually associated with a situation in which outsiders, such as creditors, investors, and shareholders, cannot evaluate the real quality of banks' assets precisely (Flannery et al., 2004). In another aspect, bank opacity is also equal to opaque information, causing the information asymmetry issue between bank managers and financing suppliers (Flannery et al., 2013). The information asymmetry means that bank insiders, such as managers and decision-makers, will have certain advantages in available information compared to outsiders; hence, misinformation can help banks conceal the fact that they are being involved in misbehavior (Zheng, 2020). Generally, according to Dang and Nguyen (2024), three main points incentivize banks to manipulate their financial information. The first motivation comes from the financial circumstances associated with lower performance along with higher risk, while the second results from the urgent need for full compliance with regulations. Also, intricate financial innovations serve as a vital catalyst.

There is a popular tendency in the existing literature towards recognizing the benefits of transparency because the more opaqueness, the higher the funding costs banks suffer (Cao & Juelsrud, 2020; Dang & Nguyen, 2023; Tran et al., 2022). The argument here is that an increase in opacity means outside lenders cannot fully observe and monitor banks' risk behaviors, hence outsiders will assume that opaque banks are associated strongly with riskier activities and will require higher funding costs as a punishment. At the same time, increasing funding costs may make banks engage further in risky businesses, resulting in an augmentation of bank instability. In addition, financing providers can punish opaque banks by withdrawing or canceling present or intended funding, which also leads banks to be more unstable.

Accordingly, the adverse consequences of opacity in the banking sector have been manifested in enormous empirical investigations, from amplifying realized risk and instability (Cao & Juelsrud, 2020; Tran et al., 2022), damaging bank stability through the inhibition of monitoring efforts of outsiders and market discipline (Bushman & Williams, 2012), to hurting bank lending (Zheng, 2020). Although the theoretical viewpoints on bank opacity remain a contentious issue (Dang et al., 2017; Flannery et al., 2013), it should be acknowledged that, irrespective of whether opaqueness is considered "the good" or "the bad", it increasingly plays an imperative role in banks' management and operation (Zheng, 2020), particularly in a less predictable world. Indeed, some studies underscore that when the business conditions become more and more uncertain, banks will distort further their financial reports, and hence, information asymmetry between bank insiders and financing suppliers can be amplified substantially (Jin et al., 2019). Unsurprisingly, there are certain efforts to pinpoint how to narrow down this asymmetry. For example, Jiang et al. (2016) find that increasing competition through lowering regulatory barriers has a certain contribution to lessening bank opacity. Nonetheless, there is no doubt that the IC-opacity link remains an unexplored area in the banking industry. Given the true fact that Vietnam is witnessing epidemic cases related to manipulating financial information in banks, along with undergoing regulatory reforms to match international standards in an unpredictable economic environment across the world, exploring this linkage is expected to provide insightful knowledge for both scholars and regulators.

2.2. Role of IC in Banking Industry

Although the interpretation of IC does not yet reach a consensus among economists, fundamentally, IC is regularly referred to as intangible resources, including human capital (such as skills, experiences, and knowledge of individuals), structural capital (such as policies, procedures, networks, infrastructure and systems), and relational capital (such as close relations with multi-stakeholders) (Keong Choong, 2008). From the theoretical views, IC has widely been acknowledged as a crucial energy for organizations to generate added value and attain competitiveness and sustainable development, especially in a dynamic and knowledge-based economy (Alvino et al., 2020; Stewart & Ruckdeschel, 1998). Since serving as financial service providers, a shift from relying on tangible assets towards leveraging intangible resources can be deemed a necessary navigation for banks to create new banking amenities to fulfill market demands immediately (Adesina, 2019; V. T. Nguyen & Lu, 2024).

Empirically, based on the resource-based view, most studies in the banking sphere have centered around the nexus between IC measured by the traditional model, namely the VAIC model, and various dimensions of bank operations. This model, developed by Pulic (2000, 2004), totalizes three

main ingredients: human capital, structural capital, and capital employed, suggesting that relational capital is not yet determined (Lu & Nguyen, 2024; Ulum et al., 2014). In this light, there are scientific efforts to address this limitation by adding some components, such as relation or innovation, into the original model; however, using these expanded approaches is relatively sparse in the banking industry (Asutay & Ubaidillah, 2024).

Generally, the bright side of IC's role in banks has been evidenced by many empirical investigations. Indeed, most studies have highlighted the positive association between IC and financial performance (Le & Nguyen, 2020; Nazir et al., 2021), diversification strategies (Lu & Nguyen, 2024), financial intermediation activities, and deposit growth (T. D. Nguyen & Lu, 2024; V. T. Nguyen & Lu, 2024), and technical, allocative, cost efficiency (Adesina, 2019; Le et al., 2022). Nonetheless, the impacts of IC's components are quite different in empirical findings. Specifically, while the positive role of human capital has been observed in numerous studies (Adesina, 2019; Le & Nguyen, 2020), others tend to support the capital employed component (Lu & Nguyen, 2024; V. T. Nguyen & Lu, 2024). Meanwhile, the recent research of Asutay and Ubaidillah (2024) suggests that these components above spur banks' financial performance, but it does not examine the effects of relational capital and structural capital. In contrast, Ur Rehman et al. (2022) find the positive influences of both relational and structural components, along with the adverse impact of human capital. Hence, the effects of IC's ingredients seemingly remain an open question. To sum up, the driving force of IC for different business activities of banks has been empirically unlocked by many scholars; nonetheless, it is undeniable that the IC-opacity nexus is not yet fully evaluated. In this vein, digging deeply into this evaluation would broaden a new horizon on IC-based strategy in the banking literature, and contribute to further enlightenment about the impacts of IC's elements that have not yet been fully explored.

3. Theoretical Framework and Hypothesis Development

Theoretically, the existing literature suggests that the conflict of interest between firm insiders, who possess certain advantages of information, and financing outsiders can be handled by leveraging performance measurement systems (Jensen & Meckling, 1976). Generally, the performance of organizations can be deemed as a combination of harnessing both tangible and intangible resources (Zéghal & Maaloul, 2010). Against the backdrop of a knowledge era, a shift of focus from a production-driven to a knowledge-led economy will underscore a crucial role of IC in the value-added creation of institutions (Alvino et al., 2020; Lu & Nguyen, 2024; V. T. Nguyen & Lu, 2024). Lotfi et al. (2022) argue that institutions possessing better IC performance will accomplish more economic benefits and stay in superior financial positions, suggesting that they are less engaged in fraud in financial information. These authors evidence that IC is negatively connected with fraudulent behaviors of companies in publicizing their financial conditions. The preceding study of Nuryaman et al. (2019) indicates that earnings management activities can be reduced by utilizing IC. Based on these findings, it is reasonably expected that as leveraging IC makes the prospects for performance brighter and narrows down the conflict of interest between banks and their financing suppliers, bank managers will have less incentive to distort their financial information, leading to reduced opacity. Accordingly, the authors hypothesize that:

H1: IC will contribute to the reduction in bank opacity.

IC-rich institutions will possess managers and employees with higher competencies, experiences, and accountability; hence, these characteristics embedded in human capital are expected to not only steer banks towards success in the financial market but also tighten their discipline on moral codes, ethical values, and social accountability. Accordingly, human capital can herald a lower degree of agency costs and operational risks for outsiders like auditors (Watts & Zimmerman, 1990). The recent research of Salehi, Asadian et al. (2023) demonstrates that human capital can mitigate audit risks by lowering agency costs and operational risks of companies. Oradi et al. (2020) assert that a CEO with higher financial knowledge can help firms alleviate the weakness of internal control. Based on the aforementioned discussion, the authors hypothesize that:

H2: Human capital will contribute to the reduction in bank opacity.

The structural capital component can minimize the agent-principal cost issues through enhanced internal controls and performance, leading banks to be less engaged in financial manipulation and consequently become less opaque. The recent finding of Salehi, Asadian et al. (2023) affirms that this component can improve internal controls by establishing well-tailored operational procedures and, consequently, help firms reduce their audit fee stickiness. Relying on the corporate governance perspective, Lotfi et al. (2022) argue that fraudulent activities related to financial reports can be minimized by the efficiency of internal controls. These authors' empirical analysis indicates that this element has a negative association with fraud in the financial information of firms. The previous study of Nuryaman et al. (2019) empirically evidences that structural capital can mitigate firms' earnings management practices. Given these findings, the authors hypothesize that:

H3: Structural capital will contribute to the reduction in bank opacity.

Along with that, relational capital is expected to tighten up an ethical relationship between institutions and their clientele, leading managers to be less involved in fraudulent behaviors (Lotfi et al., 2022). To gain well-established relationships with multi-stakeholders such as customers, suppliers, and shareholders, managers not only satisfy outsiders' economic values but also keep an eye on preserving the institution's image. Hence, managers tend to comply with moral codes, ethical values, and other social responsibilities required by customers and other outsiders. This compliance, in turn, will ensure the sustainable wealth of organizations in the long term and generate valid profitability for shareholders (Lotfi et al., 2022). The existing literature confirms that this component reduces problems related to the agency costs, resulting in a decrease in audit fee stickiness and fraudulent financial disclosure practices (Lotfi et al., 2022; Salehi, Asadian et al., 2023), and spurs business performance (Ur Rehman et al., 2022). In this light, the authors hypothesize that:

H4: Relational capital will contribute to the reduction in bank opacity.

Finally, IC measurement cannot ignore the capital employed component that also contributes to value-added creation (Pulic, 2004). The role of this component in enhancing bank performance has been widely highlighted in the existing literature (Lu & Nguyen, 2024; V. T. Nguyen & Lu, 2024). Moreover, the recent research finds that this component can serve as a reducing role in fraud in the financial information of firms and earnings management practices (Lotfi et al., 2022; Nuryaman et al., 2019). Therefore, it is expected that an enhancement in this component can deter banks from manipulating their financial information. Regarding the final correlation, the authors hypothesize that:

H5: Capital employed will contribute to the reduction in bank opacity.

4. Research Methodology

4.1. Data

In this research, a data set of Vietnamese commercial banks is used to investigate the aforementioned hypotheses. It should be noted that the Vietnamese banking sector contains two kinds: policy-oriented and commercial banks. Because operations and purposes of the former differ significantly from the latter, the current analysis focuses only on commercial banks. This approach is also found in some empirical studies based on the Vietnamese context in the IC literature (Lu & Nguyen, 2024; T. D. Nguyen & Lu, 2024; V. T. Nguyen & Lu, 2024). There are two main sources of data. The first comes from the financial statements that are disclosed yearly by banks, and the second originates from the database of the World Bank when the study controls macro conditions. After eliminating banks that do not disclose required financial information, especially expenditures related to measuring IC, the research sample encompasses 26 commercial banks over the period 2006-2020, suggesting that our annual data achieves around 380 observations.

It is noteworthy that this period is opted for analyzing since it captures major changes in the banking industry and the Vietnamese economy as a whole, from the adoption of international standards to be aligned with Basel requirements, the advent of new potential competitors like international financial institutions, fueled by joining the WTO, technology-oriented development, to booming bad debt (Dang & Huynh, 2023; Lu, 2024, 2025; T. D. Nguyen & Lu, 2024). Such paradigm shifts, to some degree, may exert both IC and bank opacity in this country. At the same time, compared to other studies in the IC banking literature, our analysis is based on approximately 380 bank-year observations, ensuring the representativeness of the research sample. For instance, Buallay et al. (2020) employ 59 banks during 5 years with around 295 observations, Duho and Onumah (2019) examine 23 Ghanaian banks between 2000 and 2015 with about 356 observations, Neves and Proença (2021) empirically investigate 12 Portuguese banks during the period 2009-2016 with more or less 96 observations, and others. Moreover, when compared with the entire banking industry in Vietnam, the total assets of the chosen banks make up approximately 70% (Lu, 2024; T. D. Nguyen & Lu, 2024). Hence, our sample is highly representative.

4.2. Variables

IC measurement

As suggested earlier, while the traditional measure, namely the VAIC model developed by Pulic (2000), seemingly remains a favorable means to calculate IC in the banking industry, so far, approaching the extended VAIC model (EVAIC) is relatively rare. One of the demerits of the original model is that it does not yet capture relational capital as mooted by the theoretical studies (Asutay & Ubaidillah, 2024; V. T. Nguyen & Lu, 2024). In this vein, EVAIC is proposed to fulfill this ignored aspect. EVAIC reflects the degree of efficiency of using intellectual resources; hence, an augmentation of this proxy means that banks leverage IC more effectively. In this research, this proxy serves as an independent variable of interest. Accordingly, following the prior works of Asutay and Ubaidillah (2024), Lu and Nguyen (2024), and Ulum et al. (2014), EVAIC is formulated as follows:

$$EVAIC_{it} = HCEC_{it} + SCEC_{it} + RCEC_{it} + CEEC_{it}, \quad (1)$$

where $EVAIC_{it}$ is the intellectual capital measured by the extended VAIC model, $HCEC_{it}$ represents human capital, $SCEC_{it}$ denotes structural capital, $RCEC_{it}$ is relational capital, and $CEEC_{it}$ is capital employed of $bank_i$ in $year_t$.

$$VA_{it} = OI_{it} + P_{it} + AD_{it}, \quad (2)$$

where VA_{it} presents the value added of $bank_i$ in $year_t$. OI_{it} , P_{it} , and AD_{it} are operating income, expenditures related to personnel, and, amortization and depreciation costs, respectively, of $bank_i$ in $year_t$.

$$HCEC_{it} = \frac{VA_{it}}{E_{it}}, \quad (3)$$

where $HCEC_{it}$ presents the human capital of $bank_i$ in $year_t$, E_{it} presents all salaries, wages and other similar items of $bank_i$ in $year_t$, and VA_{it} presents the value added of $bank_i$ in $year_t$.

$$SCEC_{it} = \frac{VA_{it} - E_{it}}{VA_{it}}, \quad (4)$$

where $SCEC_{it}$, VA_{it} , and E_{it} present the structural capital, the value added, and all employee costs, respectively, of $bank_i$ in $year_t$.

$$RCEC_{it} = \frac{MC_{it}}{VA_{it}}, \quad (5)$$

where $RCEC_{it}$, VA_{it} , and MC_{it} present the relational capital, the value added, and all marketing costs, respectively, of $bank_i$ in $year_t$.

$$CEEC_{it} = \frac{VA_{it}}{C_{it}}, \quad (6)$$

where $CEEC_{it}$, VA_{it} , and C_{it} present the capital employed, the value added, and book value of equity, respectively, of $bank_i$ in $year_t$.

Bank opacity measurement

According to Cao and Juelsrud (2020), bank opacity generally results from two sources. The first comes from an insufficiency of information about the bank asset quality, and the second arises from the existing information that is so difficult for financing suppliers to scrutinize the banks' financial health. Hence, it is not straightforward to measure bank opacity precisely. In fact, there are two main approaches to formulating bank opacity, including market-based and accounting-based indicators. Accordingly, while the former is usually performed by many researchers (e.g., Flannery et al., 2004, 2013; Fosu et al., 2017) because it can be seen as a good means to capturing the view of market participants on bank risk-taking and predicting effectively financing suppliers' reactions to banks' risk behaviors, the latter acts as a helpful tool to evaluate the major source of bank opacity that is reflected into the ways by which banks allocate their investments in a wide range of assets with

different opacity levels (Cao & Juelsrud, 2020). On the other hand, as mooted in Section 1, many empirical investigations based on the Vietnamese banking industry tend to approach discretionary loan loss provisions as a proxy for measuring earnings manipulation (Dang & Huynh, 2023; Dang & Nguyen, 2023, 2024). Therefore, determining banks' balance sheet opacity is expected to make the current analysis distinct from others in Vietnam.

Following the recent work of Cao and Juelsrud (2020), this research applies the ratio of available-for-sale securities over total assets (AFSR) as the proxy for measuring bank opacity. This measurement contains some merits. For instance, it is quite simple because the information disclosed by banks is readily available and provides an immediate understanding of the bank's profits and losses in equity. Also, it helps evaluate the major source of bank opacity that is reflected in how banks allocate their investments in a wide range of assets with different opacity levels. Furthermore, determining balance sheet opacity makes the current analysis different from others in Vietnam (Dang & Nguyen, 2023, 2024). Increasing this indicator means that financing providers can easily evaluate the financial conditions of banks, and consequently, banks are less opaque (Fuster & Vickery, 2018).

Control variables

Based on the existing studies in the IC-banking literature (Dang & Nguyen, 2024; Lu & Nguyen, 2023; V. T. Nguyen & Lu, 2024; Tran et al., 2022), the current investigation also controls various bank-specific characteristics. More specifically, these variables consist of the (natural) logarithm of assets (ASSET) and other indicators such as capital to total assets (CAPR), total profits before taxes, provisions recognized in income to total gross assets (RETURN), and loan loss reserve ratio (LLRR). Table 1 provides the detailed information about the variables mentioned above.

Table 1. Variables Interpretation

Variables	Interpretation
<i>Dependent variable</i>	
AFSR	The ratio of available-for-sale securities over total assets
<i>Main explanatory variables</i>	
EVAIC and its components	EVAIC is the intellectual capital of banks and is measured by the extended value-added intellectual coefficient model. This proxy totals four components, including human capital (HCEC), structural capital (SCEC), relational capital (RCEC), and capital employed (CEEC). EVAIC and its components serve as the main explanatory variables in the empirical models. The detailed calculation is illustrated in Equations 1 - 6.
<i>Bank-specific controls</i>	
ASSET	The (natural) logarithm of bank assets
CAPR	The ratio of equity over bank assets
LLRR	The ratio of the loan loss reserve
RETURN	The ratio of profits before taxes, provisions recognized in income to total gross assets

Note: Table 1 illustrates the definition of the dependent, independent, and control variables that are employed in the empirical models. The main independent variables are the extended VAIC model (EVAIC) and its components: HCEC, SCEC, RCEC, and CEEC.

4.3. Empirical Method

The association between IC, its element, and bank opacity is analyzed by the following empirical models:

$$AFSR_{it} = \alpha_i + EVAIC_{it} + Control_{it} + \theta_t + \varepsilon_{it}, \quad (7)$$

where $EVAIC_{it}$ is the intellectual capital of bank_i in year_t and measured by the extended value-added intellectual coefficient model. In Equation 7, this proxy acts as the main explanatory variable.

$AFSR_{it}$ is the ratio of available-for-sale securities over assets of bank_{*i*} in year_{*t*} and acts as the dependent variable in this equation. $Control_{it}$ is a vector of bank-level variables such as ASSET, CAPR, RETURN, and LLRR of bank_{*i*} in year_{*t*}. θ_t and ε_{it} present the time-fixed effect and the error term, respectively.

$$AFSR_{it} = \alpha_i + HCEC_{it} + SCEC_{it} + RCEC_{it} + CEEC_{it} + Control_{it} + \theta_t + \varepsilon_{it}, \quad (8)$$

where $HCEC_{it}$, $SCEC_{it}$, $RCEC_{it}$, and $CEEC_{it}$ are human capital, structural capital, relational capital, and capital employed elements. These proxies act as the main explanatory variables in Equation 8. Similar to Equation 7, $AFSR_{it}$ is the ratio of available-for-sale securities over assets of bank_{*i*} in year_{*t*} and acts as the dependent variable in Equation 8. $Control_{it}$ is a vector of bank-level variables such as ASSET, CAPR, RETURN, and LLRR of bank_{*i*} in year_{*t*}. θ_t and ε_{it} present the time-fixed effect and the error term, respectively.

Additionally, bank-based variables in analysis models are winsorized at the 1st and 99th percentiles to handle the outlier issue. The panel regression analysis will start with performing the ordinary least squares (OLS). Afterward, to ensure the findings are robust, an array of robustness tests will be employed. These tests include all one-year lagged independent variables and alternative econometric methods such as the Prais-Winsten and the system generalized method of moments (GMM). The advantages of these approaches will be explained when we perform a series of tests in Subsection 4.2. Table 2 below presents the descriptive statistics and correlation matrix. As the information shows, among IC's elements, the highest score is observed in the case of HCEC, which is aligned with most existing studies in the IC-banking literature (Asutay & Ubaidillah, 2024; Le et al., 2022; Lu & Nguyen, 2024; V. T. Nguyen & Lu, 2024).

In the Appendix section, we apply the Im–Pesaran–Shin (IPS) unit root test proposed by Im et al. (2003) to examine the stationarity properties of the dependent and independent variables in the baseline regression model. The Im–Pesaran–Shin (IPS) unit root test is employed because it is more appropriate for our panel data setting, allowing for heterogeneity in the autoregressive coefficients across cross-sectional units. Moreover, the IPS test considers the alternative hypothesis that at least a fraction of the series is stationary, making it more flexible and empirically relevant. The results indicate that the null hypothesis of a unit root is rejected at the 1% significance level, suggesting that the series is stationary for at least a fraction of cross-sectional units. Therefore, the variables in our baseline model can be used appropriately for analysis.

Table 2. Descriptive statistics and correlation matrix.

Panel A. Descriptive statistics

	(1) Number of observations	(2) Mean	(3) Standard deviation	(4) Minimum	(5) Maximum
AFSR	374	0.043	0.047	0.001	0.225
EVAIC	378	3.463	1.002	0.809	6.678
HCEC	378	2.463	0.785	1.001	5.467
CEEC	380	0.391	0.226	0.047	0.946
SCEC	380	0.554	0.148	0.001	0.831
RCEC	380	0.058	0.143	0.001	0.904
ASSET	380	24.94	1.448	20.840	27.910
CAPR	380	0.110	0.071	0.042	0.462
LLRR	379	-0.009	0.043	-0.274	0.032

RETURN	380	0.018	0.010	0.000	0.060
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Panel B. Correlation matrix

Variables	AFSR	EVAIC	ASSET	CAPR	RETURN	LLRR
AFSR	1.000					
EVAIC	-0.030 (0.561)	1.000				
ASSET	0.037 (0.470)	0.210* (0.000)	1.000			
CAPR	-0.030 (0.565)	0.007 (0.885)	-0.710* (0.000)	1.000		
RETURN	-0.132* (0.010)	0.693* (0.000)	0.037 (0.471)	0.291* (0.000)	1.000	
LLRR	-0.230* (0.000)	0.363* (0.000)	-0.082 (0.110)	0.132* (0.010)	0.287* (0.000)	1.000

Note: Table 2 denotes the information about descriptive statistics (Panel A) and correlation matrix (Panel B). Bank-level variables are winsorized at the 1st and 99th percentiles to minimize the outlier issue. There are around 26 banks in the sample covering the period 2006–2020. P-values are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

5. Results and Analysis

5.1. Baseline Findings

The subsection will elucidate the regression results, focusing mainly on the main correlation between IC, its elements, and opacity. These findings are presented in detail in Table 3.²

Table 3. Baseline Findings

	(1) Baseline model	(2) Macro control	(3) IC's components	(4) Adding macro variables
EVAIC	0.0103*** (0.0032)	0.0101*** (0.0033)		
CEEC			-0.0230 (0.0189)	-0.0243 (0.0188)
HCEC			0.0003 (0.0059)	-0.0005 (0.0062)
SCEC			0.0774** (0.0360)	0.0808** (0.0377)
RCEC			0.0417 (0.0265)	0.0421 (0.0271)
ASSET	0.0023 (0.0024)	0.0025 (0.0025)	0.0045 (0.0027)	0.0049* (0.0028)
CAPR	0.0921 (0.0597)	0.0941 (0.0609)	0.0699 (0.0590)	0.0718 (0.0603)
RETURN	-1.1690*** (0.3040)	-1.1600*** (0.3080)	-0.9280*** (0.3110)	-0.9110*** (0.3070)

Note: All estimations were performed using heteroskedasticity-robust standard errors (Huber–White correction) to account for potential non-constant error variance. Also, standard diagnostic checks were performed on our baseline models. Diagnostic tests confirm the absence of model misspecification (Ramsey RESET test: $p = 0.2867$ for column 1 and $p = 0.4455$ for column 3). Although the Skewness–Kurtosis test indicates some deviation from normality ($\chi^2(2) = 81.89$, $p < 0.001$ for column 1 and $\chi^2(2) = 79.11$, $p < 0.001$ for column 3), the OLS estimates remain consistent. Given the relatively large sample size ($n = 371$), the Central Limit Theorem (CLT) applies, ensuring that the OLS estimators are asymptotically normal. Therefore, our statistical inference remains valid (Wooldridge, 2010).

LLRR	-0.2720*** (0.0517)	-0.2720*** (0.0543)	-0.2690*** (0.0569)	-0.2710*** (0.0614)
GDPGR		0.1180 (0.2380)		0.1720 (0.2270)
INFLR		0.0057 (0.0518)		0.0110 (0.0527)
Constant	-0.0412 (0.0632)	-0.0548 (0.0711)	-0.0992 (0.0682)	-0.1210 (0.0749)
Observations	371	371	371	371
R-squared	0.0820	0.0830	0.0970	0.0990

Note: Table 3 illustrates the baseline results focusing mainly on the IC-opacity linkage (models 1 to 3), and the correlation between IC's components and bank opacity (models 4 and 5). The Baltagi–Wu LBI test for serial correlation yields statistics of 0.9506 for column 1 and 0.9582 for column 3, indicating the presence of AR(1) disturbances ($p < 0.01$).

Robust standard errors in parentheses: * Significance at 10%; ** significance at 5% level; *** significance at 1%.

First, in order to pin down the relationship between IC and bank opacity, the current research starts with regressing Equation 7. Looking at column 1, also labeled as Baseline model, the multiple regression analysis shows that the coefficient of IC (measured by EVAIC) is positive and statistically significant at 1% ($\beta=0.0103$), suggesting an increase in IC will augment available-for-sale securities (measured by AFSR). As mentioned before, the augmentation of these assets will help investors and lenders more easily assess the bank's financial health, leading banks to be less opaque. In this case, a linear association between two proxies: EVAIC-AFSR means that IC can serve as an alleviating role in bank opacity, hence the baseline regression result tends to advocate Hypothesis 1.

In column 2, both bank-level and macroeconomic variables are controlled. Controlling macro variables, including the rate of GDP growth and inflation, is necessary since several studies highlight that the adverse impact of opacity on banking operations may vary depending on macroeconomic conditions (Cao & Juelsrud, 2020; Zheng, 2020). It is observed that the effect of EVAIC on AFSR is very similar to the finding illustrated in the previous two columns. Hence, Hypothesis 1 is continuously supported, meaning that an enhancement in IC results in a reduction in bank opacity.

Next, to determine the link between IC's components and bank opacity, Equation 8 will be regressed. The result in column 3 shows that among four components, only structural capital (measured by SCEC) is positive and statistically significant at 5% ($\beta=0.0774$). Similarly, when macro variables are controlled in the last column, while the impact of SCEC also remains unaltered, that of other components is not statistically significant. So far, it can be said that banks possessing higher structural capital may expand further their available-for-sale security holdings, leading to reduced opacity. Therefore, Hypothesis 3 is tested; however, the current analysis until now does not find evidence to support other hypotheses related to other elements.

It should be noted that to address serial correlation in our panel data, we employ the locally best invariant (LBI) test proposed by Baltagi and Wu (1999) rather than the conventional Durbin–Watson test because unlike the Durbin–Watson statistic, which is designed for time series with equally spaced observations, the Baltagi–Wu test is specifically developed for panel data with AR(1) disturbances and unequally spaced time dimensions. This makes it a more efficient and reliable procedure in panel settings, as it accommodates both cross-sectional heterogeneity and irregular time structures that are common in applied economic data. Accordingly, we test the autocorrelation in the panel residuals for our baseline model (columns 1 and 3) by using the LBI test implemented via “xtregar with rhotype (dw)” in Stata application. The results show a significantly positive estimated

autocorrelation coefficient, confirming the presence of first-order serial correlation. Hence, this reinforces the need for applying robustness checks like the Prais–Winsten estimator illustrated in the next subsection.³

In short, the preliminary evidence underscores that IC-intensive banks tend to enlarge their holdings of available-for-sale securities. Because these assets allow financing suppliers to scrutinize banks' financial health easily and effectively, this enlargement will make banks less opaque. Hence, increasing IC can reduce bank opacity, supporting Hypothesis 1. Regarding IC's elements, the initial finding suggests that structural capital is the unique and most important factor that reduces bank opacity, advocating Hypothesis 3. Before reaching the final conclusion, an array of tests will be performed in the next subsection.

5.2. An Array of Robustness Tests

In order to tackle the concern about whether the preliminary findings are robust, the current analysis applies three different approaches as follows. First, all variables in the empirical models will be lagged one year. This strategy is probably important because it can help address concerns related to intra-period reverse causality and endogeneity; besides, the impact of IC may take some time to be observed (Cao & Juelsrud, 2020; Lu & Nguyen, 2024; V. T. Nguyen & Lu, 2024). Second, an alternative econometric method, namely Prais-Winsten estimation, is used as an additional test. This method is quite useful since it effectively corrects for the problem of correlated error terms in a linear regression model, specifically when the errors follow a first-order autoregressive pattern (AR(1)) (Tran et al., 2022). Finally, the robustness test will end up with the system GMM method, which can be utilized as a popular estimation to handle the endogeneity as well as heteroscedasticity between independent variables in both IC and bank opacity literature (Dang & Huynh, 2023; Le & Nguyen, 2020; V. T. Nguyen & Lu, 2024; Tran et al., 2022). The testing results are depicted in Table 4.

The analysis commences with regressing Equations 7 and 8 by lagging all variables one year, and the results are illustrated in columns 1 and 2, respectively. Looking at these columns, it is easy to see that the impacts of both EVAIC and SCEC on AFSR are again positive; however, their magnitude and statistical significance level are lower than the preceding findings. Specifically, the coefficient of EVAIC is around 0.0065 at the 5% statistical significance level, while that of SCEC stands at about 0.0615 at only a 10% level of statistical significance. Meanwhile, the influences of other components remain statistically insignificant. Overall, the findings above are aligned with the baseline results.

Moving to the next two columns, Prais-Winsten estimation shows that a linear correlation between two proxies: EVAIC-AFSR at the 1% statistical significance is again observed, which is consistent with the baseline finding. Besides, the positive impact of SCEC is similar to the previous robustness test. Surprisingly, the capital employed component (measured by CEEC) has a negative impact at a statistical significance level of 1%, contrary to all previous findings. The impacts of other components continue to be statistically insignificant. In the final two columns, when using the system GMM estimation, it is observed that both AR(1) and AR(2) indicators are valid, and both

³ The results from applying Stata show that the estimated autocorrelation coefficient (ρ_{ar}) for columns 1 and 3 is 0.5247 and 0.5209, respectively, indicating that LBI is 0.9506 ($LBI = 2(1 - 0.5247)$) and 0.9582 ($LBI = 2(1 - 0.5209)$). Hence, LBI is far below the benchmark value of 2. In columns 2 and 4, we add macro variables to the baseline model to test our baseline results; thus, it is not necessary to conduct an LBI test here.

EVAIC-AFSR and SCEC-AFSR linkages are positive and statistically significant at 5%. In contrast to the result of the second test, the influence of CEEC is not statistically significant; however, that of relational capital (measured by RCEC) is positive at the statistical significance of 1%. The impact of human capital continues to be elusive.

In general, after performing a series of robust tests, the preliminary results still withstand. Accordingly, an increase in both IC and structural capital components can augment banks' available-for-sale security holdings, which, in turn, reduces bank opacity. Hence, both hypotheses 1 and 3 are supported. Although the impacts of both capital employed and relational capital components, to some extent, are observed, but not persistent. Along with not finding the influence of human capital, the study does not find robust evidence to advocate for the rest of the hypotheses.

Table 4. A Series of tests

	(1)	(2)	(3)	(4)	(5)	(6)
	all variables lagged		Prais-Winsten approach		GMM approach	
	Baseline model	IC's components	Baseline model	IC's components	Baseline model	IC's components
EVAIC	0.0065** (0.0032)		0.0097*** (0.0022)		0.0056** (0.0025)	
CEEC		-0.0290 (0.0187)		-0.0309** (0.0156)		-0.0113 (0.0075)
HCEC		-0.0012 (0.0062)		0.0031 (0.0045)		0.0010 (0.0038)
SCEC		0.0615* (0.0363)		0.0525* (0.0307)		0.0361** (0.0141)
RCEC		0.0368 (0.0301)		0.0497 (0.0393)		0.0386*** (0.0065)
ASSET	0.0048* (0.0025)	0.0073*** (0.0028)	-0.0038 (0.0040)	0.0004 (0.0036)	0.0001 (0.0015)	0.0006 (0.0016)
CAPR	0.1930*** (0.0714)	0.1700** (0.0711)	-0.04930 (0.0457)	-0.0614 (0.0469)	0.0555 (0.0389)	0.0288 (0.0415)
RETURN	-1.0850*** (0.3110)	-0.8080** (0.3310)	-0.7180** (0.2990)	-0.4130 (0.3010)	-0.6420*** (0.2260)	-0.4650** (0.2140)
LLRR	-0.2560*** (0.0556)	-0.2570*** (0.0572)	-0.1010*** (0.0392)	-0.0926** (0.0397)	-0.1370*** (0.0269)	-0.1410*** (0.0323)
L.AFSR					0.5250*** (0.0347)	0.5260*** (0.0325)
Constant	-0.1010 (0.0650)	-0.1670** (0.0721)	0.1170 (0.1030)	0.0124 (0.0932)	-0.0011 (0.0441)	-0.0139 (0.0460)
AR(1)					0.0060	0.0050
AR(2)					0.7420	0.7390
Observations	346	346	371	371	347	347
R-squared	0.0840	0.0980	0.0970	0.1120		

Note: Table 4 illustrates the regression results coming from various robustness tests, such as lagging variables one year in the first two models and alternative econometrics methods: Prais-Winsten in the next two models and System GMM in the final two models. Robust standard errors in parentheses: * Significance at 10%; ** significance at 5% level; *** significance at 1%.

5.3. Influence of Bank Size

The existing empirical evidence tends to support the view that small banks seemingly leverage intellectual resources more effectively than their counterparts, from the expansion of financial intermediation and deposit growth to income diversification strategy (Lu & Nguyen, 2024; T. D. Nguyen & Lu, 2024; V. T. Nguyen & Lu, 2024). On the other side, the adverse impact of opacity is also more evident in large banks than in small ones (Tran et al., 2022). Hence, the investigation in this subsection is to pinpoint whether the IC-opacity linkage is different between large and small banks. Following the studies above, the research sample is segregated into two categories: small and large, in which banks will be labeled as the former if their assets are below the median value, and the rest are named as the latter. Accordingly, the study regresses Equations 7 and 8 based on large and small banks displayed respectively in the first two columns and the final two columns of Table 5.

Generally, the IC-opacity linkage is consistent with preceding findings; however, the impact of IC's components seems to differ substantially between large and small banks. More specifically, although the association between the two main proxies, EVAIC-AFSR, is positive and statistically significant in both groups, the power of statistical significance is stronger in small banks (at a 1% level) than in large ones (at a 5% level). Moreover, while in large banks relational capital and human capital have a positive impact and statistical significance at 1% and 5%, respectively, the influence of these components is statistically insignificant in small banks. Meanwhile, the impact of structural capital and capital employed is completely different between the two groups. In large banks, the former component is negatively associated with the AFSR proxy; however, the opposite association is observed in the case of the latter component (both of them at a 10% level of statistical significance). By contrast, in small banks, the influence of the former and the latter is positive and negative, respectively, at the same 1% level of statistical significance.

To sum up, the empirical examination indicates that the alleviating role of IC in opacity is found in both large and small banks, but the differential impact of IC elements on large and small banks is noteworthy. In large banks, relational, human, and capital employed efficiency are associated with a reduction in opacity. Conversely, structural capital tends to increase opacity. In smaller banks, structural capital is more effectively utilized, while capital employed efficiency exhibits a negative correlation with opacity.

Table 5. Evaluation of Bank Size

	(1)	(2)	(3)	(4)
	large banks		small banks	
EVAIC	0.0126** (0.0060)		0.0178*** (0.0055)	
CEEC		0.0573* (0.0324)		-0.0719*** (0.0271)
HCEC		0.0443** (0.0199)		0.0038 (0.0078)
SCEC		-0.1800* (0.0928)		0.1600*** (0.0534)
RCEC		0.1260*** (0.0474)		0.0038 (0.0207)
ASSET	-0.0009 (0.0055)	-0.0024 (0.0049)	0.0022 (0.0087)	0.0050 (0.0085)
CAPR	0.0267 (0.1510)	0.1920 (0.1850)	0.1310 (0.0825)	0.0876 (0.0771)
RETURN	-1.4580***	-1.7830***	-1.3930**	-1.4010**

	(0.4490)	(0.5590)	(0.6030)	(0.6810)
LLRR	-0.2820***	-0.2850***	-0.2810***	-0.3260***
	(0.0689)	(0.0754)	(0.0907)	(0.1110)
Constant	0.0377	0.0703	-0.0886	-0.1580
	(0.1420)	(0.1190)	(0.2140)	(0.2080)
Observations	204	204	167	167
R-squared	0.1550	0.2180	0.2030	0.2630

Note: Table 5 illustrates the regression results based on the different subsamples: large and small banks. Specifically, Equations 7 and 8 are regressed based on large banks (the first two models) and small ones (the rest of the models) to determine the influence of bank size on the IC-opacity linkage. Robust standard errors in parentheses: * Significance at 10%; ** significance at 5% level; *** significance at 1%.

6. Discussions and Conclusions

Bank opacity remains one of the main concerns of many regulators worldwide, especially the central banks in emerging markets, which have strived to adopt new international standards to enhance the transparency and resilience in the banking system and then encourage market participants to monitor banks' risk behaviors. In this light, to satisfy this desire, Vietnamese regulators have instituted far-reaching reforms in their banking sector; however, financial manipulation is so far an increasingly worrying problem that has partially been reflected in the recent typical case of a local bank (see the introduction section). Given the fact that in a dynamic and unpredictable world nowadays, moving the emphasis towards non-physical resources to generate more added value and gain ahead of the curve may open a sustainable roadmap for banks, empirically exploring the IC-opacity linkage would provide important insights for both Vietnam and other emerging countries to handle the aforementioned concerns. By carrying out the panel regression analysis supported by various sensitivity tests, our evidence strongly proves that banks with high IC become less opaque, meaning that strengthening IC will disincentivize bank managers to engage in financial manipulation, and consequently, banks will be more transparent. When decomposing IC into its four elements, we find that structural capital is the most important factor driving the reduction in bank opacity. Besides, the impact of these four elements seemingly varies significantly between large and small banks. Regarding the former, relational capital, human capital, and capital employed contribute substantially to reduced opacity, while structural capital tends to increase opacity. Meanwhile, the latter seems to benefit more from structural capital; however, the increasing capital employed element has an unintended impact on opacity.

The recent studies evidence that IC can act as an effective measurement to enhance the quality of firms' financial statements, deter them from money laundering activities, and prevent their earnings management (Lotfi et al., 2022; Nuryaman et al., 2019; Salehi et al., 2022). Beyond these findings, the research proves that IC can serve as an alleviating role in bank opacity, meaning that banks with higher IC tend to have lower opacity. Accordingly, this empirical evidence advocates the argument that IC can plug the conflict of interest between inside managers and outside lenders since it generates more added value for multiple stakeholders, spurs business performance, consolidates internal controls, and consequently inhibits institutions from inappropriate financial abuses (e.g, Alvino et al., 2020; Salehi et al., 2022). For IC's components, structural capital emerges as a unique and crucial factor contributing to banks' reduced opaqueness. This finding supports the view that well-tailored operational procedures and effective internal control systems (both related to this component) can minimize institutions' financial misbehaviors (Lotfi et al., 2022; Salehi, Rajaei et al., 2023). Unexpectedly, the regression analysis does not find the impact of human, relational, and

capital employed efficiencies. In the prior study, Lu and Nguyen (2024) argue that a lack of skilled employees may give a reasonable ground for why Vietnamese domestic banks do not yet leverage human capital effectively. This is partially true in our analysis because adopting international criteria to improve banks' transparency requires the preparedness of qualified employees who are experienced and knowledgeable about Basel standards. Moreover, these authors note that the bank-stakeholder relationship may virtually be eroded by some serious events connected with the manipulation of financial information of local banks in recent times. This, in turn, may be mirrored partially in not finding a relational capital-opacity correlation, which is also in line with the result of Asutay and Ubaidillah (2024). Meanwhile, the impact of the capital employed component is not observed. This result is seemingly aligned with Le and Nguyen (2020), who find an inverted U-shaped association between this component and bank performance, and suggest that increasing equity should be taken into account carefully.

On the other side, although the alleviating role of IC in bank opacity is quite similar in both large and small banks, the evidence from IC's components lends its support to the argument that the larger banks possess the sufficiency of required experience and knowledge to manage their risks and operations compared to their counterparts, and they usually suffer higher pressure coming from market discipline and monitoring efforts of external agents (Freixas et al., 2007). Consequently, these banks are less involved in misbehaviors and risky businesses (Dang & Huynh, 2023). More specifically, except for structural capital, all components contribute to reducing opacity in large banks, while small ones only leverage structural capital effectively and suffer an unexpected impact from capital employed. This finding partially reflects the consequences of quickly increasing small banks' equity to meet Basel requirements. Also, large banks seem to have less incentive to refine their operational procedures and improve their infrastructure (Lu & Nguyen, 2024), hence they do not yet harness structural capital more effectively than their counterparts.

There are some implications springing from the aforementioned findings. First, since IC is related to reducing bank opacity, policy-makers should institute new IC-oriented regulations that encourage banks to further disclose their IC performance. This will not only help financing suppliers evaluate banks' business operations and opacity more easily and effectively, but also address the agency conflicts (Lotfi et al., 2022). Furthermore, local banks should pay special attention to structural capital, such as internal control systems and operational procedures, to minimize opaque issues, especially in large banks, because they seem to endure the adverse impact of this component. Additionally, small banks should take their physical capital into account to mitigate the unintended influence of this element. Along with that, these banks cannot ignore other components, such as human capital and relational capital, because these components are not yet leveraged effectively like large banks. Therefore, in the coming future, they should develop their human resources proactively by connecting closely with educational institutions and foreign partners; besides, they need to herald a strong pledge to obey social responsibilities and other ethical values desired by their clientele and communities. Such navigation will, in turn, support them to not only polish their image and sustain their wealth in the long term, but also prevent opportunistic managers from being involved in discretionary behaviors and financial manipulation (Lotfi et al., 2022; Salehi et al., 2022).

In nature, the study has the following limitations. First, although the sample covers a long period, it should be acknowledged that it does not yet contain the COVID-19-incurred period in Vietnam. Hence, future researchers should expand the sample to determine the extent to which IC may dilute

the COVID-induced consequences on banks' businesses. Furthermore, regardless of employing the extended VAIC model to measure IC, which can help us capture the ignored aspect, namely the relational capital, this measurement does not yet reflect other elements of IC, especially the innovation capital of banks. In this vein, it is hoped that future studies can approach alternative methods to handle this drawback, for example, utilizing research and development (R&D) investments to determine banks' innovation capital and then re-investigating our findings. Despite the robustness of our empirical findings, this study acknowledges certain methodological boundaries that offer avenues for future inquiry. While we have addressed the issues of stationarity and model specification using standard diagnostics, future research could benefit from adopting more advanced nonlinearity tests (e.g., Bai et al., 2018; Hui et al., 2017) to further explore the complex functional forms of bank opacity. Additionally, the recent literature highlights the risk of spuriousness even in stationary regressions, suggesting that the integration of specialized remedies could provide even deeper layers of reliability (e.g., Cheng et al., 2021; Wong et al., 2024a, 2024b; Wong & Pham, 2023, 2025a, 2025b; Wong & Yue, 2024). Future studies might also consider the implications of autoregressive noise and nearly non-stationary series to extend the validity of intellectual capital models across different market cycles (see Cheng et al., 2022; Wong & Pham, 2022). Finally, while the adverse impact of increasing bank opacity has been accentuated by numerous studies, the moderating role of IC in the relationship between opacity and other banking operations should be investigated carefully. For example, Vietnamese researchers can puzzle out whether IC can mitigate the negative consequence of opacity on banks' funding costs or dig further into the moderating role of IC in the opacity-deposit and the opacity-risk linkages. We leave these suggestions as future research directions for academicians to discover in the coming times. Given the true fact that both opacity and IC are very important in banks' businesses nowadays, the authors strongly hope that the current research will lay a sound foundation for many studies to explore further both factors in the banking industry in the future.

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Appendix

Table A1. The Im–Pesaran–Shin (IPS) unit root test

Variables	IPS Statistic (t-bar)	P-value	Stationarity Result
AFSR	-2.9126	0.0018	Stationary (1% level)
EVAIC	-6.9855	0.0000	Stationary (1% level)
HCEC	-7.8403	0.0000	Stationary (1% level)
CEEC	-6.9396	0.0000	Stationary (1% level)
SCEC	-7.7072	0.0000	Stationary (1% level)
RCEC	-2.6232	0.0000	Stationary (1% level)
ASSET	-2.4728	0.0067	Stationary (1% level)
CAPR	-3.9203	0.0000	Stationary (1% level)
LLRR	-4.6282	0.0000	Stationary (1% level)
RETURN	-3.6983	0.0001	Stationary (1% level)

Note: This table reports the results of the Im–Pesaran–Shin unit root test for the dependent and independent variables in our baseline model. The results show that all variables are stationary at the 1% significance level, thus they can be directly used in the regression model.