DOI: https://doi.org/10.37075/EA.2025.3.10 Economic Alternatives, 2025, Issue 3, pp. 815-844

Financial Access and Transitional Economy Productivity: Is Faster Better?

Received: 27.05.2024
Available online: 30.09.2025

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Abstract

This study provides empirical evidence concerning the impact of financial access on total factor productivity (TFP) and its components in a transitioning nation (i.e., Vietnam). The results reveal a U-shaped relationship between financial access and TFP. This implies that the rapid rise of financial access in an economy characterized by informal sectors, high cash usage, and substantial state bank control, as in Vietnam, may result in costs outweighing the benefits. Notably, the study affirms the positive moderating role of institutional quality on the nexus being examined, while the application of information and communication technology (ICT) might exacerbate pre-existing risks in the financial market when the population accesses financial services to excess. The study's findings are reinforced by addressing endogeneity, cross-sectional dependence, and heteroscedasticity concerns through estimations utilizing the two-step generalized method of moments (GMM) system, a panel-corrected standard error estimator (PCSE), and feasible generalized least squares (FGLS) estimators. Consequently, these research findings offer a more in-depth insight for policymakers and researchers regarding the impact of financial inclusion on the economy, particularly in transitioning nations.

Keywords: Financial Access, Financial Inclusion, Total Factor Productivity (TFP), Transitioning Economies

JEL: D24, O16, O47

1. Introduction

Financial inclusion has been recognized as a significant facilitator contributing to 7 out of the 17 Sustainable Development Goals. Over the past two decades, abundant theoretical and empirical evidence has underscored its implications for social equity, poverty reduction, and economic growth (Demirgüç-Kunt & Singer, 2017; Sarma & Pais, 2011; Swamy, 2014). Among these factors, financial access (a key dimension of financial inclusion) has been debated regarding its influence on economic efficiency. On the one hand, theoretical and empirical research supports a positive correlation between financial access and economic growth through (i) reducing transaction costs, (ii) enhancing financial intermediary services (Sarma & Pais, 2011), (iii) optimizing the

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allocation of public goods in the economy through increased taxation (Mitchell et al., 2019), and (iv) augmenting productive investments in local enterprises (Le et al., 2019). Conversely, rapid growth in financial access can lead to adverse consequences for the economy, particularly for people with low incomes and those in highly informal sectors (Bateman, 2019; Butcher & Galbraith, 2019; Hembruff & Soederberg, 2019; Mader, 2018). These discussions raise the critical question whether expanding financial inclusion for the population yields more or fewer benefits compared to the costs it incurs.

A significant observation is the wealth of research supporting the notion that increased financial access leads to economic improvement, utilizing samples from developed nations or global data where data from developing countries is less represented (Dang et al., 2019). Conversely, studies taking the opposite view focus on less developed regions, concentrating on specific aspects of financial services, e.g., in Ghana (Adomako et al., 2016), in Kenya (Musau et al., 2018a, 2018b), and in other developing countries (Gathergood, 2012; Mader, 2018; Mansour et al., 2022; Saleh & Mansour, 2024). Thus, this study presents empirical evidence in the context of a transitioning country, Vietnam, which has experienced rapid growth across multiple dimensions, offering a more comprehensive perspective on the relationship under examination. Notably, this study's analytical unit comprises 63 provinces/cities in Vietnam, presenting advantageous material for assessing causality: (i) provincial policy independent of centralized policies, known as an "independent laboratory," (ii) rapid changes in socio-economic indicators where financial and economic factors allow for the examination of significant data fluctuations in a short period, and (iii) uniformity among provinces/cities regarding other characteristics (Van Le & Tran, 2022; Van Le et al., 2022), allowing the elimination of unobserved factors that typically pose challenges when considering global data samples.

The study makes several key contributions. *First*, it presents fresh evidence of the effect of financial access on economic efficiency in transitioning economies (i.e., Vietnam). Accordingly, economic efficiency is measured through the total factor productivity (TFP) index, decomposed into various component indices using an advanced technique proposed by O'Donnell (2018). *Second*, given the breakdown of TFP, this study explains the mechanism of financial access on various aspects of efficiency (e.g., scale efficiency and technical efficiency) within the economy, thus offering further insight into the disparate empirical outcomes observed across diverse contexts. *Third*, the study examines the moderating influence of contextual factors (i.e., institutions and the adoption of information and communication technology [ICT]) on the nexus, thereby providing pertinent implications for policymakers and researchers. Thus, the findings in the current study supplement empirical evidence on the impact of the relationship between financial access (one of the three primary aspects of financial inclusion) and economic performance. Interestingly, closely observing the dynamics of this nexus in the context of transitioning countries partly explains the inconsistent results between financial access and representative economic indices across nations (Le et al., 2019; Mader, 2018). Furthermore, in light of one of the biggest financial frauds in Southeast Asia (in which real estate tycoon Trương Mỹ Lan siphoned

off $12.46 billion in Vietnam),[2] this study verifies the systemic financial risks when financial access for all individuals is rashly allowed.

The findings indicate that, *first*, the relationship between financial access and TFP and its components is nonlinear (i.e., an inverted U shape). Accordingly, the financial access index (FAI) positively influences economic efficiency as long as it remains within the financial capacity of the nation. *Second*, sound institutional quality enhances the positive relationship between the FAI and TFP up to a certain threshold. This is explained by efficient financial access growth under good institutional arrangements promoting "learning by doing" capabilities among provinces/cities (reflected through technical efficiency), for instance, integrating formal financial services among provinces and efficiently distributing resources to businesses. *Third*, conversely, ICT adoption amplifies risks when financial access surpasses given thresholds, reducing allocative scale and technical efficiency.

The remainder of the paper is structured as follows. Section 2 delineates the distinction between the terms—financial access and financial inclusion—utilized in this study and presents a discussion related to the impact of financial access on economic efficiency. Section 3 details the experimental model, TFP index decomposition methodology, and relevant data. Section 4 presents the research findings, while Section 5 suggests and discusses policy implications.

2. Literature review

2.1. Financial access and financial inclusion

The term "financial inclusion" used in various discussions exhibits a degree of inconsistency across different literature sources. In certain studies (Ozili, 2021), authors refer to financial inclusion merely as the process of broadening access to financial services. For instance, *"financial inclusion (i.e., opening a bank account) may translate to higher financial risk (e.g. non-performing loans) especially for account owners who take loans from lending institutions"* (Ozili, 2021, p. 904). Similarly, Honohan (2008) measured financial inclusion by statistically estimating the percentage of the adult population/households possessing a bank account within an economy. Going further, Aziz and Naima (2021) addressed the concept of "financial inclusion" more broadly as accessibility (financial access), effectiveness (via financial literacy), and affordability. Similarly, the World Bank Group (2023, p. 1) emphasizes that *"financial inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way."* Likewise, Sarma (2008, p. i) avers that *"financial inclusion, [as defined in this paper], is the ease of access, availability and usage of the formal financial system by all members of the economy."*

In theoretical terms, the majority of studies understand the (digital) financial inclusion index to be based on three fundamental pillars: (i) accessibility, (ii) affordability, and (iii) efficiency (Demirguc-Kunt et al., 2018;

[2] https://asianews.network/trial-begins-in-largest-financial-fraud-case-in-vietnam/

Demirgüç-Kunt et al., 2022; Demirgüç-Kunt & Klapper, 2012b; Demirgüç-Kunt et al., 2015). In empirical contexts, however, the proxies used to reflect this definition are inconsistent. While a considerable portion of studies employs the Global Findex — which illuminates the utilization levels and trends of diverse financial services globally and among distinct demographics, such as impoverished individuals, youth, and women — as a well-attuned indicator for this definition (Allen et al., 2016; Demirgüç-Kunt & Klapper, 2013; Demirguc-Kunt et al., 2018), some studies instead gauge the extent of financial access within an economy (Honohan, 2008; Kim et al., 2018; Ozili, 2021).

Furthermore, studies focusing on constructing and measuring financial inclusion at the micro or sub-national level often address only the supply aspect of financial services, failing to consider affordability and efficiency due to comprehensive data limitations (Tran & Dinh, 2021). The clear differentiation between financial access and financial inclusion is critical for various reasons. As emphasized by Demirgüç-Kunt and Klapper (2013, p. 6), *"access most often refers to the supply of services, whereas use [financial inclusion] is determined by demand as well as supply factors."* For instance, Tahiri Jouti (2018) illustrates that individuals may have access to the financial system but refrain from utilizing it due to a lack of trust in financial institutions or due to religious beliefs. Similarly, while observing commercial banks in Kenya, Musau et al. (2018a, 2018b) added that enhancing financial access by augmenting their customer base, deposits, and loan accounts led to an increase in nonperforming loans, adversely affecting the stability of commercial banks in Kenya. Therefore, throughout the remainder of this paper, we consistently define expanded financial inclusion as growth in the three pillars of financial services for individuals: (a) accessibility, (b) affordability, and (c) efficiency, and we consider financial access as an aspect of financial inclusion that reflects the extent to which individuals have access to financial services. Practical measurements of financial inclusion indices at the national level have predominantly revolved around the Global Findex, while empirical studies at cross-princes or individual levels have yet to demonstrate consistency.

2.2. Financial access on economic efficiency

Financial access as a driver of economic growth

Extensive evidence substantiates the positive impact of financial inclusion on economic performance across various regions, demographics, and mechanisms (Estrada et al., 2010; Pradhan et al., 2021; Sarma & Pais, 2011; Sharma, 2016; Swamy, 2014). Specifically, financial access stands out as a significant factor in the alleviation of poverty and inequality (Omar & Inaba, 2020), leading to increased savings among farmers (Demirgüç-Kunt & Singer, 2017), contributing additional tax revenue for governments (Mitchell et al., 2019), enhancing the quantity, quality, and efficiency of financial intermediary services (Sarma & Pais, 2011), and fostering increased productive investments in local businesses (Le et al., 2019), subsequently boosting productivity and economic growth. For instance, access to bank accounts results in heightened savings among farmers, thus boosting agricultural output due to investments in more advanced equipment. The amplified savings, moreover, generate a larger pool of capital within localities, subsequently

increasing productive investments in local businesses.

Demirgüç-Kunt and Singer (2017) assert that financial access plays a pivotal role in supporting daily livelihoods, facilitating the formation of long-term financial plans, and addressing unexpected emergencies for families and businesses. Moreover, initial bank account ownership allows individuals to access various other financial services within the financial system (e.g., insurance, credit facilities, risk management, and investments in education or healthcare). Access to branch banking enhances economic efficiency by enabling individuals and businesses to secure microloans through visits to nearby bank branches, acquiring funds for consumption and entrepreneurial endeavors, as envisaged by the original 'branch-banking theory of change' (Mader, 2018).

Consequently, Kim et al. (2018) conclude that, on an economic scale overall, financial access (measured by automated teller machines per 100,000 adults, bank branches per 100,000 adults, deposit accounts with commercial banks per 1,000 adults, borrowers from commercial banks per 1,000 adults, and life insurance premium volume to GDP) has a positive effect on economic growth. Rizzo (2014) affirms that digital finance is a potent tool to broaden access beyond financial services to other sectors, such as agriculture, transportation, water, health, education, and clean energy. Particularly noteworthy in the context of the COVID-19 pandemic, the utilization of cost-effective digital methods becomes imperative for extending formal financial services to financially marginalized and underserved populations. These services can be customized to their specific needs and delivered in a responsible, affordable manner to customers, while ensuring sustainability for service providers (World Bank Group, 2023).

According to institutional theory (North, 1990; Williamson, 1989), financial inclusion or, more narrowly, financial access, can potentially reduce transaction costs — the source of a country's growth — through several mechanisms. In this regard, robust financial access serves as a facilitator, mitigating various impediments and expenses linked to economic transitions, fostering adaptability, and contributing to smoother socioeconomic change. *First*, enhanced financial access and proficient financial practices afford individuals and enterprises easier access to necessary resources, given proper time and with cheaper information exchange, aiding effective navigation through economic transitions. Access to credit, savings, and insurance offers liquidity and a buffer against financial shocks during transitional periods (Claessens & Perotti, 2007), facilitating smoother transitions.

Second, financial access facilitates risk mitigation, enhancing the management of transition uncertainty and reducing incurred costs (Beck et al., 2007). Improved financial access diminishes information asymmetries and transaction expenses by providing more straightforward access to capital and augmenting market knowledge, thereby streamlining transitions between economic activities (Allen et al., 2011). Furthermore, financial inclusion stimulates investments in human capital through improved access to education and skills development, reducing human capital transition costs and enabling individuals to adapt more readily to evolving economic landscapes (Demirgüç-Kunt & Klapper, 2012a).

Contesting financial access

In contrast, arguments against financial access typically focus on two primary points. The first is that rapid escalation of financial access (from the supply side) compared to actual demand may result in adverse consequences for the welfare of socially vulnerable individuals who cannot anticipate and manage new risks (Mader, 2018). For instance, as observed by Ozili (2020a, 2020b), for individuals, especially the disadvantaged, the transition from physical cash to digital finance products may expose them to serious systemic risks (e.g., market risk, interest rate risk, credit risk, and liquidity risk) and (digital) finance-related risks (e.g., fraud liability, cybercrime, financial distress, credit traps, over-indebtedness, misuse or poor use of credit products). It should be noted that in transitioning economies like Vietnam, the variety of goods that the poor trade in is often limited, including lower-quality products (e.g., goods sold in street vending areas) that are harder to pay for through (digital) financial services.

Hembruff and Soederberg (2019) concur that payday lenders, falling under the micro-finance lending category, not only impose high-interest rates on individuals with low incomes but also establish lending structures that compel those with limited financial resources to depend on these loans to meet their basic needs. This arises from the asymmetry between buyers and sellers in the usage of financial services (Mhlanga, 2021), particularly in the digital era (Dinh et al., 2023). Accordingly, big banks (with more information) might make use of information about customers (who have less power) to manipulate and influence the financial consumption behavior of consumers, rather than conducting discreet business based on consumers' financial data. More critically, the classification of consumers on the basis of their assets when accessing unregulated financial services (e.g., altering just one line of code) leads to high economic costs for efficient resource allocation and social equity.

Turning now to the second point, enhancing financial access (e.g., increased account ownership) in the informal sector (e.g., high nonperforming loans) generates financial risks, while the disparity between informal and formal finances incurs substantial costs for the economy (Casson et al., 2010; Ozili, 2021). Increasing financial access for individuals lacking financial risk mitigation capacities increases the likelihood of financial fraud employing finance tools (e.g., Ponzi schemes or Ponzi-type dynamics in Latin America) (Butcher & Galbraith, 2019). Another risk highlighted by Bateman (2019) emerges from the possibility of financial elites within nations leveraging diverse strategies to take advantage, potentially undermining other essential pillars of the economy and society, and consequently eroding the trust of the impoverished (Ozili, 2020a). It should be noted that trust provides a fundamental basis for reducing transaction costs (Chiles & McMackin, 1996; Williamson, 1989). Moreover, excessive expansion of financial services beyond people's needs may generate costs in establishing and maintaining unused accounts, leading to the wastage of resources.

Conditional impact of enhanced financial access on economic performance

The discussion above suggests that the influence of increased financial access on economic performance is contingent upon the financial capacity in the studied region (e.g., the absorptive capacity of impoverished individuals and the transition from informal

services to formal financial services). Barr (2020) and Hakim (2012) emphasize that the effectiveness of digital finance relies on the socioeconomic status of beneficiaries and their willingness to adopt financial technology, a consideration that particularly affects disadvantaged groups compared to affluent and educated individuals. Similarly, Aziz and Naima (2021) conducted a study in Bangladesh, finding that social support and formal and informal support-seeking behaviors significantly influence the adoption and utilization of financial digital technologies. These scholars suggest that influential social figures can motivate and educate individuals by sharing financial resources and information.

Furthermore, Adomako et al. (2016) affirm that financial literacy moderates the relationship between finance accessibility and firm growth in Ghana. They also indicate that increased credit access for small and medium-sized enterprises (SMEs) can mitigate financial risks by reducing non-performing loans (NPLs) and the likelihood of default by financial institutions (Morgan & Pontines, 2014). In Kenya, efforts to expand the customer base, deposits, and loan accounts of commercial banks led to an increase in non-performing loans, negatively affecting the stability of these banks (Musau et al., 2018a, 2018b). Studying 48 firms listed from 2009 to 2019 in Palestine, Saleh et al. (2022) provide evidence concerning the moderating role of CEO power in the positive correlation between institutional ownership and the performance of listed companies, whereas foreign ownership may engender adverse dynamics (Saleh & Mansour, 2024). Similarly, the influence of CEO political connections and experience on the effectiveness of corporate performance is affirmed (Saleh et al., 2020). In Jordan, Mansour et al. (2022) utilize data from non-financial listed firms from 2014 to 2019 to confirm that capital structure (represented by the ratio of total debt to total assets) moderates the relationship between the quality of corporate governance and firm performance.

Notably, Gathergood (2012) and Mader (2018) argue that an excessive focus on credit without self-control heightens exposure to various risks, fostering over-indebtedness, hampering women's empowerment, and results in excessive fixed-cost spending, leaving insufficient funds for small businesses and individuals, and providing inadequate education for micro-borrowers regarding the consequences of loan defaults. Concerns also arise about the rapid growth of digital finance, raising fears that regulators may struggle to fully monitor and control the digital finance ecosystem (Zetsche et al., 2017). Also, the impact of financial access on economic performance hinges on consumer protection capacities within the respective countries (e.g., through personal data protection laws, anti-monopoly measures, or transparent penalty mechanisms) (Dinh et al., 2023; Kriese et al., 2019) and its timing (De Koker & Jentzsch, 2013).

Several key aspects have emerged in the present state of scholarly inquiry regarding the impact of financial access on economic performance. *First*, there needs to be a greater utilization of the concepts of financial access and financial inclusion across empirical studies. This study refers to financial access delineated as the supply of financial services, while financial inclusion encompasses three facets: (i) accessibility, (ii) affordability, and (iii) efficiency, comprising both demand and supply factors.

Second, while financial inclusion exhibits positive effects on economic performance,

financial access yields heterogeneous effects on economic performance for distinct target groups (e.g., the impoverished) across different contexts (e.g., formal versus informal sectors and performing versus non-performing loans), contingent upon the financial capacity of the respective nation. *Third*, financial access might have a delayed effect on economic performance, and the adoption of technology (e.g., digital finance) could be considered an amplifying factor that accentuates the complexities of financial access. In other words, digitalization amplifies both the advantages and disadvantages of financial access to the economy.

Moreover, research on transitioning countries emphasizes caution in rapidly expanding certain financial services due to variances in the economic structure of the economy. For instance, Fungáčová and Weill (2015) observe that formal credit usage is less prevalent in China than in other BRICS countries because borrowing practices rely predominantly on familial or social networks. Consequently, when considering limited financial capacity (e.g., financial literacy), some studies have labelled the swift expansion of financial access as "extreme financial inclusion" (Ozili, 2021).

Hypothesis 1: Financial access continues to have a positive impact on economic performance until it surpasses a certain threshold, contingent upon the financial capacity of the respective region.

Hypothesis 2: Contextual factors (e.g., digitalization and institutional frameworks) may magnify both the benefits and risks of financial access on economic performance.

3. Methodology and data

3.1. Empirical strategy

This study builds upon prior empirical research that evaluates the impact of financial inclusion/financial access on economic performance (Estrada et al., 2010; Kim et al., 2018; Kriese et al., 2019; Swamy, 2014). The model is structured as follows:

$$Y_{it} = \underbrace{\beta_1 FAI_{i,t}}_{=\sum_{j=1}^{J} \text{Eigenvalue of PC}_j \times \text{Proportion}_j} + \sum_{m=1}^{m} \delta_m Z_{m,i,t} + \theta_i + \lambda t + \varepsilon_{i,t} \quad (1)$$

where Y_{it} represents the economic efficiency indicator in province i during period t. We have chosen total factor productivity (TFP) as the specific metric in this study. Total factor productivity (TFP) is a more robust proxy for economic performance than conventional measures like gross domestic product (GDP) or GDP growth, due to its ability to encompass efficiency gains and technological advances that contribute to sustainable economic development. While GDP quantifies the overall market value of goods and services produced within an economy, it cannot accommodate changes in output resulting from enhancements in efficiency, innovation, or technological advances (Caselli & Feyrer, 2007; Jorgenson & Griliches, 1967). According to the argument made by (Gomme & Rupert, 2007), TFP comprehensively embodies the impact of innovation, managerial practices, and technological advances that drive prolonged economic expansion, making it a more holistic gauge of economic performance than GDP or GDP growth alone. Notably, this paper applies the advanced methodology proposed by O'Donnell (2018) that enables the decomposition of TFP into component indices

reflecting different aspects of growth (e.g., allocative scale and technical efficiency).

FAI_{it} denotes the degree of financial access adapted to the feasible data context of Vietnam by constructing an index based on the method proposed by Tran and Dinh (2021). Accordingly, we established a composite index comprising five components that gauge the extent of access to financial services: (i) possession of a bank account, (ii) possession of savings books, (iii) possession of an ATM card, (iv) possession of a credit card, and (v) possession of a stock account. The determination of weights was carried out by rotating the dataset and synthesizing it, using principal component analysis (PCA). Accordingly, the five components of financial access were transformed into principal components (PC), which include their eigenvalue and proportion (i.e., they are treated as weights in the index computation) (see more in Appendix [1]). Data collected from the Vietnamese Household Living Standard Survey (VHLSS) includes information at the household level. Thus, we aggregated it to the provincial level and merged it with the general statistical yearbook dataset for each province i in year t as an observation. The advantage of this approach lies in its ability to examine the level of accessibility to financial services at the household level while still controlling for various characteristics at the sub-national level (Z).

Z denotes the local control variable identified through previous studies, encompassing educational attainment (Grohmann et al., 2018), the multidimensional poverty level, private sector development (Van Le & Tran, 2022; Van Le et al., 2022), information and communication technology (ICT) applications (Le & Tran, 2023), and institutional quality (represented by the Provincial Competitiveness Index [PCI]) (Van et al., 2021). θ denotes fixed effects, describing unobservable invariant factors of provinces/cities that could affect TFP (e.g., historical background, ethnicity, and legal origin). λt and ε signify time trends and error terms. Thus, the empirical model has the following structure for examining the first hypothesis.

$$Y_{it} = \beta_1 FAI_{i,t} + \beta_2 FAI_{i,t}^2 + \sum_{m=1}^{m} \delta_m Z_{m,i,t} + \theta_i + \lambda t + \varepsilon_{i,t} \quad (2)$$

3.2. TFP decomposition and data preparation

Evaluating productivity and its components at sub-national levels (Njuki et al., 2018; Thanh et al., 2019) reflects the framework established by O'Donnell (2018). Accordingly, researchers have proposed a method to decompose total factor productivity (TFP) changes into (i) an output-oriented technological index (OTI) to measure shifts in technological advancement, broader policy changes, and energy-related aspects; (ii) an output-oriented environmental index (OEI) comprising external environmental variables that influence productivity; (iii) an output-oriented scale efficiency index (OSEI) reflecting the degree of efficacy in utilizing inputs such as labor, capital, and natural resources; (iv) an output-oriented technical efficiency index (OTEI) representing the "learning-by-doing" capability, as proposed by Farrell (1957); and (v) a statistical noise index (SNI) reflecting unobserved changes in the model (e.g., shifts in economic structure that contribute to statistical variations). In economic terms, OSEI combines both allocative and scale efficiency (see more in Appendix [2]). Mathematically, we have:

$$TFPI_{ksit} = \underbrace{\frac{\exp(\lambda t)}{\exp(\lambda s)}}_{OTI} \underbrace{\frac{\exp(\emptyset_i)}{\exp(\emptyset_k)}}_{OEI} \underbrace{\prod_{m=1}^{M}\left(\frac{x_{mit}}{x_{mks}}\right)^{\beta_m\left(\frac{r-1}{r}\right)}}_{OSEI} \underbrace{\frac{\exp(-u_{it})}{\exp(-u_{ks})}}_{OTE} \underbrace{\frac{\exp(v_{it})}{\exp(v_{ks})}}_{SNI} \quad (3)$$

The $TFPI_{ksit}$ represents the ratio of the productivity index in province i during period t over the TFP of province k in period s. u_{it} denotes a non-negative technical efficiency, as Farrell (1957) proposed, indicating the learning-by-doing capability of provinces/cities in disseminating accomplishments among themselves. The error term, represented by v_{it}, encompasses functional errors and unobservable variables, while $\emptyset$ accounts for fixed effects related to unobservable invariant factors, $\sum_{l=1}^{L}\gamma_l = 1$, and $\sum_{m=1}^{M}\beta_m = \text{r}$. $\sum_{m=1}^{M} lnx_{imt}$ comprises standard input variables, including labor, capital, and land, as documented in prior research (Thanh et al., 2019). The data used to compute TFP and its components were collected from general statistical yearbooks and synthesized into Table [1].

Thus, this approach allows for examining the nuanced impact of financial access on various dimensions of efficiency within the economy, focusing mainly on two primary factors: (i) the amalgamation of allocative and scale efficiency and (ii) technical efficiency. To the best of our knowledge, this study represents the first attempt to evaluate the influence of financial access/financial inclusion on these two aspects. The dataset includes information from 63 provinces/cities in Vietnam covering the years 2014, 2016, 2018, and 2019.

4. Results

4.1. Descriptive statistics

Concerning financial access in Vietnam between 2014 and 2019, the average ownership rates among the Vietnamese population for banking accounts, ATM cards, and saving books stood at approximately 22.4%, 32.6%, and 10.8%, respectively. Conversely, the rates for credit card and stock account ownership remained low (i.e., below 3%). According to the World Bank [WB] (2019), the proportion of the population using digital wallets in 2016 was around 15%, while the utilization of online payments in Vietnam constituted only 14% of the average for middle-income countries. Notably, the business sector tends to have a higher level of access to financial services, with 51% of online firms utilizing digital payments, while only 22% of citizens reported receiving digital payments within the past year. According to data from the 2017 Global Findex, 4 million individuals without bank accounts in Vietnam receive government payments in cash, and 72% possess a mobile phone (Demirguc-Kunt et al., 2018).

Current literature highlights the crucial role played by contextual conditions (e.g., formal versus informal finance) and financial capacity (e.g., financial literacy) in the relationship under examination. According to Global Findex, 90% of online purchases in Vietnam were made using cash in 2016, indicating a significant reliance on cash as a means of payment, coupled with rapid growth in cash circulation outside the formal banking system. The average growth rate during the period before the pandemic was 10.5% (2015-2019), followed by growth rates of 11.7% and 13.6% in 2020 and 2021, respectively (General Statistical Office [GSO], 2023). The rising trend in using cash outside formal banking systems may be explained by Vietnamese individuals' cash usage habits (e.g., borrowing from family

Table 1. Descriptive statistics

	Units	Sources	MEAN	SD	MIN	MAX
Dependent variables: TFP and its components						
Total Factor Productivity Index (TFPI)	Standardized to base year 2010 (index 2010=1)	Author's calculations	1.832	0.426	0.836	2.981
Output-oriented Mixed Scale Efficiency Index (OSEI)			0.792	0.057	0.624	0.995
Output-oriented Technical Efficiency Index (OTEI)			1.085	0.237	0.461	1.850
Statistical Noise Index (SNI)			1.000	0.000	1.000	1.000
Gross Regional Domestic Product (GRDP)	Thousand bil VND	General Statistics Office	69.212	122.682	5.160	977.850
Labor	Thousand people		856.838	689.484	205.910	4553.970
Land	Thousand hectares		525.510	365.504	82.300	1649.000
Capita	Thousand bill VND	(*)	231.821	371.139	26.140	2580.896
Financial Access Index and its sub-indexes						
Financial Access Index (FAI)	[0,1]	Author's calculations (PCA technique)	0.245	0.192	0.000	1.000
FAI1: With Bank Account	[0,1]	Index aggregated from the VHLSS dataset	0.224	0.153	0.016	0.799
FAI2: With Savings Books	[0,1]		0.108	0.068	0.013	0.362
FAI3: With ATM card	[0,1]		0.326	0.150	0.063	0.792
FAI4: With credit card	[0,1]		0.022	0.028	0.000	0.187
FAI5: With stock account	[0,1]		0.002	0.004	0.000	0.020
Other variable: Taking a loan	[0,1]		0.194	0.090	0.000	0.510
Control variables						
Provincial Competitive Index (PCI) on logarithm	[0,100]	PCI index	4.116	0.069	3.918	4.296
Literacy	%	General Statistics Office	93.110	6.823	60.200	99.200
Private Sector Labor Share	%		91.468	8.225	44.886	99.281
E government Index: proxy for ICT	z-score	Ministry of Information and Communication	0.000	0.994	-2.541	3.382
ICT application index, overall	z-score		0.000	0.994	-2.044	3.795
Multidimensional Poverty	%	General Statistics Office	11.873	11.626	0.100	60.800
Observation			252.000			

Source: Authors.

Notes: (*) capital stock is not available in existing datasets. Consequently, we applied the formula proposed by Schreyer (2009) to estimate capital stock (K) using investment data as follows: $K_t = (1 - \delta) \times K_{t-1} + I_t$, where K_t and I_t represent capital stock and investment at year t, respectively. The initial-year capital stock (K_0) in the base year, 2002, is calculated as follows: $K_0 = I_0 / (\delta + \theta)$, where θ is the average annual growth rate over the research period, calculated as $= ([\frac{GDP_n}{GDP_0}]^{\frac{1}{n}} - 1) \times 100$; δ represents the depreciation rate.[1]

[1] Available at: https://www.rug.nl/ggdc/productivity/pwt/?lang=en

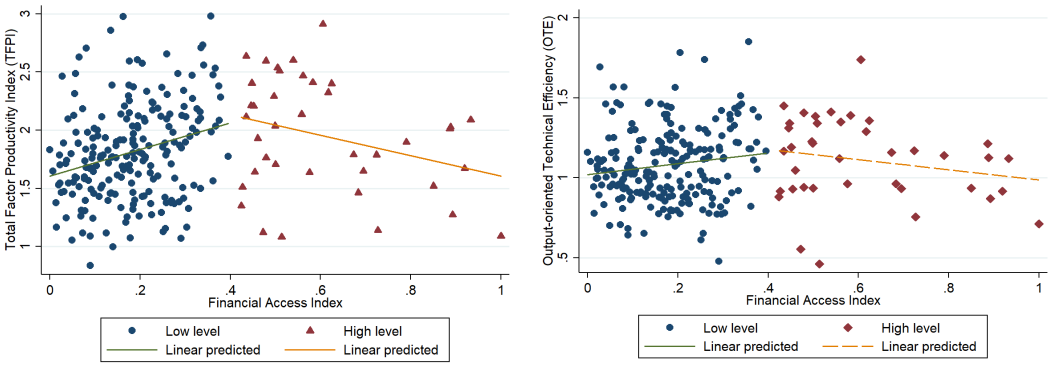

Figure 1. The correlation between the Financial Access Index and TFP and its components
Source: Authors

or relatives) and the limited competitiveness of services offered by the formal banking sector. It is worth noting that (i) the majority of banks in Vietnam are state-owned or state-influenced commercial joint-stock banks (e.g., Vietcombank, BIDV, MBBank, and VietinBank) and (ii) the shadow economy accounts for over 20% of GDP (World Economics, 2023), resulting in unpredictable financial practices (e.g., the zero-dong bank in Vietnam).[3] Moreover, Vietnam's high-quality labor force accounts for only about 10% of the country's workforce, while there are no official statistical data available concerning the level of financial literacy in Vietnam. Consequently, a rapid increase in financial access might lead to unforeseen risks in a transitioning economy.

Figure [1] illustrates the relationship between financial access and TFPI, as well as technical efficiency. In the initial stages, when financial access remains below the 40% threshold, this relationship shows a positive correlation, whereas it exhibits a negative one beyond the threshold. This emphasizes once again the nonlinear nature of the nexus under consideration.

4.2. Primary results

Table [2] examines the relationship between FAI and TFPI along with its components. Columns [1]-[3], employing the OLS estimator, indicate that the impact of FAI does not have statistically significant effects on the outcome variables. OLS estimation may yield biased coefficients if there are unobservable invariant factors influencing the use of various financial services in the model (e.g., ethnicity, geographical characteristics, historical factors). For instance, areas in the delta region tend to be characterized by better digital financial usage due to internet connectivity. Thus, columns [4]-[6] present a fixed-effect estimator that eliminates these factors from the model. The results demonstrate that the impact of FAI on OSEI (reflecting allocative and scale efficiency within the economy) is negative and statistically significant. This finding aligns with studies contesting the rapid expansion of financial access, mainly focusing on impoverished groups, asymmetric information, and regions with high informality (Gathergood,

[3] The "zero-dong bank" is a term applied to Vietnamese banks with negative capital, unable to restructure, and forced by the State Bank of Vietnam (SBV) to be completely acquired with a zero-dong share price.

Table 2. Financial Access Index and TFPI and its components: Linear relationship

Dependent variables	TFPI	OSEI	OTEI	TFP	OSEI	OTEI
Estimator:	OLS	OLS	OLS	FEM	FEM	FEM
	(1)	(2)	(3)	(4)	(5)	(6)
Financial Access Index	0.160	-0.016	0.111	-0.078	-0.032***	-0.041
	(0.172)	(0.022)	(0.093)	(0.122)	(0.011)	(0.062)
PCI on logarithm	1.696**	0.066	0.880**	0.756	0.096**	0.319
	(0.679)	(0.074)	(0.381)	(0.467)	(0.043)	(0.238)
Literacy	-0.009*	0.001	-0.008***	0.006	0.002	0.002
	(0.005)	(0.001)	(0.003)	(0.011)	(0.001)	(0.005)
Private Sector Labor Share	-0.002	0.000	-0.001	-0.001	-0.000	-0.002
	(0.003)	(0.000)	(0.002)	(0.003)	(0.000)	(0.002)
E-government	0.059	0.014***	0.016	0.006	-0.005***	0.011
	(0.039)	(0.005)	(0.023)	(0.016)	(0.001)	(0.008)
ICT application	-0.134***	-0.020***	-0.054*	-0.014	0.006***	-0.024**
	(0.050)	(0.006)	(0.028)	(0.024)	(0.002)	(0.012)
Multidimensional poverty	-0.007*	-0.001	-0.004*	0.007	0.001	0.002
	(0.004)	(0.001)	(0.002)	(0.005)	(0.000)	(0.002)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
ID dummies	No	No	No	Yes	Yes	Yes
Constant	-4.192	0.455	-1.611	-1.958	0.279	-0.229
	(2.933)	(0.320)	(1.659)	(2.153)	(0.199)	(1.096)
Observations	252	252	252	252	252	252
R-squared	0.131	0.205	0.050	0.560	0.815	0.058
Number of years	4	4	4	4	4	4
Number of provinces/cities	63	63	63	63	63	63

Source: Authors.

Notes: The Provincial Competitiveness Index (PCI) reflects the quality of local governance, available from https://pcivietnam.vn/. Multidimensional poverty evaluates various aspects of individuals' well-being, such as income, access to clean water, healthcare, electricity, and other relevant factors. E-government and ICT applications are proxies for measuring the government's and overall economy's ICT utilization, available from the Ministry of Information and Communication. The data was gathered from 63 provinces/cities in Vietnam, in 2014, 2016, 2018, and 2019. Robust standard errors are presented in parentheses, and significance levels are indicated as *** p<0.01, ** p<0.05, * p<0.1.

2012; Hembruff & Soederberg, 2019; Mader, 2018; Ozili, 2020a, 2020b).

Accordingly, the expansion of financial access may raise transaction costs in the economy when (i) older systems (using cash) are incompatible and not integrated with new financial applications, (ii) costs arise from fraud and system errors, (iii) resources are wasted, where the excessive supply of a product does not match with actual demand, and (iv) costs are incurred to rectify information asymmetry, where larger companies often possess more information than their customers. However, the impact of FAI on TFPI and OTEI is statistically insignificant.

Table 3. Financial Access Index and TFPI and its components: Non-linear relationship

Dependent variables	TFPI	OSEI	OTEI	TFP	OSEI	OTEI
Estimator:	OLS	OLS	OLS	FEM	FEM	FEM
	(1)	(2)	(3)	(4)	(5)	(6)
Financial Access Index	1.459***	0.082	0.784***	0.679***	0.041**	0.300***
	(0.424)	(0.057)	(0.247)	(0.212)	(0.020)	(0.109)
Financial Access Index square	-1.500***	-0.113*	-0.777***	-0.980***	-0.094***	-0.441***
	(0.449)	(0.059)	(0.250)	(0.229)	(0.021)	(0.118)
PCI on logarithm	1.698***	0.066	0.882**	0.786*	0.099**	0.332
	(0.648)	(0.073)	(0.368)	(0.447)	(0.041)	(0.230)
Literacy	-0.010**	0.001	-0.008***	0.006	0.002	0.002
	(0.005)	(0.001)	(0.003)	(0.010)	(0.001)	(0.005)
Private Sector Labor Share	-0.000	0.000	-0.001	0.001	0.000	-0.001
	(0.003)	(0.000)	(0.002)	(0.003)	(0.000)	(0.002)
E government	0.070*	0.015***	0.021	0.010	-0.004***	0.013*
	(0.039)	(0.005)	(0.023)	(0.015)	(0.001)	(0.008)
ICT application	-0.136***	-0.021***	-0.055**	-0.024	0.005**	-0.029**
	(0.047)	(0.006)	(0.027)	(0.023)	(0.002)	(0.012)
Multidimensional poverty	-0.005	-0.000	-0.003	0.011**	0.001**	0.004*
	(0.004)	(0.001)	(0.002)	(0.005)	(0.000)	(0.002)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
ID dummies	No	No	No	Yes	Yes	Yes
Constant	-4.338	0.444	-1.686	-2.359	0.241	-0.409
	(2.795)	(0.311)	(1.599)	(2.059)	(0.190)	(1.059)
Observations	252	252	252	252	252	252
R-squared	0.162	0.214	0.077	0.601	0.833	0.127
The thresholds	0.486	0.362	0.504	0.346	0.218	0.340
Number of years	4	4	4	4	4	4
Number of provinces/cities	63	63	63	63	63	63

Source: Authors.

Notes: The Provincial Competitiveness Index (PCI) reflects the quality of local governance, available from https://pcivietnam.vn/. Multidimensional poverty evaluates various aspects of individuals' well-being, such as income, access to clean water, healthcare, electricity, and other relevant factors. E-government and ICT applications are proxies for measuring the government's and overall economy's ICT utilization, available from the Ministry of Information and Communication. The data was gathered from 63 provinces/cities in Vietnam, in 2014, 2016, 2018, and 2019. Robust standard errors are presented in parentheses, and significance levels are indicated as *** p<0.01, ** p<0.05, * p<0.1.

Table [3] presents the nonlinear relationship between FAI and TFPI alongside its components. Interestingly, all models exhibit a consistent inverse U-shaped nexus. These findings, *first*, are consistent with the explanation why two diverging streams of discourse persist concerning the empirical impact of financial access (referred to in some papers as financial inclusion) on socio-economic performance: (i) proponents (e.g., Demirgüç-Kunt and Singer (2017)) and (ii) opponents (e.g., Mader (2018)). Accordingly, opposing arguments often center on the benefits to vulnerable populations and the heterogeneous effects of financial access on individuals within a weak institutional framework or with limited financial literacy. In other words, when the capacity to harness the benefits of financial access for the entire population is lower than the costs it incurs, the impact is negative and vice versa.

Second, in the Vietnamese context (i.e., a transitioning economy), and given the low financial access index, low financial literacy rates, high informality, high cash usage, and restricted financial competition between the public and private sectors, the acceleration of universal financial access is uncertain. Consequently, expanding such access may be positive and statistically significant in the initial stage, whereas in subsequent stages it may be characterized by excessive financialization. The computed threshold values, illustrated in Figure [2], imply that the impact of FAI may differ across various efficiency aspects of the economy.

In the third strand of literature, the impact of FAI on economic performance relies on contextual factors. For instance, within weak institutional frameworks (e.g., in developing countries), the rapid rise of FAI can lead to mismatches in the financial market and incur social costs (Ozili, 2020a, 2020b), mainly in informal sectors (i.e., non-performing loans) (Butcher & Galbraith, 2019; Musau et al., 2018a, 2018b). Another consideration is that while digital finance caters to the financial needs of citizens, it may exacerbate risks due to information asymmetry in the digital financial market (Dinh et al., 2023). Thus, Table [4] illustrates the impact of the interaction between contextual conditions (i.e., institutional setup and technological application) and FAI on TFPI, classified before and after the threshold established in Table [3]. The findings in column [2] indicate that a better institutional setup enhances the effect of FAI on TFP when FAI is below the threshold, whereas the application of ICT exacerbates its adverse impact once FAI surpasses the threshold.

These results bridge two strands of literature. *First*, the positive impact of FAI on economic performance is observed when the institutional environment (proxied by the provincial competitiveness index [PCI]) ensures the application of regulations for labor protection, efficient business support, and predictability in the informal sector. It should be noted that the PCI is an index reflecting the quality of economic governance by provincial authorities in fostering a conducive business environment for private sector development. *Second*, the rapid rise of FAI (from the supply side), which does not stem from actual demand, coupled with weak financial capacity (e.g., financial literacy), raises transaction costs, thereby diminishing economic efficiency. Notably, this effect is amplified by the application of ICT, as confirmed in columns [4] and [6].

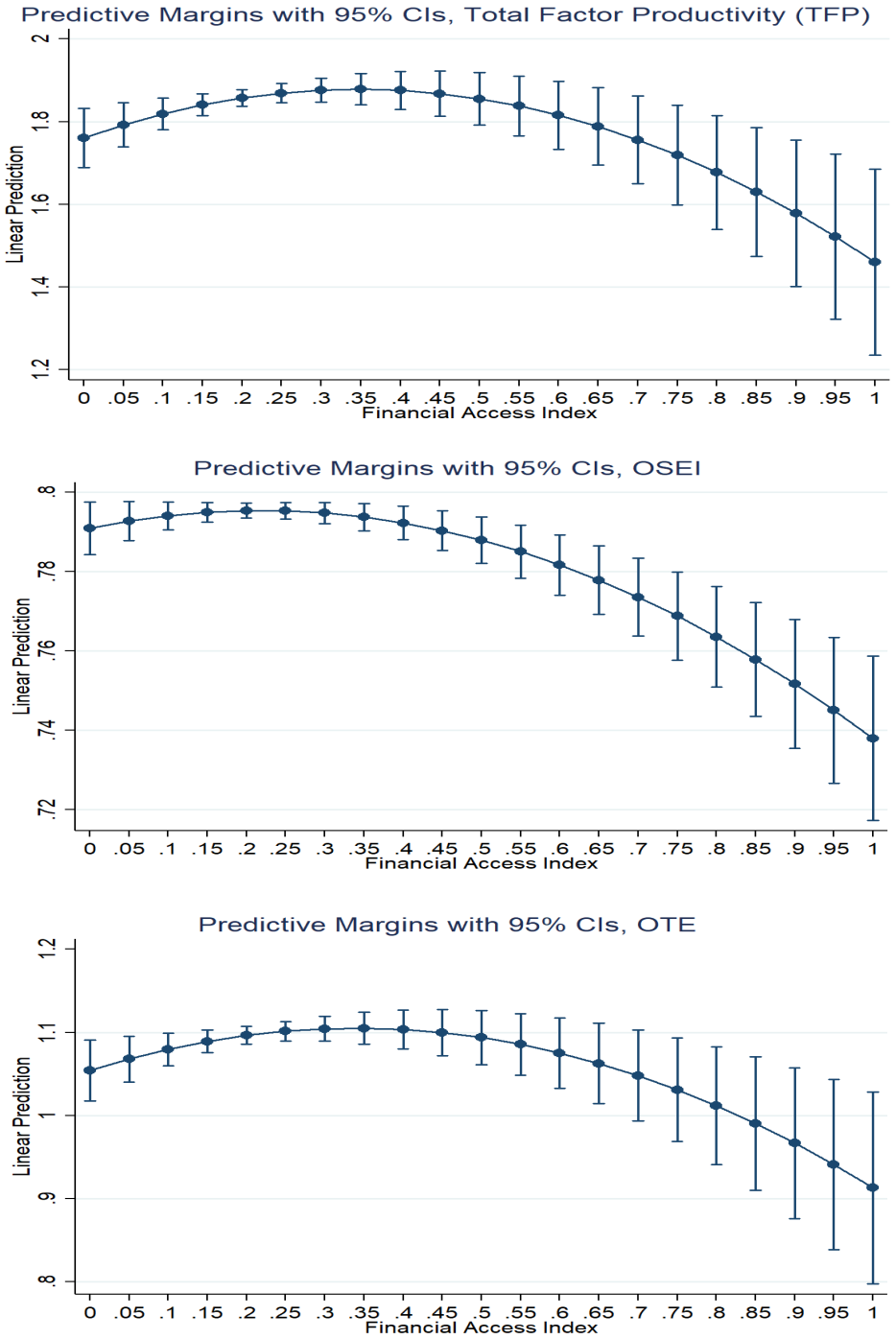

Figure 2. Non-linear relationship between the Financial Access Index and TFP and its components

Source: Authors

Table 4. Financial Access Index and Total Factor Productivity Index: under contextual conditions

Dependent variable:	Total Factor Productivity Index (TFPI)					
Sub-groups:	All sample	Above threshold	Above threshold	All samples	Above threshold	Above threshold
Estimator:	FEM	FEM	FEM	FEM	FEM	FEM
	(1)	(2)	(3)	(4)	(5)	(6)
Financial Access Index	3.667	-22.444**	22.289	0.107	0.128	-0.234
	(4.201)	(9.065)	(15.528)	(0.122)	(0.221)	(0.306)
$\log(PCI)$	0.982*	-0.775	5.902*	0.338	0.052	1.439
	(0.532)	(0.614)	(2.793)	(0.451)	(0.567)	(0.960)
$FAI \times \log(PCI)$	-0.906	**5.540****	-5.549			
	(1.015)	(2.214)	(3.690)			
ICT application	-0.022	0.024	-0.150	0.044*	0.026	0.047
	(0.025)	(0.026)	(0.096)	(0.026)	(0.037)	(0.085)
$FAI \times ICT$ aplication				**-0.294*****	-0.076	**-0.303****
				(0.063)	(0.181)	(0.121)
Literacy	0.007	0.006	0.026	0.005	0.008	-0.019
	(0.011)	(0.010)	(0.092)	(0.010)	(0.011)	(0.055)
Private Sector Labor Share	-0.000	-0.002	-0.009	-0.000	-0.001	-0.009
	(0.004)	(0.004)	(0.021)	(0.003)	(0.004)	(0.011)
E government	0.008	-0.009	0.048	0.016	-0.003	0.066
	(0.016)	(0.016)	(0.063)	(0.015)	(0.017)	(0.047)
Multidimensional poverty	0.010*	-0.002	0.041	0.007	0.005	-0.017
	(0.006)	(0.006)	(0.044)	(0.005)	(0.006)	(0.023)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
ID dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-3.068	4.432	-24.082	-0.238	0.701	-1.194
	(2.488)	(2.805)	(14.131)	(2.070)	(2.541)	(6.389)
Observations	252	203	49	252	185	67
R-squared	0.562	0.594	0.738	0.608	0.539	0.759
Number of provinces/cities	63	59	25	63	58	31

Source: Authors.

Notes: The Provincial Competitiveness Index (PCI) reflects the quality of local governance, available from https://pcivietnam.vn/. Multidimensional poverty evaluates various aspects of individuals' well-being, such as income, access to clean water, healthcare, electricity, and other relevant dimensions. E-government and ICT applications are proxies for measuring the government's and overall economy's ICT utilization, available from the Ministry of Information and Communication. The data was gathered from 63 provinces/cities in Vietnam, in 2014, 2016, 2018, and 2019. The sample division was based on the threshold determined in Table [3]. Robust standard errors are presented in parentheses, and significance levels are indicated as *** p<0.01, ** p<0.05, * p<0.1.

Utilizing the technique of decomposing TFPI into component indices allows for an analysis of FAI's influence on different forms of efficiency within the economy (i.e., allocative scale efficiency reflected through OSEI and technical efficiency, OTEI). Thus, Table [5] presents the effects of the FAI mechanism on TFPI components. Accordingly, column [3] of Table [5] confirms that a more efficient institutional setup fosters better mutual learning among provinces/cities (proxied by OTEI) in Vietnam as financial access increases. Indeed, expanding financial access within an efficient institutional framework enables provinces/cities to integrate swiftly and adapt various forms of payment/savings/credit effectively at the local level. On the other hand, columns [6] and [8] indicate that the rapid adoption of ICT in the financial field diminishes both OSEI and OTEI when FAI exceeds the threshold. This can be explained by observing excessive digital finance in Vietnam, disrupting market signals, and leading to inefficient resource allocation and difficulties in replicating and learning from the successes of other provinces/cities.

4.3. Robustness checks

The results discussed so far may encounter issues related to (i) endogeneity and (ii) cross-sectional dependence and heteroscedasticity. Simultaneous endogeneity, wherein productivity growth may increase resources and lead to increased financial investment, is a primary factor causing endogeneity and biased estimates (Wintoki et al., 2012). Cross-sectional dependence and heteroscedasticity, in our context, indicate that the behavior or attributes of one province/city may be heterogeneously influenced by or associated with the behavior or attributes of others, leading to biased estimates and erroneous inferences (Bailey & Katz, 2011; Liao & Cao, 2013).

Thus, we validate the model through several robustness checks: (i) We examine the reverse causal relationship by replacing FAI at year t with FAI at year $t + 1$ (Table [6]). Accordingly, if the coefficients remain statistically significant, this indicates that the estimates are not valid; (ii) we employ different estimators. Specifically, the two-step system generalized method of moments (GMM) (Blundell & Bond, 1998; Wintoki et al., 2012) is used to address endogeneity, while the panel-corrected standard error estimator (PCSE) (Bailey & Katz, 2011) and the feasible generalized least squares estimator (FGLS) (Liao & Cao, 2013) are utilized to address cross-sectional dependence and heteroscedasticity (Table [7]). It should be noted that the generalized method of moments (GMM) serves as an estimator particularly adept at managing potential endogeneity concerns in the context of panel data analysis, while the two-stage and three-stage least squares (2SLS and 3SLS) methods are commonly employed in research reliant on survey data (Ullah et al., 2018). Also, GMM offers the advantage of addressing dynamic potential endogeneity issues using lagged instrumental variables (Wintoki et al., 2012).

Moreover, to avoid the complexity of the independent variables, we rerun the models using the original components of the financial access index (see Appendix [3]). The outcomes of the robustness checks align with expectations, indicating a consistent non-linear relationship between FAI and economic performance.

Table 5. Financial Access Index and TFP components, under contextual conditions

VARIABLES	OSEI		OTEI		OSEI		OTEI	
Sub-groups:	Below threshold	Above threshold	Below threshold	Above threshold	Below threshold	Above threshold	Below threshold	Above threshold
Estimator:	FEM	FEM	FEM	FEM	FEM	FEM	FEM	FEM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Financial Access Index	-0.793	2.672	-13.466***	9.819	-0.008	0.010	0.061	-0.140
	(0.804)	(1.808)	(4.767)	(7.067)	(0.020)	(0.032)	(0.115)	(0.148)
$\log(PCI)$	0.019	0.799**	-0.451	2.446*	0.037	0.221**	0.079	0.578
	(0.054)	(0.325)	(0.323)	(1.271)	(0.050)	(0.100)	(0.295)	(0.465)
$FAI \times \log(PCI)$	0.192	-0.654	**3.317*** **	-2.453				
	(0.197)	(0.430)	(1.165)	(1.680)				
ICT application	0.007***	0.004	-0.003	-0.080*	0.007**	0.026***	-0.010	-0.001
	(0.002)	(0.011)	(0.014)	(0.044)	(0.003)	(0.009)	(0.019)	(0.041)
$FAI \times ICT$ aplication					-0.012	**-0.040*** **	0.022	**-0.119***
					(0.016)	(0.013)	(0.095)	(0.059)
Literacy	0.002*	-0.007	0.001	0.014	0.002**	-0.004	0.003	-0.017
	(0.001)	(0.011)	(0.005)	(0.042)	(0.001)	(0.006)	(0.006)	(0.026)
Private Sector Labor Share	0.000	-0.001	-0.003	0.000	0.000	-0.001	-0.002	-0.001
	(0.000)	(0.002)	(0.002)	(0.009)	(0.000)	(0.001)	(0.002)	(0.005)
E-government	-0.005***	-0.012	0.003	0.020	-0.004***	-0.006	0.005	0.031
	(0.001)	(0.007)	(0.008)	(0.029)	(0.001)	(0.005)	(0.009)	(0.023)
Multidimensional poverty	0.001**	0.004	-0.003	0.022	0.002***	-0.000	0.001	-0.006
	(0.001)	(0.005)	(0.003)	(0.020)	(0.001)	(0.002)	(0.003)	(0.011)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ID dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.532**	-1.695	3.081**	-10.160	0.425*	0.318	0.652	0.721
	(0.249)	(1.645)	(1.475)	(6.432)	(0.225)	(0.668)	(1.324)	(3.092)
Observations	203	49	203	49	185	67	185	67
R-squared	0.837	0.879	0.126	0.725	0.828	0.900	0.094	0.634
Number of provinces/ cities	59	25	59	25	58	31	58	31

Source: Authors.

Notes: The Provincial Competitiveness Index (PCI) reflects the quality of local governance, available from https://pcivietnam.vn/. Multidimensional poverty evaluates various aspects of individuals' well-being, such as income, access to clean water, healthcare, electricity, and other relevant dimensions. E-government and ICT applications are proxies for measuring the government's and overall economy's ICT utilization, available from the Ministry of Information and Communication. The data was gathered from 63 provinces/cities in Vietnam, in 2014, 2016, 2018, and 2019. The sample division was based on the threshold determined in Table [3]. Robust standard errors are presented in parentheses, and significance levels are indicated as *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Robustness check 1: Verify simultaneous endogeneity

Dependent variables	TFPI	OSEI	OTEI	TFP	OSEI	OTEI
Estimators:	OLS	OLS	OLS	FEM	FEM	FEM
	(1)	(2)	(3)	(4)	(5)	(6)
$Financial\ Access\ Index_{(t+1)}$	0.197	-0.001	0.097	0.485	0.028	0.156
	(0.166)	(0.016)	(0.086)	(0.334)	(0.023)	(0.173)
$Financial\ Access\ Index^2_{(t+1)}$				-0.353	-0.036	-0.071
				(0.355)	(0.024)	(0.184)
PCI on logarithm	0.759	0.079	0.395	0.612	0.067	0.365
	(0.589)	(0.058)	(0.304)	(0.608)	(0.053)	(0.315)
Literacy	0.008	0.002	0.003	0.008	0.002**	0.003
	(0.012)	(0.001)	(0.006)	(0.012)	(0.001)	(0.006)
Private sector labor share	0.002	0.000	-0.000	0.002	-0.000	-0.000
	(0.005)	(0.000)	(0.002)	(0.005)	(0.000)	(0.002)
E government	0.002	-0.005***	0.008	0.001	0.002	0.008
	(0.018)	(0.002)	(0.009)	(0.018)	(0.001)	(0.009)
ICT application	-0.017	0.007**	-0.022	-0.016	-0.002	-0.022
	(0.030)	(0.003)	(0.015)	(0.030)	(0.002)	(0.016)
Multidimensional poverty	0.006	0.001	0.002	0.007	0.000	0.002
	(0.006)	(0.001)	(0.003)	(0.007)	(0.001)	(0.003)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
ID dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-2.429	0.299	-0.779	-1.930	0.293	-0.678
	(2.662)	(0.260)	(1.374)	(2.709)	(0.226)	(1.404)
Observations	189	189	189	189	189	189
R-squared	0.501	0.775	0.054	0.505	0.777	0.056
Number of provinces/cities	63	63	63	63	63	63

Source: Authors.

Notes: The Provincial Competitiveness Index (PCI) reflects the quality of local governance, available from https://pcivietnam.vn/. Multidimensional poverty evaluates various aspects of individuals' well-being, such as income, access to clean water, healthcare, electricity, and other relevant dimensions. E-government and ICT applications are proxies for measuring the government's and overall economy's ICT utilization, available from the Ministry of Information and Communication. The data was gathered from 63 provinces/cities in Vietnam, in 2014, 2016, 2018, and 2019. Robust standard errors are presented in parentheses, and significance levels are indicated as *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Robustness check 2: Different estimators

Dependent variables	TFPI	OSEI	OTEI	TFPI	OSEI	OTEI	TFPI	OSEI	OTEI
Estimators:	GLS	GLS	GLS	PCSE	PCSE	PCSE	GMM	GMM	GMM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Financial Access Index	1.459***	0.082	0.784***	1.459***	0.082***	0.784**	4.749***	0.412***	2.387***
	(0.461)	(0.060)	(0.270)	(0.500)	(0.029)	(0.306)	(1.344)	(0.101)	(0.823)
Financial Access Index square	-1.500***	-0.113*	-0.777***	-1.500***	-0.113***	-0.777***	-6.242***	-0.598***	-2.950***
	(0.490)	(0.063)	(0.286)	(0.450)	(0.019)	(0.262)	(1.617)	(0.130)	(1.009)
PCI on logarithm	1.698**	0.066	0.882**	1.698***	0.066	0.882***	4.802**	0.640***	0.090
	(0.736)	(0.095)	(0.430)	(0.428)	(0.055)	(0.218)	(2.369)	(0.193)	(2.207)
Literacy	-0.010	0.001	-0.008**	-0.010***	0.001***	-0.008***	0.084**	0.006***	0.056***
	(0.007)	(0.001)	(0.004)	(0.003)	(0.000)	(0.001)	(0.032)	(0.002)	(0.018)
Private sector labor share	-0.000	0.000	-0.001	-0.000	0.000	-0.001	-0.001	-0.000	0.006
	(0.004)	(0.000)	(0.002)	(0.003)	(0.000)	(0.001)	(0.007)	(0.001)	(0.007)
E government	0.070*	0.015***	0.021	0.070**	0.015	0.021*	0.193***	0.026***	0.648***
	(0.039)	(0.005)	(0.023)	(0.032)	(0.011)	(0.012)	(0.069)	(0.007)	(0.195)
ICT application	-0.136***	-0.021***	-0.055**	-0.136***	-0.021	-0.055***	-0.212**	-0.032***	-0.542***
	(0.046)	(0.006)	(0.027)	(0.051)	(0.013)	(0.016)	(0.089)	(0.008)	(0.148)
Multidimensional poverty	-0.005	-0.000	-0.003	-0.005*	-0.000	-0.003**	0.050**	0.004**	0.025**
	(0.005)	(0.001)	(0.003)	(0.003)	(0.000)	(0.001)	(0.020)	(0.002)	(0.011)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ID dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.338	0.444	-1.686	-4.338***	0.444*	-1.686**	-17.432	0.073	-17.017
	(3.132)	(0.405)	(1.830)	(1.668)	(0.258)	(0.838)	(20.203)	(1.678)	(17.824)
Observations	252	252	252	252	252	252	189	189	189
Number of provinces/cities	63	63	63	63	63	63	63	63	63
R-squared				0.162	0.214	0.077			
Arellano-Bond test for AR(1)							0.080	0.182	0.235
Hansen test of overid. restrictions							0.122	0.150	0.505

Source: Authors.

Notes: The Provincial Competitiveness Index (PCI) reflects the quality of local governance, available from https://pcivietnam.vn/. Multidimensional poverty evaluates various aspects of individuals' well-being, such as income, access to clean water, healthcare, electricity, and other relevant dimensions. E-government and ICT applications are proxies for measuring the government's and overall economy's ICT utilization, available from the Ministry of Information and Communication. The data was gathered from 63 provinces/cities in Vietnam, in 2014, 2016, 2018, and 2019. Robust standard errors are presented in parentheses, and significance levels are indicated as *** p<0.01, ** p<0.05, * p<0.1

5. Discussion and policy implications

This study presents empirical evidence regarding the impact of financial access on economic performance in the context of a transitioning economy (i.e., Vietnam). The dynamic nature of Vietnam's economy offers an ideal case study to examine this highly debated relationship. Economic performance, measured by total factor productivity (TFP), provides several advantages over traditional indicators (e.g., GDP growth), particularly in this study which employs advanced techniques to decompose TFP into component indices, thereby providing better insight into how the financial access index (FAI) exerts a heterogeneous influence on economic efficiency (i.e., allocative scale efficiency and technical efficiency).

The study's findings show that, at least within the transitioning national context of Vietnam, (i) the effect of financial access on TFP and its components indicates a non-linear relationship (i.e., an inverse U-shaped form); (ii) contextual factors play a significant role in moderating the relationship between FAI and TFP. Accordingly, a well-structured regulatory framework improves the positive influence of financial access on technical efficiency, consequently enhancing TFP. Meanwhile, when FAI surpasses the threshold, the rapid application of information and communication technology (ICT) in the financial field diminishes both allocative scale and technical efficiency. The robustness of endogeneity, cross-sectional dependence, and heteroscedasticity substantiates these results.

These findings partly elucidate why, in more developed countries (with better regulatory frameworks and financial capacity), the impact of financial access on economic performance demonstrates positivity, whereas this relationship is negative in less developed countries. More interestingly, this discovery aids policymakers in transitioning countries to avoid being ensnared in the popular doctrine that advocates promoting digital finance to the entire population. Indeed, while ICT applications can be highly beneficial, they also exacerbate existing economic mismatches. Additionally, experimental studies must exercise caution in employing representative indices measuring financial access with financial inclusion, in which *"… [financial access] most often refers to the supply of services, whereas use [financial inclusion] is determined by demand as well as supply factors"* (Demirgüç-Kunt & Klapper, 2013, p. 6).

So, what lessons remain for policymakers, particularly in Vietnam? We may revisit the case of SCB Bank, from 2012 to 2022, which siphoned off $12.46 billion from customers' deposits and was regarded as one of Southeast Asia's biggest financial fraud cases. National policies to accelerate financial access during this period (e.g., Decision No 1726/QD-TTg in 2016) undoubtedly contributed to this shocking figure of $12.46 billion, catching many observers off guard. While there are undeniable positive aspects to the Vietnamese government's efforts, this study's findings suggest several caveats. *First*, it is essential to ascertain the financial capacity of the economy and pursue a rational approach to enhancing financial access rather than expanding it at any cost. Accordingly, we identify a threshold point for the Financial Access Index (FAI) where the positive impact of FAI on total factor productivity (TFP) remains significant, around 0.4-0.5. The index in major cities (i.e., Ho Chi Minh City and Hanoi) has exceeded this threshold since around 2017. *Second*, to

improve the effectiveness of enhancing FAI for the economy, the government needs to promote institutional quality (represented by the PCI index) and exercise caution in financial matters when implementing information and communication technology (ICT). Although there is much to be said about the advantages for latecomers in applying ICT to overall economic development, caution in its application in the financial sector is preferable to recklessness, given the country's limited financial capacity.

Acknowledgments

This research is funded by International School, Vietnam National University, Hanoi (VNU-IS) under project number QG.23.82

References

Adomako, S., Danso, A., & Ofori Damoah, J. (2016). The moderating influence of financial literacy on the relationship between access to finance and firm growth in Ghana. *Venture Capital, 18*(1), 43-61.

Allen, F., Carletti, E., & Marquez, R. (2011). Credit market competition and capital regulation. *The Review of Financial Studies, 24*(4), 983-1018.

Allen, F., Demirguc-Kunt, A., Klapper, L., & Peria, M. S. M. (2016). The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of Financial Intermediation, 27*, 1-30.

Aziz, A., & Naima, U. (2021). Rethinking digital financial inclusion: Evidence from Bangladesh. *Technology in Society, 64*, 101509.

Bailey, D., & Katz, J. N. (2011). Implementing panel-corrected standard errors in R: The pcse package. *Journal of statistical software, 42*, 1-11.

Barr, N. (2020). *Economics of the welfare state*: Oxford University Press, USA.

Bateman, M. (2019). *South Africa's post-apartheid microcredit experiment: moving from state-enforced to market-enforced exploitation.* Paper presented at the Forum for Social Economics.

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2007). Finance, inequality and the poor. *Journal of economic growth, 12*, 27-49.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 89*, 115—143. doi:https://doi.org/10.1016/S0304-4076(98)00009-8

Butcher, W., & Galbraith, J. (2019). *Microfinance control fraud in Latin America.* Paper presented at the Forum for Social Economics.

Caselli, F., & Feyrer, J. (2007). The marginal product of capital. *The Quarterly Journal of Economics, 122*(2), 535-568.

Casson, M. C., Della Giusta, M., & Kambhampati, U. S. (2010). Formal and informal institutions and development. *World Development, 38*(2), 137-141.

Chiles, T. H., & McMackin, J. F. (1996). Integrating variable risk preferences, trust, and transaction cost economics. *Academy of management review, 21*(1), 73-99.

Claessens, S., & Perotti, E. (2007). Finance and inequality: Channels and evidence. *Journal of Comparative Economics, 35*(4), 748-773.

Dang, H. A., Jolliffe, D., & Carletto, C. (2019). Data gaps, data incomparability, and data imputation: A review of poverty measurement methods for data-scarce environments. *Journal of Economic Surveys, 33*(3), 757-797.

De Koker, L., & Jentzsch, N. (2013). Financial inclusion and financial integrity: Aligned incentives? *World Development, 44*, 267-280.

Demirgüç-Kunt, A., & Klapper, L. (2013). Measuring financial inclusion: Explaining variation in use of financial services across and within countries. *Brookings papers on economic activity, 2013*(1), 279-340.

Demirguc-Kunt, A., Klapper, L., Singer, D., & Ansar, S. (2018). *The Global Findex Database 2017: Measuring financial inclusion and the fintech revolution*: World Bank Publications.

Demirgüç-Kunt, A., Klapper, L., Singer, D., & Ansar, S. (2022). *The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19*: World Bank Publications.

Demirgüç-Kunt, A., & Klapper, L. F. (2012a). Financial inclusion in Africa: an overview. *World Bank Policy Research Working Paper*(6088).

Demirgüç-Kunt, A., & Klapper, L. F. (2012b). Measuring financial inclusion: The global findex database. *World Bank Policy Research Working Paper*(6025).

Demirgüç-Kunt, A., Klapper, L. F., Singer, D., & Van Oudheusden, P. (2015). The global findex database 2014: Measuring financial inclusion around the world. *World Bank Policy Research Working Paper*(7255).

Demirgüç-Kunt, A., & Singer, D. (2017). Financial inclusion and inclusive growth: A review of recent empirical evidence. *World Bank Policy Research Working Paper*(8040).

Dinh, V., Le, D.-V., Duong, D., & Pham, D. (2023). Determinants affecting digital financial consumer protection: Evidence from 135 countries. *The Journal of Economic Asymmetries, 27*, e00301. doi:https://doi.org/10.1016/j.jeca.2023.e00301

Estrada, G. B., Park, D., & Ramayandi, A. (2010). Financial development and economic growth in developing Asia. *Asian Development Bank Economics Working Paper*(233).

Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society, 120*(3), 253-282. doi:https://www.jstor.org/stable/2343100

Fungáčová, Z., & Weill, L. (2015). Understanding financial inclusion in China. *China economic review, 34*, 196-206.

Gathergood, J. (2012). Self-control, financial literacy and consumer over-indebtedness. *Journal of economic psychology, 33*(3), 590-602.

General Statistical Office [GSO]. (2023). *Total liquidity, credit outstanding of credit institutions, branches of foreign bank as of annual 31/12 by Classify, Total liquidity, deposits and Year*. Vietnam Retrieved from https://www.gso.gov.vn/en/px-web/?pxid=E0317&theme=National%20Accounts%20and%20State%20budget.

Gomme, P., & Rupert, P. (2007). Theory, measurement and calibration of macroeconomic models. *Journal of Monetary Economics, 54*(2), 460-497.

Grohmann, A., Klühs, T., & Menkhoff, L. (2018). Does financial literacy improve financial inclusion? Cross country evidence. *World Development, 111*, 84-96.

Hakim, C. (2012). *Research design: Succesful designs for social economics research*: Routledge.

Hembruff, J., & Soederberg, S. (2019). *Debtfarism and the violence of financial inclusion: The case of the payday lending industry.* Paper presented at the Forum for Social Economics.

Honohan, P. (2008). Cross-country variation in household access to financial services.

Journal of Banking & Finance, 32(11), 2493-2500.

Jorgenson, D. W., & Griliches, Z. (1967). The explanation of productivity change. *The review of economic studies, 34*(3), 249-283.

Kim, D.-W., Yu, J.-S., & Hassan, M. K. (2018). Financial inclusion and economic growth in OIC countries. *Research in International Business and Finance, 43*, 1-14.

Kriese, M., Abor, J. Y., & Agbloyor, E. (2019). Financial access and economic development: the moderating role of financial consumer protection. *International Journal of Managerial Finance, 15*(4), 406-424.

Le, D. V., & Tran, T. Q. (2023). Heterogenous effects of ICT application on local tourism development: a quantile regression approach. *Journal of Policy Research in Tourism, Leisure and Events*, 1-23.

Le, T.-H., Chuc, A. T., & Taghizadeh-Hesary, F. (2019). Financial inclusion and its impact on financial efficiency and sustainability: Empirical evidence from Asia. *Borsa Istanbul Review, 19*(4), 310-322.

Liao, H., & Cao, H.-S. (2013). How does carbon dioxide emission change with the economic development? Statistical experiences from 132 countries. *Global Environmental Change, 23*(5), 1073-1082. doi:https://doi.org/10.1016/j.gloenvcha.2013.06.006

Mader, P. (2018). Contesting financial inclusion. *Development and Change, 49*(2), 461-483.

Mansour, M., Al Amosh, H., Alodat, A. Y., Khatib, S. F., & Saleh, M. W. (2022). The relationship between corporate governance quality and firm performance: The moderating role of capital structure. *sustainability, 14*(17), 10525. doi:https://doi.org/10.3390/su141710525

Mhlanga, D. (2021). Financial inclusion in emerging economies: The application of machine learning and artificial intelligence in credit risk assessment. *International journal of financial studies, 9*(3), 39.

Mitchell, K., Scott, I., Robert H, Mitchell, K., & Scott, R. H. (2019). Public revenue, financial inclusion and value-added tax in Argentina. *Pesos or Plastic? Financial Inclusion, Taxation, and Development in South America*, 33-58.

Morgan, P., & Pontines, V. (2014). Financial stability and financial inclusion.

Musau, S., Muathe, S., & Mwangi, L. (2018a). Financial inclusion, bank competitiveness and credit risk of commercial banks in Kenya. *International Journal of Financial Research, 9*(1), 203-218.

Musau, S., Muathe, S., & Mwangi, L. (2018b). Financial inclusion, GDP and credit risk of commercial banks in Kenya. *International Journal of Economics and Finance, 10*(3), 181-195.

Njuki, E., Bravo-Ureta, B. E., & O'Donnell, C. J. (2018). A new look at the decomposition of agricultural productivity growth incorporating weather effects. *PloS one, 13*(2), e0192432. doi:https://doi.org/10.1371/journal.pone.0192432

North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press.

O'Donnell, C. J. (2018). *Productivity and efficiency analysis*: Springer.

Omar, M. A., & Inaba, K. (2020). Does financial inclusion reduce poverty and income inequality in developing countries? A panel data analysis. *Journal of economic structures, 9*(1), 37.

Ozili, P. K. (2020a). Contesting digital finance for the poor. *Digital Policy, Regulation and Governance, 22*(2), 135-151.

Ozili, P. K. (2020b). Theories of financial inclusion *Uncertainty and challenges in contemporary economic behaviour* (pp. 89-115): Emerald Publishing Limited.

Ozili, P. K. (2021). *Financial inclusion research around the world: A review.* Paper presented at the Forum for social economics.

Pradhan, R. P., Arvin, M. B., Nair, M. S., Hall, J. H., & Bennett, S. E. (2021). Sustainable economic development in India: The dynamics between financial inclusion, ICT development, and economic growth. *Technological Forecasting and Social Change, 169*, 120758.

Rizzo, M. (2014). Digital Finance: empowering the poor via new technologies. *Washington DC: The Word Bank*.

Saleh, M. W., Eleyan, D., & Maigoshi, Z. S. (2022). Moderating effect of CEO power on institutional ownership and performance. *EuroMed Journal of Business*. doi:https://doi.org/10.1108/EMJB-12-2021-0193

Saleh, M. W., & Mansour, M. (2024). Is audit committee busyness associated with earnings management? The moderating role of foreign ownership. *Accounting Research Journal, 37*(1), 80-97. doi:https://doi.org/10.1108/ARJ-04-2023-0106

Saleh, M. W., Shurafa, R., Shukeri, S. N., Nour, A. I., & Maigosh, Z. S. (2020). The effect of board multiple directorships and CEO characteristics on firm performance: evidence from Palestine. *Journal of Accounting in Emerging Economies, 10*(4), 637-654. doi:https://doi.org/10.1108/JAEE-12-2019-0231

Sarma, M. (2008). *Index of financial inclusion*. Retrieved from

Sarma, M., & Pais, J. (2011). Financial inclusion and development. *Journal of International Development, 23*(5), 613-628.

Schreyer, P. (2009). Measuring capital: OECD manual 2009.

Sharma, D. (2016). Nexus between financial inclusion and economic growth: Evidence from the emerging Indian economy. *Journal of Financial Economic Policy, 8*(1), 13-36.

Swamy, V. (2014). Financial inclusion, gender dimension, and economic impact on poor households. *World Development, 56*, 1-15.

Tahiri Jouti, A. (2018). Islamic finance: financial inclusion or migration? *ISRA International Journal of Islamic Finance, 10*(2), 277-288.

Thanh, V. N., Simioni, M., & Dao, L. V. (2019). Assessment of TFP change at provincial level in Vietnam: New evidence using Färe–Primont productivity index. *Economic Analysis and Policy, 64*, 329-345. doi:https://doi.org/10.1016/j.eap.2019.09.007

Tran, T. Q., & Dinh, V. T. T. (2021). Provincial governance and financial inclusion: micro evidence from rural Vietnam. *International public management journal, 24*(6), 792-812. doi:https://doi.org/10.1080/10967494.2021.1964009

Ullah, S., Akhtar, P., & Zaefarian, G. (2018). Dealing with endogeneity bias: The generalized method of moments (GMM) for panel data. *Industrial Marketing Management, 71*, 69-78. doi:https://doi.org/10.1016/j.indmarman.2017.11.010

Van, H. V., Van Dao, L., Hoang, L. K., & Van Hien, N. (2023). The efficiency of government finanical expenditures before and during the COVID-19 pandemic: A cross-country investigation. *Finance Research Letters, 54*, 103697. doi:https://doi.org/10.1016/j.frl.2023.103697

Van Le, D., & Tran, T. Q. (2022). Does the private sector increase inequality? Evidence

from a transitional country. *Structural Change and Economic Dynamics, 62*, 451-466. doi:https://doi.org/10.1016/j.strueco.2022.06.005

Van Le, D., Tran, T. Q., & Doan, T. (2022). The private sector and multidimensional poverty reduction in Vietnam: A cross-province panel data analysis. *International Journal of Social Welfare*.

Van, L. T.-H., Vo, A. T., Nguyen, N. T., & Vo, D. H. (2021). Financial inclusion and economic growth: An international evidence. *Emerging Markets Finance and Trade, 57*(1), 239-263.

Williamson, O. E. (1989). Transaction cost economics. *Handbook of industrial organization, 1*, 135-182.

Wintoki, M. B., Linck, J. S., & Netter, J. M. (2012). Endogeneity and the dynamics of internal corporate governance. *Journal of Financial Economics, 105*(3), 581-606. doi:https://doi.org/10.1016/j.jfineco.2012.03.005

World Bank [WB]. (2019). *The digital economy in Southeast Asia: Strengthening the foundations for future growth*: World Bank.

World Bank Group. (2023). Financial Inclusion: Financial inclusion is a key enabler to reducing poverty and boosting prosperity. https://www.worldbank.org/en/topic/financialinclusion/overview

World Economics. (2023). Vietnam's Informal Economy Size. Retrieved November, 22, 2023 https://www.worldeconomics.com/Informal-Economy/Vietnam.aspx

Zetsche, D. A., Buckley, R. P., Arner, D. W., & Barberis, J. N. (2017). From FinTech to TechFin: the regulatory challenges of data-driven finance. *NYUJL & Bus., 14*, 393.

Appendixes

Appendix 1. PCA results: eigenvalue and its proportion

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	3.224	2.394	0.645	0.645
Comp2	0.830	0.300	0.166	0.811
Comp3	0.530	0.202	0.106	0.917
Comp4	0.327	0.239	0.066	0.982
Comp5	0.089		0.018	1.000
Year	**MEAN**	**SD**	**p25**	**p75**
2014	0.160	0.160	0.060	0.210
2016	0.220	0.200	0.100	0.280
2018	0.260	0.170	0.140	0.320
2019	0.340	0.190	0.210	0.460
Total	0.250	0.190	0.110	0.310

Source: Authors

Appendix 2. TFP decomposition

TFP of province/city *i* in period *t* can be defined as

$$TFP_{it} = \frac{Q(q_{it})}{X(x_{it})} \quad \text{(a)}$$

where $Q(.)$ and $X(.)$ denote scalar aggregator functions characterized by properties such as non-decreasing behavior, non-negativity, linearity, and homogeneity. The notation q_{it} signifies the vector encompassing *L* outputs, whereas x_{it} represents the vector comprising *M* inputs. We establish both the output distance function, which pertains to a distinct period and environment, and the input distance function in our framework.

$$D_O^t(x,q) \equiv inf\,[p > 0\colon (x, q/p) \in \mathrm{T}^t]$$
$$D_I^t(x,q) \equiv sup\,[\theta > 0\colon (x/\theta, q) \in \mathrm{T}^t] \quad \text{and (b)}$$

where $\mathrm{T}^t, = [(x,y)$: input x can produce output y in period $t]$, denotes the production possibilities set tailored to a specific period and environment, made up of the feasible combinations of outputs and inputs achievable through the meta-technology employed during that particular period. $D_O^{\bar{t}}(\bar{x},\mathrm{q})$ (resp. $\mathrm{X(x)} = D_I^{\bar{t}}(\mathrm{x},\bar{q})$, where $\bar{x}$ and $\bar{q}$ are vectors of representative input and output variables in the representative time period $\bar{t}$. The output/input distance relevant to a particular period possesses two essential characteristics: it is positively valued and exhibits linear homogeneity concerning outputs (or inputs). The calculation of the index used to compare the total factor productivity (TFP) of province i in year t with that of province k in year s involves deriving the ratio of TFP_{it} to TFP_{ks}, formulated as:

$$TFPI_{ksit} = \frac{D_O^{\bar{t}}(\bar{x},q_{it},\bar{z})}{D_O^{\bar{t}}(\bar{x},q_{ks},\bar{z})} \frac{D_I^{\bar{t}}(x_{ks},\bar{q},\bar{z})}{D_I^{\bar{t}}(x_{it},\bar{q},\bar{z})} \quad \text{(c)}$$

This mathematical model has been utilized in recent empirical investigations, such as those conducted in Njuki et al. (2018); H. V. Van, Van Dao, Hoang, and Van Hien (2023):

$$LnD_O^t(x_{it}, q_{it}) = \sum_{l=1}^{L} \gamma_l lnq_{ilt} - \emptyset_i - \lambda t - \sum_{m=1}^{M} \beta_m lnx_{imt} \quad \text{(d)}$$

In this context, $\emptyset_i$ denotes a fixed effect that accommodates constant unobservable elements, where $\sum_{l=1}^{L} \gamma_l = 1$, and $\sum_{m=1}^{M} \beta_m = r$. In empirical investigations, when replacing equations (d) with (c), the total factor productivity index (TFPI) takes the following form:

$$TFPI_{ksit} = \frac{q_{lit}}{q_{lks}} \prod_{m=1}^{M} \left(\frac{x_{mks}}{x_{mit}}\right)^{\frac{\beta_m}{r}} \quad \text{(e)}$$

The estimation of the parameters $\beta_1, \ldots, \beta_M$ in equation (d) can be attained by employing stochastic frontier analysis (SFA) techniques. Accordingly, the distance function is defined in the following manner:

$$lnq_{it} = \emptyset_i + \lambda t + \sum_{m=1}^{M} \beta_m lnx_{imt} + u_{it} + v_{it} \quad \text{(f)}$$

where $u_{it}, = -LnD_O^t(x_{it}, q_{it}, z_{it})$, non-negative technical efficiency, commonly referred to as such by Farrell (1957), is significant in reflecting the capacity of provinces/cities to learn-by-doing and disseminate advances among themselves. Economically, this efficiency denotes the capability to spread achievements. The error term, denoted as v_{it}, includes both functional error (which may arise from deviations of the distance function from the Cobb-Douglas form) and unobservable variables. The conventional input variables are represented by $\sum_{m=1}^{M} lnx_{imt}$, while λ serves as a binary variable aiding the evaluation of the pace of technological progress. Consequently, Equation (f) presents a method for breaking down changes in total factor productivity into distinct components attributable to (i) technological progress, (ii) shifts in the environment, and (iii) changes in efficiency.

$$TFPI_{ksit} = \underbrace{\frac{\exp(\lambda t)}{\exp(\lambda s)}}_{OTI} \underbrace{\frac{\exp(\emptyset_i)}{\exp(\emptyset_k)}}_{OEI} \underbrace{\prod_{m=1}^{M} \left(\frac{x_{mit}}{x_{mks}}\right)^{\beta_m\left(\frac{r-1}{r}\right)}}_{OSEI} \underbrace{\frac{\exp(-u_{it})}{\exp(-u_{ks})}}_{OTE} \underbrace{\frac{\exp(v_{it})}{\exp(v_{ks})}}_{SNI} \quad \text{(g)}$$

Appendix 3. Sub-indexes of the Financial Access Index on TFPI and its components

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variables:	TFPI	OSEI	OTEI	TFPI	OSEI	OTEI	TFPI	OSEI	OTEI
PANNEL A (*FAI*) is:		Bank Account			Saving Books			ATM card	
Financial Access Index component *j* (FAI_j)	0.703**	0.048	0.369**	1.453**	0.166**	0.602*	0.830**	0.084**	0.467**
	(0.316)	(0.029)	(0.161)	(0.709)	(0.065)	(0.362)	(0.392)	(0.037)	(0.199)
FAJ_j^2	-0.647*	-0.110***	-0.375**	-4.448**	-0.688***	-1.572	-0.517	-0.129***	-0.333
	(0.369)	(0.034)	(0.188)	(2.202)	(0.203)	(1.125)	(0.443)	(0.041)	(0.225)
Constant	-1.898	0.229	-0.232	-2.170	0.254	-0.298	-2.485	0.207	-0.541
	(2.142)	(0.198)	(1.089)	(2.139)	(0.198)	(1.093)	(2.148)	(0.201)	(1.092)
R-squared	0.571	0.820	0.084	0.570	0.820	0.071	0.575	0.817	0.091
PANEL B (FAI_j) is:		Credit Card			Stock Account			Loan	
Dependent variables:	TFPI	OSEI	OTEI	TFPI	OSEI	OTEI	TFPI	OSEI	OTEI
Financial Access Index component *j* (FAI_j)	-2.654**	-0.185*	-1.560***	5.042	0.138	2.474	-1.374**	-0.087	-0.814**
	(1.044)	(0.099)	(0.535)	(6.658)	(0.628)	(3.384)	(0.677)	(0.064)	(0.341)
FAJ_j^2	-3.176	-0.687	0.284	-552.072	-38.992	-292.760	1.531	0.068	0.902
	(5.472)	(0.517)	(2.804)	(452.214)	(42.673)	(229.830)	(1.337)	(0.127)	(0.674)
Constant	-1.003	0.383**	0.202	-1.893	0.287	-0.200	-1.248	0.334	0.191
	(2.041)	(0.193)	(1.046)	(2.152)	(0.203)	(1.094)	(2.136)	(0.203)	(1.077)
R-squared	0.611	0.829	0.155	0.564	0.809	0.069	0.580	0.813	0.117
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ID dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	252	252	252	252	252	252	252	252	252
Number of provinces/cities	63	63	63	63	63	63	63	63	63

Source: Authors.

Notes: The Provincial Competitiveness Index (PCI) reflects the quality of local governance, available from https://pcivietnam.vn/. Multidimensional poverty evaluates various aspects of individuals' well-being, such as income, access to clean water, healthcare, electricity, and other relevant dimensions. E-government and ICT applications are proxies for measuring the government's and overall economy's ICT utilization, available from the Ministry of Information and Communication. The data was gathered from 63 provinces/cities in Vietnam, in 2014, 2016, 2018, and 2019. Robust standard errors are presented in parentheses, and significance levels are indicated as *** p<0.01, ** p<0.05, * p<0.1.