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Fintech Adoption as a Productivity-Enhancing Capability under Resource Constraints: Evidence from Young Entrepreneurs in an Emerging Economy

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Fintech Adoption as a Productivity-Enhancing Capability under Resource Constraints: Evidence from Young Entrepreneurs in an Emerging Economy

Abstract: The rapid expansion of financial technology (fintech) is reshaping financial intermediation globally, particularly in emerging economies where entrepreneurs face persistent resource constraints. Despite its potential, evidence on whether fintech adoption enhances entrepreneurial productivity remains limited and often overlooks selection bias and heterogeneity across entrepreneurs. This study conceptualizes fintech adoption as a productivity-enhancing capability that enables entrepreneurs—particularly young entrepreneurs—to improve resource mobilization and operational efficiency. Using survey data from 637 young entrepreneurs in Indonesia, we employ an Endogenous Switching Regression (ESR) model to address non-random selection into fintech adoption and to estimate counterfactual outcomes. The results show that fintech adoption significantly increases entrepreneurial productivity, with substantial heterogeneity between adopters and non-adopters. Counterfactual estimates indicate that adopters would experience lower productivity in the absence of fintech, while non-adopters could achieve notable gains if they adopted fintech technologies. Theoretically, this study advances entrepreneurship research by reframing fintech adoption as a capability that mitigates resource constraints and by demonstrating the importance of selection and heterogeneity in evaluating digital technology effects. Practically, the findings highlight the role of fintech ecosystems in enhancing entrepreneurial efficiency, suggesting that policies aimed at strengthening digital financial capability and access can unlock productivity gains among young entrepreneurs in emerging economies.

Keywords: Fintech adoption; entrepreneurial productivity; resource constraints; digital financial capability; emerging economies; heterogeneous effects.

1. Introduction

The rapid expansion of financial technology (fintech) has transformed the global financial landscape and reshaped how individuals and businesses access financial services. Digital financial innovations such as mobile payments, peer-to-peer lending, and digital wallets have significantly expanded financial inclusion and improved access to capital for small and medium-sized enterprises (SMEs) across many regions of the world (Lee & Shin, 2018; Shen et al., 2021; Thakor, 2020). In the context of sustainable development, fintech is increasingly recognized as a catalyst for inclusive economic growth and innovation, contributing to several targets of the United Nations Sustainable Development Goals (SDGs), particularly SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure) (Bhatta et al., 2023). By lowering transaction costs and expanding financial accessibility, fintech ecosystems enable new forms of entrepreneurship and digital economic participation, especially among young entrepreneurs operating in technology-driven markets (Christofi et al., 2024).

From an economic perspective, these developments are particularly relevant for entrepreneurs operating under resource constraints, where limited access to formal finance, high transaction costs, and institutional inefficiencies restrict the ability of small firms to mobilize resources and scale their operations. In such contexts, fintech platforms may function not merely as technological tools, but as capabilities that reshape financial frictions and enhance entrepreneurial productivity by improving access to financial services and enabling more efficient resource allocation.

The growing integration of fintech into entrepreneurial activities has attracted considerable scholarly attention. Recent studies suggest that fintech adoption can enhance firm performance by improving payment efficiency, expanding financial access, and facilitating digital business operations (Díaz-Arancibia et al., 2024; Haddad & Hornuf, 2019; Verma et al., 2025). Digital financial services also enable entrepreneurs to manage cash flow, access alternative financing, and integrate their businesses into broader digital marketplaces (Chen et al., 2023). However, despite these potential benefits, fintech adoption remains uneven across firms and entrepreneurs, indicating that differences in capabilities, perceptions, and contextual conditions play an important role in shaping how entrepreneurs leverage digital financial innovations (Ryu, 2018). This uneven diffusion suggests that fintech adoption cannot be understood solely as a technological decision, but rather as an outcome shaped by underlying capability constraints and heterogeneous entrepreneurial conditions.

These challenges are particularly pronounced in emerging economies, where traditional financial systems often struggle to provide adequate support for small businesses and early-stage entrepreneurs (Del Sarto & Ozili, 2025). Limited access to formal credit, high transaction costs, and institutional constraints frequently restrict entrepreneurial growth in developing countries (Candiya Bongomin et al., 2017). In response, fintech platforms have emerged as alternative financial infrastructures capable of partially overcoming these limitations by providing flexible and accessible digital financial services (Wang & Fu, 2022). Consequently, fintech adoption is increasingly viewed as a mechanism for enhancing entrepreneurial activity and economic development in emerging markets (Zhang & Zhao, 2025). Nevertheless, whether fintech adoption systematically improves entrepreneurial productivity, and through which mechanisms, remains insufficiently understood.

Among emerging economies, Indonesia represents a particularly relevant empirical setting. Indonesia hosts one of the fastest-growing digital economies in Southeast Asia and has experienced rapid expansion in fintech platforms, mobile payments, and digital financial services (Nuryakin & Ardyan, 2018). At the same time, the Indonesian economy remains heavily dominated by SMEs, many of which rely on digital technologies to overcome financial and operational constraints (Nugraha et al., 2022a). The country also has a large and growing population of young entrepreneurs, often described as digital natives with high familiarity with digital technologies but heterogeneous levels of financial capability and entrepreneurial experience (Riofita, 2026). This combination of rapid fintech diffusion and persistent structural constraints provides a suitable context for examining how fintech adoption influences entrepreneurial outcomes under conditions of limited resources.

Importantly, focusing on young entrepreneurs is not merely a contextual choice but also theoretically meaningful. Compared to more established business owners, young entrepreneurs often face more pronounced financial and experiential constraints, particularly in accessing

formal credit, managing financial decisions, and building stable business networks. At the same time, they tend to exhibit higher levels of familiarity with digital technologies, creating a distinctive combination of digital readiness and capability gaps. This dual condition makes young entrepreneurs especially sensitive to the potential of fintech as a mechanism for relaxing financial constraints and improving resource mobilization. Moreover, the effects of fintech adoption are likely to be more heterogeneous within this group, as differences in financial capability, trust, and risk perceptions may lead to divergent outcomes. Examining fintech adoption among young entrepreneurs therefore provides a theoretically grounded context for understanding how digital financial capabilities translate into entrepreneurial productivity under conditions of constraint.

Despite increasing interest in fintech and entrepreneurship, several important gaps remain. First, much of the fintech literature focuses on consumer adoption of digital financial services, while relatively fewer studies examine fintech usage among entrepreneurs and business owners (Haddad & Hornuf, 2019; Lahiri & Biswas, 2022). Second, the relationship between fintech adoption and entrepreneurial outcomes remains insufficiently explored, particularly in emerging economies where institutional conditions differ substantially from those in advanced markets (Klapper & Lusardi, 2020). Third, existing empirical studies often rely on conventional econometric models that treat fintech adoption as exogenous and do not adequately address potential self-selection bias, which may arise because entrepreneurs who adopt fintech technologies differ systematically from those who do not (Kindermann et al., 2026). As a result, current evidence may not fully capture the causal and heterogeneous effects of fintech adoption on entrepreneurial productivity.

To address these limitations, this study advances a conceptual shift by framing fintech adoption not merely as a technological choice, but as a productivity-enhancing capability that relaxes binding resource constraints. Drawing on Financial Capability Theory and the Resource-Based View, we argue that entrepreneurs with stronger financial capabilities are better positioned to adopt and utilize fintech services, while fintech adoption itself alters the structure of financial frictions—such as transaction costs, access barriers, and information asymmetries—thereby improving firms' ability to mobilize resources and enhance operational efficiency (Morgan & Long, 2020; Barney, 1991). Importantly, the economic effects of fintech adoption are expected to be inherently heterogeneous, as entrepreneurs differ in their capabilities, perceptions, and access to digital infrastructures.

Empirically, this study examines fintech adoption among young entrepreneurs in Indonesia using an Endogenous Switching Regression (ESR) model, which allows us to address endogenous selection into fintech adoption and estimate counterfactual outcomes (Kindermann et al., 2026). By accounting for non-random selection and enabling the estimation of alternative outcome scenarios, this approach provides a more rigorous basis for identifying the causal and heterogeneous effects of fintech adoption on entrepreneurial productivity.

Building on this framework, the study addresses three research questions.

RQ1. What factors drive fintech adoption among young entrepreneurs?

RQ2. Does fintech adoption enhance entrepreneurial productivity after accounting for endogenous self-selection?

RQ3. What counterfactual entrepreneurial outcomes emerge under fintech adoption and non-adoption?

This study makes three main contributions. First, it advances the entrepreneurship literature by reconceptualizing fintech adoption as a capability that mitigates resource constraints and enhances entrepreneurial productivity, rather than treating it as a purely technological or behavioral phenomenon. Second, it contributes to the understanding of entrepreneurial heterogeneity by demonstrating that the productivity effects of fintech adoption are not uniform, but depend on underlying capabilities and selection processes. Third, it provides a more nuanced explanation of the economic role of digital financial technologies by identifying the mechanisms through which fintech adoption reduces financial frictions and improves resource allocation in entrepreneurial contexts, particularly among young entrepreneurs in emerging economies.

The remainder of this article is organized as follows. Section 2 reviews the relevant literature and develops the theoretical framework. Section 3 describes the research methodology and econometric strategy. Section 4 presents the empirical results. Section 5 discusses the findings in relation to the theoretical framework. Section 6 outlines the policy and practical implications of the study. Finally, Section 7 concludes the article and highlights directions for future research.

2. Literature Review and Hypothesis Development

2.1. Fintech and Entrepreneurial Transformation

The rapid expansion of fintech has reshaped the structure of financial intermediation and created new opportunities for entrepreneurial activity in the digital economy. Fintech platforms such as digital payments, peer-to-peer lending, and mobile banking have significantly reduced transaction costs, improved access to financial services, and enabled small businesses to integrate into digital markets (Lee & Shin, 2018; Shen et al., 2021; Thakor, 2020). As digital financial infrastructures continue to expand globally, fintech is increasingly viewed as a driver of entrepreneurial dynamism, particularly in contexts where firms operate under financial constraints and limited access to formal financial systems (Bhatta et al., 2023; Christofi et al., 2024; Del Sarto & Ozili, 2025).

Recent studies suggest that fintech adoption can enhance entrepreneurial productivity through several mechanisms. Digital financial services facilitate faster transactions, improve liquidity management, and expand access to alternative financing channels that are often unavailable through conventional banking systems (Chen et al., 2023; Díaz-Arancibia et al., 2024; Haddad & Hornuf, 2019; Verma et al., 2025). These capabilities enable entrepreneurs to reduce financial frictions, improve resource allocation, and operate more efficiently, particularly in environments characterized by constrained financial access. Furthermore, fintech integration with digital platforms and e-commerce ecosystems can support business scalability and innovation, enabling small firms to compete more effectively in increasingly digitalized markets (Duarte & Baptista, 2026; Gupta et al., 2024; Zahra et al., 2023).

Despite these developments, the existing literature reveals important limitations in explaining how fintech adoption translates into firm-level outcomes. First, much of the fintech literature focuses on financial systems, banking transformation, or consumer adoption, while relatively fewer studies examine fintech usage within entrepreneurial contexts (Danladi et al., 2023; Li et al., 2024; Wang et al., 2025). Consequently, the mechanisms through which fintech adoption affects entrepreneurial productivity remain insufficiently specified. Second, many

empirical studies treat fintech adoption primarily as a technological phenomenon rather than as a capability that reshapes resource constraints and influences firms' ability to generate productivity gains (Cao & Zhang, 2022; Wang, 2024).

Another limitation concerns the fragmented nature of the literature. Research on digital finance and financial inclusion often develops separately from studies on entrepreneurship and firm-level outcomes, resulting in limited integration between these two streams (Duarte & Baptista, 2026; Gupta et al., 2024). As a result, while fintech is widely recognized as a transformative financial innovation, there remains limited theoretical and empirical understanding of how fintech adoption interacts with entrepreneurial capabilities to shape productivity outcomes, particularly among young entrepreneurs operating in digital ecosystems (Hao et al., 2026).

Taken together, these gaps suggest that fintech should be examined not only as a financial innovation but also as a capability that enables firms to relax resource constraints and improve productivity. Understanding how fintech adoption influences entrepreneurial outcomes therefore requires integrating insights from digital finance with broader theories of capability and resource utilization. Such an approach provides a foundation for explaining how financial capability and digital financial technologies jointly shape entrepreneurial productivity in contemporary digital economies.

2.2. Financial Capability and Fintech Adoption

Financial capability has increasingly been recognized as a key determinant of individuals' financial decision-making and technology adoption in modern financial systems. In the context of digital finance, financial capability extends beyond traditional financial literacy to include the ability to understand, evaluate, and effectively utilize digital financial services in managing financial activities and business operations (Candiya Bongomin et al., 2017; Del Sarto & Ozili, 2025; Ryu, 2018; Wang & Fu, 2022). As financial technologies continue to transform financial markets, entrepreneurs are required not only to possess basic financial knowledge but also to develop digital financial competencies that enable them to reduce uncertainty and navigate increasingly complex fintech ecosystems (Nugraha et al., 2022; Nuryakin & Ardyan, 2018; Zhang & Zhao, 2025).

Existing research suggests that individuals with stronger financial capability are more likely to adopt financial technologies because they are better able to recognize the benefits of digital financial services while effectively evaluating associated risks (Klapper & Lusardi, 2020; Lahiri & Biswas, 2022; Riofita, 2026). In entrepreneurial contexts, these capabilities allow individuals to reduce information asymmetry, improve financial decision-making, and increase confidence in engaging with digital financial platforms. As a result, entrepreneurs with higher levels of financial capability are better positioned to integrate fintech services into their business operations and to utilize them as tools for overcoming financial constraints and improving resource access (Hidayat-ur-Rehman et al., 2026; Zhao et al., 2024).

However, the relationship between financial capability and fintech adoption is not purely linear. Some studies indicate that technological familiarity alone does not guarantee effective fintech usage, particularly when individuals face concerns related to trust, security, or uncertainty associated with digital financial platforms (Lahiri & Biswas, 2022; Li et al., 2024; Ryu, 2018). Even among digitally oriented entrepreneurs, perceived risks related to data

security, financial fraud, or platform reliability may discourage the use of fintech services. This suggests that fintech adoption is shaped not only by cognitive capabilities but also by individuals' trust in digital financial infrastructures and their evaluation of perceived risks (Alalwan et al., 2024; Zheng et al., 2024).

These findings highlight the multidimensional nature of financial capability in the context of fintech adoption. Beyond financial knowledge, entrepreneurs must develop confidence in digital financial systems and the ability to evaluate and manage potential risks associated with technology use. The interaction between financial capability, trust in fintech platforms, and perceived risk therefore becomes central in shaping adoption decisions, particularly in environments characterized by financial constraints and evolving digital infrastructures. This perspective positions fintech adoption as a capability-driven decision rather than a purely technological choice.

Building on this reasoning, the present study conceptualizes fintech adoption as an outcome influenced by key components of financial capability, including digital financial literacy, trust in fintech services, and perceived risk associated with digital financial technologies. Accordingly, the following hypotheses are proposed:

H1. Digital financial literacy increases the likelihood of fintech adoption among entrepreneurs.

H2. Trust in fintech platforms positively influences fintech adoption.

H3. Perceived risk negatively influences fintech adoption.

2.3. Fintech Adoption as a Strategic Resource: A Resource-Based View Perspective

While fintech adoption is often examined from the perspective of technology acceptance or financial inclusion, a growing body of literature suggests that digital financial technologies may also function as strategic resources that enhance firm competitiveness. The Resource-Based View posits that firms achieve superior outcomes when they possess valuable, rare, inimitable, and non-substitutable resources that enable them to develop competitive advantages in dynamic markets (Barney, 1991; Hidayat-ur-Rehman & Hossain, 2025). Within this framework, technological capabilities and digital infrastructures are increasingly recognized as strategic assets that can shape firms' productivity and long-term competitiveness, particularly when they enable more efficient resource utilization (Adusei & Adeleye, 2024; Wang et al., 2025; Xu et al., 2024).

In the context of entrepreneurship, fintech adoption can be interpreted as a digital financial capability that enhances firms' ability to manage financial operations, access funding, and integrate into digital economic networks. Fintech tools such as digital payment systems, crowdfunding platforms, and peer-to-peer lending services allow entrepreneurs to reduce transaction costs, improve liquidity management, and expand financing opportunities beyond traditional banking channels. Importantly, the value of fintech adoption does not lie in the technology itself, but in the extent to which entrepreneurs are able to deploy it to overcome financial constraints, improve resource allocation, and enhance operational efficiency. These capabilities may therefore enable small firms to respond more effectively to rapidly changing market conditions and to improve productivity under resource-constrained environments (Dong & Yu, 2023; Li et al., 2025).

Despite the growing relevance of fintech technologies, empirical evidence linking fintech adoption to firm-level outcomes remains limited. Much of the existing research on

digital transformation focuses on general digital technologies rather than specifically examining financial technologies as strategic capabilities within entrepreneurial firms. Moreover, many studies treat fintech adoption primarily as a technological choice rather than as a capability that reshapes firms' resource configurations and productivity outcomes (Li et al., 2025; Xu et al., 2024). As a result, the mechanisms through which fintech adoption contributes to entrepreneurial productivity remain insufficiently specified.

Another limitation concerns the methodological approaches commonly used in previous research. Several studies examining digital technology adoption rely on conventional regression models that do not adequately address potential selection bias in adoption decisions. Entrepreneurs who adopt fintech technologies may systematically differ from non-adopters in terms of capabilities, risk preferences, or access to resources. Ignoring this self-selection problem may therefore bias estimates of the relationship between fintech adoption and entrepreneurial productivity (Adusei & Adeleye, 2024; Li et al., 2023). This limitation underscores the need for more rigorous empirical strategies that can isolate the causal impact of fintech adoption on firm outcomes.

Drawing on the Resource-Based View, this study conceptualizes fintech adoption as a strategic capability that enhances firms' ability to mobilize financial resources and improve productivity. By enabling entrepreneurs to access financial services more efficiently and integrate financial activities into digital business ecosystems, fintech adoption strengthens firms' resource utilization and competitive positioning, particularly under conditions of financial constraints. Based on this theoretical reasoning, the following hypothesis is proposed:
H4. Fintech adoption positively affects entrepreneurial productivity.

2.4. Fintech Adoption in Emerging Economies

The rapid diffusion of fintech technologies has been particularly pronounced in emerging economies, where structural limitations in traditional financial systems create strong demand for alternative financial services. In many developing countries, SMEs face significant barriers in accessing formal financial institutions due to stringent lending requirements, high transaction costs, and limited banking infrastructure. In such contexts, fintech platforms function not only as technological innovations but also as mechanisms that relax financial constraints by providing more accessible and flexible financial services (Del Sarto & Ozili, 2025; Wang & Fu, 2022; Zhang & Zhao, 2025).

Recent empirical studies suggest that digital financial technologies can expand financial inclusion and reduce financing constraints among small firms operating in emerging markets. By lowering transaction costs and improving access to financial services, fintech platforms enable entrepreneurs to mobilize capital more efficiently and integrate their businesses into digital economic ecosystems (Bertoni et al., 2022; Huarng & Yu, 2022). These effects are particularly relevant in resource-constrained environments, where improved access to financial services can directly enhance firms' ability to allocate resources efficiently and improve productivity. Moreover, fintech adoption may facilitate improved financial management and operational efficiency, thereby strengthening firm resilience in volatile economic environments (Banna et al., 2022; Pu et al., 2021).

However, empirical evidence regarding the impact of fintech adoption on entrepreneurial outcomes remains mixed. While some studies show that digital financial

services enhance firm productivity and growth, others suggest that fintech adoption alone does not automatically translate into improved outcomes (Cui et al., 2025; Karikari et al., 2025). These inconsistencies indicate that the value of fintech adoption is contingent upon contextual conditions such as institutional environments, digital infrastructure, and the capabilities of entrepreneurs. In emerging economies, where financial literacy gaps, technological capability constraints, and regulatory uncertainties are prevalent, the effectiveness of fintech adoption depends critically on entrepreneurs' ability to utilize these technologies productively (Frimanslund et al., 2023; Hua & Huang, 2021).

Another limitation in the current literature concerns geographical concentration. Much of the empirical research on digital finance and entrepreneurship focuses on large emerging markets such as China and India, where fintech ecosystems are relatively mature and data availability is high (Huarng & Yu, 2022; Moreira-Santos et al., 2022). In contrast, relatively fewer studies examine fintech adoption in Southeast Asian economies, despite the region's rapid digital transformation and expanding entrepreneurial ecosystems. This imbalance limits the generalizability of existing findings and underscores the need to examine fintech adoption in alternative emerging economy contexts.

Indonesia provides a theoretically meaningful context for examining fintech adoption and entrepreneurial productivity. As one of the largest digital economies in Southeast Asia, Indonesia has experienced rapid growth in fintech platforms, mobile payment systems, and digital financial services over the past decade. At the same time, the economy is heavily driven by micro and small enterprises that often operate under financial constraints and rely on digital technologies to access financial services and expand market opportunities (Frimanslund et al., 2023; Yaqub & Alsabban, 2023). This combination of rapid digital financial expansion and persistent structural constraints makes Indonesia a critical setting for understanding how fintech adoption translates into productivity gains in emerging markets.

Taken together, these observations suggest that fintech adoption should be examined as a context-dependent mechanism whose impact on entrepreneurial productivity depends on the interaction between digital financial technologies, entrepreneurial capabilities, and institutional conditions. Addressing this issue requires empirical approaches that explicitly account for selection bias in adoption decisions and allow the estimation of counterfactual outcomes associated with fintech usage among entrepreneurs.

2.5. Conceptual Framework

Building on the preceding discussion, this study integrates Financial Capability Theory and the Resource-Based View to explain the relationship between fintech adoption and entrepreneurial productivity. Financial Capability Theory emphasizes the importance of individuals' financial knowledge, confidence, and decision-making capacity in shaping financial behavior, including the adoption of digital financial technologies (Klapper & Lusardi, 2020; Lahiri & Biswas, 2022; Riofita, 2026). Entrepreneurs with stronger financial capabilities are better able to recognize the potential benefits of fintech services, evaluate associated risks, and reduce uncertainty in financial decision-making, thereby increasing the likelihood of fintech adoption.

Complementing this perspective, the Resource-Based View conceptualizes capabilities—not merely technologies—as strategic resources that enhance firms' productivity.

From an Resource-Based View standpoint, fintech adoption is interpreted as a digital financial capability whose value depends on how effectively it is deployed to improve resource utilization. By enabling firms to reduce transaction costs, improve liquidity management, and expand access to alternative financial resources, fintech adoption can strengthen entrepreneurs' ability to mobilize and allocate resources efficiently, thereby enhancing productivity under conditions of financial constraints (Dong & Yu, 2023; Li et al., 2023; Xu et al., 2024).

Integrating these perspectives, the conceptual framework proposes a sequential mechanism in which financial capability shapes fintech adoption, and fintech adoption subsequently functions as a productivity-enhancing capability. Specifically, digital financial literacy, trust in fintech platforms, and perceived risk influence the likelihood of fintech adoption among entrepreneurs, while fintech adoption in turn affects entrepreneurial productivity. Figure 1 presents the conceptual econometric framework underlying this study, illustrating the relationship between the determinants of fintech adoption and productivity outcomes.

Empirically, the relationship between fintech adoption and entrepreneurial productivity may be subject to endogenous self-selection, as entrepreneurs with higher unobserved productivity potential may be more likely to adopt fintech technologies. Ignoring this selection process would bias the estimated effect of fintech adoption on productivity. To address this issue, the present study employs an ESR model, which enables the simultaneous estimation of adoption determinants and productivity outcomes while accounting for selection bias. This approach also allows the estimation of counterfactual outcomes, providing a more rigorous assessment of the causal impact of fintech adoption.

In addition to the key explanatory variables derived from Financial Capability Theory, the empirical specification incorporates several control variables commonly used in entrepreneurship research. Entrepreneurial experience, education level, and business size are included to capture heterogeneity in capabilities and firm characteristics that may influence productivity. Furthermore, local fintech infrastructure exposure is introduced as an exclusion restriction that affects the likelihood of fintech adoption without directly influencing entrepreneurial productivity. Incorporating these variables strengthens the identification strategy and ensures that the estimated effects more accurately reflect the impact of fintech adoption on entrepreneurial outcomes.

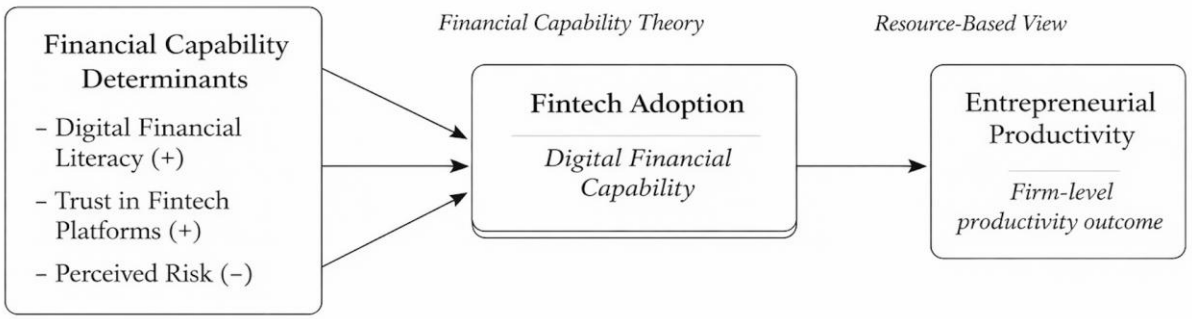


Figure 1. Conceptual econometric framework of fintech adoption and entrepreneurial productivity.

3. Methodology

3.1. Research Design

This study employs a quantitative research design to examine the relationship between fintech adoption and entrepreneurial productivity among young entrepreneurs. The empirical analysis is based on cross-sectional survey data collected from young entrepreneurs operating small and emerging business ventures in South Sulawesi, Indonesia. Data collection was conducted between February and October 2025, covering respondents across multiple districts and municipalities to ensure geographical representativeness within the provincial entrepreneurial ecosystem. The survey instrument captured information on fintech adoption behavior, financial capability, perceptions of fintech services, and key business characteristics. Respondents also reported indicators related to sales growth, profitability, and business expansion, which were aggregated to construct an entrepreneurial productivity index used as the primary dependent variable in the econometric analysis.

To address the non-random nature of fintech adoption, this study employs an ESR model. The use of ESR is motivated by the possibility that entrepreneurs with different unobserved productivity potentials may self-select into fintech adoption, leading to biased estimates if not properly accounted for. The ESR framework allows the adoption decision and entrepreneurial productivity outcomes to be jointly modeled, thereby correcting for selection bias arising from both observed and unobserved heterogeneity. By estimating regime-specific outcome equations and counterfactual expectations, this approach provides a more rigorous empirical strategy for identifying the causal effect of fintech adoption on entrepreneurial productivity under real-world decision conditions.

3.2. Data and Sampling

The empirical analysis is based on primary survey data collected from young entrepreneurs in South Sulawesi, Indonesia. The target population consists of individuals actively operating small or emerging business ventures, representing early-stage entrepreneurial activity within the regional economy. To capture variation in entrepreneurial environments and fintech accessibility, the sampling frame included multiple districts and municipalities reflecting diverse levels of economic development and digital financial infrastructure. Data were collected between February and October 2025 through structured questionnaires administered via supervised field surveys and controlled online responses, ensuring consistency and response reliability.

The selection of districts and municipalities followed a regional representativeness strategy designed to capture heterogeneity in economic conditions, fintech infrastructure, and entrepreneurial ecosystems (Table 1). Makassar City was included as the province's primary metropolitan and fintech hub, while Parepare City represents an emerging secondary urban center. Gowa and Maros Regencies were selected due to their economic integration with the Makassar metropolitan area, whereas Bone and Luwu Regencies represent large regional economies outside the metropolitan cluster. This sampling design enables the analysis to capture variation in access to financial resources, digital infrastructure, and market conditions, which are critical for identifying differences in fintech adoption behavior and entrepreneurial productivity across heterogeneous contexts.

Table 1. Sample distribution by district and municipality.

District / Municipality	Frequency	Percentage (%)
Makassar City	162	25.4
Parepare City	74	11.6
Gowa Regency	118	18.5
Maros Regency	97	15.2
Bone Regency	103	16.2
Luwu Regency	83	13.0
Total	637	100

Following geographic stratification, a multi-stage sampling procedure was implemented to identify eligible respondents. The sampling process consisted of four stages. First, provincial stratification identified South Sulawesi as the study area due to its expanding entrepreneurial ecosystem and increasing fintech penetration. Second, district and municipality selection ensured representation across metropolitan and regional economic contexts. Third, entrepreneur screening identified individuals who met two criteria: operating an active business venture and belonging to the young entrepreneur segment representing early-stage entrepreneurial activity. Fourth, proportional respondent selection was conducted within each district or municipality to ensure balanced representation across locations and business sectors. This multi-stage approach enhances the representativeness of the sample while capturing heterogeneity in entrepreneurial environments and fintech accessibility, which is essential for identifying variation in fintech adoption behavior. The final dataset consists of 637 valid responses, providing sufficient statistical power for the econometric analysis.

The demographic and business characteristics of the sampled entrepreneurs are presented in Table 2. In addition to gender and education, the table reports the urban–rural distribution of business locations, reflecting differences in local entrepreneurial environments, access to digital financial infrastructure, and exposure to fintech services. This variation is particularly relevant for the empirical strategy, as it captures contextual heterogeneity that may influence both fintech adoption decisions and entrepreneurial productivity.

Table 2. Sample characteristics of young entrepreneurs (N = 637).

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	332	52.1
	Female	305	47.9
Education Level	High School	214	33.6
	Diploma	176	27.6
	Bachelor’s Degree	247	38.8
Business Location	Urban	412	64.7
	Rural	225	35.3
Business Sector	Trade / Retail	219	34.4
	Food & Beverage	168	26.4
	Creative / Digital	146	22.9
	Services	104	16.3

Business Age	< 2 years	271	42.5
	2–4 years	223	35.0
	> 4 years	143	22.5
Fintech Adoption	Adopters	377	59.2
	Non-Adopters	260	40.8

3.3. Data Collection and Research Instrument

Primary data for this study were obtained through a structured questionnaire designed to capture information on fintech adoption behavior and entrepreneurial characteristics among young entrepreneurs. The questionnaire items were adapted from established measures in the entrepreneurship and fintech literature to ensure conceptual alignment with prior empirical research, while being contextually adjusted to reflect the characteristics of emerging economy settings.

The instrument consisted of two sections. The first section collected demographic and firm-level information, including education level, entrepreneurial experience, business age, and business size, which were used as control variables in the econometric analysis. The second section measured key constructs related to fintech adoption and entrepreneurial capabilities, including digital financial literacy, trust in fintech services, and perceived risk associated with digital financial technologies. All perceptual items were measured using a Likert-type scale to capture respondents' evaluations consistently across constructs.

To enhance clarity and content validity, the questionnaire was reviewed and refined through expert evaluation involving academics with expertise in entrepreneurship and digital finance. Minor adjustments were made to improve wording clarity and contextual relevance prior to data collection. In addition, procedural steps were taken during data collection—such as ensuring respondent anonymity and separating sections of the questionnaire—to reduce the risk of common method bias. The operational definitions of the variables are presented in Table 3, while construct reliability and validity statistics are reported in Table 4, providing further support for the robustness of the measurement model.

3.4. Variable Measurement

The variables used in this study were operationalized based on measurement approaches widely applied in the entrepreneurship, fintech, and digital finance literature. The operational definitions, indicators, and measurement specifications were adapted from prior empirical studies to ensure conceptual consistency and comparability with existing research. The detailed operationalization of all variables used in the empirical analysis is summarized in Table 3.

Table 3. Operational definition, indicators, and measurement of variables.

Variable	Definition	Indicators	Measurement	Source
Entrepreneurial Performance	Perceived improvement in business	Sales growth; Profit improvement;	3 items measured using five-point Likert scale	Dess and Robinson (1984); Wiklund and

	outcomes and venture growth	Market expansion		Shepherd (2005); Rauch et al. (2009)
Fintech Adoption	Use of digital financial technologies in business operations	Digital payments; Mobile banking; Online lending; Digital financial management tools	Dummy variable (1 = adopter, 0 = non-adopter)	Arner et al. (2020); Lee and Shin (2018); Gomber et al. (2018)
Digital Financial Literacy	Ability to understand and utilize digital financial services	Knowledge of digital finance; Ability to manage digital transactions; Understanding fintech products; Familiarity with fintech applications	4 Likert-scale items	Lusardi and Mitchell (2014); Choung et al. (2023)
Trust in Fintech	Perceived reliability and security of fintech platforms	System reliability; Transaction security; Institutional credibility	3 Likert-scale items	Gefen et al. (2003); Roh et al. (2024)
Perceived Risk	Perceived uncertainty and potential loss from fintech usage	Financial risk; Data privacy risk; Technological uncertainty	3 Likert-scale items	Featherman and Pavlou (2003); Ryu (2018)
Entrepreneurial Experience	Prior involvement in entrepreneurial activities	Years of business experience	Continuous variable (years)	Davidsson and Honig (2003)
Business Size	Scale of business operations	Number of employees	Continuous variable	Colombo and Grilli (2013)
Business Age	Duration of business operation	Years since firm establishment	Continuous variable	Colombo and Grilli (2013)
Education	Highest level of formal education	Education attainment category	Categorical variable	Davidsson and Honig (2003)

Local Fintech Infrastructure Exposure (LFIE)	Availability of fintech infrastructure in local environment	Availability of fintech providers; Accessibility of digital finance; Ease of access to mobile financial services	3 Likert-scale items	Yang and Zhou (2016)

The dependent variable in this study is entrepreneurial productivity, which reflects the extent to which entrepreneurs improve the efficiency of resource utilization and generate better business outcomes under constrained conditions. Consistent with prior entrepreneurship research, subjective performance measures are widely used due to the limited availability of reliable financial records among small ventures (Dess & Robinson, 1984; Wiklund & Shepherd, 2005; Rauch et al., 2009). Entrepreneurial productivity was therefore measured using three indicators capturing perceived improvements in sales growth, profitability, and market expansion, each assessed using a five-point Likert scale.

The key treatment variable is fintech adoption, which refers to the use of digital financial technologies in business operations. Fintech services include digital payment systems, mobile banking applications, online lending platforms, and digital financial management tools that facilitate financial transactions and access to financial services (Arner et al., 2020; Lee & Shin, 2018; Gomber et al., 2018). Fintech adoption was operationalized as a binary variable, coded as 1 if the entrepreneur reported using at least one fintech service in business operations and 0 otherwise. This binary specification is appropriate within the ESR framework, which explicitly models discrete adoption decisions and their impact on outcome differentials.

Several explanatory variables capturing financial capability and technology perceptions were also included. Digital financial literacy reflects the ability of entrepreneurs to understand and effectively utilize digital financial services (Lusardi & Mitchell, 2014; Morgan et al., 2019) and was measured using four Likert-scale indicators. Trust in fintech platforms captures entrepreneurs' perceptions regarding the reliability, security, and credibility of fintech services and was measured using three Likert-scale indicators adapted from technology trust research (Gefen et al., 2003; Roh et al., 2024). Perceived risk represents entrepreneurs' concerns regarding financial loss, technological uncertainty, and data privacy associated with fintech usage and was measured using three Likert-scale indicators reflecting financial, privacy, and technological risk (Featherman & Pavlou, 2003; Ryu, 2018).

In addition, several control variables were included to capture heterogeneity in entrepreneurial characteristics. These include entrepreneurial experience, measured as the number of years the entrepreneur has been involved in business activities; business size, measured by the number of employees; business age, measured as the number of years since firm establishment; and education level, measured as the highest formal education attained by the entrepreneur.

To ensure identification of the ESR model, the analysis also includes Local Fintech Infrastructure Exposure (LFIE) as an exclusion restriction variable. LFIE captures the extent to which entrepreneurs operate in environments with greater availability of fintech services and digital financial infrastructure. The construct was measured using three Likert-scale indicators

reflecting perceived accessibility and availability of fintech services in the local business environment. The variable satisfies the relevance condition by influencing fintech adoption decisions, while plausibly satisfying the exclusion restriction as it does not directly affect entrepreneurial productivity beyond its impact on fintech adoption (Yang & Zhou, 2024).

Prior to econometric estimation, construct reliability and validity were assessed using Cronbach's alpha (α), composite reliability (CR), and average variance extracted (AVE). Reliability values above 0.70 indicate acceptable internal consistency, while AVE values above 0.50 indicate adequate convergent validity (Hair et al., 2019). The results presented in Table 4 show that all constructs satisfy the recommended thresholds, indicating that the measurement model demonstrates adequate reliability and convergent validity for subsequent econometric analysis.

Table 4. Construct reliability and validity.

Construct	Number of Items	Cronbach's α	Composite Reliability	AVE
Entrepreneurial Performance	3	0.83	0.88	0.71
Digital Financial Literacy	4	0.86	0.90	0.69
Trust in Fintech	3	0.84	0.89	0.73
Perceived Risk	3	0.80	0.86	0.67
Local Fintech Infrastructure Exposure	3	0.82	0.87	0.69

3.5. Econometric Strategy

To estimate the impact of fintech adoption on entrepreneurial productivity, this study employs an ESR model. The ESR framework is appropriate when the decision to adopt fintech services is potentially endogenous and may lead to self-selection bias. Entrepreneurs who adopt fintech may differ systematically from those who do not, and such differences may bias conventional regression estimates if not properly addressed.

The econometric structure applied in this study is illustrated in Figure 2. The model consists of three components: (1) a fintech adoption selection equation, (2) regime-specific outcome equations explaining entrepreneurial productivity, and (3) a set of explanatory variables capturing entrepreneurial capabilities and firm characteristics. The ESR framework allows the determinants of productivity to differ across adopters and non-adopters while correcting for potential selection bias.

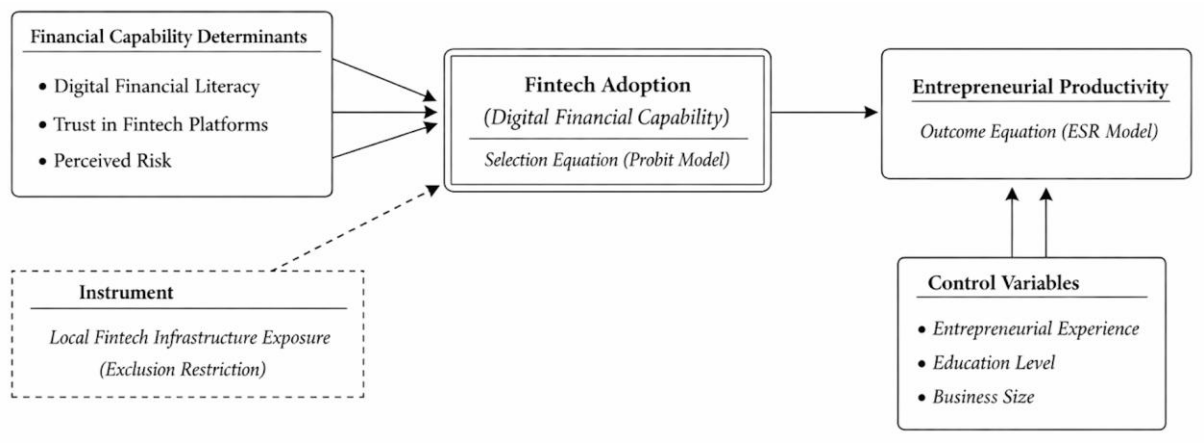


Figure 2. Conceptual structure of the ESR model

The first stage of the ESR model estimates the probability that an entrepreneur adopts fintech services. The adoption decision is modeled using a probit specification:

$$D_i^* = Z_i\gamma + \varepsilon_i \quad (1)$$

where D_i^* represents the latent propensity to adopt fintech services, Z_i is a vector of explanatory variables influencing the adoption decision, $\gamma$is the parameter vector to be estimated, and ε_i is the error term. The observed adoption decision is defined as:

$$D_i^* = \begin{cases} 1 & \text{if } D_i^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

where $D_i = 1$indicates that the entrepreneur adopts fintech services and $D_i = 0$ otherwise.

To ensure identification of the ESR model, the selection equation includes Local Fintech Infrastructure Exposure (LFIE) as an exclusion restriction variable. LFIE captures the availability and accessibility of fintech services in the local entrepreneurial ecosystem. This variable is expected to influence the likelihood of fintech adoption while not directly affecting entrepreneurial productivity once firm-level characteristics are controlled for.

Conditional on the adoption decision, entrepreneurial productivity is estimated using two regime-specific outcome equations. For fintech adopters, the outcome equation is specified as:

$$Y_{1i} = X_{1i}\beta_1 + \upsilon_{1i} \quad (3)$$

where Y_{1i} represents entrepreneurial performance for entrepreneurs who adopt fintech services, X_{1i} is a vector of explanatory variables, and $u_{1i}$is the error term.

For non-adopters, the outcome equation is defined as:

$$Y_{0i} = X_{0i}\beta_0 + \upsilon_{0i} \quad (4)$$

where Y_{0i} represents entrepreneurial performance among entrepreneurs who do not adopt fintech services.

The explanatory variables included in the outcome equations capture entrepreneurial capabilities and firm characteristics, including digital financial literacy, trust in fintech, perceived risk, entrepreneurial experience, business size, business age, and education level.

The ESR model is estimated using the full-information maximum likelihood (FIML) procedure, which simultaneously estimates the selection equation and the regime-specific outcome equations. This approach allows the error terms of the selection and outcome equations to be correlated, thereby correcting for potential self-selection bias in the adoption decision.

An important advantage of the ESR framework is its ability to estimate counterfactual outcomes, allowing the analysis of how entrepreneurs would perform under alternative adoption scenarios. The expected entrepreneurial productivity for fintech adopters is defined as:

$$E(Y_1 \mid D = 1) \tag{5}$$

while the expected productivity for non-adopters is defined as:

$$E(Y_0 \mid D = 0) \tag{6}$$

The counterfactual outcomes represent the expected productivity that entrepreneurs would experience if they had made the alternative adoption decision. For fintech adopters had they not adopted fintech:

$$E(Y_0 \mid D = 1) \tag{7}$$

and for non-adopters had they adopted fintech:

$$E(Y_1 \mid D = 0) \tag{8}$$

Using these expectations, the ESR framework allows the estimation of treatment effects. The Average Treatment Effect on the Treated (ATT) is defined as:

$$ATT = E(Y_1 \mid D = 1) - E(Y_0 \mid D = 1) \tag{9}$$

which measures the performance gain experienced by entrepreneurs who adopt fintech services.

Similarly, the Average Treatment Effect on the Untreated (ATU) captures the potential productivity gain that non-adopters would obtain if they adopted fintech:

$$ATU = E(Y_1 \mid D = 0) - E(Y_0 \mid D = 0) \tag{10}$$

To assess the robustness of the ESR results, the study also estimates a conventional Ordinary Least Squares (OLS) model as a benchmark specification. The OLS model estimates the association between fintech adoption and entrepreneurial productivity without correcting for potential self-selection bias. Comparing the OLS estimates with the ESR results allows an evaluation of whether ignoring selection effects leads to biased estimates of the fintech adoption effect.

4. Results

4.1. Descriptive Statistics and Preliminary Analysis

This section presents descriptive statistics and preliminary comparisons between fintech adopters and non-adopters. These statistics provide an overview of the sample structure and offer initial insights into the determinants of fintech adoption among young entrepreneurs, while also indicating potential differences in entrepreneurial productivity across adoption groups. Identifying systematic differences between adopters and non-adopters is particularly important in the Indonesian context, where uneven access to digital financial infrastructure and varying levels of financial capability may influence both adoption decisions and business outcomes.

The final sample consists of 637 young entrepreneurs, of whom 377 (59.2%) report using fintech services in their business operations, while 260 (40.8%) do not. This distribution provides sufficient variation across adoption regimes for the estimation of the ESR model.

Table 5 presents descriptive statistics for the main variables included in the empirical analysis. The average entrepreneurial productivity index is 0.14, with a standard deviation of 0.96, indicating substantial heterogeneity across firms. Such dispersion in productivity

outcomes is particularly relevant in the Indonesian MSME context, where firms operate under diverse resource constraints and market conditions. The mean digital financial literacy score is 3.62, while the average level of trust in fintech platforms is 3.74, suggesting generally favorable perceptions of digital financial services among young entrepreneurs. By contrast, the mean perceived risk score is 2.91, indicating moderate concerns related to fintech usage.

With respect to firm characteristics, the average business age is 2.89 years, and the mean firm size is 4.63 employees, reflecting the predominance of micro-scale entrepreneurial ventures in Indonesia. Respondents report an average entrepreneurial experience of 2.17 years, which is consistent with early-stage entrepreneurial trajectories among young entrepreneurs. Overall, the descriptive statistics reveal meaningful variation across both individual and firm-level characteristics, supporting the empirical analysis of fintech adoption and its implications for entrepreneurial productivity.

Table 5. Descriptive statistics of main variables (N = 637).

Variable	Mean	Std. Dev.	Min	Max
Entrepreneurial Productivity	0.14	0.96	-2.21	2.68
Fintech Adoption	0.592	0.492	0	1
Digital Financial Literacy	3.62	0.71	1.80	4.92
Trust in Fintech	3.74	0.69	1.95	4.96
Perceived Risk	2.91	0.76	1.12	4.73
Entrepreneurial Experience	2.17	1.58	0.5	7.5
Business Age	2.89	1.63	0.5	8.0
Business Size	4.63	3.12	1	18
Education	14.8	1.7	12	19
LFIE	0.53	0.21	0.08	0.92

This section compares the mean values of key variables between fintech adopters and non-adopters to assess whether adoption is systematically associated with observable characteristics. Table 6 presents these comparisons and provides initial evidence on the factors associated with fintech adoption among young entrepreneurs, while also indicating potential differences in entrepreneurial productivity across the two groups. Such differences are particularly relevant in the Indonesian context, where heterogeneity in digital access and financial capability may shape both adoption behavior and business outcomes.

The results reveal several statistically significant differences. Fintech adopters exhibit higher levels of digital financial literacy and trust in fintech platforms, while reporting lower levels of perceived risk compared to non-adopters. These patterns indicate that both cognitive capability and risk perception play a central role in shaping fintech adoption decisions. In addition, adopters tend to have greater entrepreneurial experience and operate slightly larger firms, suggesting that firm scale and accumulated experience may facilitate engagement with digital financial services in emerging market settings.

Most notably, fintech adopters report significantly higher entrepreneurial productivity scores than non-adopters. The mean productivity index among adopters is 0.31, compared to −0.09 among non-adopters. While this difference suggests a positive association between

fintech adoption and business outcomes, it remains descriptive and does not account for potential self-selection into fintech adoption. Entrepreneurs who adopt fintech may differ systematically from non-adopters in unobserved characteristics that also influence productivity. This limitation motivates the use of the ESR framework to obtain unbiased estimates of the impact of fintech adoption on entrepreneurial productivity.

Table 6. Mean comparison between fintech adopters and non-adopters.

Variable	Adopters (n=377)	Non-Adopters (n=260)	Mean Difference	t-stat
Entrepreneurial Productivity	0.31	-0.09	0.40***	4.87
Digital Financial Literacy	3.79	3.37	0.42***	6.12
Trust in Fintech	3.92	3.48	0.44***	6.45
Perceived Risk	2.74	3.13	-0.39***	-5.21
Entrepreneurial Experience	2.31	1.97	0.34**	2.36
Business Size	5.10	3.94	1.16**	2.54
Business Age	3.02	2.71	0.31	1.52
Education	15.0	14.5	0.50*	1.92

Notes: *p < 0.10, **p < 0.05, ***p < 0.01.

4.2. Determinants of Fintech Adoption

This section estimates the selection equation of the ESR model to identify the factors associated with fintech adoption among young entrepreneurs. Table 7 reports the results of the probit selection equation. The model is statistically significant overall (Wald $\chi^2 = 72.41$, $p < 0.001$), indicating that the included variables jointly explain variation in fintech adoption decisions.

Digital financial literacy exhibits a strong positive association with fintech adoption ($\beta = 0.418$, $p < 0.01$). Entrepreneurs with higher digital financial capability are more likely to integrate fintech services into their business operations. The marginal effect indicates that a one-unit increase in digital financial literacy increases the probability of adoption by approximately 8.6 percentage points. Trust in fintech platforms also shows a positive and statistically significant effect ($\beta = 0.364$, $p < 0.01$), with an estimated marginal effect of 7.1 percentage points. These findings highlight the importance of both capability and institutional confidence in shaping fintech adoption decisions in emerging digital economies such as Indonesia.

Perceived risk is negatively associated with fintech adoption ($\beta = -0.271$, $p < 0.05$), indicating that concerns related to financial loss, technological uncertainty, and data security continue to act as barriers to adoption. This result suggests that, despite increasing exposure to digital technologies, risk perceptions remain a relevant constraint in the Indonesian fintech ecosystem.

Among entrepreneurial characteristics, entrepreneurial experience displays a positive and statistically significant effect ($\beta = 0.129$, $p < 0.05$), suggesting that more experienced entrepreneurs are more inclined to adopt fintech services. In contrast, business age does not exhibit a significant effect, indicating that firm maturity alone does not strongly influence adoption decisions once individual-level capabilities and perceptions are accounted for.

Firm size shows a modest positive effect ($\beta = 0.067$, $p < 0.10$), implying that slightly larger ventures may face stronger incentives to adopt fintech services, particularly for transaction efficiency and financial management. Education level also demonstrates a weak but positive association, although the effect remains only marginally significant.

The Local Fintech Infrastructure Exposure (LFIE) variable—the exclusion restriction used for identification—displays a strong positive and statistically significant coefficient ($\beta = 0.512$, $p < 0.01$). Entrepreneurs operating in areas with greater fintech infrastructure exposure are substantially more likely to adopt fintech services. This variable is included only in the selection equation and excluded from the outcome equations, satisfying the identification requirement of the ESR model. The significance of LFIE supports its role as a valid instrument influencing adoption decisions without directly affecting entrepreneurial productivity.

Overall, the results indicate that fintech adoption is driven by digital financial capability, institutional trust, and infrastructure exposure, while perceived risk acts as a constraint. The presence of statistically significant predictors confirms that fintech adoption is not randomly distributed across entrepreneurs. This justifies the use of the ESR framework to account for endogenous selection in estimating the impact of fintech adoption on entrepreneurial productivity.

Table 7. Probit estimates of fintech adoption.

Variable	Coefficient	Std. Error	Marginal Effect	p-value
Digital Financial Literacy	0.418***	0.083	0.086	0.000
Trust in Fintech	0.364***	0.079	0.071	0.000
Perceived Risk	-0.271**	0.112	-0.053	0.016
Entrepreneurial Experience	0.129**	0.062	0.026	0.039
Business Age	0.041	0.057	0.008	0.472
Business Size	0.067*	0.036	0.013	0.071
Education	0.052*	0.029	0.010	0.083
LFIE	0.512***	0.101	0.104	0.000
Constant	-1.238***	0.412	—	0.003
Observations = 637				
Wald $\chi^2 = 72.41$***				

Notes: *p < 0.10, **p < 0.05, ***p < 0.01.

4.3. Outcome Equations: Entrepreneurial Productivity

This section reports the regime-specific outcome equations of the ESR model, estimating entrepreneurial productivity separately for fintech adopters and non-adopters. This specification addresses RQ2 by examining whether fintech adoption is associated with differential productivity outcomes after accounting for endogenous self-selection.

Table 8 presents the estimated coefficients for fintech adopters. Digital financial literacy exhibits a positive and statistically significant association with entrepreneurial productivity ($\beta = 0.287$, $p < 0.01$), indicating that entrepreneurs with stronger digital financial capability are better able to leverage fintech services to enhance firm-level outcomes. Trust in fintech platforms also shows a positive effect ($\beta = 0.214$, $p < 0.05$), suggesting that institutional confidence facilitates more effective utilization of digital financial tools.

Among firm characteristics, business size is positively associated with productivity ($\beta = 0.061$, $p < 0.05$), while entrepreneurial experience shows a weaker but marginally significant effect ($\beta = 0.084$, $p < 0.10$). In contrast, perceived risk, business age, and education are not statistically significant within the adopter regime.

Table 8. Outcome equation for fintech adopters (entrepreneurial performance).

Variable	Coefficient	Std. Error	p-value
Digital Financial Literacy	0.287***	0.082	0.001
Trust in Fintech	0.214**	0.095	0.024
Perceived Risk	-0.118	0.091	0.194
Entrepreneurial Experience	0.084*	0.048	0.079
Business Size	0.061**	0.028	0.031
Business Age	0.036	0.041	0.381
Education	0.052	0.037	0.158
Constant	-0.412	0.364	0.258

Notes: Observations = 377.

Table 9 reports the outcome equation for non-adopters. Digital financial literacy remains positively associated with entrepreneurial productivity ($\beta = 0.174$, $p < 0.05$), although the magnitude is smaller than in the adopter regime. This indicates that financial capability contributes to firm performance even without fintech usage but yields stronger returns when complemented by digital financial technologies.

Perceived risk shows a negative and marginally significant effect among non-adopters ($\beta = -0.149$, $p < 0.10$), suggesting that risk perceptions may constrain business outcomes in the absence of fintech-enabled financial flexibility. Business size remains positively associated with productivity ($\beta = 0.047$, $p < 0.10$), while trust in fintech does not exhibit a significant effect, consistent with the absence of direct fintech usage.

A key diagnostic feature of the ESR model is the correlation between the error terms of the selection and outcome equations. The estimated correlation coefficients indicate that ρ_1 is negative and statistically significant ($\rho_1 = -0.312$, $p < 0.05$), while ρ_0 is positive and significant ($\rho_0 = 0.276$, $p < 0.05$). These results confirm the presence of endogenous selection into fintech adoption.

The negative value of ρ_1 suggests that fintech adopters are negatively selected on unobservables, meaning that they may have lower baseline productivity in the absence of adoption. Conversely, the positive value of ρ_0 indicates that non-adopters are positively selected, implying relatively stronger baseline productivity without fintech usage. This asymmetric selection pattern reinforces the importance of correcting for selection bias when estimating the impact of fintech adoption. Overall, the results reveal clear heterogeneity in the determinants of entrepreneurial productivity across adoption regimes and confirm that fintech adoption is not randomly assigned.

Table 9. Outcome equation for non-adopters (entrepreneurial performance).

Variable	Coefficient	Std. Error	p-value
Digital Financial Literacy	0.174**	0.081	0.033
Trust in Fintech	0.058	0.092	0.531
Perceived Risk	-0.149*	0.087	0.089
Entrepreneurial Experience	0.061	0.052	0.241
Business Size	0.047*	0.027	0.074
Business Age	0.041	0.044	0.349
Education	0.039	0.035	0.268
Constant	-0.356	0.372	0.339

Notes: *p < 0.10, **p < 0.05, ***p < 0.01; Observations = 260.

4.4. Counterfactual Outcomes and Treatment Effects

This section evaluates counterfactual entrepreneurial productivity and treatment effects derived from the ESR model. While the previous section presented regime-specific outcome equations, the ESR framework additionally allows estimation of expected outcomes under both observed and counterfactual adoption states. This analysis addresses RQ3 by examining how entrepreneurial productivity would change under alternative fintech adoption scenarios.

Table 10 reports the expected entrepreneurial productivity under four ESR scenarios. The actual expected productivity of fintech adopters, $E(Y_1 \mid D = 1)$, is 0.326, whereas their counterfactual productivity in the absence of adoption, $E(Y_0 \mid D = 1)$, is 0.221. This difference indicates that adopters experience higher productivity relative to their estimated non-adoption baseline.

For non-adopters, the actual expected productivity $E(Y_0 \mid D = 0)$is 0.147, while their counterfactual productivity under adoption $E(Y_1 \mid D = 0)$is 0.298. This suggests that non-adopters could potentially achieve substantially higher productivity if they were to adopt fintech services.

Table 10. Expected entrepreneurial performance under actual and counterfactual states.

Outcome Scenario	Expected Performance
Actual performance of fintech adopters E (Y1 | D = 1)	0.326
Counterfactual performance of adopters if non-adopters E (Y0 | D = 1)	0.221

Actual performance of non-adopters E (Y0 | D = 0)	0.147
Counterfactual performance of non-adopters if adopters E (Y1 | D = 0)	0.298

Table 11 reports the estimated treatment effects. The Average Treatment Effect on the Treated (ATT) is 0.105, indicating that fintech adopters achieve, on average, higher productivity compared to their counterfactual non-adoption state. The Average Treatment Effect on the Untreated (ATU) is 0.151, suggesting that non-adopters could potentially experience even larger productivity gains if they adopted fintech.

The fact that ATU exceeds ATT indicates heterogeneous treatment effects, implying that the marginal benefit of fintech adoption is larger among current non-adopters. This pattern is consistent with the possibility that non-adopters face greater financial or operational constraints, which could be alleviated through access to digital financial services.

Importantly, these estimates are derived within the ESR framework, which accounts for endogenous selection into fintech adoption. Therefore, the reported differences reflect selection-corrected comparisons rather than simple mean differences.

Overall, the results indicate that fintech adoption is associated with higher entrepreneurial productivity under both observed and counterfactual scenarios. However, the magnitude of the effects varies across groups, highlighting the importance of accounting for heterogeneity and selection bias when evaluating the impact of fintech adoption.

Table 11. Treatment effects of fintech adoption on entrepreneurial performance.

Treatment Effect	Estimate
ATT (Average Treatment Effect on the Treated)	0.105
ATU (Average Treatment Effect on the Untreated)	0.151

Notes: Values represent expected entrepreneurial performance and treatment effects derived from the ESR model.

4.5. Robustness Checks

To assess the robustness of the main findings, a baseline Ordinary Least Squares (OLS) model is estimated as a benchmark that does not account for endogenous selection into fintech adoption. The results (Table 12) indicate that fintech adoption is positively and significantly associated with entrepreneurial productivity ($\beta = 0.132$, $p < 0.01$), consistent in direction with the ESR estimates. However, the magnitude differs from the ESR-based treatment effects (ATT = 0.105; ATU = 0.151), suggesting that conventional regression may yield biased estimates due to unobserved selection and heterogeneous treatment effects. In contrast, the ESR framework explicitly accounts for these issues, providing a more reliable estimation of the fintech–productivity relationship.

As an additional robustness check, the model is re-estimated using a logarithmic transformation of the entrepreneurial productivity index. The results remain qualitatively unchanged, with fintech adoption retaining a positive and statistically significant effect. Overall, the consistency across specifications supports the robustness of the findings, while the divergence between OLS and ESR estimates highlights the importance of accounting for selection bias and heterogeneity when evaluating the impact of fintech adoption.

Table 12. OLS estimates of fintech adoption and entrepreneurial performance.

Variable	Coefficient	Std. Error	p-value
Fintech Adoption	0.132***	0.041	0.002
Digital Financial Literacy	0.203***	0.067	0.003
Trust in Fintech	0.086	0.058	0.139
Perceived Risk	-0.074	0.061	0.227
Entrepreneurial Experience	0.052	0.039	0.182
Business Size	0.054**	0.023	0.019
Business Age	0.028	0.031	0.367
Education	0.041	0.028	0.144
Constant	-0.294	0.271	0.276
Observations = 637			
$R^2 = 0.28$			

Notes: *p < 0.10, **p < 0.05, ***p < 0.01.

5. Discussion

The findings provide robust evidence that fintech adoption functions as a productivity-enhancing capability under resource constraints, particularly among young entrepreneurs in emerging economies such as Indonesia. Using an ESR framework, the study shows that fintech adoption is shaped by financial capability and generates causal and heterogeneous improvements in entrepreneurial productivity. These results address all research questions and position Indonesia as an analytically meaningful context where financial exclusion, SME dominance, and rapid digitalization coexist.

Regarding the determinants of fintech adoption (RQ1), digital financial literacy and trust significantly increase adoption, while perceived risk reduces it. This confirms that adoption is driven by financial capability rather than mere technological familiarity. Consistent with prior research (Khuong et al., 2022), financially capable entrepreneurs are better able to evaluate and integrate fintech into business operations. Financial capability not only influences adoption but also determines the extent to which fintech can be transformed into a productive resource. In Indonesia, where young entrepreneurs are digitally exposed but uneven in financial capability and institutional trust, this explains why adoption remains heterogeneous. Trust reinforces adoption (Liébana-Cabanillas et al., 2022), whereas perceived risk remains a barrier in evolving regulatory environments (Zhao et al., 2024), conditions that are particularly salient in Indonesia's fintech landscape.

With respect to the impact of fintech adoption (RQ2), the results show that fintech significantly enhances entrepreneurial productivity. This supports the interpretation of fintech as a capability that reduces financial frictions and improves resource allocation. Through improved transaction efficiency, cash flow management, and access to alternative financing, fintech strengthens operational performance. These findings align with evidence that fintech improves firm productivity and financial efficiency (Abu et al., 2025). However, fintech becomes a capability only when supported by sufficient financial capability, highlighting a complementary relationship between user capability and digital financial tools. This is especially relevant in Indonesia, where SMEs often face limited access to formal finance and

underdeveloped financial management systems, making fintech particularly effective in relaxing structural constraints. Fintech also supports resilience under constrained conditions (Sanga & Aziakpono, 2025; Zhou & Sun, 2024) and enhances efficiency where traditional financial systems are limited (Dalal & Habib, 2023; Wang et al., 2024).

The counterfactual analysis (RQ3) reveals inherently heterogeneous effects. Adopters would experience lower productivity without fintech, while non-adopters could gain from adoption, indicating unrealized productivity potential. These results suggest that fintech amplifies differences in entrepreneurial capability, as those with higher financial literacy are better able to convert adoption into productivity gains. Heterogeneity arises because financial capability conditions the extent to which fintech can be utilized effectively. In Indonesia, this variation is reinforced by uneven access to digital infrastructure, financial services, and entrepreneurial support systems. Structural barriers—such as limited financial capability and perceived risk—continue to constrain adoption. Prior studies similarly show that digital finance enhances resilience and sustainability (Du et al., 2023) and improves productivity through more efficient resource allocation (Yu et al., 2023). The ESR approach thus confirms that fintech exerts a causal and heterogeneous impact on entrepreneurial productivity by accounting for endogenous selection.

At the ecosystem level, fintech reshapes entrepreneurial finance by expanding access to digital payments, crowdfunding, and peer-to-peer lending, reducing reliance on traditional institutions (Dong & Yu, 2023; Koroleva, 2022; Ryu & Ko, 2020). The growth of fintech ecosystems also intensifies competition and stimulates financial innovation (Khatami et al., 2024; Gupta et al., 2024). In Indonesia, where SMEs dominate and digital transformation is rapid, these changes significantly alter financial access structures.

The implications are particularly relevant for Indonesia and similar emerging economies. Fintech enhances financial inclusion and expands access to services for underserved entrepreneurs, supporting economic participation (Lee et al., 2025; Banna & Alam, 2021). However, the benefits depend critically on financial capability and trust. This suggests that policy should not only expand fintech infrastructure but also strengthen financial literacy and institutional trust. In Indonesia, productivity gains among young entrepreneurs are most likely when digital expansion is accompanied by capability development and supportive institutional ecosystems.

Overall, fintech adoption operates as a capability that relaxes resource constraints and enhances entrepreneurial productivity while producing heterogeneous outcomes. By incorporating ESR, this study provides causal evidence and advances a more integrated explanation of how financial capability and fintech jointly shape entrepreneurial outcomes, with Indonesia offering a context where these dynamics are particularly visible.

6. Conclusion

This study provides new evidence on how fintech adoption shapes entrepreneurial productivity among young entrepreneurs operating under resource constraints in emerging economies. The findings demonstrate that fintech adoption is fundamentally a capability-driven process shaped by financial literacy, trust, and perceived risk, and that its economic value lies in enhancing productivity through improved resource mobilization and operational efficiency.

The results show that fintech adoption significantly improves entrepreneurial productivity, while counterfactual analysis reveals that non-adopters forgo substantial gains. By applying an ESR framework, this study provides causal evidence that fintech adoption generates productivity advantages by reducing financial frictions and expanding access to financial resources.

Theoretically, this study advances entrepreneurship research by reconceptualizing fintech adoption as a capability that relaxes resource constraints rather than as a purely technological choice. It further shows that the effects of fintech are inherently heterogeneous, as productivity gains depend on entrepreneurs' financial capability and their ability to utilize digital financial tools effectively. This perspective integrates Financial Capability Theory with the Resource-Based View to explain how digital financial technologies are transformed into productive resources.

Importantly, the findings highlight the analytical relevance of the Indonesian context, where rapid digitalization coexists with persistent financial constraints. This setting illustrates that the impact of fintech is most pronounced where structural barriers limit access to traditional financial systems and where entrepreneurs rely on digital solutions to overcome such constraints.

Overall, this study contributes a mechanism-based explanation of how fintech adoption enhances entrepreneurial productivity, emphasizing that its effectiveness depends not only on access but also on the capability to use it. These insights provide a foundation for understanding the role of digital financial technologies in shaping entrepreneurial outcomes in emerging economies.

7. Theoretical Contributions, Practical Implications, and Limitations

7.1. Theoretical Contributions

This study contributes to the growing literature on fintech and entrepreneurship by advancing a more integrated explanation of how financial capability and digital financial technologies jointly shape entrepreneurial outcomes. Rather than treating fintech adoption as a purely technological or behavioral phenomenon, the findings demonstrate that fintech adoption is a capability-driven process in which financial literacy, trust, and perceived risk determine not only whether entrepreneurs adopt fintech but also how effectively it can be utilized.

First, the study extends Financial Capability Theory by showing that financial capability functions not only as a determinant of adoption but also as an enabling condition that allows entrepreneurs to transform fintech into a productive resource. While young entrepreneurs are often perceived as digitally inclined, the results indicate that digital familiarity alone is insufficient. Instead, financial capability remains the critical mechanism through which digital technologies are evaluated, adopted, and strategically utilized within entrepreneurial activities.

Second, the study advances the Resource-Based View by demonstrating that fintech does not inherently constitute a strategic resource. Rather, it becomes a productive capability only when combined with sufficient financial capability, highlighting a complementary relationship between user capability and digital financial technologies. This perspective refines the Resource-Based View by emphasizing that digital resources require user-level capabilities

to generate productivity gains, particularly in entrepreneurial settings characterized by resource constraints.

Importantly, the findings also show that the productivity effects of fintech adoption are inherently heterogeneous. This heterogeneity arises because differences in financial capability determine the extent to which fintech can be converted into productivity-enhancing outcomes. In this sense, the study contributes to entrepreneurship research by linking capability heterogeneity to differential productivity gains from digital technology adoption.

Finally, the Indonesian context strengthens this theoretical contribution by demonstrating how fintech operates in an environment where rapid digitalization coexists with persistent financial constraints. This setting highlights that fintech is most impactful when it functions as a mechanism for relaxing structural barriers, thereby providing a more context-sensitive understanding of how digital financial capabilities influence entrepreneurial productivity in emerging economies.

7.2. Practical Implications

The findings of this study offer important implications for entrepreneurs, policymakers, and fintech ecosystem stakeholders. For entrepreneurs, particularly those from young entrepreneurs, the results emphasize that effective fintech utilization depends on financial capability rather than digital familiarity alone. Developing financial literacy and strengthening trust in digital financial systems are therefore essential for transforming fintech adoption into productivity gains.

For policymakers and financial regulators, the findings suggest that promoting fintech adoption requires a dual approach that combines infrastructure expansion with capability development. Expanding access to fintech services without strengthening financial capability may limit the productivity gains associated with adoption. Policies should therefore prioritize financial education programs, institutional trust-building, and regulatory clarity to reduce perceived risks associated with digital financial systems.

In the Indonesian context, these implications are particularly significant. Given the dominance of SMEs and uneven access to formal financial services, fintech can play a central role in enhancing financial inclusion and entrepreneurial productivity. However, achieving these outcomes requires coordinated efforts to strengthen digital financial literacy, improve institutional reliability, and ensure inclusive access to fintech ecosystems. Such interventions can help ensure that fintech adoption translates into broader economic participation and productivity improvements among young entrepreneurs.

7.3. Limitations

Despite its contributions, this study has several limitations. First, the empirical analysis focuses on young entrepreneurs within a specific regional context in Indonesia, which may limit the generalizability of the findings. Entrepreneurial behavior and fintech adoption may differ across countries with varying financial infrastructures and institutional environments. Future studies may therefore examine similar relationships in other emerging or developed economies.

Second, although the study employs an ESR model to address endogenous selection, the analysis relies on cross-sectional data. As a result, it cannot fully capture the dynamic

evolution of fintech adoption or its long-term effects on entrepreneurial productivity. Longitudinal studies could provide deeper insights into how fintech adoption and financial capability co-evolve over time.

7.4. Future Research Directions

Future research can extend these findings in several directions. First, scholars may explore additional mechanisms through which fintech adoption influences entrepreneurial productivity, such as innovation capability, business model transformation, or access to alternative financing channels. Examining these mechanisms can deepen understanding of how fintech reshapes entrepreneurial processes. Second, future research may investigate generational differences by comparing young entrepreneurs with other cohorts. Such comparisons could provide insights into how generational characteristics influence financial capability and technology adoption. Finally, future studies may examine how institutional environments and fintech ecosystems shape adoption and outcomes across different contexts. Comparative and cross-country studies can further enrich understanding of how regulatory frameworks, financial infrastructures, and digital ecosystems influence entrepreneurs' ability to leverage fintech for productivity gains.

Declarations

Ethical

All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. Ethical approval for this study was granted by the xxxxxxx. Written informed consent was obtained from all participants prior to data collection.

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Conflict of interest

The authors declare that they have no competing interests.

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