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Fintech, Financial Inclusion, and Income Inequality

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ABSTRACT

The primary objective of this study is to analyze the relationship between fintech, financial inclusion, and income disparity. We used OLS regression on panel data for 2011, 2013, and 2017 from 93 nations. Mobile phones for bill payments served as an indicator of fintech, while account ownership, savings, and borrowing from established financial institutions were used to gauge financial inclusion. The research shows that the use of fintech, the expansion of access to financial services, and the narrowing of the income gap exist. The findings also emphasize the importance of financial inclusion as a primary factor in how fintech helps reduce income inequality. The study also highlights the significance of R&D spending innovation in successfully deploying Fintech and financial inclusion initiatives to reduce income inequality. The findings as a whole point to the importance of increased access to innovative financial services in reducing income disparities. Fintech and financial inclusion are potent instruments for fostering economic parity, since they expand people's access to resources to meet their financial needs.

Keywords: Income Inequality; Financial Inclusion; Fintech; Research and Development

JEL classification: D31, D63, F02, O11, O15

1. INTRODUCTION

One of the most crucial functions of the financial system and its markets is the equitable allocation of resources. Economic expansion is spurred by efficient resource allocation (Murinde, 2012). However, information failure and imperfect market conditions impact the optimal distribution of wealth. Income inequality (IIE) may increase as a result, as some families and businesses are cut off from access to financial markets. Barriers to reducing poverty, social unrest, and anxiety may emerge due to this rising IIE (Perera & Lee, 2013).

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Consequently, the issue of IIE continues to be a significant challenge in finance and development. This is true in particular contexts where poverty and income disparity are common. As a result of its importance, financial inclusion (FINI) is now acknowledged as a critical aspect of reaching the United Nations' Sustainable Development Goals (SDGs) and decreasing IIE among the general population (Klapper et al., 2016). Despite the importance of this, about 1.7 billion young people around the world do not have access to formal financial services. Complex paperwork, higher costs, and greater distance are frequently cited as the primary causes (Demirgüç-Kunt et al., 2018).

Developments in financial technology (Fintech) have reduced the number of 1.7 billion young people without access to formal financial services (Demir et al., 2022). Fintech's (FINT) impending ascent has the most significant potential to close this gap and usher in more broadly shared prosperity (Demirgüç-Kunt et al., 2018). The government can use FINT to help those without access to financial services. Increased efficiency, precision, and openness in business dealings may hasten the creation of products tailored to the requirements of low-income people.

Income disparity on economic growth, social stability, and individual development have persisted for decades as a significant problem worldwide. The financial technology FINT and the promotion of financial inclusion have shown promise to reduce economic inequality in modern nations. FINT is the creative use of technology in the financial sector; it includes all the apps, websites, and other digital resources that improve the quality, availability, and effectiveness of financial services for consumers (Demirgüç-Kunt et al., 2018).

FINT and FINI are gaining recognition for their potential to alter lives and reduce economic inequality, making them vital to achieving inclusive and sustainable development. These developments can strengthen people's independence, increase their financial security, and broaden their access to economic opportunities by capitalizing on technical improvements. To ensure that the benefits of this digital revolution reach those most in need, governments, policymakers, financial institutions, and innovators must work together to realize the potential of FINT and financial inclusion. This will ultimately lead to a more equitable and prosperous future for societies worldwide (Demir et al., 2022).

We add two significant new points to the FINT, FINI, and IIE discussions. We began by investigating how FINT and FINI decrease IIE after going through Demir et al., (2022). Our research aims to answer the question, "Does FINI help FINT bring down income inequality?" (Park & Mercado, 2018). Second, the study found that more innovative nations are more successful at employing FINT and FINI to

decrease IIE (Khan & Pazir, 2023) than less innovative nations. Economic growth boosts the level and structure of innovation, according to the innovation-growth literature (Pradhan et al., 2016; Maradana et al., 2017), lending credence to this argument. Therefore, countries with more inventions generate more economic growth and job openings. As a result, the wealth gap between different groups in society narrows (Ahlstrom, 2010), and people's lives improve significantly. As a whole, FINT and FINI in the financial sector can lessen IIE by democratizing investment opportunities for marginalized groups, increasing access to credit, decreasing costs, increasing financial literacy, and facilitating microfinance programs (Park & Mercado, 2018). Here is how the rest of the paper is structured. In Chapter 2, we cover the literature review. Section 3 outlines the information and procedures. The findings are presented in Section 4, and conclusions and policy implications are discussed in Section 5.

1.1 Research Questions

- Does FINT increase the level of FINI in developed and emerging economies?
- Does FT help to reduce IIE in developed and emerging economies?

2. LITERATURE REVIEW

FINI refers to the availability of banking and other financial services to individuals and businesses (Sahay et al., 2015). There has been a lot of research indicating that FINI decreases IIE. This finding is consistent with the result that greater availability of financial services reduces income disparity (Turégano & Herrero, 2018). In addition, nations with more bank branches per capita had less IIE on average (Mookerjee & Kalipioni, 2010). A similar negative correlation between FINI and IIE was discovered by Honohan (2007). He determined the percentage of households with access to banking services based on the account holder's occupation.

Results showed that countries with high FINI also have low income inequality (Turégano and Herrero, 2018). Critical indicators of FINI, such as small and medium-sized enterprise financing and account ownership, were utilized. Cámara & Tuesta's (2014) and Sarma's (2012) FINI indices were also used. The findings supported the theory that a lower IIE derives from the wider availability of financial services. Multiple studies have also highlighted the importance of microfinance in FINI, finding that countries with high participation in microfinance programs tend to have less IIE than those with lower incomes. Evidence from many countries shows a negative correlation between financial independence and income disparity.

When looking at FINI and IIE, the outcomes for particular countries are varied. There are big variances in opinion between different parts of the world, especially in the developing world. Significant evidence suggests that throughout North Africa and the Middle East, financial independence is inversely related to income disparity (Neaime & Gaysset, 2018). Previous research by Zhang and Posso (2019) also found an inverse association. Nonetheless, there are regions in the Americas, Africa, and Asia where this is not the case (Park & Mercado, 2018). The quality of banks, regulations, and the economy's growth are connected to access to FINT across nations (Demir et al., 2022). However, several empirical researches by Dimova and Adebowale (2018) find a positive correlation between FINI and IIE. Both studies found that those with lower incomes were less likely to seek out formal work opportunities than those with higher incomes.

Furthermore, a 2016 World Bank poll found that 8 out of 10 people in emerging economies own a cell phone. A household's mobile connectivity, they said, is more important than running water and power. According to Aker and Mbiti (2010), using ICT to reduce economic inequality is widely seen as a promising strategy in emerging nations. Technology like this may help governments better enforce anti-corruption measures and collect taxes. Asongu and Le Roux (2017) reported similar findings. Researchers found a positive association between mobile, broadband, and internet use and GDP growth. These nations' rapid economic expansion helped reduce widespread poverty.

In contrast, Asongu (2015) analyzed data from 52 African nations and concluded that cellphone penetration hurt IIE. Asongu and Odhiambo (2019), who examined panel data from 48 African nations, provided more support for the conclusion. Their findings show fewer people would be financially excluded due to ICT advancements. Increases in mobile phone coverage have been linked by Beuermann et al. (2012) to less severe poverty among Peru's rural elites. Similarly, Abor et al., (2018) showed that widespread access to mobile phones in Ghana was associated with decreased poverty. In addition to these benefits, higher rates of mobile phone use have led to enhancements in health care, farming, and education across several African nations (Aker & Mbiti, 2010).

Most studies are focused on ICT. Hence, FINT and mobile finance get less attention. Researchers Asongu and Nwachukwu (2018) examined the global relationship between mobile banking and inclusive development. Poverty, IIE, and growth quality were indicators of inclusive development. Asongu and Odhiambo (2018) found that in high-middle-income nations, IIE is negatively associated with the prevalence of mobile money transfers and bill payments at the 10^{th} and 90^{th} percentiles using quantile regression.

In addition to the above, the association between FINT and IIE may be moderated by the nation's economic development level (Demir et al., 2022). Recent research has supplied the requisite reasons for using FINT to mitigate poverty and economic disparity. Zhang et al., (2018) performed research in China and found that encouraging entrepreneurship investments may reduce the gap between rich and poor people. A comparable study in Kenya found that although smartphone use reduced poverty, it also boosted spending per person (Suri & Jack, 2016). Increased family savings and stability in the face of economic uncertainty were two advantages of the shift in consumer behavior. Previous research, including that by Muralidharan et al., (2014), has shown that digitizing the government payment system helps minimize corruption and administrative expenses, in addition to the abovementioned advantages.

Moreover, most studies have also discovered that ICT and FINT have a major effect on FINI (Tchamyou et al., 2019). The connection between ICT, FINT, and FINI was shown to be weak by the findings of Peruta (2018). In addition, Ghosh (2016) and Andrianaivo and Kpodar (2012) both find that the degree to which mobile phones are used in a country significantly impacts the prevalence of FINI. Increasing mobile penetration was shown to have a beneficial effect on both family income and business financial indicators. Furthermore, Ouma et al., (2017) find that families who utilize mobile money accounts are more likely to save money since they send/receive money and remittances more often. Gosavi (2018) observed that mobile money transfer favorably influences the FINI of SMEs by expanding their access to bank credit and loans.

The research agrees that low-income groups lack access to financial services due to inefficient financial markets, transaction costs, and information asymmetry (Galor & Zeira, 1993). The growth of FINT and FINI gives policymakers reason to believe

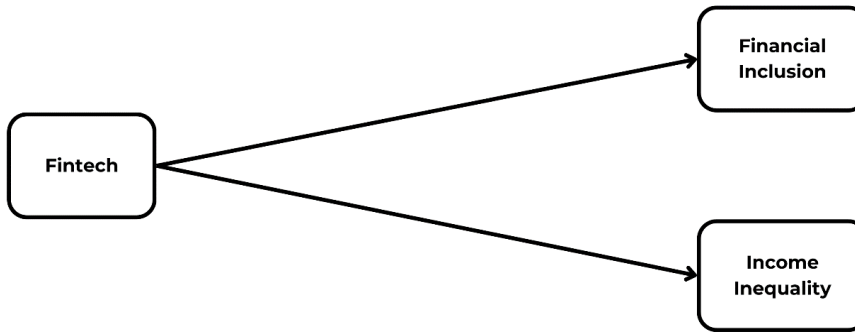

Figure 1: *Theoretical Framework*

that low-income individuals will have easier access to these services. However, further investment in R&D may be needed to make these financial services more widely available and advanced. The research on expanding new ideas significantly supports this claim (Maradana et al., 2017; Pardhan et al., 2016).

As previously mentioned, our review of the literature led to two significant additions to the FINT, FINI, and income equality literature.. We began by investigating how FINT and FINI decrease IIE after reading Demir et al., (2022). Our research aims to answer the question, "Does FINI help FINT bring down income inequality?" (Park & Mercado, 2018). Second, the research found that more innovative nations are more successful at using FINT and FINI to reduce IIE (Khan & Pazir, 2023) than less creative nations. Economic development boosts the amount and structure of innovation, according to the innovation-growth literature (Pradhan et al., 2016; Maradana et al., 2017), lending credence to this argument. Therefore, nations with more inventions generate more economic development and job openings. As a result, the wealth gap between different groups in society narrows (Ahlstrom, 2010) and people's lives improve significantly.

3. METHODOLOGY

3.1 Data and Sample Selection

Since FINI data is only accessible for 2011, 2014, and 2017, we compile information from various sources for those years. Following Demir et al., (2022), we first used a convenience sampling technique to obtain 140 nations' data. Convenience sampling is not based on statistical likelihood, but rather on the researcher's convenience. However, countries without data for the most recent three years were left out of the analysis. This study used balanced panel data instead of unbalanced panel data because it helps reduce bias in the estimation process and leads to efficient estimation and better control for unobserved heterogeneity (Finkel, 1995). As a result, 93 nations make up the whole dataset instead of a total of 140 countries. Among the sampled nations, the research further classified those with high and low levels of innovation. Researchers used 2017's Global Innovation Index as a benchmark year to determine which countries were most and least innovative. This method has been utilized in some recent studies see for instance (Nasir & Zhang, 2024).

In addition, the researchers distinguished between nations with high and poor innovation by using the second quantile as a criterion. Accordingly, nations with three-year averages below the second quartile (2011, 2014, 2017) are classified as low-innovation nations, and vice versa. Income inequality, trade, redistributive

policies, and gross domestic product are collected from the World Bank's World Development Indicators (WDI). In addition, the Global Financial Inclusion Database is used to collect information on FINI and FINT. The International Monetary Fund's (IMF) Financial Development Index is used to compile the statistics for financial advancement.

3.2 Variable Description Table 1

Table 1 *Variable Description*

Variables	Description	Source	Empirical Evidence
Dependent Variable			
Income Inequality (IIE)	It ranges from 0 to 100, where lower values indicate perfect equality and higher values indicate perfect inequality	World Development Indicators (WDI)	Demir et al., 2022
Independent Variables			
Financial Inclusion (FINI)	Percentage of the population over 15 years having an account (ACC), savings (SAV), or borrowings (BOR) from a formal financial institution	Global Financial Inclusion Database	Aslan et al., (2017)
Fintech (FINT)	Cell phones to pay bills	Global Financial Inclusion Database	Demir et al., 2022
Control Variables			
Financial Development (FD)	The level of FD is measured through the financial development index	International Monetary Fund	Jaumotte et al., (2013)
Redistributive Policies (RP)	Government spending over GDP for RP	WDI	Becket al., (2007)
Education (EDU)	The secondary school enrollment rate	WDI	Jaumotte et al., (2013)

Trade	The sum of imports and exports as a percentage of GDP	WDI	Demir et al., 2022
GDP	The yearly percentage variations in per capita	WDI	Demir et al., 2022

3.3 Econometric Models

$$\boldsymbol{Financial\ Inclusion_{it} = \alpha_0 + \alpha_1 Fintech_{it} + \alpha_2 controls_{it} + \mathcal{E}_{it}} \ldots\ldots \textbf{(1)}$$

$$\boldsymbol{Inequality_{it} = \beta_0 + \beta_1 Fintech_{it} + \beta_2 Financial\ Inclusion_{it} + \beta_3 controls_{it} + \mathcal{E}_{it}} \ldots\ldots\ldots \textbf{(2)}$$

The left-hand side variables in equations 1 and 2 are FINI and IIE. In contrast, the right-hand side variables include FINT and country-level control variables in country i and time t. Equation 2 has FINT, FINI, and country controls on the right-hand side. Eit refers to the error term. Ordinary Least Squares regression, or OLS for short, is a typical method for estimating the coefficients of linear regression equations. These equations represent the relationship between one or more independent quantitative variables and a dependent variable (single or multiple linear regression), and OLS provides a strategy for doing so.

4. RESULTS

4.1 Summary Statistics

Table 2 *Summary Statistics*

Variable	Mean	Median	Max	Min	Obs
IIE	36.60	35.10	63.00	24.00	279
FINI (ACC)	0.58	0.58	1.00	0.01	279
FINI (SAV)	0.23	0.14	0.73	0.07	279
FINI (BOR)	0.12	0.11	0.45	0.04	279
FINT	0.34	0.22	0.92	0.00	279
FD	0.38	0.32	0.90	0.00	279
EDU	92.33	98.13	162.29	13.83	225
RDP	15.92	16.11	26.55	4.35	276
Trade	91.93	78.64	400.09	19.49	276
GDP	25.35	25.81	29.92	21.72	279

With an average of roughly 37%, it is clear that IIE is an issue in several nations. About half of all adults have an account with a bank or other financial institution, making FINI a reality for about 58 percent of the population. The other two FINI metrics, savings and borrowing, average out to 23% and 12%, respectively. This finding suggests that consumers in the sample nations have access to many accounts at official financial institutions but are hesitant to utilize these accounts for saving and borrowing purposes.

With a mean value of 92%, education positively impacts IIE in the sample nations. This is because people with greater levels of education may be better able to find and pursue fulfilling careers. The mean value of about 16% implies that policymakers are attempting to adopt redistributive measures when corporations may not harm public interests. Similarly, higher levels of trade, as measured by a mean value of 92%, suggest that customers' spending power has grown, which may mitigate inflationary pressures. Income inequality in a society may be mitigated as a result of this decline in inflation. Improved economic and institutional circumstances in the sampled nations may also contribute to less income inequality. A growing population, however, might lead to dwindling supplies, exacerbating the issue of economic inequality.

4.3 Regression Outcomes

Table 3 *The Effect of FINT on FINI*

Variables	1 (ACC)	2 (SAV)	3 (BOR)
FINT	0.311*** -0.122	0.214** -0.127	0.051** -0.019
GDP	0.161** -0.042	0.111** -0.027	-0.015* -0.055
RDP	-0.042*** -0.075	0.022** -0.017	0.061* -0.023
EDU	0.231*** -0.115	0.196** -0.123	0.121*** -0.310
Trade	0.616*** -0.541	0.113*** -0.101	-0.014* -0.081
R-Square	0.771	0.793	0.337
Obs	225	225	225

Table 3 presents OLS regression results. Only coefficients and standard errors are reported for brevity. *, ** and * presents level of significance at 1%, 5%, and 10% respectively.**

All three FINI proxies (ACC, SAV, and BOR) were shown to have a positive correlation with FINT. The Accounts coefficient is the biggest of all the measures, while the Borrowings coefficient has the lowest sign. The findings imply that a country's degree of FINI rises as individuals of legal age (15+) use their mobile

phones more often to pay bills. Gosavi (2018) and Demir et al. (2022), among others, agree with our findings. Similarly, FINI tends to rise in tandem with GDP growth, educational attainment, and the strength of institutions.

Table 4 *The Effect of FINT on IIE*

Variables	1	2	3	4
FINT	-10.717***	-12.111**	-9.991***	-10.111**
	-1.313	-1.589	-1.116	-2.333
FINI (ACC)		5.815*		
		-2.515		
FINI (SAV)			-3.198	
			-2.178	
FINI (BOR)				4.111
				-5.868
GDP	0.311	0.310	0.581	0.521
	-0.299	-0.341	-0.350	-0.241
Trade	-0.524***	-0.161**	-0.217**	-0.121**
	-0.303	-0.110	-0.188	-0.099
RDP	-0.293**	-0.366**	-0.222**	-0.276*
	-0.132	-0.134	-0.134	-0.161
EDU	0.069	0.037	0.042	0.040
	-0.021	-0.021	-0.031	-0.033
R^2	0.265	0.271	0.255	0.243
OBS	224	224	224	224

Table 4 presents OLS regression results. Only coefficients and standard errors are reported for brevity. *, ** and * presents level of significance at 1%, 5%, and 10% respectivel**

Regression findings for IIE are shown in Table 4. The model's other control variables are all described in the first FINT column. We then established three FINI proxies in columns 2, 3, and 4: ACC, SAV, and BOR. Results revealed an inverse relationship between FINT and IIE. This suggests that when more individuals use their mobile phones to pay their bills, it helps to reduce IIE. This indicates that, at least in the chosen sample nations, the issue of IIE may be mitigated by an increase in the quantity of high-tech services individuals consume through their mobile phones. It should be highlighted, however, that when FINI factors are included in the model, FINT affects IIE much more, as shown in the prior findings in Table 3.

The findings in columns 2–4 emphasize the importance of FINI, which mitigates the effects of more extreme income disparities. The computed coefficient implies that when a nation adopts FINI policies, IIE drops by almost 12-14%. This further demonstrates that FINI is a critical mechanism via which FINT mitigates the issue

of IIE. The results suggest that FINT may help reduce income disparity when widespread service adoption increases use to meet basic financial requirements.
In conclusion, the findings suggest that FINT as a kind of financial technology is well on its way to becoming a serious contender for the role of existing financial institutions all around the globe. Narrowing the gap between the unbanked, underbanked, and developed may open up new opportunities for the global digital economy. In countries where low-income people are underrepresented, this might lead to more remarkable economic development and social justice (Bisht & Mishra, 2016).

Our findings are consistent with those of earlier research (Zhang & Posso, 2019; Demir et al., 2022). Regarding the behavior of the control variables, it can be said that it is most consistent with what was anticipated. The reduction of income disparity among the sampled nations may be attributed to trade, redistributive policies, and financial integration. The findings of this study are comparable to those found in other research (Demir et al., 2022).

Table 5 *The Effect of FINT and FD on IIE*

Variables	**1**	**2**	**3**
FINT	-7.459***	-9.515**	-10.355**
	-0.279	-1.171	-1.210
FD			1.616
			-3.221
GDP		0.399	0.111
		-0.273	-0.363
Trade		-0.020*	-0.015**
		-0.001	-0.013
RDP		-0.215*	-0.310**
		-0.144	-0.121
EDU		0.038	0.037
		-0.028	-0.028
R^2	0.113	0.251	0.279
OBS	279	224	224

Table 5 presents OLS regression results. Only coefficients and standard errors are reported for brevity. *, ** and * presents level of significance at 1%, 5%, and 10% respectively.**

The findings of FINT and FD on IIE are shown in Table 5. The analysis of regressing FINT on IIE may be seen in the first column. In the second column, we provide the model's control variables; in the third column, we include an alternative measure of financial inclusion known as financial development. Finally, we present

the model's results. The results are identical to those that were discovered in Table 3. However, the alternative proxy for FINI, which is FD, does not influence income inequality in the same way as the proxies that have been employed in the past, which are accounts, savings, and borrowings, do. The fact that the coefficient has a positive value indicates, however, that a rise in money supply in the form of financial development does indeed lead to an increase in the existing level of income disparity. It indicates that a suitable and robust regulatory structure is more vital and that an abundance of finance alone is insufficient to solve the wealth discrepancy problem among the general population. The results of this study (Jauch & Watzka, 2016) provide solid evidence in favor of this thesis. These statements, however, go counter to the theoretical reasoning presented in the FD and income inequality nexus (Galor & Zeira, 1993), which states that a larger FD tends to reduce income disparity. Our secondary findings, including those about the remainder of the results and the signs of the coefficients, have not changed at all.

Table 6 *High vs Low Innovation*

Variables	High	Low
FINI (ACC)	0.144	1.212
	(-6.468)	(-7.866)
FINI (SAV)	-3.880	33.166**
	(-10.411)	(-17.777)
FINI (BOR)	-33.551**	21.330
	(-15.121)	(-23.811)
FINT	-8.722**	-11.010
	(-4.110)	(-8.884)
R^2	0.771	0.681
OBS	**138**	**85**

Table 6 presents OLS regression results. Only coefficients and standard errors are reported for brevity. *, ** and * presents level of significance at 1%, 5%, and 10% respectively.**

The findings shown in Table 6 revealed that nations with high innovation ratings tend to employ FINT and FINI more successfully to minimize the economic disparity within their particular countries than countries with low innovation scores. It suggests that nations that engage in greater research and development activities benefit from the reduction of income disparity achieved via FINT and FINI. On the other hand, we can observe that FINT and FINI, in nations with low levels of innovation, either do not considerably decrease income inequality or maintain positive coefficient signals. The findings shown in Table 6 are supported by research on the relationship between innovation and economic development. According to this research, economic growth encourages both the level and the structure of

innovation (Pradhan et al., 2016; Maradana et al., 2017). Therefore, nations with greater levels of innovation can produce quick economic development and job possibilities, which, in turn, considerably improves people's lives by eliminating poverty and providing equitable income within a community (Ahlstrom, 2010). Our findings, which are provided in Table 5, support our contention that innovation in the form of research and development may improve the efficiency with which FINT and FINI are used to reduce IIE.

5. CONCLUSION

This work aims to investigate how FINT and FINI contribute to IIE. The research accomplished this by using OLS regression on panel data for 2011, 2014, and 2017 from 93 countries. The results show that FINT and FINI aid in lowering international income disparities. Similarly, we find that FINT is a significant element that mitigates the problem of income disparity in prior research (Gosavi, 2018). Also, the findings show that one of the effective ways to use FINT and FINI to reduce IIE successfully is via increased spending on R&D. This finding suggests that nations with excellent rates of innovation also produce higher rates of economic development and job creation. As a result, people's quality of life may increase. Overall, the findings suggest that more individuals having access to cutting-edge financial services helps reduce economic disparity among the masses, reducing social unrest and anxiety, and allowing people to meet their financial obligations better.

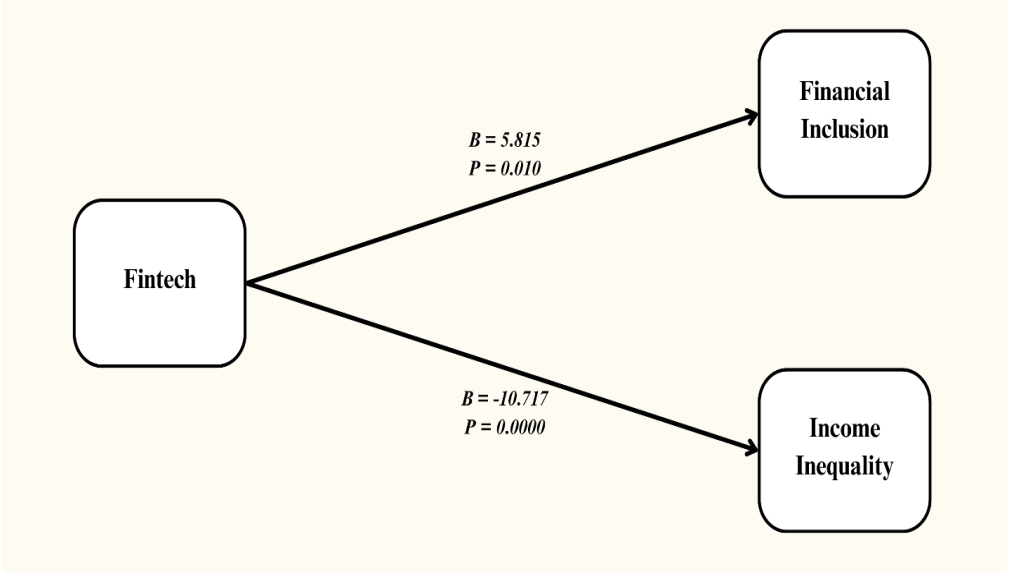

Figure 2: *Summary of Results*

The research leads to multiple significant policy consequences. As a first step, we utilize the findings to urge decision-makers to do whatever is required to create regulations that may make it easier for and encourage more individuals to use cellular networks to meet their financial obligations. Potentially, this might lead to a reduction in economic disparity. Policies encouraging individuals to utilize FINT as a source of income can reduce economic inequality. Because an excess of finance alone is insufficient to decrease wealth disparity among the people, we also propose that authorities create a robust regulatory framework before utilizing FD to do so. Third, since the need for financial services differs across cultures, traditions, beliefs, and income levels, financial institutions should tailor innovative and need-based formal financial services appropriate to financially excluded parts of the public. Fourth, the financial services infrastructure and network in rural and urban regions should be developed and upgraded by collaborative efforts between governments, central banks, financial institutions, and development partners. Fifth, low-income people's financial understanding and behavior must be altered by a specific strategy to boost financial literacy in rural and remote locations, with a clear time frame for action. Finally, we suggest that regulators encourage private investors to increase their spending on R&D for financial services—a possible benefit for those living in financially underserved or unbanked communities.

One limitation of this research is that there is not much historical data readily available, particularly about FINT. Therefore, we cannot use other econometric models to validate the study's baseline findings. Microfinance, foreign direct investment (FDI), and FI may all play a part in future studies examining the causes and solutions to income disparity worldwide.

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