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Fintech and inclusive growth: Evidence from 25 Asian developing countries

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FINTECH AND INCLUSIVE GROWTH: EVIDENCE FROM 25 ASIAN DEVELOPING COUNTRIES

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Abstract

The primary objective of this study is to unveil the impact of FinTech through financial development, financial inclusion, and institutional quality on the inclusive growth of 25 developing countries in Asia. To serve this purpose, the Human Development Index (HDI), the dependent variable, has been taken as the proxy for inclusive growth along with a set of independent variables in a well-balanced panel data set, which is then analyzed to see the impact of changing levels of independent variables on human development for the period 2014–2021. The results show that increasing the level of FinTech along with the Findex, financial inclusion, and institutional quality may increase human development.

Keywords: FinTech, financial inclusion, inequality, panel data model, Hausman test

JEL Classification: C23, D31, D63, F02

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1. INTRODUCTION

The concept of FinTech, which refers to the use of technology to deliver financial services, is an important component of financial inclusion. FinTech has the potential to revolutionize the way financial services are delivered, making them more accessible and affordable for underserved populations. With the rise of mobile banking, for example, people can now access financial services using just their mobile phones, without the need for a physical bank branch. This has the potential to bring financial services to remote areas and underserved populations. A fundamental component of social inclusion is financial inclusion, which is particularly effective in ensuring inclusive growth and consequently reducing income inequality and poverty by incorporating underprivileged groups of people into formal banking channels. Financial inclusion programs refer to those programs that make formal financial services inexpensive and accessible to all sectors of the population, particularly for low-income individuals. By providing the "newly banked" with an easy access to authorized financial services that are governed by rules, financial inclusion is promoted. Financial exclusion mainly represents poor demographic segments, and vulnerable groups including rural residents, women, and families with low incomes. It will ensure shared prosperity and inclusive economic growth if we can bring financially excluded people into basic financial services, i.e., saving, borrowing, insurance, payments, etc.

FinTech differs from traditional finance by utilizing technology to provide financial services, operating on a P2P basis to reduce transaction costs, and potentially disrupting the existing financial industry. While FinTech can offer significant benefits, such as increased access to financial services and lower costs, there are also potential risks, such as increased vulnerability to cyber attacks and less regulatory oversight. Policymakers must carefully consider these risks and benefits and ensure appropriate regulations are in place to protect consumers and ensure financial stability.

By enabling economic agents to participate in long-term participatory investment activities, access to financing promotes inclusive growth. It makes it easier to allocate resources productively, which lowers the cost of capital. It also helps deal with unforeseen short-term shocks, considerably improves day-to-day financial management, and eliminates the use of typically exploitative informal loan sources (Demirgüç-Kunt et al. 2015, 2018). In developing economies, 71% of adults now have a formal financial account, up from 42% a decade earlier, according to the most recent data from the Global Findex Database. Additionally, Demirgüç-Kunt et al. (2022) found that the disparity in access to finance between men and women in developing countries has decreased from 9 percentage points to 6 percentage points. However, because of market imperfections and knowledge gaps, the most effective use of capital resources may be compromised. Some enterprises and households may also be excluded from formal financial markets, which would be deleterious to inclusive economic growth.

Financial inclusion has gained momentum in recent years as a dynamic instrument for achieving inclusive and sustainable economic growth, multifaceted macroeconomic stability, poverty reduction, job creation, and income equality for developed and developing nations alike. Additionally, financial inclusion appears to be a supplemental and incremental strategy for achieving the United Nations' Sustainable Development Goals (SDGs). The World Bank has recognized financial inclusion as a driver for seven of the 17 SDGs.¹ In a world where financial exclusion and inclusive growth are pervasive, it is not unexpected that there are worries about the relationship between

¹ <https://www.uncdf.org/financial-inclusion-and-the-sdgs>.

finance and development. As an example, SDG 10 of the UN 2030 Agenda for Sustainable Development acknowledges the critical role that financial inclusion plays in attaining the SDGs and ensuring inclusive growth (Allen et al. 2016).

Advanced economies have already seen evidence of the positive impact of FinTech and financial inclusion on inclusive growth. By leveraging technology and finance, these economies have been able to reduce income inequality and poverty, while increasing access to capital and opportunities for underprivileged individuals. The use of FinTech in financial services has led to a rise in entrepreneurship, job creation, and economic growth. Additionally, FinTech has improved transparency and efficiency in financial transactions, which reduces the potential for corruption and fraud.

Although poverty has been reduced and income has been increased rapidly during the past few decades, millions of people are still either voluntarily or involuntarily excluded from the financial system due to market discrimination and low income levels in developing nations, which could result in the loss of investable money, savings, and wealth building. In Asia and Africa in particular, a large portion of the total population is still struggling to maintain a minimum standard of living. Most of the extreme poor live in Sub-Saharan Africa, but not at the USD3.65 and USD6.85 poverty lines. In 2019, South Asia had the highest share of the global poor at both the USD3.65 (43%) and USD6.85 (42%) poverty lines. The share of the global poor who live in the East Asia and the Pacific region is also significant at the USD6.85 poverty line (19% in 2019). A large number of the global poor at these higher lines live in India (where 595 million people live on less than USD3.65 a day) and the People's Republic of China (PRC) (where 348 million people live on less than USD6.85 a day) (World Bank 2022).

In developing countries, particularly in Asia, there is a growing need to address FinTech in order to promote inclusive growth. Many people in these countries lack access to formal financial services, making it difficult for them to invest in their future or start their own businesses. FinTech has the potential to bridge this gap, by providing low-cost and accessible financial services to underserved populations. However, developing countries also face unique challenges in implementing FinTech, such as a lack of infrastructure and regulatory frameworks.

In recent years, FinTech has seen rapid growth and adoption in both advanced and developing economies, including those in Asia. The number of FinTech start-ups in the region has been increasing steadily, with countries such as Singapore, India, and the PRC emerging as major FinTech hubs. Moreover, the usage of FinTech services has also been on the rise, with digital payments, mobile banking, and online lending becoming increasingly popular among consumers. This trend towards FinTech adoption in developing economies is closely linked to the potential for promoting inclusive growth. By leveraging technology and financial innovation, FinTech can address the financial inclusion gap that exists in many of these economies. It can provide low-cost and accessible financial services to underserved populations, including women, small businesses, and rural communities. This, in turn, can increase their access to capital and opportunities, leading to a rise in entrepreneurship, job creation, and economic growth.

Notwithstanding, there seems to be a lot of hope and optimism that recent developments in financial technology (FinTech) would offer unprecedented opportunities to overcome obstacles to financial inclusion and reduce the remaining gaps in the ownership and use of bank accounts (or accounts at a financial institution), by taking advantage of the expanding adoption of mobile technology (AFI 2018). According to the GPF (2016) and Demirgüç-Kunt et al. (2018), mobile financial

services offer the most potential for bringing the remaining unbanked population into the formal financial system and, eventually, for encouraging more equitable growth.

There has not been much research done to see if FinTech might help increase financial inclusion and how that might eventually assist us in understanding the untenable issue of inclusive growth. However, several studies have looked at the association between financial inclusion and inclusive growth at the national level. In this regard, this paper seeks to investigate the association between FinTech and inclusive growth. Therefore, the objective of this study is to investigate the impact of FinTech through financial development, financial inclusion, and institutional quality on human development, a proxy for inclusive growth, using data from the Human Development Index (HDI), Financial Development Index, Global Findex, World Governance Index (WGI), and World Development Indicators (WDIs) on the institutional quality of 25 Asian developing countries.

The rest of the paper is organized as follows. We describe existing literature related to the topic in Section 2. In Section 3, we discuss the econometric strategy, data sources, and the development of the composite financial inclusion indicator for regression analysis impact testing, while in Section 4, we present and discuss the main results of the empirical exercise. Finally, in Section 5, we provide a summary of the key conclusions and policy suggestions.

2. RELATED LITERATURE REVIEW

In light of the fundamental theory regarding financial institutions, banks and nonbank financial institutions mainly function to channel liquidity from the surplus groups to the shortage groups.. This transferring method is quite conservative long ago mostly due to lack of digitalization. These days, people are rapidly becoming involved in technologies even in the case of financial transactions. People are using FinTech facilities along with cryptocurrency and bitcoin, which are beyond the control of government, undermining monetary flow under central banks. Modern technologies shed new light on financial business models to make people's lives easier and more inclusive. Starting from increasing the efficiency of the sector in achieving economic growth, economies are having the chance to deal with less inequality via financial inclusion (Khotinskay 2019).

Hasan, Yajuan, and Mahmud (2020) describe inclusive finance as an accessibility of financial services to unbanked and low income individuals living in rural areas. Its aim is to ensure that every adult has their own financial account and other products to access with the help of an innovative and updated technological financing system. FinTech comes into this category, where root-level individuals are being enabled to gain easy access to financial services with a wide range of technology, such as online banking, agent banking, mobile financial services, etc. This will eventually bring the poor and underrated rural people into the light of the banking system, which will help enhance living standards and reduce inequality.

Financial Inclusion

Demir et al. (2022) tried to evaluate the relationship between financial inclusion, FinTech, and income inequality as well as how FinTech directly influences inequality through financial inclusion. The effects of financial inclusion on inequality and the shift in inequality brought about by adopting FinTech have both been the subject of several studies. According to this study, financial inclusion lowers income inequality in every quintile of the distribution of inequality, with higher-income nations playing a major role, whereas FinTech contributes directly to closing the inequality gap.

Using a sparse model, Omar and Inaba (2020) examined the role of financial inclusion in reducing poverty and inequality and discovered a negative correlation between the two in developing nations. The outcome, however, revealed that financial inclusion cannot completely alleviate poverty. Instead, some economic factors contribute to the effectiveness of financial inclusion. Similarly to this, Aslan et al. (2017) demonstrate that decreasing income inequality can be achieved by increasing the population's "intensity of use of financial services" (measured by the proportion of people who have a financial institution account, save at or borrow from one, and send or receive digital payments).

By using different financial inclusion measures, such as the percentage of adults (aged 15+) who have an account at a formal financial institution, the percentage of adults who save at a formal financial institution, and the percentage of adults who borrow from a formal financial institution, Allen et al. (2016) tried to investigate the advantages of financial inclusion (FI).

Asongu (2015) discovered a negative association between cell phone penetration and economic disparity because it has an income-redistributive effect using a sample of 52 African countries. However, widespread mobile use and financial inclusion significantly reduce the likelihood that a household will become impoverished and increase per capita consumption, according to a study by Abor, Amidu, and Issahaku (2018).

In order to evaluate numerous macroeconomic and country specific factors affecting the level of financial inclusion for 176 economies, including 37 from developing Asia, Park and Mercado (2018) developed a new financial inclusion index. The estimation results revealed that for the global and Asia samples, per capita income, the presence of the rule of law, and demographic traits had a substantial impact on financial inclusion. Only the overall sample, not the Asian one, saw a substantial rise in financial inclusion as a result of completing primary education and reading. The results also showed a strong correlation between lower levels of income inequality and poverty for the overall sample with financial inclusion. However, it doesn't seem as though there is a connection between financial inclusion and economic disparity in developing Asia.

FinTech

FinTech does not directly lower economic inequality in Africa, according to the SEM model. This finding indicates that while high-income earners profit from FinTech, low-income earners do not fully benefit from it to improve their financial situation (Chinoda and Mashamba 2021). Through the mediation approach, the study also discovered beneficial and direct connections between FinTech and financial inclusion.

The digitization of government payments reduces administrative costs and corruption, freeing up more money for social investment, according to data from India and Niger. This may indicate that financial inclusion is accelerated by mobile money transfers (Aker et al. 2011; Muralidharan, Niehaus, and Sukhtankar 2014). The findings show that using a mobile phone has a variety of positive externalities in Sub-Saharan countries. Mobile devices may increase consumer and producer welfare and spur more significant economic growth (Aker and Mbiti 2010). There is proof that the proliferation of mobile phones and financial inclusion both internationally and domestically are strongly correlated (e.g., Andrianaivo and Kpodar 2012; Ghosh 2016).

According to Asongu and Le Roux (2017), mobile, internet, and broadband penetration have a deleterious impact on inclusive growth in Sub-Saharan nations.

Evidence from the PRC suggests that FinTech, a measure of digital financial inclusion, reduces the income gap between rural and urban areas by encouraging rural residents

to start their own businesses (Zhang et al. 2020). According to a study by Suri and Jack (2016), using mobile money is a contributing factor towards escaping poverty among roughly 2% of Kenyan households, which also helps in upgrading their consumption levels. These advantages were fueled by rising financial stability, increased savings, and people leaving agriculture and entering the economic world.

Inequality

Turegano and Herrero (2018) discovered that financial inclusion, rather than the size of the financial institution, plays a deterministic role in dramatically reducing income inequality. As a result, they recommend that the government accelerate financial inclusion in order to reduce inequality.

Other research (Jack and Suri 2011; Ghosh 2016; Gosavi 2018; Tchamyu, Erreygers, and Cassimon 2019) has discovered that ICT and FinTech are the essential forces behind financial inclusion, with the exception of Della Peruta (2018). Additionally, the use of mobile money has a favorable effect on businesses and households in the case of financial inclusion (Morawczynski 2009; Jack and Suri 2011).

According to Huang and Zhang (2020), financial inclusion reduced urban-rural income inequality over time but increased it over the short term. The study also identified two potential causes for the short-term increase: the rapid growth of financial networks and the education gap between rural and urban areas.

De Haan and Sturm (2017) investigated the relationship between financial development, financial liberalization, and banking crises. The paper postulates that all finance variables increased income inequality, in contradiction to the majority of earlier research.

Inclusive Growth

The research by Evans (2015) offered empirical proof of how economic and financial development affects financial inclusion in Africa. According to this study, financial inclusion has a significant positive impact on economic growth; hence, the financial systems of African nations with better economic growth are more inclusive.

Using time series data from Cameroon, Puatwoe and Piabuo (2017) examined the effects of financial development on economic growth. The monetary aggregate (M2), government spending, and economic growth are found to have a short-run positive association. Bank deposits, private investment, and economic growth have a short-run negative relationship. However, over the long term, every indicator of financial development has a favorable and considerable impact on economic growth.

Telecommunications infrastructure strengthens the impact of financial development on the economic growth of Sub-Saharan African nations, according to research by Junior et al. (2021). As a result, Sub-Saharan African economies should take the necessary steps to improve their telecommunications infrastructure in order to efficiently translate the benefits of the financial sector into economic growth. Kim (2016) made an effort to calculate whether financial inclusion, defined as financial accessibility, has a favorable impact on lowering income inequality as well as examining the impact of such inclusion on economic growth. The study discovered a link between income disparity and GDP growth that was unfavorable in low-income countries. Additionally, income disparity has a more significant impact on slowing down economic growth in countries with high levels of fragility.

Song, Chang, and Gong (2021) looked into the long-term connections between corruption, economic expansion, and financial development in 142 different countries.

The findings demonstrated that in both the entire sample and the subsamples of developing nations, there is a long-term cointegration relationship between GDP, corruption, and financial development. Additionally, the panel FMOLS estimations showed that economic growth favorably influences financial development while corruption has a negative impact in both the overall sample and the subsample of developing nations. The VECM illustrates the long-term causal links between economic growth, corruption, and financial development. However, the causalities are not present for industrialized nations.

Therefore, it may be claimed that all of these studies clearly show a relationship between financial inclusion and income inequality, whereas FinTech and inclusive growth have not yet been thoroughly studied. As a result, this study aims to supplement the body of knowledge about the effects of FinTech on human development as a stand-in for inclusive growth using data from 25 developing Asian countries and a different set of variables. The paper will eventually make a contribution to the literature about the impact of FinTech via financial inclusion on human development. The Human Development Index (HDI) is popularly perceived as a proxy of inclusive growth that includes the aspects of wealth, schooling, and health. It is the most widely used analytical framework for measuring inclusive human development outcomes and also a component of calculating inclusive development indices (Mitra and Das 2018; Ejemeyovwi and Osabuohien 2020; Dörffel and Schuhmann 2022).

3. DATA AND ECONOMETRIC STRATEGY

3.1 Model

Inclusive growth is generally represented by the Human Development Index (HDI) of countries according to the related literature, and FinTech is mostly measured by the digital payment methods (Aslan et al. 2017). Having knowledge about using technology for financial transactions usually brings more benefit. People can have easy access to different financial products by using FinTech like mobile financial services, online banking, agent banking, etc., and by using these types of FinTech, people will have better living standards and can also contribute to the economy. Thus, through financial literacy, people will invest more in their education and increase their years of schooling. According to the study objective, the impact of FinTech on the HDI of Asian countries can be determined through the following model:

$$HDI_{i,t} = \alpha_0 + \alpha_1 Fintech_{i,t} + \alpha_2 Financial_Inclusion_{i,t} + \sum_k^K \rho_k X_{k,i,t} + u_{i,t}$$

where HDI is considered as a substitute for inclusive growth, Fintech stands for making digital payments (mobile financial technology), financial inclusion refers to having access to and using formal financial services, and X stands for a group of control variables that are frequently employed in the contemporary financial inequality and technological literature (Asongu and Odhiambo 2019; Demir et al. 2022).

In this model, the control variables are chosen with supported literature. The variables are: GDP per capita, trade openness, inflation, government spending, education (secondary enrollment), and population growth. Last of all, the error term, u_i , is presumed to have a variance of one and a mean value of zero.

3.2 Data

For our exploratory analysis, we assembled data from three main sources: the World Development Indicators (WDI) Database for the control variables, the Global Financial Inclusion Database (Findex) for our FinTech and financial inclusion variables, and the United Nations Development Programme (UNDP) for proxy measurement of the HDI as inclusive growth. Among the 48 countries of Asia, 25 were selected for the study following the exclusion and inclusion criteria considering the variability of the countries, particularly in terms of size and economic standing, and availability of data (Appendix A). Some Asian countries have already graduated to developed nations, and these were excluded from this data set to maintain the validity of the study. Moreover, some countries were omitted due to the unavailability of data. As per the availability of data in the Findex database, data series for the years 2014, 2017, and 2021 were selected for the study.

3.2.1 Dependent Variable

In this study, human development will be treated as the dependent variable of the model, which is measured by taking the HDI value of the selected counties (Ruiz et al. 2015). This is the proxy variable of inclusive growth and lies between 0 and 1.

3.2.2 Explanatory Variables

- (i) The FinTech variable is measured by “making digital payments” (mobile financial technology).
- (ii) Financial Inclusion: The percentage of the adult population (aged 15+) with an account at a formal financial institution, the proportion of adults saving at a formal financial institution, and the percentage of those owing debit or credit cards are the different financial inclusion measures that we use to capture access to, and use of, various forms of formal financial services. Allen et al. (2016) suggested that these measures can be used to capture access to, and use of, various formal financial services.
- (iii) The Findex variable is measured by the financial development index value of the countries ranging from 0 to 1.

3.2.3 Control Variables

Our control variables can affect the model in various ways. The variables we consider are: growth, which is measured by the annual percentage change in per capita GDP; trade openness, which is measured by trade as a percentage of GDP; inflation, which is measured by the consumer price index; redistributive policies, for which government spending over GDP is taken as a proxy; institution quality, for which regulatory quality is taken as a proxy; and population growth rate, which is measured by the annual percentage change in the population following Demir et al. (2022).

Now let's look at how the control variables can create an impact on income inequality. By increasing per capital GDP, the income share of poor people can be increased and thus may reduce inequality. But if lower-income people's share of income does not increase, there will be inequality amid GDP growth (Ruiz et al. 2015). On the other hand, increases in inflation and population growth rates generally give a sense of increased inequality.

Table 1: Variable Description

Variable	Source	Definition and Measurement
Panel A: Dependent Variables		
HDI	UNDP	Human Development Index value ranging from 0 to 1
Panel B: Financial Inclusion Indicators		
Account	Global Findex	Have an account (% age 15+),
Financial Institution Account	"	Have an account at a formal financial institution (% age 15+)
Owning Debit or Credit Card	"	An owner of a debit or credit card (% age 15+)
Panel C: FinTech Indicators		
FinTech	"	Made a digital payment (% age 15+)
Findex	International Monetary Fund (IMF), Financial Development Index Database	Financial Development Index
Panel D: Control Variables		
Trade Openness	WDI 2021, World Bank	Trade (% of GDP)
Population Growth	"	Population growth (annual %)
Government Expenditure	"	General government final consumption expenditure (% of GDP)
Inflation	"	Inflation consumer prices (annual %)
GDP Growth	"	GDP growth (annual %)
Institutional quality	World Governance Indicators 2017 (WGI) (World Bank)	Regulatory Quality 2017 (WGI) (World Bank)

Note: This table presents the variables used in the paper, their definitions and/or measurement, and the sources of raw data.

3.3 Empirical Technique

Panel data analysis enables to analyze the impact of changing levels of FinTech and financial inclusion on inclusive growth over time. Furthermore, it eliminates bias from the calculated coefficient by separating country-specific unobserved and time-fixed impacts from the error term in a panel setting (Wooldridge 2012).

When applying estimates to panel data, fixed-effect and random-effect models are both frequently exercised. Unlike the fixed-effect model, a random-effect model assumes that variation between objects is random and not related to any interpreters or independent factors. Instead of whether these effects are stochastic or not, the key distinction between fixed and random effects is whether the unobserved individual effect has elements that are linked with the regressors in the model (Green 2008).² Random effects are used when evidence show that variations between entities have effects on the dependent variable. Random effects also have the benefit of allowing time-invariant variables (e.g., gender), which are absorbed by the intercept in the fixed-effect model.

The model is specified as:

$$\begin{aligned}
 hdi_{it} = & \beta_0 + \beta_1 fintech_{i,t} + \beta_2 findex_{i,t} + \beta_3 account_{i,t} + \beta_4 finacc_{i,t} + \\
 & \beta_5 drcrcard_{i,t} + \beta_6 instqual_{i,t} + \beta_7 tradeopeness_{i,t} + \beta_8 popgr_{i,t} + \\
 & \beta_9 govexpgdp_{i,t} + \beta_{10} inf_{i,t} + \beta_{11} gdpgr_{i,t} + \gamma_t + v_i + \epsilon_{it}
 \end{aligned} \tag{1}$$

² The Hausman test was conducted and the results suggested that a random-effects static panel estimator would be a superior estimator of our model.

where i indicates country and t indicates year in the sample, hdi = log of the HDI value for each country, $fintech$ = percentage of digital payments, $findex$ = Financial development index value, $account$ = percentage of people with an account, $finacc$ = percentage of people with an account at a formal financial institution, $drcrcard$ = percentage of people owing money to a debit or credit card, $instqequal$ = regulatory quality, $tradeopenness$ = log of ratio of total trade to GDP, $popgr$ = population growth, $govexpgdpr$ = general government final consumption expenditure as a percentage of GDP, and $gdpgrowth$ = growth of gross domestic product. Time-fixed effects and country-fixed effects are denoted by γ_t and ν_i , respectively.

Time-fixed effects have been introduced to capture any variation in the HDI between years that might not be covered by the explanatory variables in the model. The idiosyncratic error term is indicated by ϵ_{it} . We expect that FinTech, financial development index, financial inclusion-related variables, and institutional quality might have a positive association with the Human Development Index (HDI). On the other hand, trade openness, government consumption expenditure to GDP, GDP growth might have a positive association with the HDI whereas population growth and inflation might have a negative association with the HDI.

4. ECONOMETRIC RESULTS

4.1 Results and Discussion

The empirical findings on the effect of FinTech, financial development, financial inclusion, and institutional quality on human development as a proxy of inclusive growth are presented in this chapter.

First, we checked to see that the data set is balanced, in accordance with the guidelines for panel data analysis methodologies. The summary statistics are depicted in the table below:

Table 2: Summary Statistics of the Panel Data Set

Variable	Obs	Mean	Std. Dev.	Min	Max
Countries	75	13	7.26	1	25
Year	75	2,017.33	2.89	2,014	2,021
HDI	75	.74	.10	.53	.93
FinTech	75	40.50	26.28	4.88	90.76
Findex	75	.39	.20	.11	.92
Number of Account Holders	75	61.30	25.85	11.46	98.49
Account Holding at Formal Channel	75	60.17	26.82	8.71	98.49
Ownership of Debit/Credit Cards	75	41.53	26.90	3.03	90.20
Institution Quality	75	— .10	.74	—1.73	1.38
Trade Openness	75	72.31	35.90	25.47	160.94
Population Growth	75	1.34	.98	— .83	5.72
Government Expenditure	75	13.87	4.73	5.12	26.06
Inflation	75	7.37	18.17	—1.35	154.76
GDP growth	75	4.76	3.04	—10.52	10.99

Source: STATA output.

Some basic diagnostic tests were conducted to guarantee the model's robustness. The Levin-Lin-Chu (2002) test first demonstrated that all the panels are (trend) stationary and the Pesaran CD test reported no cross-sectional dependence. Second, the Hausman test demonstrated that the random-effect model is appropriate for this particular analysis, which was also logically inferred from the effects of variations between entities on the dependent variable.

Table 3: Fintech and Human Development (Random Effect Estimation)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	hdi	hdi	hdi	hdi	hdi	hdi	hdi	hdi
fintech	0.000623*** (4.80)	0.000520*** (3.93)	0.000334* (2.07)	0.000393* (2.45)	0.000434* (2.39)	0.000623*** (4.76)	0.000589* (2.35)	0.00127* (2.52)
findex		0.112* (2.24)						
account			0.000599** (2.68)					
finacc				0.000509* (2.27)				
drcrcard					0.000423 (1.46)			
instqual						0.000113 (0.01)		
fintechxindex							0.0000720 (0.16)	
fintechxaccount								-0.00000729 (-1.33)
tradeopeness	-0.000109 (-0.47)	-0.000143 (-0.63)	-0.00000352 (-0.02)	-0.0000562 (-0.25)	-0.0000944 (-0.41)	-0.000109 (-0.46)	-0.000108 (-0.46)	-0.0000361 (-0.15)
popgr	0.000359 (0.14)	-0.000209 (-0.08)	0.000443 (0.18)	0.000469 (0.19)	0.000359 (0.14)	0.000358 (0.14)	0.000357 (0.14)	0.000166 (0.06)
govexpgdp	0.000836 (0.57)	0.000500 (0.35)	0.000609 (0.44)	0.000692 (0.49)	0.000560 (0.38)	0.000834 (0.56)	0.000818 (0.55)	0.00103 (0.71)
inf	-0.000129 (-0.97)	-0.000201 (-1.54)	-0.0000936 (-0.75)	-0.0000880 (-0.68)	-0.0000879 (-0.66)	-0.000129 (-0.92)	-0.000133 (-0.98)	-0.000123 (-0.94)
gdpgr	0.000714 (0.87)	0.000365 (0.46)	0.000428 (0.55)	0.000541 (0.68)	0.000918 (1.12)	0.000715 (0.87)	0.000692 (0.83)	0.000594 (0.73)
_cons	0.709*** (25.02)	0.680*** (22.16)	0.680*** (23.09)	0.686*** (23.31)	0.701*** (24.32)	0.709*** (24.36)	0.709*** (24.76)	0.698*** (23.61)
N	75	75	75	75	75	75	75	75

t-statistics in parentheses, * p < 0.05, ** p < 0.01, *** p < 0.001.

Source: STATA output.

The HDI is first regressed on FinTech alone (Model 1), then on FinTech and financial development (Model 2), then on FinTech and account holding (Model 3), then on FinTech and account holding at financial institutions (Model 4), then on FinTech and holding of a debit or credit card (Model 5), and then on FinTech and institutional quality (Model 6) with a number of control variables. With the same arrangement, Model 7 explored the interaction effect of FinTech and financial development and Model 8 examined the interaction effect of FinTech and financial inclusion, taking account holding at financial institutions as the representative variable of financial inclusion. FinTech and the HDI have a significant positive correlation in all seven models, suggesting that FinTech increases the HDI. According to the estimated coefficient, a one-point increase in a nation's adoption of FinTech increases human development

with a 90 to 99 % level of significance, although the degree of improvement would be small in the short run. The result in Column 2 captures the effect of FinTech over human development through financial development with a lower degree and significance. This might happen due to some measurement issues of the financial development index for developing countries. The results in Columns 3–5 are intriguing, with separately inserted variables representing financial inclusion "account holding," "account holding at financial institutions," and "debit or credit card holding." When the three financial inclusion-related variables are introduced in Columns 3–5, it shows that the coefficients in Columns 3 and 4 are significant and positive, which indicates that human development is enhanced due to account holding irrespective of the channel. These findings show the importance of basic orientation of general people to the financial system by opening an account. However, the coefficient in Column 5 is not significant, although positive, which shows that ownership of a debit or credit card might increase human development to some extent. This might also signal that the provision of a debit or credit card might be disproportionately beneficial to people in terms of human development. Overall, the insertion of financial inclusion-related variables lowers the significance of the coefficient for Fintech to some extent, indicating that in earlier estimates it partially captures the indirect impacts of FinTech on the HDI due to financial inclusion. It can also be said that financial inclusion mediates the influence of FinTech on the HDI to some extent and hence there might be minimal room for directly detecting the benefits of FinTech after accounting for the influence of financial inclusion on the HDI. Furthermore, Column 6 shows that the coefficient for institutional quality is positively associated with the HDI, and after introducing the variable in the model the coefficient for FinTech increases with higher significance than in Columns 3–5. This suggests that improving regulatory quality aids in enhancing human development. The possibility exists because improved institutional quality has the potential to not only close economic loopholes like corruption but also to better synchronize and increase the productivity of these countries' enormous informal sectors and integrate them into national development initiatives. Afterwards, inserting the combined variable FinTech and financial development somewhat lowered the significance with a positive effect. However, the combined variable FinTech and financial inclusion showed a negative interaction effect since account holding at financial institutions might have a negative impact on FinTech. Finally, from Model (1) to Model (8), it is clear that a 1 percentage point rise in FinTech will cause the HDI to increase by 0.033 to 0.13 percentage points. This suggests that enhancing FinTech will help to increase the HDI with a better life expectancy, education, and income, which in turn will eliminate income inequality and ensure inclusive growth to a great extent. The results for the study's primary variable are generally in line with those of Chhorn (2021), Demir et al. (2022), and Lyons, Kass-Hanna, and Fava (2022).

5. CONCLUSION AND POLICY RECOMMENDATION

In this study, we specifically try to look at the direct and indirect effects of FinTech on inclusive growth through different channels such as financial development, financial inclusion, and institutional quality, where the significance of the relationship between FinTech and HDI indicates the direct channel and other variables like account holding, account holding at financial institutions, debit or credit card holding, etc. show an indirect channel through their impact on the HDI. To the best of our knowledge, this is a contributing study using data and panel analysis to examine the relationship among some important variables at the cross-country level for Asian countries.

Our findings lead to three major conclusions. First, FinTech has a substantial positive impact on human development. Second, financial development such as better economic conditions and higher levels of economic output encourages improvements in human development. Third, better institutions can play a significant positive role in human development. Last but not least, it should also be pointed out that further research is required to solidify the evidence that financial inclusion affects human development directly, at least in developing countries. Moreover, inability to get panel data for some important variables also prevented us from obtaining more specific results. Future research works may eliminate these limitations. These findings add to the sparse but expanding body of literature that spans nations on the subject of how FinTech might support inclusive development.

Our research findings lead us to making vital policy suggestions. First, in order to reduce income inequality, financial sector policies should prioritize the development of financial services that are more inclusive and that directly benefit the underprivileged and low-income populations through improved access to necessary financial services, which is similar to the findings of Mookerjee and Kalipioni (2010). Second, in order to achieve increased "access" to formal financial services (i.e., account ownership and bank account ownership) to most effectively reduce inequality, these services must also have more "usage" (i.e., by using a debit or credit card). By encouraging account ownership among the unbanked and account usage among the banked, FinTech can play a significant role in this area. Third, reducing income inequality through FinTech-led financial inclusion is a viable policy choice, which is evident from Kim's (2016) findings. This may be the case because low-income households are not able to benefit from the increasing availability of financial services in these countries due to poor infrastructure, limited (consumer protection) rules, and minimal or zero basic financial literacy. Fourth, since there are more low-income people in developing countries, it is important to make the benefits of financial inclusion known so that more people can find the right path to financial inclusion. Our findings highlight the critical part that fiscal measures play in addressing issues hampering inclusive growth such as economic inequalities. In this regard, fiscal redistribution ought to go hand in hand with higher coverage of FinTech, financial development, financial inclusion, and better institutional quality.

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APPENDIX A: LIST OF COUNTRIES

SN	Country	SN	Country	SN	Country
1	Bangladesh	10	Japan	19	Philippines
2	Cambodia	11	Jordan	20	Saudi Arabia
3	PRC	12	Kazakhstan	21	Sri Lanka
4	Cyprus	13	Kyrgyz Republic	22	Tajikistan
5	Georgia	14	Lebanon	23	Thailand
9	India	15	Malaysia	24	Türkiye
7	Indonesia	16	Mongolia	25	Uzbekistan
8	Iran, Islamic Rep.	17	Nepal		
9	Israel	18	Pakistan		