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The Impact of Financial Inclusion in Poverty Reduction: Empirical Evidence from Emerging Economies

Solehah Yahaya,[a] Tajul Ariffin Masron[b] and Nik Hadiyan Nik Azman[c]

Abstract: *Poverty is a persistent problem that seems improbable for most developing countries to overcome. This study proposes that financial inclusion has the ability to progressively decrease poverty. The study analyses the association between financial inclusion and poverty in 57 developing countries using data from 2011 to 2017. The analysis employs generalised method of moments (GMM) estimators. The results demonstrate a strong correlation between financial inclusion and poverty, implying that increasing financial inclusion has the potential to reduce poverty levels. Enhanced financial inclusion in developing countries may empower impoverished households to effectively access and employ the services provided by financial institutions. Thus, financial inclusion is an effective tool for alleviating poverty among the underprivileged.*

Keywords: Financial inclusion; Poverty; GMM; Developing countries
JEL Classification: G21, I32, P36

[a] Corresponding author. Islamic Business School, Universiti Utara Malaysia, Sintok, Kedah. *Email: solehah.yahaya@uum.edu.my*, *ORCID ID: https://orcid.org/0009-0001-8240-9613*

[b] School of Management, Universiti Sains Malaysia, Gelugor, Pulau Pinang. *Email: tams@usm.my*, *ORCID ID: https://orcid.org/0000-0002-8564-2402*

[c] School of Management, Universiti Sains Malaysia, Gelugor, Pulau Pinang. *Email: nikhadiyan@usm.my*, *ORCID ID: https://orcid.org/0000-0003-1947-2553*

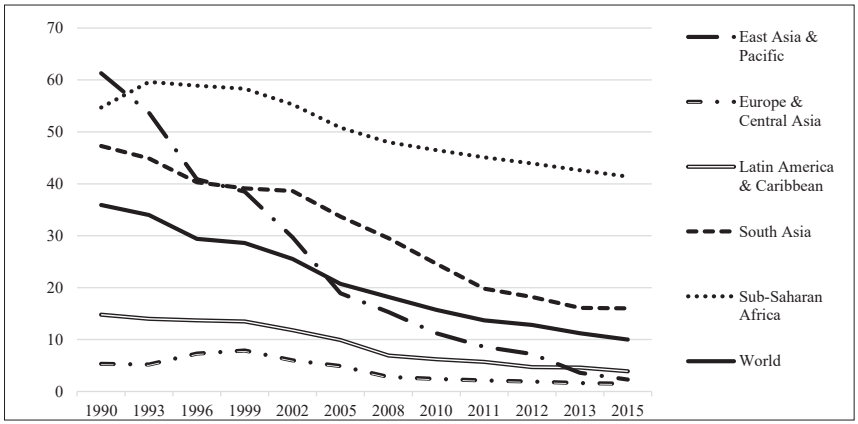
1. Introduction

Poverty has persistently plagued societies, and it is highly improbable that most developing countries would be able to overcome it. According to Jesuit and Smeething (2002), poverty is defined as the state of lacking resources in relation to one's needs. Foster (1998) argues that to put the concept of poverty into practice, it is necessary to establish a threshold that distinguishes between absolute and relative poverty. For absolute poverty, a precise poverty line or threshold is established for a specific group, determined by the resources required to provide the group's basic needs, including food, clothing, healthcare, and shelter. Relative poverty, on the other hand, pertains to the notion of living standards within the income distribution, which includes measures such as mean, median, or other quantiles that establish a cut-off as a percentage of this standard.

Poverty reduction is considered a critical step to improving living conditions in developing countries. The United Nations lists the poverty agenda as the top priority of the Sustainable Development Goals (SDGs). According to Moschen et al. (2019), the SDGs aim to reduce poverty in at least half the population of men, women, and children of all ages, with substantial coverage of the poor and vulnerable by 2030. This target needs to be stressed more in developing countries because many poor individuals continue to exist. As shown in Figure 1, several regions recorded a slow drop in poverty, namely in Sub-Saharan Africa and South Asia. Although Figure 1 shows that poverty has declined in all areas since 1990 until 2015, Sub-Saharan Africa and South Asia remain the most problematic regions.

Various factors have been suggested by past studies to reduce poverty, such as income (Adams, 1991; Adams & Page, 2005; Datt & Ravalllion, 1992), inflation (Powers, 1995; Ravallion, 2001; Braumann, 2004; Chaudhry & Chaudhry, 2008; Akobeng, 2016), remittances (Adams, 1991; Stark & Taylor, 1989; Adams & Page, 2005; Jongwanich, 2007; Ratha, 2013; Gupta et al., 2009; Adams & Cuecuecha, 2013), and trade (Dollar & Kraay, 2004). Although these factors are crucial, financial inclusion can also function as a strategy to reduce poverty. Furthermore, there are numerous studies that examine the correlation between financial inclusion and poverty reduction (Burgess & Pande, 2005; Jones, 2008; Honohan, 2008; Bhandari, 2009; Inoue, 2011; Brune et al., 2011; Fadun, 2014; Jabir et al., 2017; Omar & Inaba, 2020; Chen et al., 2022).

Figure 1: Poverty Headcount Ratio at US$1.90 Daily (% of population)



Source: World Bank (2019).

Burgees and Pandee (2005) reveal that state-led bank branch expansions into rural unbanked locations have significantly reduced poverty in India through access to formal sector credit provision and saving opportunities. For example, Jones (2008) illustrates the method of reducing poverty through financial inclusion and discovers that the availability of credit unions decreases poverty rates among low-income communities in the United Kingdom. According to Honohan (2008), households with better access to finance may be associated with lower inequality as measured by the Gini coefficient, but there is less evidence that access is causally related to a lower poverty headcount.

Inoue (2011) demonstrates through econometric results that a statistically significant negative relationship exists between financial inclusion and poverty allocation in both rural and urban areas in India. This study, however, only considers a single aspect of essential financial services, which may only partially reflect the extent of financial inclusion in a country. Brune et al. (2011) argue that increased financial access by offering commitment saving accounts to poor smallholder cash crop farmers in Malawi substantially impacted their well-being, as it provided access to funds for agricultural input. Fadun (2014) finds that financial inclusion helps to alleviate poverty and income redistribution in Nigeria. Those with access to savings accounts or simple, informal savings technologies are more likely

to increase consumption, productivity, and income; increase investment in preventive health; and reduce vulnerability to illness and other unexpected events.

Recently, Jabir et al. (2017) analysed the effect of financial inclusion on reducing poverty among low-income households in 35 countries in Sub-Saharan Africa. Using data from 2011 to 2017, the results show that financial inclusion significantly reduced poverty in Sub-Saharan Africa by providing net wealth and more considerable welfare benefits to those experiencing poverty. They suggest that financial institutions in Sub-Saharan African countries should make formal financial services easily accessible to the less privileged and marginalised in society. Omar and Inaba (2020) analyse unbalanced annual panel data for 2004 to 2016, including 116 developing countries from Asia, Africa, Latin America and the Caribbean, and find that higher financial inclusion reduces poverty rates and income inequality in developing countries. Finally, Chen et al. (2022) propose that financial institutions should provide a wide range of digital financial inclusion (DFI) services and products. This would provide customers with more options, increase information accessibility, and provide financial support for DFI in rural entrepreneurship, thereby reducing poverty vulnerability.

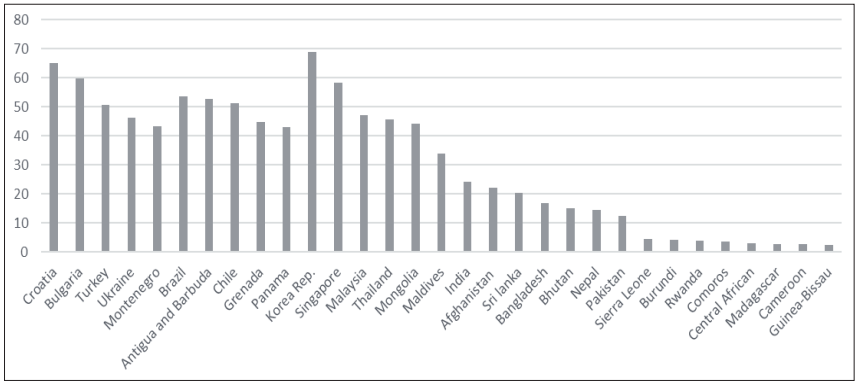
In contrast, Bhandari (2009) suggests that the growth in bank accounts is not significantly associated with the reduction in the number of individuals below the poverty line across states in India. Providing banking services to the maximum number of individuals is unsuccessful as a poverty reduction strategy. Mishra (2012) adds that poverty reduction among those who live below the poverty line across India is not associated with the growth in bank accounts. He further argues that poverty reduction strategies in developing inclusive financial systems, which are financially and socially sustainable, should be given priority.

According to the literature, the role of financial inclusion in reducing poverty could be one of the most important indicators. However, previous studies that explore the relationship between financial inclusion and cross-country studies are limited in scope. The present study therefore employs an index of financial inclusion to gauge financial inclusion, which includes factors such as the number of bank branches per 100,000 adults, the number of ATMs per 100,000 adults, the number of outstanding deposits with commercial banks, and the number of outstanding loans from commercial banks, all of which are derived from Sarma (2012). Therefore, this study

aims to provide new empirical evidence on the impact of financial inclusion in reducing poverty based on cross-country data from 2011 to 2017 based on a generalised method of moments (GMM) approach that is more capable of handling endogeneity issues, as well as the introduction of a more comprehensive elements within two similar dimensions of financial inclusion.

Nevertheless, current trends show that only some individuals can access financial systems, especially in developing countries. This is based on Park and Mercado's (2015) index of financial inclusion (IFI), as shown in Figure 2. IFI is based on five measures: automated teller machines (ATM) per 100,000 adults, commercial bank branches per 100,000 adults, borrowers from commercial banks per 1,000 adults, depositors with commercial banks per 1,000 adults, and the domestic credit to gross domestic product (GDP) ratio. This measurement closely follows the methodology of Sarma (2008).

Figure 2: Index of Financial Inclusion in Selected Developing Countries



Source: Park and Mercado (2015).

Economic growth, especially in developing countries, depends heavily on financial inclusion. According to Sarma and Pais (2011), there is a strong correlation between human development and financial inclusion. Financial inclusion also significantly lowers income inequality and poverty rates in emerging countries (Omar & Inaba, 2020). Several developmental organisations have made significant promises to advance financial inclusion, particularly in poor nations (Ozili & Mhlanga, 2023). Giron et al. (2021) state that financial inclusion is acknowledged as a growth-promoting element

for developing countries, possessing the capacity to expedite economic expansion with population increase. In addition, efforts towards financial inclusion in developing nations have encountered several obstacles, resulting in a reduced pace of advancement compared to developed countries (Ozili, 2023).

Based on the provided data, the countries with the lowest IFI rankings are the Maldives, India, Afghanistan, Sri Lanka, Bangladesh, Bhutan, Nepal, Pakistan, Sierra Leone, Burundi, Rwanda, Comoros, Central Africa, Madagascar, Cameroon, and Guinea-Bissau. Meanwhile, countries in Sub-Saharan Africa and South Asia are grappling with poverty issues. Figure 1 demonstrates that Sub-Saharan Africa and South Asia have a poverty rate that is greater than the global average. In these countries, poverty may stem from a lack of financial access. Therefore, the present study aims to examine and validate the impact of financial inclusion on poverty in developing countries.

This article is structured as follows: Section 2 provides an overview of the literature, while Section 3 delves into the panel data regression model. The empirical findings are presented and analysed in Section 4. Section 5 concludes the study.

2. Literature Review

When discussing the correlation between financial inclusion and poverty in the context of financial development, both direct and indirect pathways are considered. Financial inclusion plays a direct role in reducing poverty by expanding the accessibility of credit, insurance, and other financial services. These resources assist individuals in meeting their everyday transaction needs for consumption, investment, and overall economic growth (King & Levine, 1993; Rajan & Zingales, 1998). Financial inclusion facilitates the acquisition of productive assets by the underprivileged, enabling them to allocate resources towards investments in new technologies, education, and healthcare. The indirect channel illustrates the relationship between finance-induced economic growth and its effects on job creation, as well as increased government social expenditure on health, education, and social protection; this economic development progressively helps those with low incomes (Abosedra et al., 2016; Perotti, 1993).

Additionally, it has been shown that the availability of financial services improves overall societal welfare and reduces poverty, demonstrating

a positive impact on financial condition (Munir et al., 2022). Further highlighting the importance of financial inclusion in reducing economic disparities, studies also highlight the significance of financial inclusion in mitigating the adverse effects of income disparity on poverty (Naili et al., 2023). Past studies also investigate the relationship between financial inclusion and poverty reduction, emphasising the critical role that financial inclusion plays in improving living standards and the state of the economy (Khaki & Sangmi, 2017).

Looking at the importance of financial inclusion, researchers have focused on investigating financial inclusion as an indicator of reducing poverty. Although numerous noticeable aspects have been documented by past studies on the determinants of poverty, such as income, inflation, remittance, trade, education, infrastructure, and population (Fan et al., 2002; De la Croix & Doepke, 2003; Dollar & Kraay, 2004; Mughal, 2007; Kar et al., 2011; Ratha, 2013; Adams & Cuecuecha, 2013; Akobeng, 2016; Yolanda, 2017), it is believed that financial inclusion is one of the critical factors that can reduce poverty among poorer individuals in developing countries. The literature reveals that a country's poverty rate is determined by its income rate (Adams, 1991; Datt & Ravallion, 1992; Adams & Page, 2005; Lopez et al., 2007; Gupta et al., 2009; Kar et al., 2011). For example, Adam and Page (2005) find significant evidence that economic growth, measured by a rise in mean per capita income, reduces poverty in emerging countries. Increased economic growth, which also means higher income, will cause poverty rates to fall in Latin America and the Caribbean, East Asia and the Pacific, and Europe and Central Asia (Gupta et al., 2009). As a result, the higher the income, the lower the poverty rate.

The inflation rate may significantly impact poverty (Powers, 1995; Ravallion, 2001; Braumann, 2004; Chaudhry & Chaudhry, 2008; Akobeng, 2016; Yolanda, 2017). According to Powers (1995), individuals with limited financial resources are impacted by inflation because it leads to a reduction in their actual earnings, mostly caused by the short-term fluctuation of nominal wages. Considering these factors, a rise in inflation might potentially lead to an increase in the impoverished population. Remittances have been shown to reduce poverty in studies including many nations (Adams & Page, 2005; Freund & Spatafora, 2005). In comparative research, Jongwanich (2007) and Ratha (2013) discovered that remittances substantially influenced poverty reduction by boosting income. Furthermore,

Adams and Cuecuecha (2013) find evidence that receiving remittances in Ghana lowered the risk of household poverty.

International trade is often seen as a key potential catalyst for a global decrease in poverty. Others believe it is a waste of time (Dollar & Kraay, 2002; Aksoy & Beghin, 2004; Bhagwati & Srinivanas, 2002; Dollar & Kraay, 2004). Aksoy and Beghin (2004) state that agricultural trade liberalisation in emerging nations will alleviate rural poverty. Undeniably, education may enhance earning capacity and help the poor become more productive (Nasir & Nazli, 2000). In Pakistan, the educational attainment of the head of the household is a crucial driver of family poverty. Increasing the family head's educational level reduces the likelihood of the household becoming poor (Qureshi & Arif, 1999). Furthermore, educational levels play an important role in reducing the likelihood of a household becoming deprived (Okejie, 2002).

Amis and Kumar (2000) argue that developing social and physical infrastructure is critical for reducing poverty. Apart from that, Estache et al. (2002) contend that the expansion of services facilitated by privatisation will help reduce poverty, provided that those living in poverty have access to these infrastructure expenditures. Fan et al. (2002) demonstrate that investment in rural road infrastructure has a substantial impact on poverty levels. Kremer and Chen (2002) suggest that countries characterised by significant economic inequality will exhibit a substantial disparity in fertility rates between the educated wealthy and the uneducated poor, conceptually and empirically. Only a select few children from affluent, well-educated families will have a much greater likelihood of receiving an education; the progeny of the underprivileged and illiterate will have significantly reduced prospects. Inequality is therefore perpetuated (and perhaps exacerbated) throughout time.

3. Methodology

3.1 Model specification

This study constructs a panel from a dataset consisting of 57 developing countries for a period of seven years, between 2011 and 2017, in major regions of developing economies. These countries and periods were selected due to their ability to provide relevant data on poverty and financial inclusion

from 2011. In addition, this study will consider the year after the economic crisis of 2007–2008 to examine the impact of financial development, namely financial inclusion, on economic growth. Originally, there was a more extensive panel data set of 116 developing countries for the same period. However, missing data on poverty and financial inclusion for some countries reduced the size of the data set to 57 countries (the list is reported in the appendix).

After reviewing previous literature, the model to determine the impact of financial inclusion on poverty is derived from the following model, as shown in equation (1) below:

$$POV_{i,t} = \alpha 1 + \beta_1 FI_{i,t} + \beta_2 INC_{i,t} + \beta_3 INF_{i,t} + \beta_4 REM_{i,t} + \beta_5 TRA_{i,t} + \beta_6 EDU_{i,t} + \beta_7 INFS_{i,t} + \beta_8 POP_{i,t} + \varepsilon_{i,t} \quad (1)$$

where *POV* refers to poverty, *FI* to financial inclusion, *INC* to income, *INF* to inflation, *TRA* to trade, *EDU* to education, *INFS* to infrastructure, and *POP* to population.

Subsequently, the estimation model is logarithmically transformed by the constant elasticity of the dependent variable in relation to the explanatory variable, which is applicable to all dependent and independent variables. The logarithm function reduces the data's range, facilitating their comparison and visualisation. In specific issues, this demonstrates trends and patterns (Hedges et al., 1999). Thus, the estimation model may be represented in logarithm form:

$$ln\ POV_{i,t} = \alpha 1 + \beta_1 ln\ FI_{i,t} + \beta_2 lnINC_{i,t} + \beta_3 lnINF_{i,t} + \beta_4 lnREM_{i,t} + \beta_5 lnTRA_{i,t} + \beta_6 lnEDU_{i,t} + \beta_7 lnINFS_{i,t} + \beta_8 lnPOP_{i,t} + \varepsilon_{i,t} \quad (2)$$

where *ln* refers to the natural logarithm, *i* to country, **t** to year, and $\mathcal{E}$ to the error term.

The data for this analysis comes from two different sources. The data on poverty is obtained from the World Bank Data Indicator database. Researchers use three different measures of poverty. Accordingly, poverty is defined as a percentage of the population with a poverty headcount ratio of US$1.90 a day (2011 PPP), a poverty headcount ratio of US$3.20 a day (2011 PPP), and a poverty headcount ratio of US$5.50 a day (2011 PPP).

Seven other control variables were also included: income (INC), inflation (INF), remittances (REM), trade (TRA), education (EDU), infrastructure (INFS), and population (POP). Data on all additional variables is obtained from the World Bank database. Financial inclusion is proxied by the index of financial inclusion (FI). The data for FI is obtained from the Global Findex database. Table 1 provides a summary of the variables.

Table 1: Description of Variables

Variables	Proxies	Sources
INC	Real per capita GDP in constant 2010 US$	World Bank (2019)
INF	Inflation, consumer prices (annual %)	World Bank (2019)
REM	Remittance inflows to GDP (%)	World Bank (2019)
TRA	Trade (% of GDP)	World Bank (2019)
EDU	School enrolment, primary (% gross)	World Bank (2019)
INFS	Access to electricity (% of population)	World Bank (2019)
POP	Population growth (annual %)	World Bank (2019)
POV	Poverty headcount ratio at US$1.90 a day (2011 PPP) (% of population)	World Bank (2019)
	Poverty headcount ratio at US$3.20 a day (2011 PPP) (% of population)	World Bank (2019)
	Poverty headcount ratio at US$5.50 a day (2011 PPP) (% of population)	World Bank (2019)
FI	Financial inclusion	Global Findex (2019)

3.2 Estimation method

The GMM estimator is adopted for the present study. According to Arellano and Bond (1991), the estimation selection is solely based on delivering country-specific effects and its simultaneity bias. Its applicability to the dataset is best explained in baseline equation (1). Arellano and Bover (1995) show that specific modelling strategies may need to be revised if their explanatory variables are unrelated. To end specific inadequacies, a far more effective system GMM estimator combines the level and difference equations (Arellano & Bover, 1995; Blundell & Bond, 1998).

The GMM estimator introduced two variations, namely the one-step and the two-step estimators. Two-step estimators, in contrast to one-step estimators, provide superior benefits in terms of their efficiency in ideal

weighting metrics (Law & Azman-Saini, 2012). The Arellano and Bond (1991) GMM technique examines two diagnostics to test for first- and second-order serial correlation in the disturbance. The lack of the first serial order serial correlation mandates its rejection, whereas the existence of the second serial order serial correlation precludes its rejection. The GMM estimator employs a two-step process to examine the impact of financial inclusion on financial development. The distinguishing feature of the dynamic panel data GMM estimator is its reliance on the number of moment conditions that increase as time (t) progresses. The Sargan test is used to determine if there is overidentification. The presence of excessive moment circumstances might introduce bias while optimising efficiency, as stated by the credible and persuasive witness. Baltagi et al. (2009) suggest using a subset of momentary circumstances to achieve equilibrium or balance, thereby minimising bias and loss of efficiency.

4. Results and Discussion

According to this study's core variable, as shown in Table 2, there is a significant and negative correlation between financial inclusion (FI) and poverty (POV). The findings suggest that increased financial inclusion is associated with reduced poverty rates, which may be attributed to the impoverished population's need for funds to access education, seek decent health care, and engage in formal financial services. Even those with limited financial resources can now access and engage in formal financial services. Individuals can save savings, acquire loans, or engage in financial transactions to access quality health care and education while also actively participating in economic endeavours to produce income. Thus, this approach provides the impoverished with the chance to escape the poverty cycle trap and make substantial enhancements to better their quality of life. The analysis demonstrates that financial inclusion is critical for alleviating poverty in developing countries.

According to Table 2, the result supports the Greenwood and Jovanovic (1990) hypothesis for the association between income (INC) and poverty, because the coefficient for income is negative and significant. It shows that a 1% increase in income reduces poverty by 0.077%, 0.061%, and 0.001% at the poverty level of US$1.90 a day, US$3.20 a day, and US$5.50 a day, respectively. An income increase can reduce poverty (Adams, 1991; Datt

Table 2: Regression Results [DV=LPOV]

	POV at $1.90				POV at $3.20				POV at $5.50			
	One-step		Two-step		One-step		Two-step		One-step		Two-step	
	DGMM	SGMM	DGMM	SGMM	DGMM	SGMM	DGMM	SGMM	DGMM	SGMM	DGMM	SGMM
$LPOV_{t-1}$	0.001***	0.001***	0.001***	0.001***	0.213	0.001***	0.003***	0.001***	0.001***	0.001***	0.001***	0.001***
	[5.20]	[44.20]	[4.22]	[5.91]	[1.25]	[48.83]	[3.00]	[6.97]	[7.08]	[20.96]	[6.51]	[3.04]
LINC	-0.160	0.637	0.041**	-0.077*	-0.801	0.737	0.243	-0.061*	-0.338	-0.389	-0.190	-0.001***
	[-1.40]	[0.47]	[2.05]	[-0.29]	[-0.25]	[0.34]	[1.17]	[-1.87]	[-0.96]	[-0.86]	[-1.31]	[-4.66]
LINF	0.610	0.084*	0.441	0.069*	-0.960	0.494	0.282	0.09*	0.233	0.111	0.504	0.088*
	[0.51]	[1.73]	[0.77]	[0.39]	[-0.05]	[0.68]	[1.08]	[1.67]	[1.19]	[1.59]	[0.67]	[1.68]
LREM	-0.201	0.660	0.515	-0.001***	0.841	0.684	0.904	-0.079*	0.854	0.750	0.621	-0.007***
	[-1.28]	[0.44]	[0.65]	[-4.24]	[0.20]	[0.41]	[0.12]	[-1.76]	[0.18]	[0.32]	[0.49]	[-2.70]
LTRA	-0.612	-0.699	-0.063*	-0.001***	0.286	-0.307	-0.065*	-0.016**	-0.966	-0.069*	-0.813	-0.001***
	[-0.51]	[-0.39]	[-1.86]	[-3.20]	[1.07]	[-1.02]	[-1.85]	[-2.40]	[-0.04]	[-1.82]	[-0.24]	[-3.18]
LEDU	0.551	0.662	0.133	-0.001***	-0.120	0.832	0.847	-0.032**	-0.113	0.360	-0.107	-0.043**
	[0.60]	[0.44]	[1.50]	[-3.88]	[-1.55]	[0.21]	[0.19]	[-2.16]	[-1.58]	[0.92]	[-1.61]	[-2.06]
LINFS	0.373	0.593	-0.07*	-0.001***	0.914	-0.281	0.326	-0.001***	-0.460	0.853	-0.900	-0.001***
	[0.89]	[0.53]	[-1.81]	[-4.16]	[0.11]	[-1.08]	[0.98]	[-6.12]	[-0.74]	[0.18]	[-0.13]	[-3.72]
LPOP	-0.945	0.293	-0.933	0.001***	-0.613	0.441	0.781	0.019**	0.064*	0.577	0.275	0.001***
	[-0.07]	[1.05]	[-0.08]	[6.20]	[-0.51]	[0.77]	[0.28]	[2.35]	[1.85]	[0.56]	[1.09]	[3.20]
LFI	-0.125	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.136	-0.217	-0.110	-0.001***
	[-1.53]	[-3.41]	[-5.79]	[-4.46]	[-5.73]	[-6.74]	[-13.39]	[-36.9]	[-1.49]	[-1.24]	[-1.60]	[-3.37]
Model criteria												
Hansen	0.924	0.931	0.781	0.461	0.921	0.665	0.682	0.665	0.926	0.870	0.925	0.929
AR(1)	0.061*	0.085*	0.088*	0.082*	0.005**	0.009*	0.078*	0.011**	0.018**	0.004***	0.024**	0.008*
AR(2)	0.571	0.346	0.959	0.305	0.135	0.234	0.200	0.251	0.630	0.670	0.724	0.529
#Instruments	95	186	31	51	95	51	32	51	140	50	140	131
#Country	57	57	57	57	57	57	57	57	57	57	57	57
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *, **, and ***denote the 10%,5%, and 1% significance levels, respectively. Figures in [ ] stand for *t*-statistic. The values of the Hansen and AR tests stand for *p*-value.

& Ravalllion, 1992; Adams & Page, 2005; Lopez et al., 2007; Gupta et al., 2009; Kar et al., 2011). Adam and Page (2005) find strong evidence that economic growth, measured by an increase in average per capita income, will reduce poverty in developing economies. This implies that raising income can reduce the poverty rate in developing countries.

This study establishes that inflation (INF) has a notable and statistically significant impact on poverty. The results of this study align with the conclusions of Powers (1995), Ravallion (2001), Braumann (2004), Chaudhry and Chaudhry (2008), Akobeng (2016), and Yolanda (2017). Evidently, poverty has escalated due to rising inflation. Yolanda (2017) asserts that the escalation of food costs will impede the community's capacity to attain progress in areas such as education, health, and economics. Furthermore, the surge in food prices has resulted in a rise in the population of underprivileged individuals. Consequently, the increase in inflation reduces individuals' ability to buy goods and services, leading to an increase in poverty.

This study also finds that remittances (REM) decrease the poverty rate in developing countries. Remittances can help to reduce poverty because they contribute to better well-being for poor households in rural areas. This study's findings are similar to those by Adams and Page (2005), Freund and Spatafora (2005), Jongwanich (2007), Gupta et al. (2009), and Adams and Cuecuecha (2013). Migrants may relocate to help ease households' immediate budget constraints and provide an opportunity for small savers to gain a foothold in the formal financial sector. Hence, this allows us to conclude that increasing remittances contributes to decreasing poverty in developing countries.

On the role of trade (TRA), this study finds that trade contributes to reducing poverty as higher trade tends to reduce the poverty rate. It is generally believed that trade can stimulate economic growth and has a significant potential engine for global poverty reduction (Aksoy & Beghin, 2004; Bhagwati & Srinivanas, 2002; Dollar & Kraay, 2004). The result from this study is consistent with the findings by Aksoy and Beghin (2004), who conclude that trade would reduce poverty in developing countries through expanding employment and income opportunities beyond the farm gate. In summary, an increase in trade will reduce poverty in developing countries.

Education (EDU) has a significant negative impact on poverty, implying that improving educational achievement may reduce poverty in developing

countries. The education coefficient implies that a 1% increase in education will decrease the level of poverty by 0.001% (at a poverty rate of US$1.90 a day), 0.03% (at a poverty rate of US$3.20 a day), and 0.04% (at a poverty rate of US$5.50 a day). This indicates that the higher the population's level of education, the lower the proportion of poor individuals in the total population, as education imparts knowledge and skills associated with higher wages or earnings (Tilak, 1986). Therefore, it is evident that education can increase the earning potential of the poor, and they become productive (Nasir & Nazli, 2000).

Apart from that, infrastructure (INFS) has a statistically significant negative impact on poverty. The results are as predicted and supported by Jahan and McLeery (2005). They stress that direct channel infrastructure reduces poverty by increasing the population's access to health and educational services, cleaner energy, and the government's assurance of national catastrophe protection. The indirect effect of infrastructure supply on poverty, which may result in economic growth, is evident following an increase in workers' productivity, a reduction in transportation costs, and the creation of more job opportunities. For example, progress has been stifled in India by a need for more infrastructure investment, particularly in water and power. According to this study, providing physical and social infrastructure is critical for poverty alleviation (Amis & Kumar, 2000). As a result of infrastructure improvements, emerging nations have been able to alleviate poverty.

This study additionally demonstrates that there is a significant and positive relationship between population (POP) and poverty. A high population size has the potential to exacerbate the poverty rate. This finding is also consistent with the results obtained by Kremer and Chen (2002) as well as De la Croix and Doepke (2003). For instance, according to de la Croix and Deopke (2003), the persistence of poverty among individuals with large families may hinder the improvement of human capital, result in reduced economic growth, and perhaps perpetuate the cycle of poverty. The data indicate a positive correlation between population growth and poverty rates in developing countries.

In addition to the overall measure of financial inclusion (FI), comparable matters for individuals were also examined in all four aspects of financial inclusion. These aspects include the number of bank branches per 100,000 adults (BRANCH), the number of ATMs per 100,000 adults (ATM), the

number of outstanding deposits with commercial banks (OUTD), and the number of outstanding loans from commercial banks (OUTL). This study also incorporates multiple distinct explanatory factors. Table 3 displays the outcomes for every aspect of financial inclusion.

The GMM estimator's validity is supported by the results of the serial correlation test and the Hansen test, which both validate the GMM estimator's validity. As a result, the Hansen test refutes the null hypothesis of overidentification limitation, indicating that this study used a reliable instrument. Furthermore, the AR(1) serial correlation test supports the alternative hypothesis of first-order autocorrelation, but does not support the null hypothesis of second-order autocorrelation. Finally, the number of instruments is lower than that of cross-section countries, which is acceptable since there is no current proliferation issue. Hence, these findings prove the measurement tools and model used in this study are reliable and accurate. Notably, the *p*-value of the scalar static in the GMM method exceeds the significance threshold, indicating that the system GMM is more efficient than the difference GMM for the model. This study specifically examines the two-step system GMM approach.

The focal variable is financial inclusion, which has a significant negative impact on poverty. This present study separately tests each dimension of financial inclusion, including the number of bank branches per 100,000 adults (BRANCH), number of ATMs per 100,000 adults (ATM), number of outstanding deposits with commercial banks (OUTD), and number of outstanding loans from commercial banks (OUTL). As shown in Table 3, each dimension of financial inclusion is negatively associated with poverty. This finding supports the hypothesis that financial inclusion may provide a means of solving the poverty problem. The availability of bank branches and ATMs, especially in remote areas, may encourage the use of financial services among individuals with low incomes. The results support the findings of Koomson et al. (2020), Park and Mercado (2016), and Burgess and Pande (2005), who report that financial inclusion significantly correlates with a lower poverty ratio.

This finding implies that developing countries should enhance the availability of bank branches and ATM services to achieve poverty reduction goals. Usage of banking products and services is measured by the number of outstanding deposits with commercial banks and the number of outstanding loans from commercial banks. Loans may be used for business start-ups,

Table 3: Regression Analysis of Dimensional Model [DV=LPOV]

	FI = BRANCH						FI = ATM					
	POV = POV@$1.90		POV = POV@$3.20		POV= POV@ $5.50		POV = POV@$1.90		POV = POV@$3.20		POV= POV@ $5.50	
	One-step SGMM	Two-step SGMM	One-step SGMM	Two-step SGMM	One-step SGMM	Two-step SGMM	One-step SGMM	Two-step SGMM	One-step SGMM	Two-step SGMM	One-step SGMM	Two-step SGMM
LPOVt-1	0.001	-0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	[23.61]	[-1.66]	[49.49]	[5.01]	[17.39]	[81.36]	[24.15]	[92.47]	[44.41]	[78.53]	[22.48]	[67.06]
LINC	-0.362	-0.032	-0.848	-0.077*	-0.276	-0.058*	-0.757	-0.035	-0.897	-0.046	-0.162	-0.023
	[-0.91]	[-0.99]	[-0.19]	[-0.29]	[-1.09]	[-0.55]	[-0.31]	[-1.03]	[-0.13]	[-0.83]	[-1.40]	[-2.27]
LINF	0.412	0.025	-0.745	0.036	0.144	0.001	0.469	0.008	0.585	0.093	0.102	0.004
	[0.82]	[2.24]	[-0.32]	[0.91]	[1.46]	[4.73]	[0.72]	[2.64]	[0.55]	[0.08]	[1.63]	[2.90]
LREM	0.273	-0.054*	-0.874	-0.011	0.563	-0.015	0.241	-0.089*	0.617	-0.089*	0.639	-0.048
	[1.10]	[-0.59]	[-0.16]	[-1.59]	[0.58]	[-2.44]	[1.17]	[-1.65]	[0.50]	[-0.13]	[0.47]	[-0.70]
LTRA	-0.140	-0.002	-0.734	-0.043	-0.065*	-0.001	-0.195	-0.001	-0.455	-0.966	-0.033	-0.005
	[-1.48]	[-3.08]	[-0.34]	[-0.78]	[-1.84]	[-5.93]	[-1.30]	[-3.71]	[-0.75]	[-0.04]	[-2.14]	[-2.78]
LEDU	-0.812	-0.012	-0.227	-0.031	0.582	-0.001	-0.354	-0.028	0.882	-0.018	0.463	-0.042
	[-0.24]	[-1.53]	[-1.21]	[-1.01]	[0.55]	[-4.04]	[-0.93]	[-2.19]	[0.15]	[-1.33]	[0.73]	[-2.03]
LINFS	-0.645	-0.027	-0.249	-0.045	-0.878	-0.001	-0.233	-0.001	-0.332	-0.001	0.984	-0.036
	[-0.46]	[-1.09]	[-1.15]	[-2.01]	[-0.15]	[-6.32]	[-1.19]	[-3.18]	[-0.97]	[-4.33]	[0.02]	[-0.90]
LPOP	0.278	0.007	-0.606	0.012	0.795	0.019	0.208	0.001	0.345	0.065*	0.842	0.059*
	[1.08]	[2.70]	[-0.52]	[2.50]	[0.26]	[2.35]	[1.26]	[4.56]	[0.94]	[0.44]	[0.20]	[0.53]
LFI	-0.415	-0.001	0.055*	-0.001	-0.969	-0.029	-0.416	-0.088*	-0.843	-0.036	0.272	-0.044
	[-0.82]	[-4.80]	[1.92]	[-4.81]	[-0.04]	[-2.19]	[-0.81]	[-1.70]	[-0.20]	[-2.10]	[1.10]	[-2.01]
Model criteria												
Hansen	0.850	0.850	0.776	0.776	0.659	0.924	0.437	0.924	0.951	0.951	0.784	0.753
AR(1)	0.082*	0.084*	0.009	0.010	0.004	0.008	0.081*	0.081*	0.008	0.012	0.004	0.007
AR(2)	0.372	0.382	0.236	0.243	0.758	0.603	0.388	0.398	0.234	0.257	0.745	0.602
#Instruments	51	51	51	51	51	132	51	87	51	51	51	50
#Country	57	57	57	57	57	57	57	57	57	57	57	57
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Asterisks * denote the 10% significance levels. Figures in [] stand for *t*-statistics. The Hansen and AR test values stand for the *p*-value.

	FI = OUTD						FI = OUTL					
	POV = POV@$1.90		POV = POV@$3.20		POV= POV@ $5.50		POV = POV@$1.90		POV = POV@$3.20		POV= POV@ $5.50	
	One-step SGMM	Two-step SGMM	One-step SGMM	Two-step SGMM	One-step SGMM	Two-step SGMM	One-step SGMM	Two-step SGMM	One-step SGMM	Two-step SGMM	One-step SGMM	Two-step SGMM
LPOVt-1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	[35.88]	[38.53]	[50.23]	[51.91]	[20.89]	[93.60]	[23.12]	[8.24]	[51.57]	[68.26]	[21.64]	[14.74]
LINC	0.462	-0.016	0.636	-0.017	-0.305	-0.036	0.890	-0.016	0.606	-0.018	-0.487	-0.074*
	[0.74]	[-2.40]	[0.47]	[-2.38]	[-1.03]	[-0.90]	[0.14]	[-1.38]	[0.52]	[-2.37]	[-0.70]	[-0.33]
LINF	0.322	0.001	0.558	0.039	0.073*	0.018	0.703	0.001	0.510	0.026	0.150	0.012
	[0.99]	[3.51]	[0.59]	[2.07]	[1.66]	[2.36]	[0.38]	[8.20]	[0.66]	[1.13]	[1.44]	[1.56]
LREM	0.672	-0.024	0.563	-0.001	0.597	-0.083*	0.076*	-0.001	0.808	-0.093*	0.626	-0.013
	[0.42]	[-2.25]	[0.58]	[-3.34]	[0.53]	[-0.21]	[1.77]	[-3.59]	[0.24]	[-1.68]	[0.49]	[-1.49]
LTRA	-0.769	-0.071*	-0.293	-0.113	-0.047	-0.009	-0.198	-0.001	-0.245	-0.016	-0.027	-0.001
	[-0.29]	[-1.81]	[-1.05]	[-1.58]	[-1.99]	[-2.60]	[-1.29]	[-6.15]	[-1.16]	[-2.42]	[-2.22]	[-4.10]
LEDU	0.946	-0.069*	0.831	-0.026	0.427	-0.024	-0.268	-0.027	0.825	-0.023	0.557	-0.051*
	[0.07]	[-0.39]	[0.21]	[-1.13]	[0.79]	[-1.17]	[-1.11]	[-2.22]	[0.22]	[-2.28]	[0.59]	[-1.95]
LINFS	-0.141	-0.001	-0.156	-0.001	-0.921	-0.042	-0.198	-0.001	-0.198	-0.001	-0.468	-0.001
	[-1.47]	[-8.97]	[-1.42]	[-7.25]	[-0.10]	[-2.03]	[-1.29]	[-7.31]	[-1.29]	[-7.01]	[-0.73]	[-4.59]
LPOP	0.831	0.035	0.507	0.047	0.719	0.035	0.183	0.001	0.464	0.006	0.902	0.024
	[0.21]	[0.93]	[0.66]	[1.99]	[0.36]	[0.93]	[1.33]	[3.46]	[0.73]	[2.77]	[0.12]	[1.17]
LFI	-0.061*	-0.001	-0.001	-0.001	-0.189	-0.001	-0.069*	-0.001	-0.001	-0.001	-0.314	-0.001
	[-1.87]	[-7.10]	[-7.15]	[-27.4]	[-1.31]	[-5.09]	[-1.82]	[-13.9]	[-8.34]	[-39.2]	[-1.01]	[-4.10]
Model criteria												
Hansen	0.968	0.968	0.514	0.514	0.703	0.865	0.491	0.998	0.541	0.541	0.562	0.756
AR(1)	0.076*	0.088*	0.009	0.011	0.003	0.007	0.081*	0.086*	0.009	0.010	0.004	0.007
AR(2)	0.371	0.335	0.234	0.252	0.755	0.586	0.345	0.364	0.236	0.257	0.707	0.612
#Instruments	87	87	51	51	51	50	51	87	51	51	51	50
#Country	57	57	57	57	57	57	57	57	57	57	57	57
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Asterisks * denote the 10% significance levels. Figures in [] stand for *t*-statistics. The Hansen and AR test values stand for the *p*-value.

which lower unemployment and poverty levels. Financial inclusion in the form of deposits may help to reduce poverty. Individuals who are significantly poorer and live in remote areas need to start depositing their money in formal banking institutions to ensure a better plan for future needs, especially to run a new business or save for health and education needs.

Income shows a significant negative impact on poverty at the three levels of poverty: poverty rate at US$1.90 a day, poverty rate at US$3.20 a day, and poverty rate at US$5.50 a day. This implies that income plays a vital role in reducing poverty. Studies previously concluded that income determines a country's poverty rate (Adams, 1991; Datt & Ravalllion, 1992; Adams & Page, 2005; Lopez et al., 2007; Gupta et al., 2009; Kar et al., 2011). According to Adam and Page (2005), economic growth, measured by an increase in mean per capita income, will reduce poverty in developing economies. Consequently, higher economic growth, which means higher income, would lead to a lower poverty rate in Latin America, the Caribbean, East Asia and the Pacific, Europe, and Central Asia (Gupta et al., 2009). Again, high income will lead to economic growth and instantly reduce poverty.

Inflation positively and significantly affects all three poverty levels, as shown in Table 3. This aligns with the findings of Powers (1995) and Yolanda (2017). According to Powers (1995), inflation causes a decline in real wages for those living in poverty due to the short-run rigidity of nominal wages. Similarly, Yolanda (2017) indicates that an increase in the prices of goods will affect the community's ability to access development in the fields of education, health, and economy, and the rising prices of these goods have led to an increase in the number of poor individuals. Thus, it can be concluded that inflation worsens the condition of low-income individuals by reducing their purchasing power.

Moving forward, remittances yield a negative and significant result. The findings of an adverse effect between remittances and poverty include a poverty rate of US$1.90 a day, US$3.20 a day, and US$5.50 a day. It suggests that raising remittances reduces poverty, as it becomes a source of income among remit families. Households from remit families can use money sent to them from abroad to meet their daily consumption needs like purchasing food, medication expenses, and going to school. These findings are similar to a few previous studies by Adams and Page (2005), Freund and Spatafora (2005), Jongwanich (2007), and Ratha (2013). In summary,

these studies validate the detrimental impact of remittances on poverty by showing that remittances, as a source of income, contribute to an increase in household income in developing countries.

The same holds true for trade, as these variables have a negative impact on poverty. These research findings parallel the previous studies that indicate international trade as a significant potential engine for global poverty reduction (Aksoy & Beghin, 2004; Bhagwati & Srinivanas, 2002; Dollar & Kraay, 2004). As in developing countries, Aksoy and Beghin (2004) find that agricultural trade liberalisation would reduce poverty in developing economies by having a strong comparative advantage in agriculture, and because the agricultural sector is vital for income generation in these countries. Agriculture has the potential to expand employment and income opportunities beyond those found in developing economies. It is believed that trade is one of the essential tools to reduce poverty in developing countries.

Similarly, education negatively impacts poverty at US$1.90 a day, US$3.20 a day, and US$5.50 a day. These indicated that the improvement in education reduced poverty among the poor. Even though education and poverty are negatively related, the higher the level of education of the the population, the lower the level of poverty, since education provides knowledge and skills that enable higher incomes. These findings are consistent with earlier research, as Nasir and Nazli (2000) find that education may enhance the earning potential of the impoverished and help them become productive. Furthermore, in Pakistan, the educational attainment of the family head is a crucial driver of household poverty (Qureshi & Arif, 1999). According to these studies, education is thought to have a negative relationship with poverty among the poorest individuals in developing nations.

Table 3 demonstrates a substantial inverse correlation between infrastructure in emerging nations and poverty. In terms of infrastructure considerations (INFS), a previous study found that investing in infrastructure has a significant impact on reducing poverty. However, for this reduction to occur rapidly, the investment in physical infrastructure must be substantial and accompanied by improvements in social infrastructure. This conclusion is supported by Jalilian and Weiss (2006), Estache et al. (2002), and Amis and Kumar (2000). According to Fan and Chan-Kang (2005), the benefits-

to-cost ratio for GDP in China is around four times higher for low-quality roads compared to high-quality roads. When it comes to reducing poverty, it is said that investing in low-quality roads helps a greater number of impoverished individuals in both rural and urban areas escape poverty for each unit of currency spent, compared to investing in high-quality roads. Consequently, the presence of infrastructure is crucial for reducing poverty in emerging nations.

Furthermore, the estimated population coefficient has a significant positive sign, indicating an increase in poverty as the population grows. These findings are similar to Kremer and Chen (2002) and de la Croix and Doepke (2003). The offspring of educated affluent individuals would have a much higher likelihood of becoming educated themselves. However, the children of uneducated poor individuals will have a much lower chance. If individuals experiencing poverty continue to have large families, improving the population's human capital will be difficult, and growth will be slower. Therefore, in developing countries, there is a significant positive correlation between the population and poverty.

5. Conclusion

The present study investigated the impact of financial inclusion on poverty reduction in 57 developing countries. The study tests the data over a seven-year period, specifically from 2011 to 2017. Prior research demonstrates that financial development, particularly the availability of financial institutions, plays a crucial role in enabling impoverished individuals to break free from the cycle of poverty. The results from the dynamic panel system GMM analysis suggest that financial inclusion has the potential to alleviate poverty. Facilitating the interaction between individuals, particularly those who are economically disadvantaged, and financial institutions might provide beneficial outcomes. Individuals who engage in official dealings with financial institutions are more likely to allocate funds to entrepreneurial endeavours. Moreover, engaging in a transaction with a financial institution has the potential to enhance financial literacy among impoverished families. By following this regimen, individuals will progressively enhance their financial situation and quality of life. Therefore, the implementation of financial inclusion initiatives will play a crucial role in alleviating poverty in developing countries.

These findings can also serve as a guide for policymakers to justify the need for more effective approaches. It is helpful to identify how banking and non-banking sectors could react to promote their services and ensure that the services provided can reach the hardcore poor. Bank and non-bank institutions can enhance their financial accessibility by expanding their branches and ATMs, thereby catering to a larger customer base, particularly within impoverished communities. Moreover, bank and non-bank institutions should think about providing affordable loan rates, enabling poor communities to access loans for business start-ups, business expansion, and education.

The present study has several limitations. As such, a need for longitudinal data to establish a causal relationship between financial inclusion measures and poverty reduction could be one major constraint. One limitation is this study's reliance on cross-sectional data, which makes it difficult to assess how financial inclusion affects poverty levels over the long run. Additionally, the study may not fully capture poverty's complex, multifaceted character. Beyond just income levels, poverty is a multitude of conditions driven by a variety of social, economic, and environmental factors. Strictly focusing on financial poverty while ignoring other factors like social service, healthcare, and educational opportunities could lead to an incorrect evaluation of how financial inclusion affects individuals' general well-being and ability to overcome poverty.

Authors' Contributory Statement

Solehah Yahaya: Conceptualization, design methodology, data collection, formal analysis, original draft preparation, editing, revision and amendment for every comment received. Tajul Ariffin Masron: Original draft, data collection, formal analysis. Nik Hadiyan Nik Azman: Conceptualization, original draft preparation, editing.

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Appendix

Appendix 1: Sample of Countries

Albania	Dominican Republic	Madagascar	Pakistan	South Sudan
Armenia	El Salvador	Malawi	Panama	Thailand
Bangladesh	Ghana	Malaysia	Paraguay	Togo
Bhutan	Guatemala	Mauritania	Peru	Tonga
Bolivia	Guinea	Mexico	Philippines	Tunisia
Botswana	India	Moldova	Romania	Turkey
Brazil	Indonesia	Mongolia	Russian	Uganda
Bulgaria	Iraq	Montenegro	Rwanda	Ukraine
Burkina Faso	Jordan	Morocco	Samoa	Zambia
Colombia	Kazakhstan	Nepal	Senegal	
Costa Rica	Kenya	Niger	Serbia	
Croatia	Kyrgyz Republic	Nigeria	South Africa	