

THE IMPACT OF FINANCIAL ACCESS ON INCOME INEQUALITY: EVIDENCE FROM PANEL DATA ESTIMATION

Philip Arestis¹; Khai Ying Eng²

Abstract

As there are limited attempts made by previous studies, this paper examines the impacts of financial access on income inequality using a panel data of 52 developed and developing countries ranging from 2005 to 2020. Initially, the Financial Access Survey (FAS), launched in 2009 suggested that demographic and geographical data of bank branches and automated teller machine (ATM) able to reflect the accessibility of financial service and UN SDG also adopted the demographic data of bank branches and automated teller machine in the SDG target goal as an alternative to expand financial access and strengthen the capacity of domestic financial institution. To measure financial access effectively, indicators such as the number of bank branches and automated teller machines per thousand square feet and hundred thousand adults are employed in this paper to proxy financial access and examine its impact on income inequality. In addition, since the empirical model is largely unexplored, this paper aims to examine the issue thoroughly with secondary data that cover a broader duration and capture changes within the same observation over time. Dynamic panel system generalized method of moments (GMM) estimators is used and the empirical result grounded in real-world data could adopt the outputs, which disclose the relative strength of the influence of financial access on income inequality and identify whether access to finance is useful to narrow down income inequality. The conclusions are also critical for policy design as well.

Keywords: Financial Inclusion, Income Inequality, Panel Data, System Generalized Method of Moments

JEL: G20, E25, C33, D31

1. Introduction

Income inequality is one of the social challenges in recent years as half of the poorest population typically holds less than 10% of the wealth in developed and developing countries. The income inequality issue has grown significantly and urged researchers to attempt more effort to identify the underlying causes of rising inequality (Josifidis, Supić & Pucar, 2017; Peterson, 2017; Prante, 2018; Polacko, 2021; Perugini & Tekin, 2022). Regarding the severe level of inequality, the Lošonc (2016), and Chancel, Piketty, Saez, & Zucman (2022) contribution, sheds light that global inequalities are in bad shape across the century. On the other hand, studies including Milanovic (2013), Lakner and Milanovic (2015), and Lahoti, Jayadev and Reddy (2016) proposed that,

¹ Department of Land Economy, University of Cambridge, Cambridge UK, 19 Silver Street, Cambridge CB3 9EP (e-mail address: pa267@cam.ac.uk)

² Department of Land Economy, University of Cambridge, Cambridge, UK (e-mail address: engkying@gmail.com)

because of the convergence of incomes in several developing nations over past decades, leading to a global decline in poverty rates, along with diminishing in inequality.

This circumstance has called for further action and investigation. Regarding the causes contributing to the inequality issue, the usage and access to financial services have drawn increasing recognition from researchers and policymakers. Lack of financial access has been acknowledged as a major driver of inequality. Claessens and Perotti (2007) and Aslan et al. (2017) argue that different levels of financial access lead to unequal opportunities and exacerbate inequality in income and economics. Besides, the World Bank (2014) stated that low access to finance limits individual education investment and widens the wage difference between the skill and non-skill labour, resulting in income inequality. Theoretically, unequal financial access would stop particularly groups from participating in economic opportunities and exacerbate income inequality.

Previous studies commonly investigate the impact of financial access on income inequality in terms of fixed effect estimation (Agyemang-Badu, Agyei, & Kwaku Duah, 2018 ; Neaime & Gaysset, 2018 ; Omar & Inaba, 2020). Unfortunately, in a short panel, fixed effects are biased because the lagged dependent variables are correlated with the error term. To address endogeneity bias, GMM is the most efficient method through utilising several instrumental variables; however, the risk of bias persists, especially during overidentification or weak instrumental variables. automated teller machine density on income inequality. To our best understanding, there hasn't been any efforts in comparing the effect of financial access on income inequality in terms of demographic and geographical aspect. By dividing the financial access into two categories of geographical and demographical aspects, this study provides additional insights to analyse the influential level of different financial access indicators on income inequality and has implications on policymakers in formulating the appropriate policy and deciding suitable indicators to promote accessibility to finance. Further, this study will complement previous studies by employing panel data, and econometric techniques to achieve the above objective. Panel data is preferable because it covers higher degrees of freedom and greater sample variabilities. Moreover, as panel data is used, the analysis covers rich data across several countries with different degrees of development, serving as a useful reference point for future researchers.

2.Literature review

Compared to research on the effect of finance and other macroeconomic variables, studies exploring the relationship between access to finance and income inequality is relatively scant. Since financial access is one of the components of financial development, hence, this literature review will include other research papers using financial development indicators.

Related studies, focusing on multiple countries, such as Neaime and Gaysset (2018) and Mookerjee and Kalipioni (2010) have presented a negative association between financial access

and income equality. Focusing on eight Middle East and North Africa (MENA) countries, Neaime and Gaysset (2018) assesses the implication of access to finance on income inequality from 2002 to 2015 using the Generalized Method of Moments (GMM) method and the empirical result indicates that access to finance decreases income inequality. Mookerjee and Kalipioni (2010) estimate the impact of demographic aspects of bank branches on income inequality in emerging and advanced countries. Their results show that removing banking access barriers and increasing bank branches' access could narrow down income inequality. Nonetheless, this study suffers from a shorter duration, in which only data from 2000 to 2005 are examined. Focusing on a single country, Kapingura (2017) proposed that greater coverage of automated teller machines per hundred-thousand adults diminished the income inequality in South Africa. While D'Onofrio, Murro and Minetti (2016) and Burgess and Pande (2005) both applied bank branch indicators and achieved similar results. D'Onofrio, Murro and Minetti (2016) indicate in their findings, an adverse effect between the development of local banking and the Gini coefficient and reckon that higher penetration of bank branches is vital for financial inclusion in Italy because lending beyond the local market is challenging for consumers and businesses. Burgess and Pande (2005) found that enhancing the outreach of bank branches improved the accessibility to loan, which encouraged greater business investment and raised standard of living. This promotes income redistribution and reduces inequality.

In contrast, a positive connection between financial access and income inequality has been established when financial access is measured by private credit to Gross Domestic Product or credit access market. First, positive evidence with a large sample size includes Jauch and Watzka (2011) and Sturm and De Haan (2016). Sturm and De Haan (2016) have a larger sample size of 121 countries and the fixed-effect panel model suggests that financial development increases income inequality. Jauch and Watzka (2011) analysed the credit-to- Gross Domestic Product ratio on different income inequality measurements (gross and net Gini coefficient) with a broader data range of 138 countries. By accounting country fixed effects and Gross Domestic Product per capita, financial development positively affects income inequality results, rejecting the theoretical assumption that better financial development reduces income inequality. This conclusion is robustly supported when testing in different settings. Further, the findings illustrate that gross income allocation has stronger responses to financial development than net income distribution.

Besides, selected panel data studies including Batabyal & Chowdhury (2015), Denk and Cournède (2015) and Seven and Coskun (2016) have focused on countries with a similar specific characteristic while Sehrawat and Giri (2015) tend to compare across the urban and suburban areas within a single country using a time series method. For instance, using 30 commonwealth countries data from 1995 to 2008, Batabyal & Chowdhury (2015) discovered that policies aimed at both max financial development and min corruption have a more significant effect in narrowing income inequality. Denk and Cournède (2015) proposed that better finance levels deteriorate income inequality and higher access to finance has worse income inequality in 33 OECD countries. This

relationship is valid when intermediated credit and stock market capitalisation are employed to determine the finance size. Besides, Seven and Coskun (2016) focus on emerging countries and include more credit market indicators such as the logarithm of liquid liabilities to Gross Domestic Product, the logarithm of bank deposits to Gross Domestic Product, the logarithm of private credit to Gross Domestic Product, and the logarithm of private credit. Their findings indicate that improvement in finance may not bring advantages to low-income nations as the development of the banking sector has a significant positive association with the Gini coefficient. Hence, improvements in the banking sector indicators could worsen income inequality in developing countries.

Instead of covering countries with similar country-specific characteristics, Sehrawat and Giri (2015) investigate the impact of financial development on income inequality in India and aims to fill in the gap with basic principles of GJ hypothesis and ARDL techniques of co-integration. Drawing a comparison between the bank-based indicator and market-based indicator, the result suggests that, in the long-run, financial development worsened the income inequality and proposed that suitable monetary reforms that focus on financial access should be implemented by the Indian government to eliminate income inequality in India.

Finally, a U-shaped relationship may also occur between access to finance and income inequality. The model of Greenwood and Jovanovic (1990) states that at the early stage of formal financial sector development, when income levels increase, so does the financial structure; the income gap between the rich and the poor are exacerbated. When an economy's financial structure is completely established, it achieves a more equitable income distribution among the population and reduces the gap. Both Nguyen et al. (2019), Younsi and Bechtini (2020) and Kocak and Uzay (2019) confirmed the Greenwood–Jovanovich (GJ) hypothesis. Using fixed effect and GMM estimation, Nguyen et al. (2019) indicates the effectiveness of financial development in promoting economic growth of 21 emerging markets, while Younsi and Bechtini (2020) employ the POL and GMM estimator and draw similar conclusions in BRICS countries. Focusing on a single country, Kocak and Uzay (2019) and Bittencourt et al. (2019) validate the GJ hypothesis in Turkey and USA.

Other researches related to nonlinear finance–inequality nexus include Law et al. (2014), Sukmana and Ibrahim (2018), Sahay and Cihak (2020) and Mbona (2022). Law et al. (2014) included different institutional qualities when testing a panel relationship between private credit, bank credit and commercial bank branches and income inequality and the results suggest that financial development only served to alleviate income inequality once attaining a specific point of institutional quality; the impact of financial development on income inequality before that threshold is non-existent. Investigate the effect of access to finance on income inequality from a different perspective, Sukmana and Ibrahim (2018) complement existing studies by bringing a different form of non-linearity and the quantile regressions result of 73 countries indicates that financial access is central in effort to reducing income inequality, particularly when the income

inequality of a country is low. In contrast, financial access is ineffective in mitigating income inequality in nations with high inequality. Finally, comparing the effect of access to finance and financial depth on income inequality, both Sahay and Cihak (2020) and Mbona (2022) get a similar result. Reviewing 180 advanced and emerging market countries, Sahay and Cihak (2020) stated that access to finance could narrow inequality, in contrast, financial depth has a U-shaped linkage with inequality. Similarly, using a dataset of 120 countries from 2004 to 2019, both linear and non-linear GMM results of Mbona (2022) supports the positive effect of financial access in decreasing income inequality.

By studying the existing papers, we discover that the financial access indicators are regularly measured from the usage aspect (i.e. *deposit* account, loan activity), access indicators (i.e. penetration of bank branches) and financial development (i.e. broad money supply, private credit, capital market). Indeed, to our best understanding, penetration of automated teller machines (ATM) is seldom being used to measure the relationship between financial access and income inequality. Finally, previous research seldom uses the GMM method even though GMM estimates could perform smaller standard errors than the OLS standard errors and deals well with endogeneity, which is able to produce efficient results with a limited time dimension, hence, this provides gaps for future research to study in this aspect.

3. Hypothetical Relationship

An annual balanced panel data cover period from 2005 to 2020 is gathered and estimated. 53 countries in the panel analysis included in the Table 3.1 and Table 3.2 shows the hypothesis development of each control variable to income inequality.

Table 3.1 Selected regions and counties in the study

Regions	Countries
Europe	Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Rep, Denmark, Estonia, Georgia, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Moldova, Netherlands, Poland, Portugal, Slovak republic, Slovenia, Spain, Sweden, Switzerland
Asia	Australia, Bangladesh, Bhutan, China, India, Indonesia, Israel, Kazakhstan, Korea, Kyrgyz Rep, New Zealand, Philippines, Russia, Singapore, Thailand, Ukraine
American	Brasil, Chile, Costa Rica, Dominican Rep., Ecuador, Honduras, Mexico, Peru
Africa	Kenya, Uganda

Table 3.2 Hypothesis development of control variables

Variables	Possible Sign	Rationale	Source from
Financial access indicators: ATM per 1000km ² ATM per 100,000 adults Bank Branches per 1000 km ² Bank Branches per 100,000 adults	Positive/ negative	Negative: (i) Financial access increases economic opportunity for the vulnerable, which in turn alleviates inequality. (ii) Financial access facilitates efficient allocation of productive resources, and encourages the poor to accumulate assets, contributing to income redistribution. Positive: (i) Better financial access benefits the entrepreneurs by allowing them to invest in new business opportunities with excess capital and worsens income inequality.	Financial Access Survey
Gross Domestic Product per capita	Positive/ negative	1) Negative: (i) Growth in Gross Domestic Product per capita leads to job creations and occupational resources, especially for the poor. 2) Positive: (i) Globalisation and technological advancement enhance capital-intensive production processes and reduce the demand of non-skill labour which could lower their wages, leading to higher income inequality. (ii) Economic growth and globalisation surge the labour market competitiveness, the non-skill labour involuntary accept a lower wage just to get the job and worsen income inequality.	World Development Indicators, World Bank
Trade openness	Positive/ negative	1) Negative: (i) Trade openness raises the need and wages for non-skilled labour and empower the balance of wage dispersion. (ii) Trade openness lowers the prices of consumer goods and allows the	World Development Indicators, World Bank

		poor to have more allocated real income. 2) Positive: (i) Trade openness widens income inequalities in a country with an overabundant workforce. (ii) Trade liberalisation is more prominent in specialisation and skilled labourers profiting through higher wages while unskilled labourers gain less or lose out.	
inflation	Positive/ negative	1) Negative: (i) Inflation mitigates income inequality as inflation leads to higher income tax payable by the rich, resulting in income redistribution. 2) Positive: (i) Inflation eases the real income of the low-income people, reduces their purchasing power and exacerbates income inequality. (ii) During inflation, the poor cannot resist currency depreciation and exacerbate income inequality.	World Development Indicators, World Bank

The dependent variable of this paper is the *Gini* coefficient, which is expressed as a percentage. The Gini coefficient measures the income distribution, where perfect equality is indicated as 0, given that everyone receives an equal share, while the Gini coefficient of 1 stands for perfect inequality where income concentrates on small groups or single recipients. Gini coefficient is commonly applied in existing research to reflect the level of income inequality. For example, Ravallion and Chen (2007) used the Gini coefficient to measure income inequality and found that it has been gradually increasing in both cities and suburbs. The Gini indicator from SWIID applied in this thesis is also used by Jauch and Watzka (2011) and Law et al. (2014).

This paper applies four financial access *indicators*, including the number of ATM and bank branches per thousand kilometres square, and the number of ATM and bank branches per hundred thousand. The FAS is a broad, publicly accessible dataset that contains 152 series of variables. As a result, 47 basic indicators have been created and organised according to geographic outreach and financial service usage. The database is regularly kept up to date as financial systems development, and its scope will expand as additional data is gathered.

The implication of financial access to income inequality could be ambiguous. Existing discrimination in least developed nations restrict the community's ability to access finance and

lose the opportunity of savings and asset accumulation. The extensive margin theory is also applicable because the theory suggests that policymakers should enhance coverage on the unbanked population, promoting equal access to finance and reducing inequality (Black & Lynch, 1996; Mookerjee and Kalipioni, 2010; Precious, Bahle & Praise, 2014; Batabyal & Chowdhury, 2015; Zhang and Naceur, 2016). Conversely, a positive association between access to finance and income inequality is possible because an increase in financial access could also be more favourable to the entrepreneurs as the rich are able to concentrate wealth and make invest in new business opportunity, gaining higher profit margin, and leads to higher income inequality (Banerjee and Newman, 1993; Lippmann, Davis & Aldrich, 2005; Atems & Shand, 2018 [38]). Therefore, the expected sign of financial access in the equation of income inequality remains unclear.

Increases in per capita Gross Domestic Product tended to reduce inequality because economic growth has been associated with more occupational resources and job opportunities for the poor (Mookerjee and Kalipioni, 2010; Brei et al., 2018). On the other hand, although economic growth is boosted by globalization, industrial productivity growth is driven by technological development and multinational companies have transferred a large number of labour-intensive jobs into capital intensive as a result to increase the productivity, resulting in the loss of a large number of industrial jobs and reducing the non-skill labour demand, could lower their wages, which in turn expands income disparities in the countries. Moreover, economic growth and globalisation surge the labour market competitiveness, the non-skill labour involuntary accept a lower wage just to get the job and worsen income inequality (Slaughter, & Swagel, 1997).

Trade Openness is used to describe how trade integration affects inequality; it is probable to have a negative association with income inequality. Referring to Heckscher-Ohlin and the Stolper-Samuelson theoretical framework, improved trade openness *allows* countries to export goods with comparative advantage and trade openness encourages firms to hire more unskilled workers and drives a rise in wages for non-skilled worker, encouraging the equality of wage distribution in low-skilled-labour abundant countries (Ohlin, 1933; Heckscher, Ohlin, Flam, & Flanders, 1991; West and Tari, 2013). Besides, trade liberalisation increases market competitiveness and reduces the price of necessity goods. The poor normally have a greater proportion of expenses on consumer goods and allow the poor to have more allocated *income*, which encourages them to save or make investment, and narrow down the income inequality (World Bank, 2018).

Nonetheless, the trade openness could have a positive association with income inequality when there is an increase in the wage inequality between informal and formal workers, especially in a country with an overabundant workforce. Likewise, greater trade openness could increase income disparities as trade liberalisation more prominent in specialisation and firms more favourable to skilled workers, willing to provide higher wages to skilled workers and unskilled workers gaining less (Yeaple, 2005; Davidson, Matusz and Shevchenko, 2008; Sampson, 2014; Paz, 2014; Becker, 2018; Aleman-Castilla, 2020).

Previous studies suggest that inflation improves income distribution by redistributing income to the low-income quintiles, and the negative correlation between these two variables is shown in the studies of Blinder and Esaki (1978). Coibion et al. (2017) have consistently shown a negative correlation between these two variables. Using a progressive tax system, inflation causes higher income earners being categorised into higher tax brackets and the increased tax revenue effectively switches the resources access from the wealthy to the poor, which in turn reduces income inequality (Heer & Süssmuth, 2003; Yue, 2011).

On the other hand, inflation influences the macroeconomic environment and reduces real income for low-income people with fixed nominal wages. Hence, real purchasing power will drop. Besides, the poor cannot increase their income during the inflation process, yet the nominal income of wealthy people *would not* be affected. It is because the rich have access to other sources of income besides their employment, while the poor do not have additional reserves to participate in investment and gain return. Finally, when inflation occurs, their fixed income cannot resist the currency depreciation and exacerbates income inequality (Li and Zou, 2002).

4. Methodology

Since the dataset contains numerous countries throughout *a few years* (multiple cross-sectional and time dimensions), panel data study approaches are the best way to test if financial access holds a statistically significant effect on the income inequality.

$$INE = \gamma_1 + \gamma_2 INE_{t-1} + \gamma_3 LFA + \gamma_4 LGDPC + \gamma_5 LTRA + \gamma_6 IN + \eta + \varepsilon_{it}$$

The dependent variables, *INE* is income inequality proxied by Gini Coefficient. In particular, the *IN* is inflation and is proxied by the inflation rate; *LGDPC* is the natural logarithm of gross domestic product per capita. *LTRA* is the natural logarithm of Trade Openness. The η and ε in equation reveal the unobserved country-specific influence separately and uniformly distributed error term.

To control the fixed effect and consist of a different equation, this paper employed the system generalised method of moments (S-GMM) estimator developed by Blundell and Bond (1998). Additional moment conditions based on the initial observation's stationary conditions under dependent variable's persistence properties is absent in the difference GMM but included in the system GMM because of the estimation of level and difference equations.

To improve estimation efficiency, System Gmm addresses endogeneity bias and serial correlation in a dynamic panel model by utilising the instrument variables. However, the greater instrument variables involved in the S-GMM estimation could lead to instrument proliferation. To prevent this, this study limits the number of lags used as instruments and the number of lags should

be lower than the number of cross-sectional units under the rule of thumb. The Stata code *xtdpdsys* is used for the estimation.

Additionally, the autoregressive (AR) autocorrelation test verifies the absence of the second-order autocorrelation of the residuals with the assumption that the null hypothesis of no second-order autocorrelation. Also, Sargan test is used to assess validity of the instrument with the null hypothesis of the instruments being valid. Finally, to detect outliers, Cook's Distance Outlier test is applied; these outliers are excluded from estimations to avoid its influence on the estimation result and the regression's slope.

5. Result Discussions

Before interpreting the estimators, the paper first stated the properties of the estimation. The result shows that the number of groups is larger than the number of instrument variables in all estimated system GMM results, showing the estimation is not subject to the proliferation of instrument variables. In addition, the Sargan test did not reject the overidentification restrictions at a 5 percent significance level; it verifies the assumptions made in the estimations. Furthermore, the second-order autocorrelation test (AR2) failed to reject the null hypothesis of second-order autocorrelation, whereas the first-order autocorrelation test (AR1) did. Therefore, the validity of the estimated outputs is confirmed.

Table 5.1 indicates the effect of financial access on the income inequality, supported by the coefficient of the Gini index and lagged dependent variables that is close to one and statistically significant. Generally, the coefficient of financial access indicators is statistically significant across the models and show a negative relationship between financial access and income inequality, excluding bank branches per 1000-kilometre square. Moreover, the coefficients' sign of all control variables is consistent except education variables.

Table 5.1 The income inequality equation

Variables	Atm per hundred thousand adults	Atm per thousand-kilometre square	Branch per hundred thousand adults	Branch per thousand-kilometre square
Gini coefficient	0.9129***	0.8995***	0.8872***	0.8059***
	(0.0095)	(0.0118)	(0.0116)	(0.0208)
LFA	-0.1153***	-0.1167***	-0.2878***	0.0084**
	(0.0305)	(0.0276)	(0.0874)	(0.0037)
inflation	-0.0026*	-0.0023	-0.0032**	-0.0001
	(0.0014)	(0.0014)	(0.0014)	(0.0002)
LTRA	-0.0778	-0.1479***	-0.1823***	-0.0121
	(0.0486)	(0.0571)	(0.0562)	(0.0098)
LGDP	0.0433	0.0712	0.1512**	0.0064
	(0.0757)	(0.0897)	(0.0757)	(0.0072)
education	-0.7784**	-1.1612***	-1.0448***	0.0828***

	(0.3483)	(0.4018)	(0.2793)	(0.0273)
tdum2	4.8286***	6.2335***	6.3876***	
	(0.7684)	(1.0040)	(1.0202)	
tdum3	4.8366***	6.2672***	6.4101***	0.0059***
	(0.7675)	(1.0060)	(1.0259)	(0.0023)
tdum4	4.8529***	6.2893***	6.4334***	
	(0.7712)	(1.0171)	(1.0333)	
tdum5	4.8964***	6.3316***	6.4412***	
	(0.7743)	(1.0067)	(1.0211)	
tdum6	4.8807***	6.3134***	6.4145***	
	(0.7757)	(1.0106)	(1.0250)	
tdum7	4.9363***	6.3704***	6.4575***	
	(0.7758)	(1.0160)	(1.0302)	
tdum8	4.8888***	6.3287***	6.4153***	0.0184***
	(0.7847)	(1.0181)	(1.0343)	(0.0031)
tdum9	4.8490***	6.3068***	6.3619***	0.0197***
	(0.7829)	(1.0146)	(1.0326)	(0.0026)
tdum10	4.8103***	6.2466***	6.3132***	0.0236***
	(0.7842)	(1.0123)	(1.0283)	(0.0022)
tdum11	4.8486***	6.2835***	6.3112***	0.0203***
	(0.7838)	(1.0052)	(1.0193)	(0.0025)
tdum12	4.7998***	6.2297***	6.2463***	0.0114***
	(0.7816)	(1.0012)	(1.0151)	(0.0025)
tdum13	4.8117***	6.2460***	6.2420***	0.0364***
	(0.7836)	(1.0070)	(1.0159)	(0.0034)
tdum14	4.8245***	6.2578***	6.2452***	0.0320***
	(0.7868)	(1.0107)	(1.0171)	(0.0034)
tdum15	4.8853***	6.3326***	6.2946***	0.0709***
	(0.7919)	(1.0159)	(1.0204)	(0.0036)
tdum16	4.8543***	6.3101***	6.2442***	0.1076***
	(0.7903)	(1.0115)	(1.0171)	(0.0044)
Observations	764	764	764	764
Number of C	54	54	54	54
Sargan test	0.6837	0.7035	0.7065	0.5670
AR(1)	0.0983	0.0974	0.0987	0.0074
AR(2)	0.6956	0.6691	0.6405	0.3453

Note: ***, **, and * indicate the statistical significance at 1%, 5%, and 10%. The values in the parentheses are the standard errors. LFA refers to the natural logarithm of financial access includes LAD, LAG, LBD and LBG; LGDPC is natural logarithm of gross domestic product per capita. LEDU is the natural logarithm of education attainment, in terms of secondary school and IN is proxy by inflation rate. LTRA is the natural logarithm of Trade Openness.

The negative coefficients for inflation and trade openness and the positive coefficients of Gross Domestic Product per capita are robust and significant across all specifications. In contrast, the education indicator shows a negative significant sign in most of the financial access *indicators*, but this peculiar result turns positive in bank branches per kilometre square. This result suggests that there is insufficient evidence to determine whether others control variables that are statistically significant on income inequality. Additionally, comparing the bank branches' coefficient size and the automated teller machine (ATMs) indicators shows it is larger in the bank branches. It implies that the existing bank branches per hundred thousand adults could be a more influential factor in affecting income inequality.

This negative linkage for financial access and income inequality is in line with *the relevant hypothesis*. Ouechtati (2020) suggests that the better access to finance in terms of bank penetration rate, or the greater the availability of automated teller machines (ATMs) included the vulnerable into the financial system and reduced the income inequality. The income distribution narrows down as financial access would minimise the income inequality by increasing economic opportunity for the less fortunate classes and helps the poor to avoid suffering from exploitative informal sources of credit. Therefore, an increase in bank branch penetration includes individuals that are involuntarily excluded from the financial system and helps to reduce income inequality. Moreover, financial access facilitates the unbanked individual to take part in economic activities, assist efficient allocation of productive resources, allow the underprivileged group to save and build assets, which in turn narrow down income inequality (Black & Lynch, 1996; Mookerjee and Kalipioni, 2010; Precious, Bahle & Praise, 2014; Batabyal & Chowdhury, 2015; Zhang and Naceur, 2016).

The positive linkage between per capita Gross Domestic Product and income inequality indicates that, even though economic growth under globalisation, certain industries are also experiencing industrialisation and tend to replace labour-intensive jobs with capital-intensive ones to increase productivity. The competitive nature of the global labour market pushes for lower wages, particularly for non-skilled labourers. The non-skill labour is pressured to accept low wages to secure employment, resulting in widening income inequality (Slaughter, & Swagel, 1997).

Finally, inflation may narrow the income distribution as expansionary monetary policy designed to accelerate output growth correlates with better living conditions for the poor. Moreover, unexpected inflation can transfer wealth from lenders to borrowers (Romer and Romer, 1998). The negative sign of trade openness suggests that greater trade openness leads to openness, increases labour productivity and increases wages; this results in a decrease in overall wage inequality (Manni, Siddiqui and Afzal, 2012).

6. Summary and Conclusion

Income inequality has become a debated issue and has recently received a considerable amount of worldwide attention. The income inequality gap has been widespread in many countries, and this phenomenon has driven researchers to spend more time and effort searching for the root causes of rising inequality. The results suggest that a rise in financial access narrows down income inequality and is in line with Mookerjee and Kalipioni (2010), Kendall, Mylenko and Ponce (2010) and Batabyal & Chowdhury (2015). Our contribution uses secondary data to conduct the estimation with a system GMM. The secondary data covers a longer period and allows estimations to include the changes in the same observation over time. Furthermore, the empirical evidence allows us to empirically verify the theoretical study. This result contributes to the existing study and policymakers in advanced countries by encouraging them to concentrate on bank branch indicators during the implementation of financial access development. *Whereas policymakers* in emerging countries should *investigate* the reasons that prevent the poor from better financial access.

References

- Aleman-Castilla, B. (2020). *Trade and labour market outcomes theory and evidence at the firm and worker levels* (Working Paper No. 12). International Labour Organization. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---inst/documents/publication/wcms_758485.pdf
- Atems, B., & Shand, G. (2018). An empirical analysis of the relationship between entrepreneurship and income inequality. *Small Business Economics*, 51(4), 905–922. doi:10.1007/s11187-017-9984-1
- Batabyal, S., & Chowdhury, A. (2015). Curbing corruption, financial development and income inequality. *Progress in Development Studies*, 15(1), 49–72
- Becker, D. (2018). Heterogeneous firms and informality: the effects of trade liberalization on labour markets. *Oxford Economic Papers*, 70(1), 47-72.
- Bittencourt, M., Chang, S., Gupta, R., & Miller, S. M. (2019). Does financial development affect income inequality in the US States? *Journal of Policy Modelling*, 41(6), 1043-1056.
- Black, S. E., & Lynch, L. M. (1996). Human-capital investments and productivity. *The American Economic Review*, 86(2), 263-267.
- Blinder, A. S., & Esaki, H. Y. (1978). Macroeconomic Activity and Income Distribution in the Postwar United States. *The Review of Economics and Statistics*, 60(4), 604. <https://doi.org/10.2307/1924254>

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115-143.

Brei, M., Ferri, G., & Gambacorta, L. (2018). *Financial structure and income inequality* (BIS Working Papers No. 756). Bank for International Settlements. <https://www.bis.org/publ/work756.pdf>

Burgess, R., & Pande, R. (2005). Do Rural Banks Matter? Evidence from the Indian Social Banking Experiment. *American Economic Review*, 95(3), 780-795.

Chancel, L., Piketty, T., Saez, E., & Zucman, G. (Eds.). (2022). *World inequality report 2022*. Harvard University Press.

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

Coibion, O., Gorodnichenko, Y., Kueng, L., & Silvia, J. (2017). Innocent Bystanders? Monetary policy and inequality. *Journal of Monetary Economics*, 88, 70–89. <https://doi.org/10.1016/j.jmoneco.2017.05.005>

Cong Nguyen, T., Ngoc Vu, T., Hong Vo, D., & Thi-Thieu Ha, D. (2019). Financial development and income inequality in emerging markets: a new approach. *Journal of Risk and Financial Management*, 12(4), 173.

Davidson, C., Matusz, S. J., & Shevchenko, A. (2008). Globalization and firm level adjustment with imperfect labor markets. *Journal of international Economics*, 75(2), 295-309

Denk, O., & Cournède, B. (2015). *Finance and Income Inequality in OECD Countries* (Working Paper No. 1224). OECD Economics Department

D'Onofrio, A., Minetti, R., & Murro, P. (2016). *Banking Development, Economic Structure and Income Inequality* (Working Papers No. C08). CERBE Centre for Relationship Banking and Economics

Greenwood, J., & Jovanovic, B. (1990). Financial Development, Growth, and the Distribution of Income. *Journal of Political Economy*, 98(5), 1076–1107. <https://doi.org/10.1086/261720>

Heckscher, E. F., Ohlin, B., Flam, H., & Flanders, M. J. (1991). *Heckscher-Ohlin trade theory*. Cambridge, Mass: MIT Press.

Heer, B., & Süßmuth, B. (2003). *Cold Progression and its Effects on Income Distribution* (Working Paper No. 951). CESifo.

Josifidis, K., Supić, N., & Pucar, E. B. (2017). Institutional quality and income inequality in the advanced countries. *Panoeconomicus*, 64(2), 169-188.

Kapingura, Forget M. 2017. Financial Sector development and income inequality in South Africa. *African Journal of Economic and Management Studies*, 8: 420–32

Koçak, E., & Uzay, N. (2019). The effect of financial development on income inequality in Turkey: An estimate of the Greenwood-Jovanovic hypothesis. *Review of Economic Perspectives*, 19(4), 319-344.

Lahoti, R., Jayadev, A., & Reddy, S. (2016). *The Global Consumption and Income Project (GCIP): An Introduction and Preliminary Findings* (DESA Working Paper No. 140). United Nation, Department of Economic & Social Affair.

Lakner, C., & Milanovic, B. (2015). Global income distribution: from the fall of the berlin wall to the great recession. *The World Bank Economic Review*, 30(2), 203–232.

Law, S. H., Tan, H. B., & Azman-Saini, W. N. W. (2014). Financial development and income inequality at different levels of institutional quality. *Emerging Markets Finance and Trade*, 50(1), 21-33.

Lippmann, S., Davis, A., & Aldrich, H. E. (2005). Entrepreneurship and Inequality. In *Entrepreneurship* (pp. 3–31). Bingley: Emerald Group Publishing Limited.

Li, H. Y., & Zou, H. F. (2002). Inflation, Growth, and Income Distribution: A Cross-Country Study. *Annals of Economics and Finance*, 3(1), 85-101.

Lošonc, A. (2016). Global Inequality: A New Approach for the Age of Globalization by Branko Milanovic. *Panoeconomicus*, 63(4), 493-501.

Manni, U., Siddiqui, S., & Afzal, M. N. (2012). An Empirical Investigation on Trade Openness and Economic Growth in Bangladesh Economy. *Asian Social Science*, 8(11), 154.

Mbona, N. (2022). Impacts of overall financial development, access and depth on income inequality. *Economies*, 10(5), 118.

Milanovic, B. (2013). Global Income Inequality by the Numbers: in History and Now. *Global Policy*, 4(2), 198–208.

Mookerjee, R., & Kalipioni, P. (2010). Availability of financial services and income inequality: The evidence from many countries. *Emerging Markets Review*, 11(4), 404-408

Neaime, S., & Gaysset, I. (2018). Financial inclusion and stability in MENA: Evidence from poverty and inequality. *Finance Research Letters*, 24, 230-237. Available at: <https://doi.org/10.1016/j.frl.2017.09.007>

Ohlin, B. (1935). *Interregional and international trade*. Harvard University Press, Cambridge.

Omar, M. A., & Inaba, K. (2020). Does financial inclusion reduce poverty and income inequality in developing countries? A panel data analysis. *Journal of Economic Structures*, 9(1), 1-25. Available at: <https://doi.org/10.1186/s40008-020-00214-4>.

Ouechtati, I. (2020). The contribution of financial inclusion in reducing poverty and income inequality in developing countries. *Asian Economic and Financial Review*, 10(9), 1051.

Paz, L. S. (2014). The impacts of trade liberalization on informal labour markets: A theoretical and empirical evaluation of the Brazilian case. *Journal of International Economics*, 92(2), 330-348.

Perugini, C., & Tekin, İ. (2022). Financial development, income inequality and governance institutions. *Panoeconomicus*, 69(3), 353-379.

Peterson, E. (2017). Is Economic Inequality Really a Problem? A Review of the Arguments. *Social Sciences*, 6(4), 147. <https://doi.org/10.3390/socsci6040147>

Polacko, M. (2021). Causes and consequences of income inequality—an overview. *Statistics, Politics and Policy*, 12(2), 341-357.

Prante, F. J. (2018). Macroeconomic effects of personal and functional income inequality: Theory and empirical evidence for the US and Germany. *Panoeconomicus*, 65(3), 289-318.

Precious, C., Bahle, M., & Praise, G. (2014). Impact of financial liberalization on economic growth: A case study of South Africa. *Mediterranean Journal of Social Sciences*, 5(23), 238.

Ravallion, M., & Chen, S. (2007). China's uneven progress against poverty. *Journal of Development Economics*, 82(1), 1-42.

Romer, D. C., & Romer, H. D. (1998). *Monetary policy and the well-being of the poor* (Working Paper No. 6793). National Bureau of Economic Research. <https://www.nber.org/papers/w6793>

Sahay, Ratna, Martin Cihak, Papa M N'Diaye, Adolfo Barajas, Srobona Mitra, Annette J. Kyobe, Yen N. Mooi, and Reza Yousefi. 2015. Rethinking Financial Deepening; Stability and Growth in Emerging Markets. IMF Staff Discussion Notes 2015/008. Washington, DC: International Monetary Fund

Sampson, T. (2014). Selection into trade and wage inequality. *American Economic Journal: Microeconomics*, 6(3), 157-202.

Sehrawat, M., & Giri, A. K. (2015). Financial development and income inequality in India: an application of ARDL approach, *International Journal of Social Economics*, 42(1), 64- 81.

Seven, U., & Coskun, Y. (2016). Does financial development reduce income inequality and poverty? Evidence from emerging countries. *Emerging Markets Review*, 26(C), 34-63.

Slaughter, M. J., & Swagel, P. L. (1997). *Does globalization lower wages and export jobs?. In Does Globalization Lower Wages and Export Jobs?* International Monetary Fund.

Sturm, J. E., & D Haan, J. (2016). *Finance and Income Inequality: A Review and New Evidence* (Working Paper No. 530). De Nederlandsche Bank.

Sukmana, R. A. D. I. T. Y. A., & Ibrahim, M. H. (2018). Financial access and inequality: A quantile assessment. *International Journal of Economics and Management*, 12(2), 551-557.

West, J. K., & Tari, Z. (2013). *Competition and Poverty Reduction* (Document paper No. 12). Organisation for Economic Co-Operation and Development (OECD), Global Forum on Competition

World Bank (2014). *Global Financial Development Report 2014: Financial Inclusion*. Washington, D.C.: World Bank.

World Bank (2018). *Stronger Open Trade Policies Enable Economic Growth for All*. Washington, D.C.: World Bank. Retrieved from: <https://www.worldbank.org/en/results/2018/04/03/stronger-open-trade-policies-enables-economic-growth-for-all>

Yeaple, S. R. (2005). A simple model of firm heterogeneity, international trade, and wages. *Journal of international Economics*, 65(1), 1-20.

Younsi, M., & Bechtini, M. (2020). Economic growth, financial development, and income inequality in BRICS countries: does Kuznets' inverted U-shaped curve exist?. *Journal of the Knowledge Economy*, 11(2), 721-742.

Yue, H.-Y. (2011). Income Inequality, Economic Growth and Inflation: A Study of Korea. *International Journal of Economics Research*, 2(5), 14–21.

Zhang, R., & Ben Naceur, S. (2019, May). Financial development, inequality, and poverty: Some international evidence. *International Review of Economics & Finance*, 61(C), 1–16.