

# A G D I Working Paper

WP/23/073

**Threshold effect of banking on income inequalities in developing countries:  
the importance of mobile money**

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**Abstract**

This study investigates the role that of mobile money on the effect of banking on income inequalities on a panel of 105 developing countries over a period from 1990-2019. We use the system GMMs estimator to examine this relationship for income inequality before as well as after taxes and transfers. Results show that increased in banking contributes to the upsurge in income inequalities in developing countries. Likewise, an increase in bank borrowing also contributes to an increase in income inequality in developing countries. These results were robust to spatial analysis for Sub-Saharan Africa and Latin America and the Caribbean. Policy enactment wise, developing countries should ameliorate mobile money services and access points to significantly reduce inequality.

*Keywords:* Mobile banking; developing countries; poverty; inequality

*JEL Classification:* G20; O40; I10; I20; I32

## **1. Introduction**

The fight against poverty and income inequalities is today one of the major objectives of sustainable development policies and strategies in developing countries (DCs). The adoption in 2015 of a sustainable development agenda for 2030 and its 17 sustainable development goals placed emphasis on poverty and income inequalities. According to Chancel et al. (2022), in all major regions of the world, except Europe, the share of the poorest 50% in total income is less than 15% (less than 10 in Latin America, MENA region and in sub-Saharan Africa), while the share of the richest 10% is above 40% and, in many regions, closer to 60%. But what is perhaps even more striking is the evolution of wealth. The share of the world's poorest 50% of total global wealth is 2%, while the share of the richest 10% is 76%. Between 1995 and 2021, the richest 1% captured 38% of the global increase in wealth, while the poorest 50% captured 2%. Indeed, the persistence of high levels of income inequality around the world, particularly in developing countries (DCs), has detrimental effects on both social well-being and social capital (Asongu and Vo, 2020).

Several governments and international organizations have focused on finance as a corrective measure to income inequality. But the relationship between finance and income inequality is the subject of much controversy within the scientific community: some studies support the existence of a non-linear relationship (inverted U) between finance and income inequality. income while others support a linear relationship.

Greenwood and Jovanovic (1990) in their studies predict a nonlinearity between finance and income inequality with emphasis on the level of financial development. In the early phases of development, access to financing requires several conditions that only the rich can fulfill unlike the poor, which leads to increasing income inequalities. The more the financial system develops, the more access to financial services and financing for investment becomes favorable for the poor, which promotes the reduction of income inequalities. On the other hand, Galor and Zeira (1993) like Galor and Moav (2004) postulate a linearity between finance and income inequalities. In their studies, they argue that financial deepening reduces difficulties in accessing credit, which benefits the poor through human capital and capital accumulation.

Generally speaking, a country's banking rate is proportional to its level of economic development. The more developed a country is, the higher its banking rate and vice versa. Faced with this gap in the level of banking between countries, we highlight certain elements which are nowadays considered major obstacles to the banking process in certain countries, namely: the costs of opening and managing a bank account and the spatial distance from formal financial establishments, given that banking is defined as access and use of formal financial services for all, including the most vulnerable (Fouejieu et al., 2020). Following the low banking rate in developing countries compared to developed countries (71% in developing countries compared to 94% in developed countries in 2021 according to global finindex) and the expansion of digital technology in the world, numerous studies such as those of Sekantsi and Motelle (2016), Gosavi (2018) and Ngono (2020) looked at new technologies and showed that their integration into formal financial services holds enormous potential in terms of banking.

The expansion of new technologies, particularly mobile telephony throughout the world, has come to lend a hand to financial and banking services in their quest to provide more banking services to populations excluded from these services (Jack and Suri, 2011; Demirgüç-Kunt and Klapper , 2012 ). In 2021, the mobile money sector processed more than \$1 trillion in transactions for 1.35 billion registered mobile accounts worldwide, an increase of 18% compared to the previous year, and a figure that is 10 times higher than that of 2012 which was 134 million (GSMA, 2022). Indeed, the use of new technologies in formal financial services makes it possible to reduce income inequalities because they offer accessible and affordable financial services to all groups of people, including those with low income and who were previously unbanked due to financial market imperfections (Asongu et al., 2018).

The effect of banking on income inequality through information and communication technologies (ICT) is still growing. Mobile money, for example, has enormous potential in terms of banking because it facilitates access to financial services by reducing transaction costs, information asymmetries and transport costs, because it can be used at any location through the mobile phone (Aron, 2018; Ahmad et al., 2021). The purpose of this study is to examine the threshold effect of banking on income inequalities by highlighting the role of mobile money in developing countries. The generalized method of moments (GMM) will be applied to a sample of 105 developing

countries over the period 1990-2019. The sample will then be split into several developing regions in order to check the robustness of the results.

## **2. Literature review**

Several studies attest to the effects of banking on income inequalities in developing countries. But the results of this work are contradictory as to the effect of banking on the reduction of income inequalities.

Using a sample of 35 developing countries, Tan and Law (2012) confirmed the existence of an inverted U-shaped relationship between financial deepening and income inequality. Similarly, using ordinary least squares to test the nonlinearity hypothesis of Greenwood and Jovanovic (1990), Salazar-Cantú et al. (2015) show that firstly, the higher the financial inclusion, the greater the income inequalities in Mexican municipalities and then, secondly, the more financial inclusion continues to grow, the more income inequalities decrease. Similarly, Neaime and Gaysset (2018) using the generalized method of moments and generalized least squares find that financial inclusion reduces income inequality significantly in the MENA region over a period from 2002-2015. Other studies such as those of Turégano and García- Herrero (2018) analyzed the effect of financial inclusion on income inequality in 150 countries over a period from 2000-2011 based on pooled regression and showed that financial inclusion significantly reduces income inequality. Furthermore, Huang and Zhang (2020) using panel co-integration methods over the period from 1985-2013 find that in China, financial inclusion reduces income inequality in urban and rural areas in the long term but increases income inequality in the short term.

However, as access to financial services in developing countries is difficult due to problems of information asymmetries, formal financial institutions are forced to require guarantees which are sometimes proportional to or greater than the loan requested (Akerlof, 1970 ; Stiglitz and Weiss, 1981). Apart from these guarantees, there is also the problem of the interest rate which is one of the determining factors of access to financing intended for investment. Indeed, Baumol 's (1952) money demand model mentioned the importance of transaction costs on access to financial services. Transaction costs promote financial exclusion when they are high. This is how Aglietta (1993), Fox and Van Droogenbroeck (2017), Bachas et al. (2018) argue that the use of ICT has a

competitive effect on banks and non-bank financial institutions, which leads to lower costs and requirements for the latter.

The influence of mobile money on financial inclusion has been highlighted in certain works such as those of Sekantsi and Motelle (2016). The use of mobile money in formal financial services has improved the banking rate in developing countries due to the reduction of financial market imperfections, notably the reduction of transaction costs and also the reduction of information asymmetries. This is how Asongu and Odhiambo (2018) used the generalized method of moments implemented on a panel of 48 African countries over the period from 2004-2014 and showed the importance of ICT within services financial and banking sectors and their capacity to bank groups that were previously excluded from formal financial services.

To assess the effect of ICT associated with formal financial services on income inequality, Asongu (2015) uses ordinary least squares and two-stage least squares and shows that mobile penetration in formal financial services significantly reduces income gaps in 52 African countries. Similarly, Demir et al. (2022) using survey data from the Global Findex 2011, 2014 and 2017 on a sample of 140 countries find that new financial technologies promote banking and subsequently make it possible to significantly reduce income inequalities.

### **3. Empirical analysis**

#### **3.1. Empirical strategy**

Chart A.1 (see appendix) shows that access to banking institutions increases income inequality before taxes and transfers in all developing countries. While graph A.2 (see annex) indicates that access to financial institutions reduces income inequality after taxes and transfers in all developing countries. Taxes being proportional to income and transfers benefiting the poor in the majority of cases can justify these results. It should nevertheless be observed that the majority of countries are far from the trend line whatever the graph. Furthermore, graph A.3 (see appendix) indicates that mobile money increases banking use in all developing countries. These results call out three aspects to consider. First, these results require the examination of a threshold effect of banking. To achieve this, in this study, we opt for the generalized method of moments applied to dynamic panel models. Secondly, the econometric results must take into account regional specificities which require that

estimates be made for all developing countries and for groups of countries. Third, it will be necessary to analyze the combined effect of banking and mobile money on income inequalities.

### 3.2 Model and estimation method

Following the approach of Dutta and Roy (2011) we can use the following modeling:

$$GiniMKT_{i,t} = \beta_0 + \beta_1 GiniMKT_{i,t-1} + \beta_2 Bank_{i,t} + \beta_3 Bank_{i,t}^2 + \beta_4 Mobile_{i,t} + \beta_5 (Bank * Mobile)_{i,t} + \sum_j \beta_{6j} X_{i,t} + \varepsilon_{i,t} (1)$$

$$GiniDISP_{i,t} = \alpha_0 + \alpha_1 GiniDISP_{i,t-1} + \alpha_2 Bank_{i,t} + \alpha_3 Bank_{i,t}^2 + \alpha_4 Mobile_{i,t} + \alpha_5 (Bank * Mobile)_{i,t} + \sum_j \alpha_{6j} X_{i,t} + u_{i,t} (2)$$

Where  $GiniMKT_{i,t}$  represents income inequality before taxes and transfers, and  $GiniDISP_{i,t}$  income inequality after tax and transfer for country  $i$  at date  $t$ . Income inequality represents the dependent variable and is measured by the Gini index (Haggard et al., 2019; Neaime and Gaysset, 2018). Data comes from Standardized World Income Inequality Database (SWIID).  $GiniMKT_{i,t-1}$  and  $GiniDISP_{i,t-1}$  mean the lagged variables of order 1 of income inequality before taxes and transfers and after taxes and transfers, respectively.

$Bank_{i,t}$  is the banking index for country  $i$  on date  $t$ . The banking index takes into account two dimensions, namely: accessibility and use. The first dimension consists of the sub-indexes of access to financial institutions from Svirydzenka (2016) for the services of the IMF (International Monetary Fund), in particular the number of bank branches per 100,000 adults whose data comes from Financial Development Indicator (FDI, 2021). The second dimension consists of the number of loans from commercial banks whose data comes from World Development Indicator (WDI, 2021). Given that there could exist a non-linear relationship between finance and income inequality (Greenwood and Jovanovic, 1990), the idea is that an opposition of signs between  $Bank$  and  $Bank^2$  reflects the existence of a threshold from which banking reduces income inequalities.

$Mobile_{i,t}$  is the mobile money index for  $i$  country on date  $t$  which represents mobile phones used to pay bills (15 years and over) whose data comes from the GFD (2022), ( $Bank * Mobile_{i,t}$ ) represents the interaction between mobile money and the banking index for country  $i$  at time  $t$ . the idea is that the banking rate coupled with mobile money will have an amplifying effect on income inequalities. Data comes from WDI (2021).  $X_{i,t}$  designates all the control variables taken into

account in the study, namely: GDP growth calculated at the constant 2015 price expressed in US dollars, the inflation rate, access to electricity in rural areas and commercial opening.  $\varepsilon_{i,t}$  And  $u_{i,t}$  being the error terms. Indeed, Kuznets (1955) results in a non-linear relationship due to the fact that economic growth initially increases income inequalities then, from a certain threshold, it reduces income inequalities. Hence the choice of economic growth from the WDI (2021). Trade openness from the KOF is a sub-index of economic globalization. Indeed, trade openness can also reduce income inequality when it is significant (Daumal, 2013). Inflation from WDI,2021 can increase income inequality.

The specification of equations (1) and (2) may pose problems of endogeneity which may be due to the inverse causality between banking and income inequalities which does not allow the use of the least estimation technique. ordinary squares, because it is inappropriate. Hence the choice of the generalized method of moments (GMM). Concerning this GMM method, the literature contrasts GMMs in difference with GMMs in system. Following this, the work of Arellano and Bover (1995) and Blundell and Bond (1998) showed that system GMMs are more robust, hence the choice of system GMMs.

## **4. Results and discussion**

### **4.1 Results and discussion in developing countries**

We estimated the empirical model using the two-step GMM method, which is asymptotically more efficient than the one-step GMM method. We run the empirical models for inequality before taxes and transfers (Tables 1 and 2 Col. 1-4) and income inequality after taxes and transfers (Tables 1 and 2, Col. 5-8), in which we incorporate the variable capturing the quadratic effect of banking, as described in equations 1 and 2. For inequality before and after taxes and transfers, the GMM estimates corroborate the existence of a non-linear relationship between banking and income inequality. This is illustrated by the fact that access to financial institutions significantly affects increasing income inequality, while a much higher level of access is significantly associated with reducing income inequality.



### ***4.1.1 Analysis of the effect of banking***

According to the results in Table 1, the evolution of the effects of the variables access to financial institutions and access to financial institutions squared reveals that in the entire sample, banking increases income inequalities in the first phases of development of the banking system then, inequalities begin to decrease from a certain threshold of development of banking, thus reflecting the existence of a non-linearity between finance and income inequalities (Greenwood and Jovanovic, 1990). Bank loans, which are another form of banking, significantly affect the increase in income inequality. Which means that when a financial sector is not developed enough, bank loans benefit the rich social class more than the poor social class, resulting in the creation of income inequalities. Indeed, the first phases of financial development (Tan and Law, 2012) and financial inclusion (Salazar-Cantú et al., 2015) positively influence the increase in income inequality.

Regarding the control variables, inflation increases income inequality in developing countries. Inflation, by reducing the purchasing power of the poor, also reduces their possibilities for bank loans, resulting in an increase in income inequalities.

Furthermore, economic growth is significantly correlated with the increase in income inequality. If banking among the poor is low and inflation exacerbates this situation, it is not surprising that the redistribution of income from economic growth escapes the poor social class and consequently creates strong income inequalities. But access to electricity in rural areas is an opportunity for reducing income inequalities, because its absence is an obstacle to rural activities. Similarly, gross capital formation is positively correlated with the reduction in income inequality. Investment enables job creation which is a potential source of income for the poor.

Table 1: Estimation results with banking

Variables	(Col.1)	(Col.2)	(Col.3)	(Col.4)	(Col.5)	(Col.6)	(Col.7)	(Col.8)
	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers
Income inequality lagged by one period	0.4136*** (0.0087)	0.3792*** (0.0519)	0.5729*** (0.0337)	0.6668*** (0.0070)	0.6605*** (0.0098)	0.8325*** (0.0154)	0.9062*** (0.0111)	0.2412*** (0.0146)
Access to financial institutions	0.0022*** (.00022)	0.00328*** (0.0004)	0.0014** (0.0007)	0.0003*** (.00003)	0.0019*** (0.00005)	0.0006*** (0.0001)	0.0002** (0.0001)	0.0016*** (0.0001)
Access to financial institutions squared	-0.0162*** (0.0014)	-0.0283*** (0.0034)	-0.0179*** (0.0060)	-0.0017*** (0.0004)	-0.0144*** (0.0003)	-0.0076*** (0.0013)	-0.0049*** (.0008)	-0.0009*** (0.0003)
Bank loans		0.0082** (0.0039)	0.0147*** (0.0044)			0.0024** (0.0011)	0.0029*** (.0007)	
Inflation			0.0207*** (0.0014)	0.0012*** (0.0004)			0.0005* (0.0003)	0.0113*** (0.0008)
Economic growth				0.0001 (0.0006)				0.0031** (0.0015)
Access to electricity in rural areas				-0.0002*** (.00004)				-0.0009*** (.00014)
Gross capital formation				-0.0002*** (.00004)				-0.0003*** (0.0001)
Constant	0.3059*** (0.0077)	0.3316*** (0.0308)	0.1597*** (0.0235)	0.1667*** (0.0176)	0.1734*** (0.0033)	0.0845*** (0.0076)	0.0439*** (0.0060)	0.2785*** (0.0347)
Observations	1,221	693	610	808	1,221	693	610	808
Number of countries	105	66	64	82	105	66	64	82
Number of instruments	57	44	39	79	64	52	52	60
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.102	0.701	0.521	0.265	0.120	0.304	0.575	0.420
Hansen	0.188	0.622	0.256	0.585	0.108	0.223	0.142	0.993

Source: the authors. Standard errors in parentheses. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

### *4.1.2 Analysis of the interaction effect*

Following the low rate of banking in developing countries, the results in Table 2 show that the integration of mobile money into financial services promotes banking and subsequently further reduces income inequalities in developing countries. Indeed, the interaction between financial institutions and mobile money presents negative and statistically significant coefficients. This interaction implies an increase in the banking rate which has the effect of significantly reducing income inequalities. These results are in the same direction as those of studies which found that the introduction of mobile payments in formal financial services facilitates the banking process and subsequently makes it possible to significantly reduce income inequalities (Ngono, 2020; Demir et al., 2022).

As for the control variables, the results reveal that economic growth has a positive and significant effect on income inequality. Indeed, in developing countries, an increase in economic growth is not accompanied by a reduction in income inequalities. This is how Kuznets (1955) in his work deduces that economic growth can reduce income inequalities in developed countries and not in developing countries. On the other hand, the results show that inflation has a positive and significant effect on income inequality. This effect means that an increase in inflation can lead to a worsening of income inequalities in developing countries, because it reduces the possibilities of bank borrowing and access to financial services for the poor social class. To this result, Dao and Godbout (2014) in their work find that inflation increases income inequality.

Following this, the results show that foreign direct investment inflows (FDI inflows) have a positive and significant effect on income inequality. Indeed, FDI inflows capture qualified labor much more than unskilled labor, which increases income inequalities in host countries. It also appears that trade opening in developing countries has a positive and significant effect on reducing income inequalities. The developing countries import more than they export, which promotes poverty and income inequalities. Indeed, faced with a trade deficit, national producers struggle to cope with foreign competition, which can lead to the closure of certain businesses, unemployment and an increase in income inequalities.

The results also show that access to electricity in rural areas has a negative and statistically significant effect on income inequalities. The presence of electricity in rural areas contributes to the reduction of income inequalities because it facilitates the banking process through the development of ICT; given that mobile money is the easiest way to access the range of financial services remotely and at a reduced cost.

**Table 2: Results of estimations with banking – mobile money interaction**

	(Col.1)	(Col.2)	(Col.3)	(Col.4)	(Col.5)	(Col.6)	(Col.7)	(Col.8)
Variables	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers
Income inequality lagged by one period	0.3647*** (0.0097)	0.2034*** (0.0051)	0.1937*** (0.0241)	0.6338*** (0.0409)	0.3616*** (0.0212)	0.1372*** (0.0214)	0.1673*** (0.0431)	0.5469*** (0.0507)
Financial institutions * mobile money	-0.00001*** (0.0000)	-0.00001*** (0.0000)	-0.00001*** (0.0000)	-0.00001*** (0.0000)	-0.00001*** (0.0000)	-0.00001*** (0.0000)	-0.00001*** (0.0000)	-0.00001*** (0.0000)
Economic growth			0.0037 (0.0042)	0.0144*** (0.0054)		0.0096*** (0.0030)	0.0102* (0.0053)	0.0005 (0.0026)
Inflation		0.00003** (0.00001)	0.0006*** (0.00001)	0.0006 (0.0017)			0.0007*** (0.0011)	0.0007*** (0.00004)
Access to electricity in rural areas				-0.0004*** (0.00010)	-0.0011*** (0.0001)	-0.0019*** (0.0001)	-0.0019*** (0.0001)	-0.0012*** (0.0002)
Commercial opening				0.0007*** (0.00013)				0.0008*** (0.0001)
IDE Inputs				0.0135*** (0.0024)				0.0048*** (0.0003)
Constant	0.2887*** (0.0057)	0.3643*** (0.0041)	0.2744** (0.1104)	-0.4677*** (0.1424)	0.3375*** (0.0125)	0.2531*** (0.0836)	0.2218 (0.1431)	0.1069** (0.0444)
Observations	516	495	491	247	446	442	421	267
Number of countries	85	83	82	52	76	75	73	52
Number of instruments	45	70	35	46	31	31	31	44
AR(1)	0.000	0.000	0.001	0.003	0.000	0.016	0.004	0.006
AR(2)	0.304	0.102	0.121	0.935	0.877	0.603	0.968	0.848
Hansen	0.114	0.987	0.182	0.957	0.156	0.260	0.251	0.668

Source: Authors. Standard errors in parentheses. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1.

## 4.2 Robustness control

For the examination of robustness, two most unequal regions in terms of income were chosen, namely Sub-Saharan Africa (39 countries) and Latin America and the Caribbean (22 countries). After estimation by the GMM in system, it emerges from tables 3 and 4 that in the first phases of development of the banking system, banking also induces a significant effect on the increase in

income inequalities in Sub-Saharan Africa as well as in Latin America. But, the more the banking system develops, square measure banking, that is to say higher access to financial services, significantly affects the reduction of income inequalities in these two regions. It should also be noted that bank loans have a significant effect on increasing income inequality in these two developing regions. Bank loans are primarily accessible to the rich because they are able to meet the eligibility conditions.

Table 3: Estimation results with banking in SSA

Variables	(Col.1)	(Col.2)	(Col.3)	(Col.4)	(Col.5)	(Col.6)	(Col.7)	(Col.8)
	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers
Income inequality lagged by one period	0.7996*** (0.0179)	0.8510*** (0.0093)	0.6702*** (0.1169)	0.9459*** (0.0267)	1.0775*** (0.0213)	0.8858*** (0.0418)	0.9982*** (0.0424)	0.9262*** (0.0245)
Access to financial institutions	0.0024*** (0.0008)	0.0031*** (0.0011)	0.0052*** (0.0007)	0.0015*** (0.0004)	0.0022*** (0.0005)	0.0047*** (0.00077)	0.0006* (0.0003)	0.0016*** (0.0005)
Access to financial institutions squared	-0.0115*** (0.0016)	-0.0143*** (0.0046)	-0.0280*** (0.0028)	-0.0035*** (0.0012)	-0.0082*** (0.0014)	-0.0172*** (0.0016)	-0.0028** (0.0013)	-0.0043** (0.0019)
Economic growth		0.0031*** (0.0010)	0.0124 (0.0101)	0.0017*** (0.0004)		0.0154*** (0.0026)	0.0009 (0.0005)	0.0017** (0.0006)
Access to electricity in rural areas				-0.0003*** (0.0001)				-0.0002*** (0.0003)
Inflation				0.0001*** (0.0002)				0.0001*** (.00003)
Bank loans			0.0022 (0.00179)				0.0012** (0.0005)	
Constant	0.1086*** (0.0092)	0.0152 (0.0246)	-0.09503 (0.22991)	-0.00879 (0.01619)	-0.02875*** (0.01042)	-0.28760*** (0.06810)	-0.0196 (0.0305)	-0.0016 (0.0214)
Observations	408	398	243	333	408	398	243	333
Number of countries	39	39	27	38	39	39	27	38
Number of instruments	31	35	23	24	34	34	26	31
AR(1)	0.000	0.000	0.015	0.000	0.000	0.000	0.001	0.000
AR(2)	0.209	0.176	0.175	0.716	0.297	0.592	0.562	0.307
Hansen	0.165	0.341	0.367	0.362	0.245	0.359	0.990	0.705

Source: the authors. Standard errors in parentheses. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

Table 4: Result of estimates with banking in Latin America

Variables	(Col.1)	(Col.2)	(Col.3)	(Col.4)	(Col.5)	(Col.6)	(Col.7)	(Col.8)
	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers
Income inequality lagged by one period	0.8945*** (0.0166)	0.7378*** (0.0532)	0.5178*** (0.1691)	0.8344*** (0.0393)	0.8068*** (0.0218)	0.6857*** (0.0245)	0.7565*** (0.0894)	0.6658*** (0.0635)
Access to financial institutions	0.0016*** (0.0004)	0.0035*** (0.0008)	0.00183** (0.0008)	0.0070*** (0.00101)	0.0026*** (0.0006)	0.0013** (0.0005)	0.0051*** (0.0016)	0.0024* (0.0012)
Access to financial institutions squared	-0.0174*** (0.0033)	-0.0328*** (0.0079)	-0.0403*** (0.0085)	-0.0399*** (0.0084)	-0.0248*** (0.0046)	-0.0139*** (0.0036)	-0.0462*** (0.0139)	-0.02113** (0.0099)
Bank loans			0.03409** (0.0127)				0.0256* (0.0119)	
Access to electricity in rural areas		-0.0004* (0.00021)	-0.0027** (0.0011)	0.00022 (0.0002)		-0.0005*** (0.00014)	-0.0023** (0.0009)	-0.0005** (0.0002)
Inflation				0.0005* (0.0003)				0.0061*** (0.0014)
Economic growth			0.0055 (0.0072)	0.0032 (0.0022)			0.0093** (0.0040)	0.0062*** (0.00129)
Constant	0.11440*** (0.01434)	0.27034*** (0.05320)	0.3231 (0.2199)	0.07955* (0.03992)	0.1733*** (0.0236)	0.2355*** (0.03102)	10486 (0.09513)	0.0974** (0.0358)
Observations	269	262	156	229	269	262	156	224
Number of countries	22	21	13	18	22	21	13	18
Number of instruments	19	17	12	17	16	19	12	17
AR(1)	0.001	0.001	0.036	0.002	0.001	0.000	0.048	0.009
AR(2)	0.981	0.997	0.640	0.959	0.329	0.706	0.748	0.176
Hansen	0.232	0.124	0.134	0.120	0.163	0.140	0.102	0.129

Source: the authors. Standard errors in parentheses. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

The results of Tables 5 and 6 indicate on the other hand that the interaction (financial institutions\*mobile money) induces a negative and statistically significant effect on income inequalities in the two regions. Indeed, this result corroborates relative theories in the matter since the use of mobile money in formal financial services promotes the banking process and makes it possible to further reduce income inequalities in these two developing regions.

Regarding the control variables, the results show that in Sub-Saharan Africa and Latin America and the Caribbean, an increase in economic growth does not translate into a reduction in income inequality. The results also reveal that an increase in inflation in Sub-Saharan Africa and Latin America leads to an increase in income inequality. As for trade openness, the results show that it significantly reduces income inequalities in Sub-Saharan Africa. Wood (1994), in his studies, finds a similar result and explains that North-South commercial exchange is much more beneficial to the South. In the countries of the South, this trade benefits unskilled labor more; on the other hand, in the North, trade opening benefits skilled labor more while unskilled workers suffer a drop in wages. and an increase in unemployment.

In contrast to the result found in Sub-Saharan Africa, trade opening in Latin America tends to widen income gaps significantly on the one hand, and to have no significant effect on the other hand. Wood (1997) in his work analyzes the effect of trade openness on income distribution and finds that in this region, from the mid-1980s, there were virtually no restrictions imposed on the quantity of 'imports. Following this period, due to rising wages, skills gaps widened and the demand for skilled versus unskilled labor became strong. Gross capital formation, on the contrary, negatively influences income inequalities in the two regions. This indicates that an increase in investment promotes job creation and therefore the reduction of income inequalities in these two regions. Likewise, access to electricity in rural areas of Sub-Saharan Africa and Latin America and the Caribbean significantly reduces income inequality.



Table 5: Results of estimations with the interaction between financial institutions and mobile money in SSA

	(Col.1)	(Col.2)	(Col.3)	(Col.4)	(Col.5)	(Col.6)	(Col.7)	(Col.8)
Variables	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers
Income inequality lagged by one period	0.3089*** (0.0082)	0.7529*** (0.0337)	0.9198*** (0.0303)	0.9558*** (0.0142)	1.2455*** (0.0770)	1.1475*** (0.0522)	1.0272*** (0.0425)	1.0468*** (0.0663)
Financial institutions * mobile money	-0.0002*** (0.0000)	-0.00016*** (.00003)	-0.00051*** (0.00001)	-0.0002*** (0.0001)	-0.00001 (0.0001)	-0.00011*** (0.00004)	-0.00011*** (0.00003)	-0.0004*** (0.0001)
Inflation		.00013* (.00007)	0.0003** (0.0001)	0.00011 (0.00018)		0.0002*** (0.0001)	0.0006*** (0.0001)	0.0007*** (0.0018)
Gross capital formation			-0.00193*** (0.0001)	-0.0008*** (0.0003)				-0.00105** (0.0005)
Commercial opening				-0.00072*** (0.0002)			-0.0008*** (0.0001)	-0.0016*** (0.0003)
Constant	0.3334*** (0.0075)	.11556*** (0.0165)	0.0817*** (0.0128)	0.07294*** (0.0113)	-0.1104*** (0.0357)	-0.0671** (0.0249)	0.0218 (0.0170)	0.0748** (0.0304)
Observations	151	148	133	119	151	148	133	119
Number of countries	34	34	32	29	34	34	31	29
Number of instruments	21	21	21	18	15	21	21	21
AR(1)	0.021	0.001	0.001	0.000	0.003	0.006	0.004	0.004
AR(2)	0.271	0.325	0.363	0.787	0.944	0.624	0.912	0.488
Hansen	0.989	0.190	0.305	0.113	0.105	0.224	0.304	0.579

Source: the authors. Standard errors in parentheses. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

Table 6: Estimation results with banking-mobile money interaction in Latin America

Variables	(Col.1)	(Col.2)	(Col.3)	(Col.4)	(Col.5)	(Col.6)	(Col.7)	(Col.8)
	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini before taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers	Gini after taxes and transfers
Income inequality lagged by one period	0.6382*** (0.0819)	0.24692** (0.0985)	0.39501*** (0.1264)	0.3725** (0.1322)	0.51268*** (0.0885)	0.7686*** (0.0229)	0.5042*** (0.0795)	0.6322** (0.2242)
Financial institutions * mobile money	-0.00001 (.00001)	-0.00003** (0.00001)	-0.00003* (0.00001)	-0.00002* (0.00001)	-0.00002** (0.00001)	-0.00002*** (0.0000)	-0.00002** (0.00001)	-0.00002* (0.00001)
Access to electricity in rural areas		-0.0024*** (0.0005)	-0.0014*** (0.0004)	-0.0027** (0.0009)			-0.0006** (0.0003)	0.0008 (0.0010)
Commercial opening			0.0089** (0.0035)	-0.0006 (0.00052)		0.0004* (0.0002)	0.0004 (0.00023)	0.0012*** (0.0003)
Economic growth				0.02292** (0.00856)				-0.0144 (0.01341)
Gross capital formation				0.0008 (0.0016)				-0.0033*** (0.0006)
Constant	0.1644*** (0.0370)	0.5497*** (0.0901)	0.1757** (0.0747)	-0.0375 (0.1283)	0.2154*** (0.0397)	0.0786*** (0.0105)	0.2448*** (0.0525)	0.4531** (0.1898)
Observations	114	114	113	104	114	105	105	104
Number of countries	16	16	15	15	16	16	16	15
Number of instruments	13	15	14	14	12	14	14	14
AR(1)	0.011	0.025	0.018	0.016	0.014	0.007	0.021	0.046
AR(2)	0.676	0.940	0.926	0.351	0.243	0.104	0.105	0.315
Hansen	0.206	0.639	0.173	0.567	0.445	0.206	0.155	0.413

Source: the authors. Standard errors in parentheses. \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

## **5. Conclusion**

The purpose of this study was to analyze the effect of banking on income inequalities in developing countries by specifically considering the role that mobile money plays in this relationship. As an estimation technique, we used system GMMs applied to a panel of 105 developing countries over a period from 1990-2019. In this study, we considered income inequality before taxes and transfers and after taxes and transfers. Banking has been defined, on the one hand as access to banking institutions, and on the other hand as bank loans.

The results showed that an increase in banking contributes to the increase in income inequalities, while an additional increase in banking favors the reduction of income inequalities in developing countries. Likewise, an increase in bank borrowing also contributes to an increase in income inequality in developing countries. Following this, it emerged that the integration of mobile money into formal financial services further promotes the banking process with the consequent reduction of income gaps in developing countries. These results were subjected to a robustness examination by extracting from the sample two most unequal developing regions, namely Sub-Saharan Africa and Latin America and the Caribbean. The results found were similar to the previous ones.

Following these results, it is important for developing countries to place more emphasis on mobile money, because it increases the banking rate and consequently, it makes it possible to significantly reduce income inequalities.

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## Appendices

Table A.1: List of sample countries

Europe	America Latin and Caribbean	Asia	ASS		MENA
Albania	Argentina	Azerbaijan	Angola	Madagascar	Algeria
Armenia	Bahamas	Bangladesh	Benign	Malawi	Egypt
Austria	Barbados	Bhutan	Botswana	Mali	Iran
Bosnia and Herzegovina	Belize	Cambodia	Burkina Faso	Mozambique	Iraq
Bulgaria	Bolivia	Fiji	Burundi	Niger	Libya
Estonia	Chile	Indonesia	Cape Verde	Nigeria	Morocco
Georgia	Colombia	Kazakhstan	Cameroon	Central African Republic	Oman
Kosovo	Costa Rica	Malaysia	Comoros	Rwanda	Qatar
North Macedonia	Dominic	Mongolia	DRC	Senegal	Tunisia
Moldova	Ecuador	Nepal	Republic of Congo	Seychelles	Türkiye
Montenegro	Guatemala	Papua	Ivory Coast	Sierra Leone	Yemen
Poland	Guyana	Philippines	Djibouti	Sudan	
Romania	Haiti	Samoa	Eswatini	South Sudan	
Serbia	Honduras	Thailand	Ethiopia	Tanzania	
Ukraine	Jamaica	Tonga	Gabon	Chad	
	Mexico	Vanuatu	Gambia	Togo	
	Nicaragua	Vietnam	Ghana	Zambia	
	Paraguay		Guinea	Zimbabwe	
	Suriname		Guinea -Bissau		
	Uruguay		Kenya		
	Venezuela		Liberia		

Source: Authors

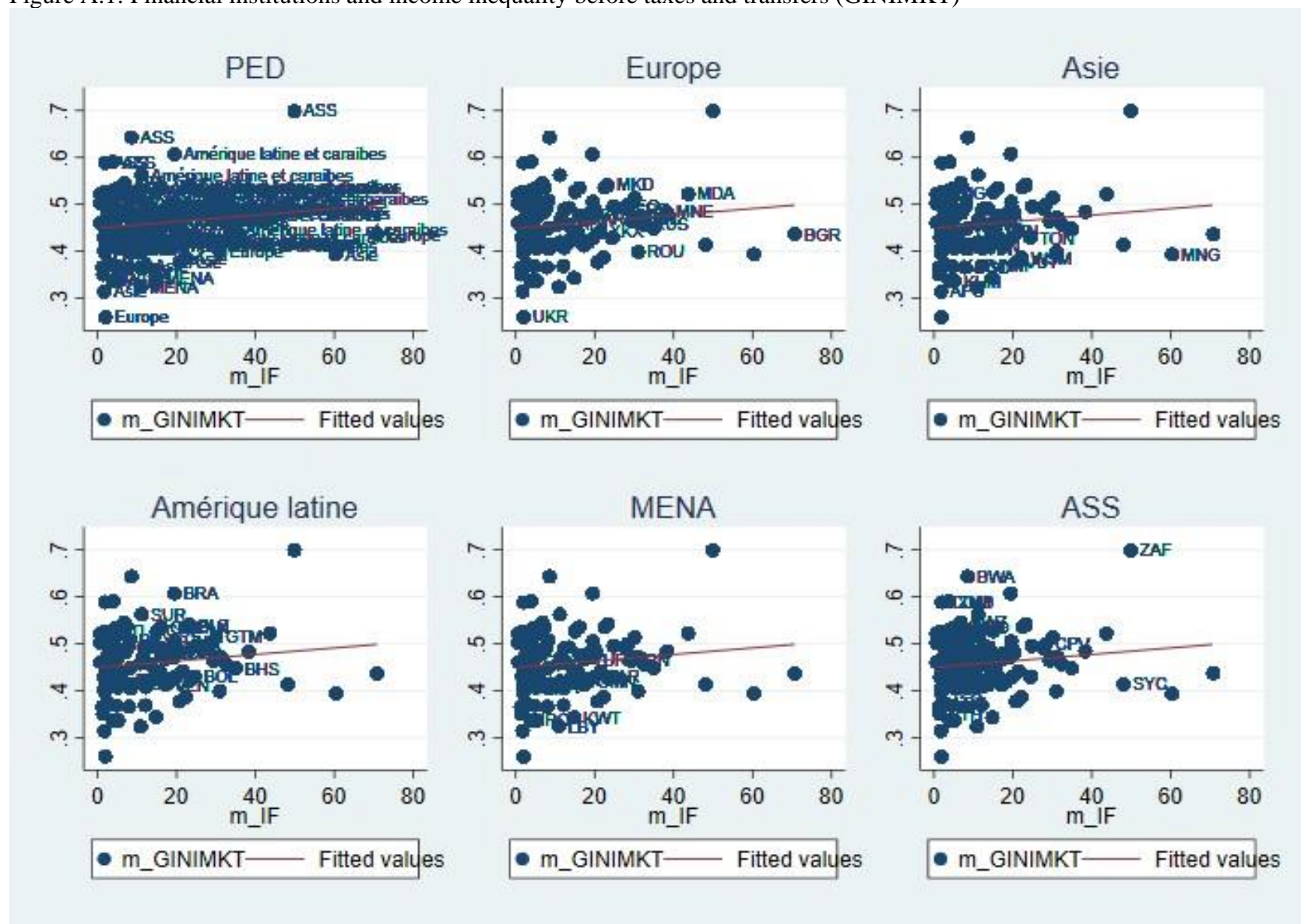
Table A.2: Descriptive statistics of variables

Variables	Obs	Mean	Std.Dev .	Min	Max	Source
Income inequality before taxes and transfers	2,435	0.4594	0.0704	0.2395	0.7621	SWIID
Income inequality after taxes and transfers	2,435	0.4158	0.0746	0.2180	0.6449	SWIID
Commercial opening	3,335	47.101	17.915	0	89.764	KOF
Number of bank branches	1,751	13.048	12.936	0.1368	92.338	GFD
Access to electricity in rural areas	2,392	62.001	39.317	0.5229	100	WDI
Economic growth	3,478	23.302	1.9946	16.886	27.858	WDI
Inflation	2,805	1.7298	1.3394	-5.0730	10.076	WDI
IDE Inputs	2,521	18.997	2.5684	2.3026	24.652	WDI
Gross capital formation	2,487	21.859	8.5029	-2.4243	81.021	WDI
Number of bank loans	1,067	150.05	162.53	-8.67	871.81	WDI
Mobile money	884	3.4417	9.0427	0	78.55	WDI
Financial Institution * mobile money	816	56.968	195.00	0	1836.3	Author

Source: the authors

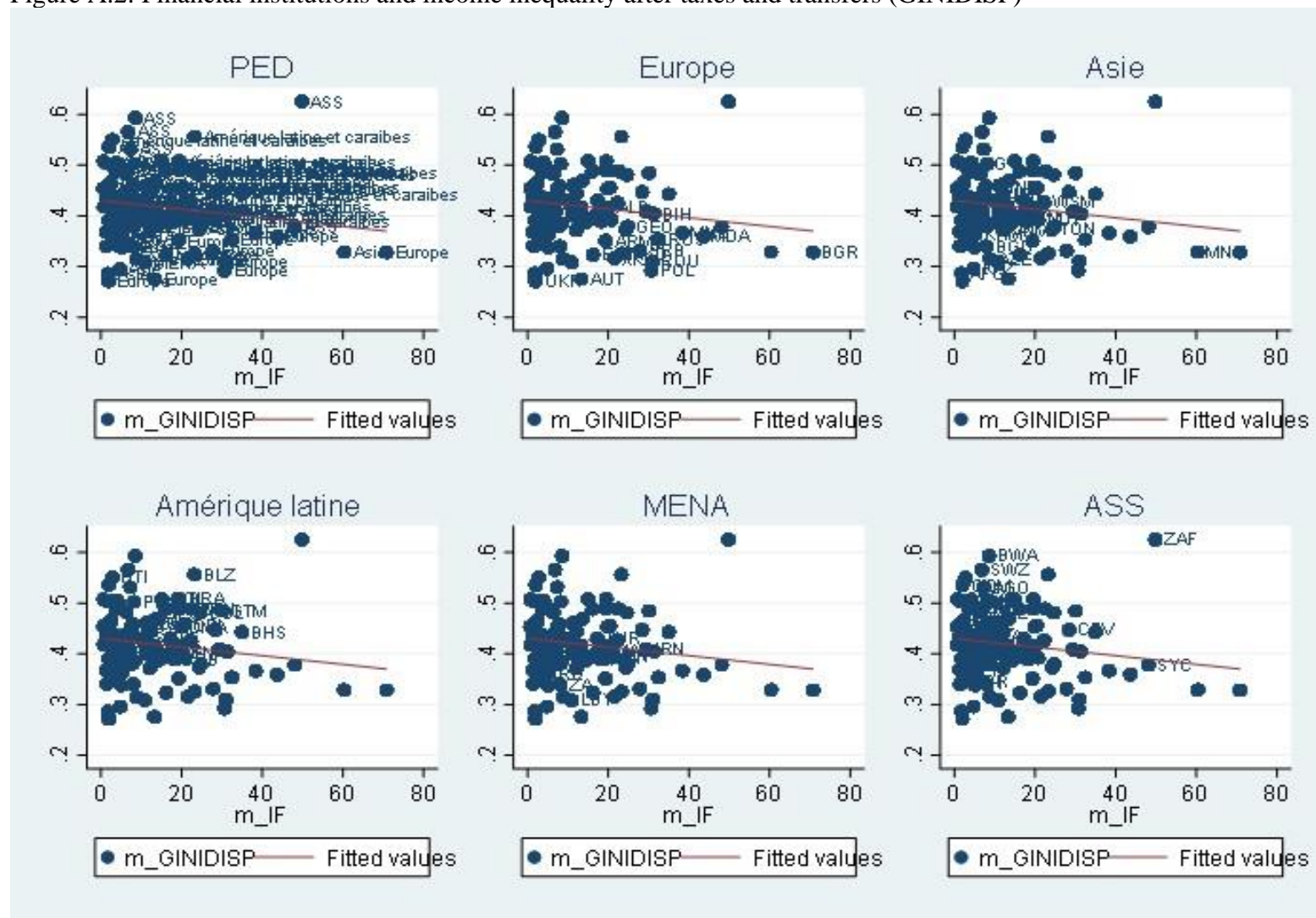


Figure A.1: Financial institutions and income inequality before taxes and transfers (GINIMKT)



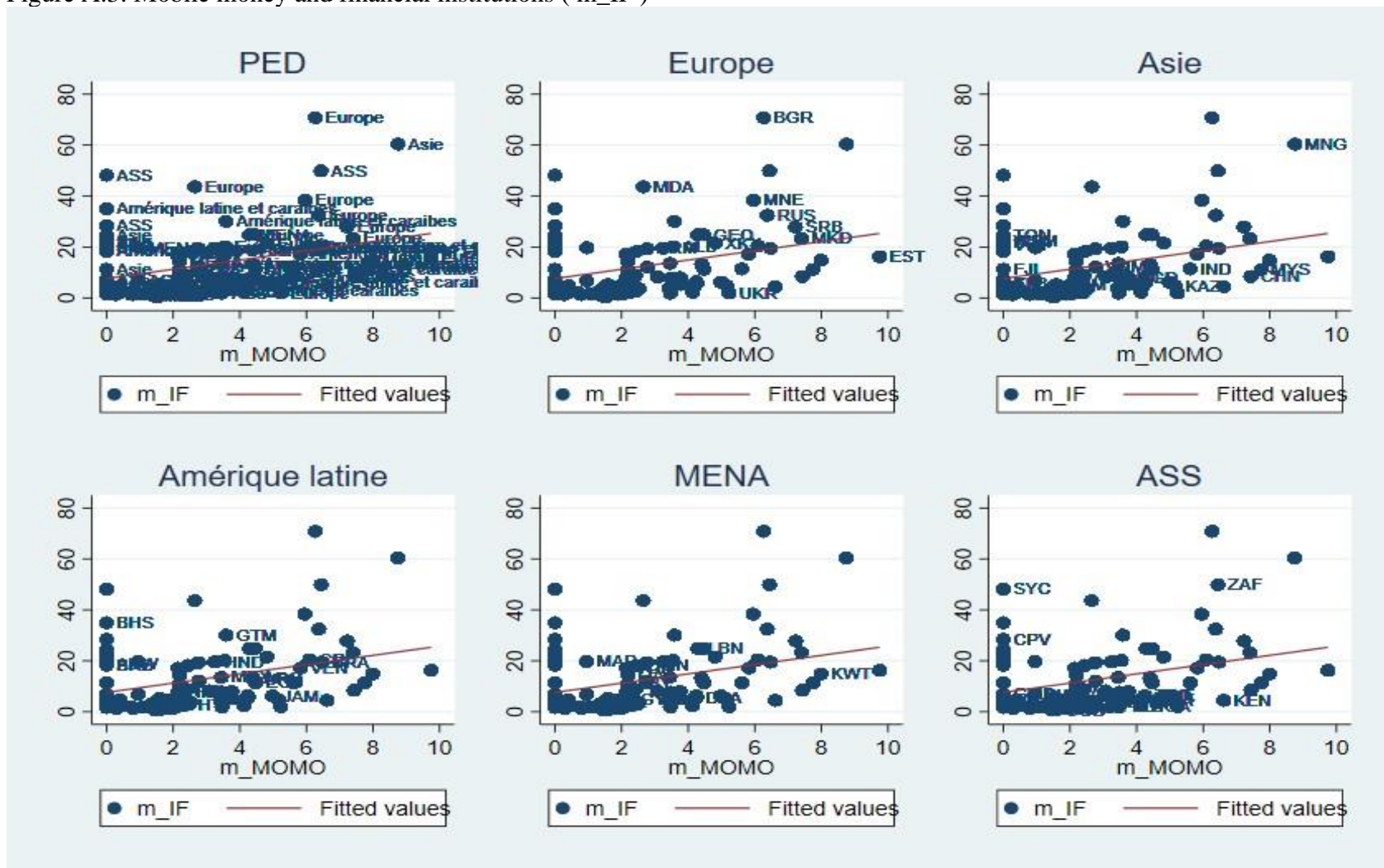
Source: the authors.

Figure A.2: Financial institutions and income inequality after taxes and transfers (GINIDISP)



Source: the authors.

Figure A.3: Mobile money and financial institutions ( m\_IF )



Source: the authors.