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The role of financial development in poverty reduction☆

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Abstract

This paper investigates whether financial development is conducive in poverty reduction. Separating financial development into four categories and using newly available data this paper finds that both financial deepening and greater physical access is beneficial in reducing the proportion of people below the poverty line. Using alternative measures of financial instability, the results also challenge existing findings that it may increase the incidence of poverty. In addition, the results remain robust even when controlling for mobile money, providing a further valuable contribution to the literature.

JEL classification: G21; I3; O16

Keywords: Financial development; Poverty reduction; Mobile money

1. Introduction

As the millennium development goals (MDGs) drew to a conclusion in 2015, one of the main aims was to halve the poverty headcount rate worldwide. Alongside several other policies, promoting financial sector development was one of the key strategies to achieve this outcome. Specifically, policy was geared at increasing the depth of the financial sector, but recently, greater attention has been paid towards its inclusiveness or outreach. Indeed, since the turn of the Millennium, many technocrats argued that increasing access to the financial system may be as important in reducing poverty as increasing its depth. Furthermore, half way through the 15 year period of the MDGs, the world suffered one of the largest financial crises since the Great Depression of which the financial sector bore the brunt of the blame. This led to policymakers becoming more attentive to the issue of financial stability, adding a further policy goal to their financial sector objectives. A World Bank study by Cihak et al. (2013) categorises financial development into four components to measure the characteristics of the financial system. The first category is the size of the financial system (its depth) and the second is the accessibility of the financial system. This is defined as the degree to which individuals and firms can use financial services. The third category examines the efficiency of the financial sector, examining how well financial intermediaries can facilitate financial transactions at the lowest cost possible, and finally the stability of the financial system, and its robustness to withstand negative shocks. To this end, this paper examines all four aspects of financial development in one comprehensive study, examining the role of financial sector development in poverty reduction. The results show that financial development may be poverty reducing, drawing from a sample of developing countries over the period 2004–2015. Whilst the results are largely consistent with many prior empirical findings, a key contribution of this paper is that the results remain robust when controlling for a dummy variable that captures the presence of mobile money in an economy. As mobile money may result in the poor no longer requiring formal financial services, the results show that despite this innovative shock, formal financial development is still important in the quest to alleviate poverty. The majority of prior studies examining the role of finance on poverty examine the role of financial deepening in poverty reduction. Beginning with Honohan (2004), studies have shown that financial depth is negatively related with headcount poverty. The causal nature

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of this relationship was investigated by Perez-Moreno (2011) who shows that financial development may reduce headcount poverty, although there are caveats in his findings. For example, the results are sensitive to the time periods studied, and depend on the nature of the financial development indicator used. Perez-Moreno (2011) shows that when measuring financial deepening using liquid liabilities to GDP, the results are more supportive that finance reduces poverty than when using credit to the private sector.[1] A recent study by Donou-Adonsou and Sylwester (2016) provides evidence that financial sector development may reduce poverty using a plethora of poverty measures as their dependent variables. Using both depth measures of formal and informal financial sector variables, they find that whilst both contribute to poverty reduction, the impact of the informal sector is not as strong as the formal banking sector. Studies examining the impact of financial access on the poor are far fewer than those on financial deepening. One possible reason for this is due to data availability, however, Burgess and Pande (2005) provide a comprehensive study on India. The authors study the impact of the Indian Social Banking Experiment, where the Bank of India decreed that for every bank branch opened up in a previously served area, an institution had to open four branches in currently unserved areas. The impact on poverty was dramatic with the rural headcount falling by 14–17 percentage points. Notably, rural savings accounts increased by over 100 million and rural loan accounts by 25 million. A further study on financial access is carried out by Mookerjee and Kalipioni (2010). The authors investigate the link between financial access and income inequality finding a negative and significant correlation between bank branch expansion and the Gini coefficient. The additional two characteristics of financial development are financial sector efficiency and financial stability. Banking sector efficiency is primarily constructed to measure the cost of intermediating credit and its role in poverty alleviation may not be obvious. However, the most efficient banks should be able to deliver financial services to the poor in a cost effective manner, for example via low interest rate spreads, and using quick, cheap administrative procedures to facilitate service exchange.[2] As a result, a more efficient financial system should be in a strong position to identify the poor who are low credit risk, provide them with the correct services they require, and avoid costly account fees so that financial efficiency should be poverty reducing. Nevertheless, the impact of financial sector efficiency on poverty is largely under-researched and to our knowledge this is one of the first empirical studies to investigate it. Akhter and Daly (2009) show that financial instability is an unintended negative consequence that arises with greater financial development (deepening of the financial sector). The authors show that financial development is conducive in reducing headcount poverty; however, financial instability which accompanies financial deepening is harmful to the poor. A further study by Guillaumont Jeanneney and Kpodar (2011) confirms these findings, showing that although financial instability arising from financial development hurts the poor (measured by the income share of the lowest quintile), the benefits of financial development outweigh the costs overall. The remainder of this paper is structured as follows. Section 2 describes the data set and explains the estimation method. Section 3 presents the results and Section 4 concludes.

2. Empirical strategy

The baseline model estimates the poverty headcount ratio, conditional on financial development and a matrix of covariates that are shown to impact poverty. These include GDP per capita, trade openness, the inflation rate, government spending, economic growth and mobile money. The data is averaged from 2004 to 2015 to form a cross-section due to the limitations in the dependent variable.[3] Data on the headcount ratio is scarce and for a number of developing countries there are only one or two observations throughout the sample period. In more economically developed countries (middle income economies) where poverty is still largely prevalent, poverty data is far more abundant and in some cases a complete time series is available. Whilst a panel would permit the use of additional estimation techniques such as fixed effects that may capture unobserved country heterogeneity, there would be several drawbacks using this approach. First, we would have to estimate many additional parameters and as many cross-sections only have a few observations there would not be that many gains in degrees of freedom using this approach. Additionally, there are certain countries with far more reliable and historical data, specifically eastern European economies and Latin American countries. Adopting annual data would result in sample bias, with the majority of the data coming from middle-income countries as opposed to the poorest countries in the world, specifically sub-Saharan Africa. Finally, the data has far more between variation than within variation. This may result in variables that are economically significant being found to be statistically insignificant purely due to the variation in the data. A further method that was possible was to average into three non-overlapping four year periods. Again, this approach was rejected as for many poor countries, the four year averages were driven by one observation. Additionally, this would only provide two time periods when examining financial stability and efficiency. As a result, due to the data limitations we adopt a cross-sectional study. Nevertheless, this study offers an important benchmark for further studies to use as a springboard once more reliable data is made available in future. The data is available from the *World Development Indicators*, and we bring together two further databases to estimate the impact of financial development in poverty reduction. These databases

[1] The literature supports the view that the variable private credit best captures the lending channel to the poor. On the other hand, liquid liabilities to GDP may capture the McKinnon conduit effect, which assumes that even if financial institutions do not provide credit to the poor, they are still useful to the poor because they offer a profitable way to save.

[2] For example, as Prokopenko and Holden (2001) suggest, high interest rate spreads suggest the financial sector's ability to resolve the problem of informational asymmetries is low, indicating many credit-worthy but poor borrowers may be excluded from the financial system.

[3] For, the two variables that are used to measure financial stability and efficiency, the data is averaged from 2004 to 2012.

Table 1
Summary statistics.

Variable name	Mean	Standard deviation	Minimum	Maximum
Poverty	3.35	0.60	1.12	4.34
Private credit	3.55	0.94	0.46	5.36
Broad money	3.90	0.73	1.02	6.95
ATMs per 1000 km^2	2.26	2.36	−4.05	10.01
Banks per 1000 km^2	1.71	2.12	−3.66	8.64
Impaired loans	1.64	0.76	−0.30	3.26
Cost to income ratio	58.49	12.86	13.67	108.18
Resource rents	0.63	2.71	−11.51	5.24
GDP per capita	9.10	1.23	6.39	11.71
Economic growth	2.50	2.67	−8.20	18.78
Government spending	2.72	0.37	1.65	4.42
Inflation rate	−3.24	0.73	−5.31	−1.39
Trade openness	4.42	0.48	2.54	6.02
Mobile money dummy	0.42	0.49	0.00	1.00

All variables reported as natural logarithms with the exception of the cost to income ratio and economic growth. The mobile money dummy takes the value of 1 if mobile money operators are present, otherwise it equals 0.

include the New International Database on Financial Fragility by Andrianova et al. (2015), and the *GSMA Mobile Money tracker*. The former provides data for the ratio of impaired loans to gross loans and the cost to income ratio, where the latter provides the data on mobile money. The summary statistics are presented in Table 1.

The dependent variable is headcount poverty at the national poverty line. This variable is preferred to the $1.90 or $3.10 poverty lines also available from the World Bank, as these variables have many values close to zero and their distributions are highly skewed, compared to the headcount variable at national poverty lines.[4] Moreover, our chosen measure of headcount poverty provides us with the most observations and as all three measures of the headcount ratio are well correlated with one another, it provides further support for our chosen measure. We break down financial development into four sub-categories. The first is financial depth where we use two measures commonly used in the literature. The first is credit to the private sector as a ratio of GDP which may best capture the intermediation ability of the financial sector. In studies examining finance and poverty, this variable best measures the credit channel. The second variable is broad money to GDP which may capture the McKinnon conduit effect (McKinnon, 1973). This effect suggests that even if financial institutions do not provide the poor with credit, they may still render themselves useful to the poor by offering them with a profitable way to save. Financial access is measured using two variables, the number of ATMs per 1000 km^2 and the number of bank branches per 1000 km^2. It is important to use both of these variables as bank branches offer additional services compared to ATMs which just offer the poor a method of withdrawing money. There are caveats with using such measures as the concentration of bank branches is unlikely to be equally distributed across countries. Given data availability, there is no natural remedy to overcome this issue, and as a result this paper has to make do with the data available but issues caution when interpreting the findings. The variable used to measure financial stability is a measure of financial instability (fragility). We use the ratio of impaired loans to gross loans frequently used in the literature.[5] A higher value of the impaired loans ratio implies financial underdevelopment as the financial sector is not adequately screening or monitoring clients to whom it is extending credit too. Guillaumont Jeanneney and Kpodar (2011) measure financial instability as the absolute residual in financial development arising from regressing their financial deepening variable on its lag and a time trend. However, if credit is extended at a greater (or slower) rate than anticipated, this may not necessarily indicate financial instability. Pending borrowers are credit worthy and well screened, an over-extension of credit compared to expectations may not be worrying. Likewise, reductions in credit allocation may be a response where financial institutions are implementing decisions to safeguard the financial system. As a result the variable impaired loans to gross loans is preferred as it overcomes some of the shortcomings in credit instability measure. Financial efficiency is the final sub-component of financial development and we measure it using a key metric proposed by Cihak et al. (2013), the cost to income ratio. A high cost to income ratio may represent financial underdevelopment therefore we would expect it to be positively related to the poverty rate. There are alternative measures available to measure financial efficiency such as the interest rate spread. However, this variable only calculates the efficiency in lending. Therefore we prefer the cost to income ratio as it provides a more inclusive measure of inefficiency across the entire financial system.

We control for the level of economic development using GDP per capita, in constant US 2011 dollars adjusted by PPP. As income is highly correlated with economic development and more economically developed countries have lower poverty rates, we would expect this coefficient to be negative in the regressions. In addition we control for the growth rate of GDP as economic theory suggests high aggregate growth should trickle-down to the poor, thus reduce poverty. If financial development does not have a direct effect on the poverty rate, it would be expected that it may have an indirect effect via economic growth. Financial deepening has shown to be growth enhancing, and whilst Rioja and Valev (2004) suggest that this relationship is the strongest in countries with an intermediate level of financial development, Rousseau and D'Onofrio (2013) show that in 22 African economies (some of the poorest in the world), financial development in the form of basic monetisation may cause growth. However, evidence by Rousseau and Wachtel (2011) has shown that the relationship between finance and growth has weakened in recent years and Demetriades et al. (2017) has shown that private credit over the period of 2000–2011 has negatively affected the growth rate. In addition, the authors

[4] Log transforms do not have much impact in normalising the $1.90 or $3.10 poverty headcount variables.

[5] In additional regressions, alternative measures of financial fragility were used including the return on assets and the *Z*-score. However, the regression diagnostics were poor and as a result we favour the variable impaired loans to gross loans.

Table 2
Correlations between additional covariates.

	GDP per capita	Economic growth	Government spending	Inflation rate	Trade openness	Mobile money dummy
GDP per capita	1					
Economic growth	−0.12	1				
Government spending	0.21	−0.20	1			
Inflation rate	−0.47	0.31	−0.30	1		
Trade openness	0.30	−0.04	0.11	−0.20	1	
Mobile money dummy	−0.47	0.16	−0.28	0.38	−0.19	1

Table 3
Instrument and financial development correlations.

	Resource rents	Private credit	Broad money	ATM per 1000 km^2	Banks per 1000 km^2	Impaired loans	Cost to income ratio
Resource rents	1						
Private credit	−0.55	1					
Broad money	−0.48	0.77	1				
ATM per 1000 km^2	−0.68	0.70	0.58	1			
Banks per 1000 km^2	−0.70	0.61	0.54	0.94	1		
Impaired loans	0.34	−0.46	−0.37	−0.32	−0.22	1	
Cost to income ratio	−0.03	−0.13	−0.29	−0.02	0.00	0.11	1

find financial fragility negatively affects the growth rate, providing additional evidence of how indirectly finance may influence poverty reduction. The additional variables we control for are standard in the macroeconomic literature and include: the inflation rate that proxies for macroeconomic stability, the amount of government spending to GDP and trade openness, measured as the sum of imports and exports to GDP.[6] A dummy variable that measures the prevalence of mobile money and is an important covariate included in additional regressions. It takes the value one if mobile money providers are operating in a country and zero otherwise. The correlations between the control variables is shown in Table 2. The table shows that multi-collinearity should not be an issue as the highest correlation is (−0.47) between GDP per capita and both the inflation rate and mobile money prevalence. When introducing schooling into the matrix of control variables, the correlations between schooling and a number of covariates is very high, in particular income per capita. As both appear to measure the level of economic development, we omit schooling from the equation, in favour of GDP per capita as we believe it is a more important conditioning variable to include. The data spans from 2004 to 2015 but due to the highly unbalanced nature of the panel, we average our data to form a cross-section creating one observation per country. As opposed to using ordinary least squares (OLS), our preferred specification is an instrumental variable (IV) estimator because there is potential for financial development to be endogenous, and thus the OLS results would be biased (Donou-Adonsou and Sylwester, 2016). We use an IV model as shown in Eq. (1) to address these endogeneity concerns.

$$Y_i = \alpha + \beta_1 FD_i + \beta_2 GDP_i + \beta_3 X_i + \epsilon_i \quad (1)$$

In Eq. (1) the subscript i denotes each country and depending on the specifications this ranges from 72 to 124. Our dependent variable Y is our poverty rate, FD represents the different measures of financial development, GDP controls for income and is a control variable in all the specifications and X is a matrix of additional covariates used in the full specification. The error term is denoted ϵ and α and β are parameters to be estimated.

To identify the coefficient β_1 we instrument for our financial development variables. Natural resource rents have shown to explain cross country variation in financial development, where Bhattacharyya and Hodler (2014) show that countries with high extraction rates tend to be financially underdeveloped. This follows the endowment theory proposed by Acemoglu et al. (2001) where in countries abundant in natural resources, institutions were set up to facilitate extraction to favour the political elite. Rajan and Zingales (2003) suggest that the political elite, which may include industrial incumbents would restrict financial development for their own personal gain.[7] As financial development increases, so do the opportunities for new firms to enter established markets. These new firms and the resulting competition may threaten the dominant market position of established industrial incumbents. As a result, these incumbents may lobby to restrict financial development and protect their own interests. As a result we would expect in the present day that countries with high extraction rates to be less financially developed than their non-extracting counterparts. We use two instruments in our regression specifications so that we have an overidentified model, which then allows us to check the validity of the instruments using a Hansen test. The first instrument is the natural resource rate and the second is multiplying the resource rate with the initial values of the financial development variables. There are two main diagnostics to check when using an instru-

[6] In the regressions the inflation rate is logged after applying a transform (1 + inflation rate) to avoid logging negative values.

[7] Restricting financial development may be just one tool available to maintain the dominant position of the elite.

mental variable specification. The first is the Hansen *p*-value that tests for weak instruments, where a non-rejection of the null indicates the instruments are valid. The second diagnostic is the first stage *F*-statistic which is used to test for weak instruments. A weak instrument problem would result in bias close to OLS where a first stage statistic exceeding 10 suggests the instruments are strong in practice. Table 3 shows the correlation between the resource rents variable and the variables used to measure financial development. We observe that all financial development variables are highly correlated with one another with the exception of the cost to income ratio. This transcends to the correlations between the instrument and the financial development measures so in the majority of the specifications we would expect to avoid a weak instrument problem. As the correlation between financial efficiency and resource rents is close to zero the instruments may perform poorly in this regression specification. If this is the case, then the results examining financial efficiency may be subject to bias (similar to OLS) and would require careful interpretation.

3. Results

3.1. Benchmark findings

Tables 4–6 present the estimates between financial development and poverty reduction. The first table examines the relationship between financial deepening and poverty using two different measures of financial depth, private credit and broad money. Table 5 examines the role of increased financial access in poverty reduction using ATM and bank branch coverage. The final table shows the impact of financial stability and efficiency on poverty.

There are four separate regressions shown in Table 4. In columns one and two the financial deepening variable is private credit (showing the intermediation aspect of financial depth) and in columns three and four we measure financial deepening using broad money. In column one, we measure an entry level regression containing our variable of interest and income per capita to control for the level of economic development. We find that both variables are negative and significant. As all the variables are measured in natural logarithms we can interpret the coefficients as elasticities. In column two, we add further covariates into the regression. Whilst many of these additional covariates are statistically insignificant, economic growth enters with a negative and significant sign indicating a unit increase in the growth rate may reduce poverty by 3.8%. Private credit retains its statistical significance where a 1% increase in private credit may reduce poverty by 0.24%. The latter two columns in Table 4 are similar to the first two. Broad money and income per capita are both statistically significant and negative in the entry regression. Upon adding further covariates they retain their significance and economic growth is statistically significant as well, although its magnitude increases. Throughout all the columns, the coefficient on income shows that being 1% richer may reduce poverty by approximately 0.25% across all four columns. Broad money has a larger magnitude than private credit which is a common finding in the literature. In Table 4 it shows that a 1% increase in broad money may reduce poverty by 0.5%. The diagnostics in Table 4 are well satisfied with first stage *F*-statistics exceeding the target figure of 10 and the Hansen test of instrument validity is not rejected (the null hypothesis is that the instruments are valid) with *p*-values ranging from 0.52 to 0.68.

Table 4
Financial depth as the financial development variable.

	(1)	(2)	(3)	(4)
	Private credit		Broad money	
Financial Depth	−0.220** (−2.18)	−0.240** (−2.14)	−0.366** (−2.04)	−0.505*** (−3.12)
GDP per Capita	−0.274*** (−3.82)	−0.232*** (−3.37)	−0.248*** (−3.11)	−0.173** (−2.56)
Economic Growth		−0.038* (−1.88)		−0.066*** (−3.21)
Government Spending		−0.139 (−1.18)		−0.140 (−1.22)
Inflation Rate		−0.019 (−0.24)		−0.048 (−0.52)
Trade Openness		−0.015 (−0.13)		0.094 (0.72)
Constant	6.411*** (17.61)	6.592*** (12.08)	6.848*** (17.62)	6.728*** (10.19)
First stage *F* stat	36.1	38.9	11.6	11.7
Hansen	0.68	0.52	0.59	0.57
R-squared	0.39	0.40	0.33	0.30
Observations	122	118	120	116

Each column represents a different regression. The first two columns report private credit to GDP as the financial deepening variable. The latter two measure financial depth as broad money as a ratio of GDP. All variables are logged in the specification with the exception of economic growth. All regressions are estimated using the ivreg2 command in Stata and the instruments include total natural resource rents and the initial value of financial development multiplied by resource rents. Robust standard errors where (*) (**) (***) denotes (10) (5) (1) significance levels. *T*-statistics are reported in parentheses and the first stage *F*-statistic is reported as a diagnostic as is the Hansen *p*-value.

Table 5 examines whether physical financial access has any influence on poverty. A lack of financial infrastructure, including a lack of terminals may result in the poor being financially excluded. If this is the case then the benefits of financial development may not reach the poor regardless of how deep the financial sector is. In column one, the entry regression shows that physical access measured by ATM coverage and income per capita are both negatively related to poverty. The magnitude on the financial access variable is much smaller than for the corresponding regressions in Table 4. Adding further variables into the regression, whilst the coefficient on ATM coverage remains stable, it becomes only statistically significant at the 10% level. The latter two columns replace ATM coverage with bank branch coverage. Whilst ATMs are cheaper to install and may provide greater penetration in rural areas, physical bank branches can provide far more services than just cash withdrawal. Column three shows that in the entry regression, both income per capita and the number of bank branches are negatively related to poverty and are statistically significant. The final column which adds the remaining conditioning variables shows that the variable of interest

Table 5
Financial access as the financial development variable.

	(1)	(2)	(3)	(4)
	ATMs per 1000 km^2		Banks per 1000 km^2	
Financial Access	−0.077** (−1.99)	−0.073* (−1.83)	−0.074** (−1.98)	−0.073* (−1.90)
GDP per Capita	−0.259*** (−3.23)	−0.225*** (−2.76)	−0.296*** (−4.36)	−0.252*** (−3.60)
Economic Growth		−0.044*** (−2.65)		−0.044*** (−2.79)
Government Spending		−0.150 (−1.09)		−0.164 (−1.15)
Inflation Rate		0.033 (0.51)		0.035 (0.53)
Trade Openness		−0.031 (−0.26)		−0.043 (−0.34)
Constant	5.673*** (9.10)	6.142*** (7.81)	5.957*** (11.20)	6.441*** (9.56)
First stage *F* stat	54.5	50.0	55.8	58.8
Hansen	0.44	0.38	0.60	0.60
R-squared	0.36	0.40	0.36	0.39
Observations	122	116	124	118

Each column represents a different regression. The first two columns report the number of ATM machines per 1000 km^2 and the latter two report the number of bank branches per 1000 km^2. All variables are logged in the specification with the exception of economic growth. All regressions are estimated using the ivreg2 command in Stata and the instruments include total natural resource rents and the initial value of financial development multiplied by resource rents. Robust standard errors where (*) (**) (***) denotes (10) (5) (1) significance levels. *T*-statistics are reported in parentheses and the first stage *F*-statistic is reported as a diagnostic as is the Hansen *p*-value.

Table 6
Financial instability/efficiency as measures of financial development.

	(1)	(2)	(3)	(4)
	Impaired loans		Cost to income	
Financial Stability/efficiency	0.356 (1.26)	0.344 (1.41)	0.001 (0.03)	0.010 (0.63)
GDP per Capita	−0.338*** (−4.54)	−0.282*** (−3.29)	−0.364*** (−4.80)	−0.284*** (−4.17)
Economic Growth		−0.092*** (−2.82)		−0.065** (−2.43)
Government Spending		−0.162 (−0.72)		−0.117 (−0.66)
Inflation Rate		−0.012 (−0.13)		0.077 (0.90)
Trade Openness		−0.142 (−0.68)		0.021 (0.13)
Constant	5.586*** (5.46)	6.418*** (6.22)	6.447*** (4.01)	5.861*** (3.75)
First stage *F* stat	9.6	10.0	6.0	7.9
Hansen	0.21	0.09	0.30	0.18
R-squared	0.17	0.27	0.36	0.41
Observations	73	72	87	85

Each column represents a different regression. The first two columns report the financial instability measure impaired loans to total gross loans. The latter two report the cost to income ratio, one measure of financial efficiency. All variables are logged in the specification with the exception of economic growth and the cost to income ratio. All regressions are estimated using the ivreg2 command in Stata and the instruments include total natural resource rents and the initial value of financial development multiplied by resource rents. Robust standard errors where (*) (**) (***) denotes (10) (5) (1) significance levels. *T*-statistics are reported in parentheses and the first stage *F*-statistic is reported as a diagnostic as is the Hansen *p*-value.

remains statistically significant with the expected sign. A 1% increase in bank branch coverage may reduce poverty by 0.07%, quite a small figure, when compared with the financial depth results. Income per capita is strongly significant with a magnitude similar to that in Table 4 and provides evidence that richer, more economically developed economies have lower poverty rates. The instruments in Table 5 perform well, with first stage *F*-statistics exceeding 50 in all the specifications and the Hansen *p*-values range from 0.38 to 0.60 suggesting that the instruments are valid.

Table 6 examines the two further dimensions of financial development, the stability of the financial system and its efficiency. Admittedly the measures chosen to proxy for these two channels are rather crude, however, they are readily available and introduced as valid measures by the World Bank. The measure of financial stability is the ratio of impaired loans to gross loans. Whilst statistically insignificant in columns one and two the variable enters with its expected positive sign. In column one and two, income per capita is negative and significant complimenting the results from the previous two tables. In columns three and four we examine the efficiency of the financial sector, and the variable of interest is the cost to income ratio. Whilst the cost to income ratio is used to measure the efficiency of the financial sector, it may also capture some elements of financial stability. If financial institutions have costs greater than their income and face repeated losses, this may create panic about the health of the financial sector which may cumulate in a bank run. Nevertheless, in columns three and four, the cost to income ratio enters with the correct positive sign, but is statistically insignificant.[8] Similarly to the previous results, income per capita is negative and significant as is economic growth. In Table 6 the instruments do not perform as well as in previous Tables. Whilst the instruments are plausibly exogenous (although the *p*-value in column two falls to 0.09) the regressions may suffer from a weak instruments problem which was anticipated when examining the correlations between the variables. In the first two columns the instruments are close to the target figure of 10, although they fall in the latter two columns. Therefore, it is important to interpret the results in Table 6 cautiously.

[8] In supplementary regressions financial efficiency was measured using the interest rate spread. Whilst this variable was positive and significant in the regression specifications and the Hansen test was not rejected, those regressions had lower first stage *F*-statistics than those reported for the cost to income ratio. These results are available upon request.

3.2. Robustness checks: mobile money

Towards the middle of the sample period and starting in Kenya in 2007, mobile money, a new innovative method of accessing financial services came into fruition in developing countries. Whereas initially provided by mobile phone networks, M-Pesa, as it is known in Kenya, provided individuals the ability to store money on mobile phones as if it was a bank account and make payments via mobile devices. Whilst this has expanded and now providers even offer insurance and other products, many financial institutions have begun to embrace the idea and tried to attract mobile money customers through their own plans. As the selected variables that measure financial development overlook this new technological shock, not controlling for mobile money may bias the results in Tables 4–6. Furthermore, the results in Table 5 show that the magnitudes of financial access are relatively small in comparison to those of financial depth. It could possibly be that mobile money is one reason why the coefficients are so small as mobile money may substitute for the need of a physical ATM or bank branch. Therefore, the results in Table 5 may show signs on downward bias.

Table 7 shows the correlations between mobile money and the variables that measure financial development. It is evident that there is a strong negative correlation between the measures of financial deepening and physical access, and a positive correlation between mobile money and financial instability and inefficiency. Therefore, we see that mobile money is inversely related to financial development, backing up the idea that mobile money may be a response due to underdeveloped financial systems. Likewise, when examining the correlation between mobile money and income per capita in Table 2 we have further evidence that it is in the poorest developing countries where mobile money has thrived. As a result Table 8 estimates our full specifications from Tables 4–6 including this additional variable.

Table 7
Financial variables and mobile money correlations.

Variable name	Mobile money
Private credit	−0.31
Broad money	−0.27
ATM per 1000 km^2	−0.34
Banks per 1000 km^2	−0.30
Impaired loans	0.18
Cost to income ratio	0.11

Table 8 presents six regressions. The first two columns examine the role of financial depth in poverty reduction, the following two columns the financial access variables, column five examines financial instability and the final column examines the role of financial sector inefficiency in poverty reduction. The results compliment the earlier findings where in all six columns the signs attached to financial development are as expected. In columns one to four the variables are statistically significant, where the latter two variables are insignificant. The magnitudes are similar to those in the previous tables, although in the first

Table 8
Robustness tests on the finance-poverty nexus.

	(1)	(2)	(3)	(4)	(5)	(6)
	Private credit	Broad money	ATM per 1000 km^2	Banks per 1000 km^2	Impaired loans	Cost to income ratio
Financial Development	−0.254**	−0.509***	−0.078*	−0.076**	0.308	0.010
	(−2.24)	(−3.08)	(−1.94)	(−1.96)	(1.27)	(0.66)
GDP per Capita	−0.201***	−0.151**	−0.202**	−0.234***	−0.300***	−0.284***
	(−2.72)	(−2.15)	(−2.38)	(−3.22)	(−3.15)	(−4.01)
Economic Growth	−0.041**	−0.069***	−0.046***	−0.046***	−0.096***	−0.065**
	(−2.17)	(−3.50)	(−2.90)	(−3.04)	(−3.01)	(−2.42)
Government Spending	−0.143	−0.146	−0.151	−0.167	−0.164	−0.117
	(−1.22)	(−1.28)	(−1.10)	(−1.18)	(−0.74)	(−0.65)
Inflation Rate	−0.024	−0.048	0.032	0.034	−0.008	0.077
	(−0.30)	(−0.52)	(0.48)	(0.51)	(−0.08)	(0.90)
Trade Openness	0.016	0.119	−0.011	−0.024	−0.170	0.021
	(0.13)	(0.91)	(−0.09)	(−0.18)	(−0.76)	(0.12)
Mobile Money	0.182*	0.148	0.119	0.115	−0.107	−0.008
	(1.75)	(1.28)	(1.11)	(1.09)	(−0.54)	(−0.06)
Constant	6.116***	6.375***	5.787***	6.136***	6.878***	5.850***
	(9.34)	(9.48)	(6.38)	(7.83)	(4.76)	(3.55)
First stage *F* stat	39.4	11.5	48.9	58.1	9.7	7.8
Hansen	0.65	0.50	0.57	0.77	0.10	0.16
R-squared	0.41	0.31	0.41	0.40	0.30	0.41
Observations	118	116	116	118	72	85

Each column represents a different regression. All variables are logged in the specification with the exception of economic growth, the cost to income ratio and the mobile money dummy. All regressions are estimated using the ivreg2 command in Stata and the instruments include total natural resource rents and the initial value of financial development multiplied by resource rents. Robust standard errors where (*) (**) (***) denotes (10) (5) (1) significance levels. *T*-statistics are reported in parentheses and the first stage *F*-statistic is reported as a diagnostic as is the Hansen *p*-value.

four columns they are slightly higher. The results suggest that on average, a 10% increase in financial depth may reduce poverty by 3.8%, and a 10% increase in financial access may reduce poverty by 0.77%.[9] Additionally GDP per capita is negative and significant as is economic growth, suggesting richer countries with high growth rates have lower poverty levels. Surprisingly, mobile money is insignificant in five of the six specifications and enters with a positive sign in the first four columns. This may be attributable to the fact that countries with high poverty rates are more likely to use mobile money than more economically developed countries. The diagnostics in Table 8 are generally well satisfied, in particular for the first four columns. As in Table 6, the instruments appear exogenous with Hansen values all exceeding 0.10 although there is an issue of weak instruments in column six.

4. Conclusion

This paper examines the role of financial development in poverty reduction. As financial development may be broken into four sub-categories, this paper examines all four in turn. The results find that financial deepening has the greatest poverty reducing effect followed by increasing physical financial access. The results show that financial instability and banking sector inefficiency have no harmful effects on poverty reduction. Whilst the results suggest that financial instability and inefficiency have no direct detrimental effect on poverty in contrast to Guillaumont Jeanneney and Kpodar (2011), they may have indirect effects on the poverty rate. Demetriades et al. (2017) show that financial instability is detrimental to economic growth and the results in this paper and numerous other studies show that economic growth may reduce poverty. Furthermore, financial sectors that are increasingly fragile may impair the financial sectors' ability to extend credit to individuals or innovative small enterprises which may block a poverty reducing channel. This would be as in times of financial sector distress, banks may hoard liquidity, or improve their capital ratios by reducing the total amount of risk-weighted assets. Whilst examining the impact of formal financial sector development, this paper also attempts to control for new technological innovations in the financial sector, specifically mobile money. This adds a further contribution to the study as it appears to be the first paper that controls for this form of informal finance at the country level. Interestingly, even when controlling for mobile money, which may substitute for fixed physical branches, the results show increasing physical access may still reduce poverty. If the key goal for policymakers is to reduce poverty, then the greatest impact is via increasing the depth of the financial sector. However, it is important for policymakers not to focus exclusively on the ideas that greater volumes of credit or a larger financial sector may achieve that on its own. Evidence by Arcand et al. (2015) shows that once financial depth to GDP exceeds 121% it has a negative effect on growth, and increasing lending without adequate credit checks may result in credit booms that may cumulate in financial crises. Finally, the poverty reducing effect of financial deepening may be heightened if it coincides with increasing the inclusiveness and accessibility of the financial sector.

[9] In unreported regressions we interacted the financial depth and access variables together. The findings show that the magnitude of the financial depth coefficients increase and the level of financial depth and the interaction term are jointly significant.

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