Financial development and the redistributive channel of monetary policy

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Received 12 March 2021
Revised 1 July 2021
4 October 2021
19 December 2021
Accepted 8 January 2022

Abstract

Purpose – This paper aims to examine the distributional channel of monetary policy (MP) and evaluate how financial development (FD) affects the transmission mechanism from MP to income inequality.

Design/methodology/approach – The empirical investigation is implemented for 32 sub-Saharan African countries over the period 2000–2017, with the aid of vector autoregressions and a dynamic panel data model.

Findings – This study shows that MP has a significant impact on income inequality and the financial system plays an important role by dampening the dis-equalising effects of MP shocks. Both MP and FD directly exert redistributive effects. However, the financial system appears to wield the greatest impact and contribute more to the inequality dynamics.

Practical implications – The policy-relevant conclusion is that the financial system is crucial for the monetary transmission mechanism and the effects of MP actions. As the economy develops financially, it may require less movement in the policy position to achieve the desired policy outcome. Also, macroeconomic stabilisation policies may not be distributionally neutral and may have a role to play in averting longer-term increases in inequality.

Originality/value – Contrary to previous studies, this study indicates MP by the structural shocks to purge the MP stance of the issues of endogenous and anticipatory actions. A distinctive finding of this paper is that cross-country differences in monetary regimes and income explain a significant variation in the distributional impacts of monetary policy. Notwithstanding, the evidence shows that the strength of the transmission is more dependent on FD than the nature of the policy regime.

Keywords Monetary policy, Financial development, Income inequality, Sub-Saharan Africa

Paper type Research paper

1. Introduction

A rapidly growing literature analyses the redistributive effects of monetary policy (MP) both within theoretical frameworks (Gornemann *et al.*, 2016; Kaplan *et al.*, 2018; Auclert, 2019) and empirical evaluations (Mumtaz and Theophilopoulou, 2017; Furceri *et al.*, 2018; Guerello, 2018)[1]. The conclusion from these studies is that, apart from the macroeconomic and financial effects of monetary measures, redistribution is a side effect of MP changes. Auclert (2019) argues that the effects of MP on macroeconomic aggregates are realised via the redistribution channel. If the

This paper is a revised version of Chapter 2 of the author's PhD dissertation at the University of Verona. He cannot find enough words to thank his advisors Prof. Roberto Ricciuti and Prof. Alessia Campolmi for their continuous guidance and support. He has particularly benefited from the detailed comments of the editor, as well as anonymous referees.

Studies in Economics and Finance
Vol. 39 No. 2, 2022
pp. 279-296
Emerald Publishing Limited
1086-7376
DOI 10.1108/SEF-03-2021-0104

pass-through of MP depends on the distribution of income and wealth, then understanding the strength of this transmission mechanism is important for improving the countercyclical effects of MP and guiding policy responses to contain the distributional consequences of macroeconomic shocks. In this study, we evaluate the role of financial development (FD) in the monetary transmission to income inequality. Our laboratory is sub-Saharan Africa (SSA) where the financial systems of the countries have common features, suggesting a similar role of the financial systems. Nonetheless, the variations in the monetary frameworks and the structure of the countries' financial systems may point to important differences in the specific role that the financial system plays in the conduct of MP in the sub-region.

While there has been increased awareness of the inequality consequences of monetary policy, how the redistributive effect of MP depends on the extent of FD has not been studied, despite the conventional view that FD is relevant to the effectiveness of monetary transmission. This study addresses this important gap. We simultaneously analyse the inequality effects of MP and FD and explore the role of FD in the propagation of MP shock to income inequality. This contribution also expands the literature on FD and income distribution. Prior literature primarily examined the distributive effects of FD. But which system generates more inequality – a bank-based or market-based financial system? Does a more market-based economy co-move positively with inequality? Does a predominantly bank-based economy correlate negatively with inequality? Empirical evidence on these correlations and distinctions is non-existent. Our framework considers the different financial systems and evaluates which financial system is most regressive and in which system can the monetary authority tolerate the inequality effects of monetary actions in pursuit of macroeconomic stability and efficiency. This current contribution is imperative, as Effiong *et al.* (2020) reveal that the cross-country differences of the MP transmission in a monetary union are approximately accounted for by the idiosyncrasies in the financial structure of member countries. For the European Monetary Union, Elbourne and de Haan (2006) contend that the heterogeneity in the individual countries' financial structures ensures that regional MP affects member countries differently.

In contrast to the practice in the literature on the interaction of FD and monetary policy, we analyse the effects of MP by relying on the structural innovations. By this novelty, we eschew the well-documented difficulty in the monetary transmission literature that centres on separating the MP effects from the impacts originating from exogenous developments to which MP reacts. We use a structural vector autoregression system comprising real economic activity, inflation and MP and use a recursive identification scheme to obtain the series of MP innovations. We estimate straightforward regressions of a measure of income inequality on the MP shocks, FD and interaction between MP and FD. Our results show that monetary expansion exerts a positive impact on income inequality, but when interacted with financial system variables, the effect is negative. The effects of MP have been analysed in the literature with the aid of vector autoregressions. To facilitate comparisons with this literature, we run panel vector autoregression with exogenous variables (PVARX), using the MP shock series and its interaction with FD as exogenous variables. The results of the dynamic multipliers confirm the findings from the baseline analysis.

A version of our analysis that includes only low-income countries shows that the interaction between MP and FD exerts insignificant impacts on inequality. This may indicate the shallow nature of financial systems and markets in developing countries. When we exclude the countries within the CFA franc zone from the sample, the result shows that MP has no significant inequality effects. However, the interaction between MP and FD affects income inequality significantly. These findings highlight the significant role that the financial system plays in the transmission of monetary policy. The financial system may amplify the effects of MP actions, and it may require less movement in policy directions to achieve policy intentions in financially

developed economies. There is firm evidence that both MP and FD contribute to the development of income inequality. However, FD exhibits the most redistributive effects and contributes more to the evolution of income inequality. The results are robust to MP shocks identified via the sign restriction approach.

The remainder of the paper is structured as follows. Section 2 introduces the empirical methods, econometric model and the data that is used in our analysis. Section 3 presents the empirical findings and analysis of the results. Section 4 concludes the study.

2. Empirical methods

Our analysis evolves in two steps. First, we estimate MP shocks for each country in a structural VAR identified by Cholesky decomposition. Finally, we regress a measure of income inequality on the estimated shocks and measures of FD.

2.1 Monetary policy in sub-Saharan Africa

In most SSA countries, the de jure policy regime in place is best described as a hybrid regime. The official nominal anchor for many SSA countries is money targeting, albeit there is significant flexibility in meeting the target. In a hybrid system, short-term interest rates have mostly featured within the toolbox of monetary actions; however, monetary aggregates persist as the overwhelming intermediate target. Hence, monetary aggregates provide the best direct indicator of the central banks' MP actions in many SSA countries. A multiplicity of objectives (such as inflation, exchange rates and credit output) and instruments (including interest rates, monetary aggregates, reserve requirement ratios and foreign exchange intervention) characterised the monetary frameworks in SSA (IMF, 2008). Monetary aggregates play a fundamental role in the conduct of MP in SSA and in most of these countries, interest rates play a subordinated secondary role in the MP frameworks to improve monetary transmissions. We follow Saiki and Frost (2014) and Guerello (2018) and measure MP stance by central bank assets[2]. We consider changes in the central bank's balance sheet apt for our analysis to capture the multiplicity of objectives and instruments of monetary frameworks in SSA countries.

2.2 Monetary policy shocks

Exogeneous MP shocks are required in an estimation of the causal effect of MP on inequality (Furceri *et al.*, 2018). In our benchmark model, we apply the structural autoregressive (SVAR) approach to identify MP shocks. Lütkepohl *et al.* (2004) explain that the errors in the SVAR system are interpreted as exogenous shocks. We consider an SVAR specification as follows[3]:

$$A_0 Y_t = \sum_{i=1}^{p} A_i Y_{t-i} + B\varepsilon_t \tag{1}$$

where p is the lag length and Y_t is a vector of endogenous variables, including real gross domestic product (GDP), inflation and the MP indicator. A_i ($i = 1, \ldots, p$) is a coefficient matrix capturing the lagged relationships between the endogenous variables. A_0 is a 3×3 matrix of parameters and specifies the instantaneous relationships between the endogenous variables. ε_t is a 3×1 vector of structural shocks with (diagonal) identity covariance matrix and a Gaussian distribution of mean 0. B is a 3×3 matrix and specifies the correlation structure of the errors. In this representation, the form of the matrix A_0 imposes the recursive structure, whereas the diagonal matrix B orthogonalizes the effects of the

innovations. The reduced form representation of the structural form in equation (1) is as follows:

$$Y_t = \sum_{i=1}^{p} C_i Y_{t-i} + u_t \quad (2)$$

where $C_i = A_0^{-1}A_i$ $(i = 1, \ldots, p)$ and $u_t = A_0^{-1}B\varepsilon_t$.

The concern is to isolate the monetary innovations from demand and supply/cost shocks. We follow the contemporaneous restrictions identification approach and impose a recursive structure on the instantaneous relations between the variables as per the following ordering, consistent with the standard assumption in the literature:

$$Y_t = \begin{pmatrix} real\ GDP \\ inflation \\ monetary\ policy\ stance \end{pmatrix}$$

Per this approach, the variables placed above are contemporaneously exogenous to the shocks of the variables below. The recursive restrictions identification scheme has been extensively applied and discussed in the literature on MP shocks (Bernanke and Mihov, 1998; Christiano *et al.*, 1999; Davtyan, 2017). The assumptions of no contemporaneous effects are apt and more plausible with quarterly or monthly data (Walsh, 2010).

The structural parameters are estimated via the maximum likelihood (ML) estimator. The trending properties of the variables reveal evidence of unit roots in the real GDP time series for some countries. Notwithstanding, we follow Lütkepohl *et al.* (2004) and include the variables in levels. According to Lütkepohl *et al.* (2004), even if the variables have unit roots, cointegration restrictions can be ignored, and the ML estimator applied to a VAR model fitted to the levels. This is a frequent phenomenon in SVAR modelling, ostensibly to eschew imposing too many restrictions and losing information. The lag-length information criteria (Hannan–Quinn and Akaike's Information Criteria) suggest a VAR order of $p = 2$. The VAR (2) satisfies the stability conditions, as no root lies outside the unit circle. Data on real GDP, inflation and central bank assets are sourced from the international monetary funds (IMF's) International Financial Statistics. We use quarterly series and estimate the SVAR on the country level to identify MP shocks for each country. We follow Romer and Romer (2004) and sum the quarterly observations into annual series to implement the analysis. The structural shocks are standardised to have zero mean and variance equal to one, so we can interpret the response of the Gini coefficient as the response to a one standard deviation change in the MP shock.

2.3 Econometric estimation: dynamic panel model

In this paper, we seek to evaluate how FD shapes the redistribution effects of monetary policy. Our approach is to regress a measure of inequality on its own lagged values, a constant and measures of FD and monetary policy. We augment our model with an interaction term between FD and MP to capture how FD affects the inequality effects of monetary policy. The FD and MP shocks are included individually to capture their direct impacts on income inequality and the lagged value of inequality is included to control for the normal dynamics of income inequality. A natural variation is to control for other variables that may affect income inequality. Our basic specification therefore includes real income per capita as a control.[4] There is no reason to expect the MP measure to be correlated with real

GDP per capita, as we control for the central bank's information about output growth in constructing the MP measure. Our baseline regression is specified as follows:

$$Inq_{i,t} = a_0 + a_1 Inq_{i,t-1} + a_2 gdppc_{i,t} + a_3 FD_{i,t} + a_4 MP_{i,t} + a_5 FD_{i,t} \times MP_{i,t} + \mu_i + \varepsilon_{i,t} \quad (3)$$

where *Inq* is income inequality, *gdppc* is the log of real GDP per capita, *FD* represents measures of FD, *MP* represents the MP indicator, μ accounts for unobserved country-specific effects and ε is the remaining disturbance term. We apply the system generalized method of moments (GMM) of Arellano and Bond (1991), Blundell and Bond (2000) to estimate the model coefficients to address the endogeneity issue regarding the correlation between the lagged dependent variable and the error term. The empirical framework proposed here allows us to identify directly both whether MP affects income inequality and whether financial systems affect the transmission of MP shocks to income inequality.

2.4 Data

Our sample focusses on countries and periods that have the data necessary for the investigation. We conduct the analysis using annual data for an unbalanced panel of 32 SSA countries over the period 2000–2017. The Standardized World Income Inequality Database's (SWIID 8.2) estimates of the Gini are used as a measure of income inequality. We take cognizance of the potential effects of MP on inequality through redistribution (transfers and taxes) and focus the analysis on the net, rather than the gross Gini coefficient. Our investigation uses the FD Index constructed by the IMF[5]. The IMF's FD Index summarises how developed financial markets and financial institutions (FI) are in terms of their access, depth and efficiency. Thus, the FD Index is an aggregate of the FI Index and Financial Markets (FM) Index. The analysis also gauges the respective effects of FI and financial markets on the dynamics of income inequality. Finally, we use data on real income per capita (GDPpc) and proxy MP using the estimated structural innovations. The data on real GDP per capita is sourced from the World Bank's World Development Indicators.

The data (Figure 1A) shows that the financial system in SSA has improved over the years as the FD indicators trend northwards and assume a relatively steep slope from the year 2000. The trend shows a broad-based move towards market-based financial systems. This is a testament to the varied financial sector reforms[6] implemented since the mid-1980s. The banking sector appears to have recorded significant progress, while the financial markets (particularly secondary markets) across the region remain undeveloped and shallow. The development of the financial systems in SSA largely traces out the trend in Low-Income and Developing Countries (LIDC) but remains considerably shallow relative to the financial systems in Emerging Markets (EM) and the Asia and Pacific region (Figure 1B). The data (Table 1) shows that the financial system is most developed in South Africa, while Guinea-Bissau is the least financially developed economy. In our sample, the net Gini averaged 46.84 (Table 1). Namibia was the most unequal country, while Mauritius recorded the least income gap but the highest income per capita. Burundi posted the least income per person over the period 2000–2017.

3. Empirical results

Three key testable predictions are highlighted in our empirical frameworks. First, there are inequality effects from FD. Second, there are redistributive consequences from monetary policy. Finally, the redistributive effects of MP depend on the financial system. The findings (Table 2) show that expansionary MP exerts a significant positive impact on income

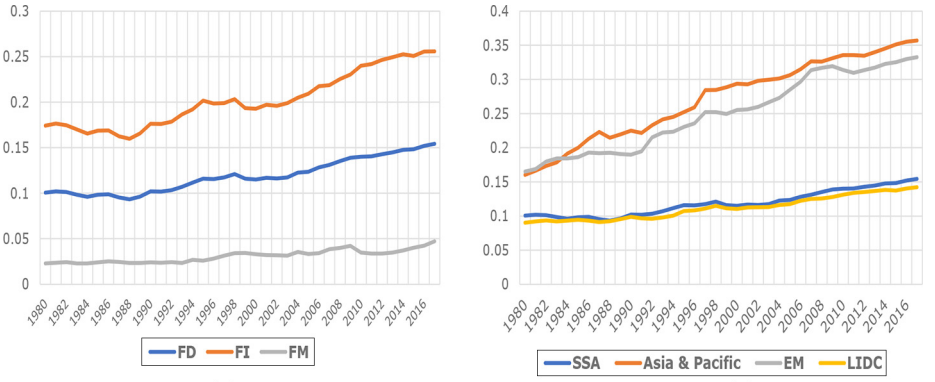

Figure 1.
(a) Financial development in SSA; (b) Financial development across regions

Notes: This figure shows the development of the financial system in SSA. Panel 1A shows the time path of the Financial Development (FD), the Financial Institution (FI) and Financial Market (FM) indices in SSA. Panel 1B compares the trend of financial development in SSA to the development of the financial system in Emerging Markets (EM), Income and Developing Countries (LIDC) and Asia & Pacific regions

inequality and the financial system dampens these effects. The results show the importance of FD in shaping the potential effects of monetary actions on the income gap. The redistribution effects of MP depend not only on the activities of the financial markets but also on the arrangements pertaining to financial intermediation.

There are several factors underscoring these results. In the financial markets, the resultant reductions in interest rates from expansionary monetary action decreases interest income to redistribute between the top and the bottom of the income ladder. This is the case because the top of the income distribution is conventionally believed to be the chief holders of financial assets. Meanwhile, the relatively less developed stock markets in the sub-region may undermine the direct impact of rising stock prices on income distribution. Also, monetary expansion operating via the financial system redistributes away from net nominal creditors to net nominal debtors by affecting interest payments. The orthodox assumption suggests that the rich are the net savers while the bottom of the income ladder features net borrowers. The reduced interest rates arising from monetary easing indicates lower interest payments by net borrowers to narrow the income gap.

The importance of financial intermediation in the determination of aggregate demand may underscore these results as well. Through the credit channel of monetary transmission, monetary expansion bolsters credit expansion, investments and economic activities to generate labour demand, additional labour income and reduce income inequality. This may imply that monetary expansion may increase aggregate demand via the redistribution channel. This result is consistent with the conclusion of Auclert (2019) that the redistribution channel amplifies the effects of MP since those who gain from an accommodative MP have higher marginal propensities to consume than those who lose. The results of this paper bring to the fore the role of liquidity constraints in the overall effectiveness of monetary policy. Werning (2015) disputes the significance of liquidity constraints to the efficiency of monetary policy. However, in line with the observations of Kaplan *et al.* (2018), the findings of this study demonstrate the importance of the responses of price and quantity of credit/capital in the indirect channel of monetary transmission.

Country	GDPpc	Net Gini	FD Index	FI Index	FM Index	MP
Benin	765.80	45.29	0.12	0.24	0.0002	−0.02
Botswana	6,467.61	58.07	0.25	0.42	0.07	0.13
Burkina Faso	559.19	44.07	0.11	0.22	0.002	0.10
Burundi	229.51	38.73	0.11	0.18	0.03	0.43
Cameroon	1,296.42	44.63	0.10	0.19	0.002	0.12
Cape Verde	3,061.61	50.26	0.21	0.42	0.002	0.37
Central African Republic	421.30	52.31	0.07	0.13	0.00	0.61
Côte d'Ivoire	1,294.97	49.94	0.19	0.24	0.13	0.46
Gambia	800.11	44.69	0.09	0.18	0.00	0.33
Ghana	1,292.28	42.51	0.11	0.17	0.04	0.31
Guinea-Bissau	555.13	42.77	0.05	0.09	0.00	0.11
Kenya	942.66	46.66	0.16	0.25	0.07	0.21
Lesotho	1,130.38	52.21	0.14	0.28	0.002	−0.22
Madagascar	475.96	43.98	0.10	0.18	0.006	0.58
Malawi	441.43	46.38	0.08	0.14	0.02	0.18
Mali	679.62	40.21	0.12	0.23	0.006	0.22
Mauritania	1,211.84	39.49	0.11	0.20	0.01	0.57
Mauritius	7,652.64	37.69	0.39	0.50	0.28	0.34
Mozambique	448.13	46.00	0.12	0.21	0.03	0.07
Namibia	5,206.40	65.55	0.34	0.61	0.05	0.01
Niger	350.08	38.89	0.10	0.18	0.01	0.24
Nigeria	2,078.71	43.82	0.22	0.22	0.22	0.14
Rwanda	545.62	50.05	0.09	0.17	0.004	0.15
Senegal	1,265.12	41.73	0.13	0.26	0.003	−0.002
Sierra Leone	402.48	42.16	0.07	0.14	0.004	0.03
South Africa	7,027.20	59.36	0.55	0.66	0.42	0.31
Sudan	1,475.18	37.99	0.09	0.18	0.001	0.55
Swaziland	3,994.36	58.64	0.15	0.28	0.01	−0.11
Tanzania	717.12	43.48	0.11	0.20	0.01	0.07
Togo	546.67	43.55	0.12	0.22	0.03	0.21
Uganda	576.95	44.17	0.10	0.18	0.02	−0.02
Zambia	1,339.15	55.00	0.10	0.18	0.02	0.14
Sample average	1,726.61	46.84	0.15	0.25	0.05	0.21

Notes: This table reports the mean values of the variables used in the paper. The summary statistics show the mean value for each country and the total sample. The GDP per capita (GDPpc) is in constant US$. The Gini coefficient values are the disposable Gini. Higher values of the Gini show higher income inequality. Financial Development |(FD), Financial Institutions (FI) and Financial Markets (FM) indices range between 0 and 1. The closer the indices are to 1, the more developed the financial system. Monetary policy (MP) is represented by the structural shocks

Table 1. Sample and summary statistics (mean value, 2000–2017)

Our findings suggest that MP actions are propagated to aggregate variables and the real economy via financial sector variables and aggregate demand behaviour. The results illustrate quantitatively, an important point: the effects of MP actions depend strongly on the reactions of financial sector variables and investment. These results are in sharp contrast to the general notion that developing and emerging economies are characterised by undercapitalized banks which significantly constrains credit expansion and undermines the effectiveness of MP transmission. It is however instructive to note that the findings may suggest that in a more developed financial system, less shift in the policy position is needed to achieve policy objectives. Perhaps, the relatively low FD in developing and emerging economies may explain the large movements in MP stance usually observed in these jurisdictions.

Our findings are coherent with theories that predict equalising effects of FD. FD reduces financing and borrowing constraints to enable the efficient allocation of capital which enhances growth, *ceteris paribus*. Improved economic growth may generate increased employments and enhanced labour income to reduce income inequality. However, there are heterogeneities in the inequality effects of the different financial arrangements. The evidence from our sample shows that financial markets worsen the income gap (though insignificant) while FI exert equalising effects. Financial markets disproportionately improve the wealth of the top of the income distribution who are the usual participants in these markets. In economies with predominant public bond markets, the government's debt demand crowds out the credit needs of the private sector to limit private investment and further lessens general employment and income while generating higher returns for participants in the bond market who are chiefly the top of the income ladder. Meanwhile, potential inflation erodes the non-indexed income of the bottom of the distribution who are exposed to liquidity risk to further worsen the income gap. Financial intermediation activities and credit expansions anchored by financial institutions, may improve income and narrow the income gap.

These results are consistent with the observation that the financial system in SSA appears to be predominantly bank-based. Also, these results may suggest that the market-based financial system generates more inequality than the bank-based financial system. However, both bank-based and market-based financial systems significantly affect the transmission of MP to income inequality. Our results show that monetary easing is more equalising via the financial markets than through the FI. This evidence may suggest that the influence of MP is relatively stronger in the bond market than in the stock market in SSA. A stronger influence in the stock markets would have widened the income gap through upticks in stock prices and the associated surge in capital gains which benefit mainly the top of the distribution. The impacts of financial markets and FI on the inequality effects of MP may indicate evidence of relatively weak stock markets but high dependence on bank credit and the bond market in SSA.

In Column 4 of Table 2, we include the square term of FD and income per capita in the specification to verify the non-linear relation between inequality and growth on the one hand and between inequality and FD on the other hand[7]. The evidence from our sample shows a U-shaped relationship between FD and income inequality, contrary to the predictions of Greenwood and Jovanovic (1990). FD is equalising at the early stages but dis-equalising at later stages of its evolution. This may be explained by the notion of the "vanishing effect" of FD. This finding supports the observations in Law and Singh (2014) and Arcand *et al.* (2015) and shows that the level of FD is beneficial to growth only up to a certain threshold, beyond which further FD reduces economic growth. The U-shaped relationship between FD and income inequality may suggest that MP transmission via the financial system is likely to be dominated by the bank lending channel at lower levels of FD, whereas the wealth channel dominates at the higher levels of FD.

The relationship between income inequality and real income per capita display the Kuznets (1955) curve – the inverted U-shaped path of income inequality along the trajectory of economic development. Real income per capita worsens the income gap at the initial stages but reduces income inequality at later stages of its evolution. Finally, the results indicate persistence in income inequality, as the Gini coefficient exhibits statistically significant positive AR(1) terms in all regressions.

3.1 Robustness of the baseline results

We test the sensitivity of the results by excluding South Africa from the sample. South Africa appears to be markedly developed financially, positing an average FD index of 0.55

Variable	1	2	3	4
Gini (t-1)	1.034*** (0.015)	1.019*** (0.013)	1.034*** (0.007)	1.046*** (0.012)
Gdppc	0.152*** (0.040)	0.249*** (0.051)	0.041 (0.049)	5.368*** (0.888)
MP	0.010*** (0.003)	0.017*** (0.002)	0.010*** (0.003)	0.007** (0.003)
FD	−1.062*** (0.195)			−2.485*** (0.619)
FD×MP	−0.031*** (0.011)			
FI		−1.397*** (0.254)		
FI×MP		−0.042*** (0.005)		
FM			0.831 (0.547)	
FM×MP			−0.110* (0.064)	
$gdppc^2$				−0.372*** (0.065)
FD^2				4.395*** (1.192)
Constant	−2.459*** (0.746)	−2.273*** (0.748)	−1.860*** (0.389)	−20.960*** (3.212)
Obs	418	418	418	418
N	32	32	32	32
Wald (p-value)	0.00	0.00	0.00	0.00
Sargan[p-value]	20.22[0.99]	22.61[0.99]	17.41[0.99]	24.87[0.99]
AR(1) test[p-value]	−3.92[0.00]	−3.94[0.00]	−4.15[0.00]	−3.64[0.00]
AR(2) test[p-value]	1.03[0.30]	1.24[0.21]	1.35[0.18]	1.39[0.16]

Notes: This table presents the results from the regressions of income inequality on GDP per capita, monetary policy (MP), financial development (FD) and the interaction between monetary policy and financial development. The dependent variable is the net Gini coefficient. Columns 2 and 3 consider respectively, the financial institution (FI) and financial markets (FM) aspects of the financial system. Column 4 captures the hypothesized non-linear relationship between growth, financial development and inequality. *, ** and *** denote significance at the 10, 5 and 1% levels. Standard errors in parentheses. The results reported are for the two-step estimations and 2 maximum lags of the dependent variable are specified as instruments. For the estimation involving FM, the instrument specification includes 3 maximum lags of the dependent variables

Table 2. Redistributive effects of monetary policy and financial development

relative to the average sample FD index of 0.15 and an average FD index of 0.39 for the second most financially developed country. We estimate the baseline specification without South Africa to test the sensitivity of our results to the presence of a potential influential outlier. The results are presented in Table A1 (Appendix) and show that excluding South Africa has little impact on the conclusions and therefore parallels the findings in the baseline analysis.

Further, we restrict the analysis to low-income countries to test the robustness of our results to the exclusion of emerging economies. Six emerging countries (Botswana, Mauritius, Namibia, Nigeria, Swaziland and South Africa) are exempted from the sample and the baseline specifications estimated for 26 low-income countries[8]. The results are shown in Table A2 (Appendix) and confirm qualitatively, the findings from the total sample. MP increases income inequality while FD produces equalising effects. FI exert significant decreasing impacts on the income gap while financial markets have positive but insignificant effects on the income distribution. Generally, the interaction between MP and FD produces insignificant effects on income inequality. These findings suggest weak financial systems in peripheral and low-income countries. In most developing economies, FI and systems are shallow, whereas financial and assets markets are less developed and practically non-existent in some instances. The shallow nature of the financial systems may weaken the changes in financial conditions resulting from MP and undermine the effectiveness of MP transmission.

3.1.1 Monetary policy regimes. Our sample includes ten countries[9] that are members of the CFA franc zone with their currency pegged to the euro. The countries within the common monetary area have been widely credited for macroeconomic stability and very low rates of inflation in the sub-region. We explore the impact of this heterogeneity by excluding the ten countries from the sample[10]. The results presented in Table A3 (Appendix) suggest that contrary to the baseline results, MP is distributionally neutral. This may strengthen the doubt about the real impact of MP in SSA outside of the CFA franc zone. The insignificant impact of MP lay credence to the perceived deep uncertainty of monetary transmission in SSA largely on the account of policy incredibility, cloudiness of monetary frameworks, domestic and external supply shocks, financial and economic uncertainties. Within the CFA franc zone, these issues are principally subdued. However, when interacting with FD indicators, MP exerts significant impacts on income inequality. This emphasises the importance of the financial system in the effective transmission of monetary policy. The finding suggests that the strength of the MP transmission is less dependent on the monetary regimes than the development of the financial system.

3.1.2 Panel vector auto regression. We investigate the robustness of our baseline results along two additional dimensions. First, we engage an alternative econometric approach which entails estimating a PVARX model. The PVARX has the following reduced form:

$$Y_{i,t} = \sum_{j=1}^{p} \mathrm{A}_j Y_{i,t-j} + \gamma X_{i,t} + \varepsilon_{i,t}$$

where Y is the vector of endogenous variables, comprising the net Gini coefficient and the annual change in real GDP per capita; X is an exogenous MP shock identified from the SVAR and ε is a vector of errors. Consistent with Stock and Watson (2005), the VAR errors are assumed to follow a Gaussian distribution with zero mean and variance-covariance matrix Ω_{it}. The endogenous variables are included with a first lag,[11] whereas the exogenous structural shock is included contemporaneously. We follow the standard technique of Abrigo and Love (2016) and estimate the PVARX model using the GMM procedure. We use the estimated PVARX and compute the dynamic multipliers to measure the impact of a one standard deviation change in MP innovation on income inequality over time. The dynamic evolution of the MP transmission to income inequality is presented in Figure 1. The Gini increases in response to MP shock, whereas the income per capita declines first before increasing about a year after the shock.

Further, we estimate the PVARX model by using the interaction term between FD and MP shock as the exogenous variable. The results of the dynamic multipliers (Figure 2) show that the Gini coefficient reacted by decreasing while the real income per capita increases before returning to pre-shock levels. The PVARX yields results that are qualitatively similar to those in our baseline specification. Monetary easing increases income inequality but when combined with FD, the effect on inequality is negative. This suggests that there are important interaction effects between MP and the financial system and leaves our conclusions from the baseline analysis unchanged.

3.1.3 Alternative identification of monetary policy shocks. Finally, we verify if our results are also robust to MP shocks identified by sign restriction. Cholesky decomposition imposes a recursive structure in the VAR to identify structural shocks. However, Uhlig (2005) and Arias *et al.* (2019) espouse the idea of sign restriction and identify structural shocks by imposing restrictions on the signs of the impulse responses over a specific horizon. Table 3 shows the sign restrictions imposed to identify macro model shocks.

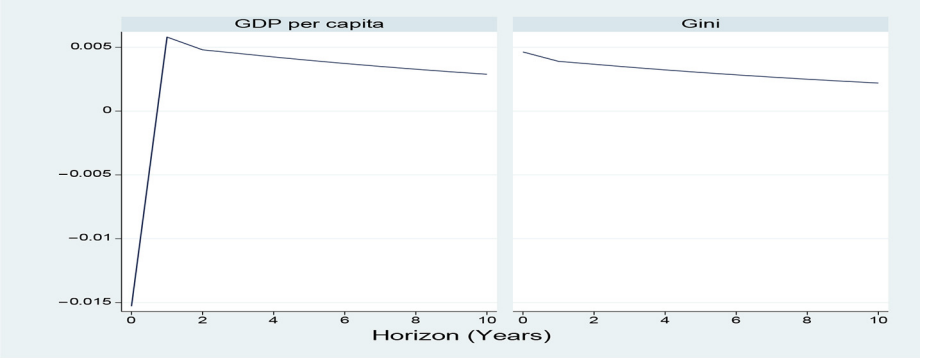

Figure 2. Responses to an expansionary monetary policy shock

Notes: This figure plots impulse responses of GDP per capita and the Gini coefficient to one standard deviation positive monetary policy shock. The vertical axis shows the response in percent

Our interest is to identify MP shocks; thus, we assume that output and prices would increase in response to monetary easing[12]. The identification procedures are applied on country level SVAR and MP shocks identified for each country. Following the transformations explained in Section 2, we generate the series of MP shocks identified by sign restriction and estimate the baseline specification in equation (3). The results of estimating equation (3) using the sign restricted shock series are reported in Table 4.

Using the shock series derived from the alternative identification of structural innovations in MP stance also has little impact on the results. The coefficient estimates show that income inequality increases in response to changes in MP but behaves countercyclically in its reaction to the combined effects of MP and FD.

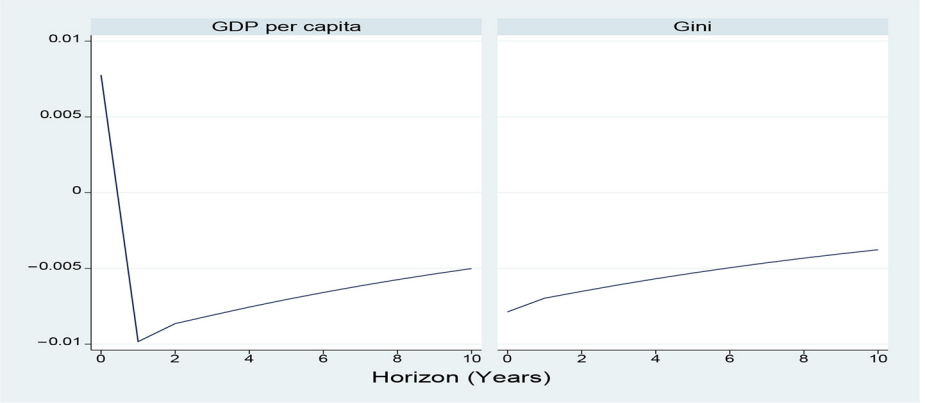

Figure 3. Responses to an expansionary monetary policy shock interacted with financial development

Notes: The figure plots impulse responses of GDP per capita and the Gini coefficient to one standard deviation positive monetary policy shock interacted with financial development. The vertical axis shows the response in percent

4. Conclusion

This paper investigates the importance of FD in evaluating the distributional effects of monetary policy. Our analysis provides evidence that MP has empirically significant redistributive effects: expansionary monetary policies lead to a significant increase in income inequality. When we examine the role of financial systems, we observe that FD plays a significant role in the transmission of MP shocks. Our results provide evidence that, although monetary easing may have adverse effects on income inequality, such effects reverse with FD. However, when the analysis is restricted to low-income countries, the inequality effect of the interaction between MP and FD is insignificant. We also examine the

Variable/shock	Demand	Supply/cost-push	Monetary policy
Output	+	−	+
Inflation	+	+	+
Interest rate	+	+	−

Table 3.
Sign restrictions for macro model shocks

Note: The sign restrictions are for positive demand and supply shocks and negative monetary policy shocks

Variable	1	2	3	4
Gini (t-1)	1.052*** (0.005)	1.033*** (0.009)	1.043*** (0.005)	1.053*** (0.009)
Gdppc	0.207*** (0.041)	0.359*** (0.049)	0.013 (0.068)	5.787*** (0.716)
MP	0.005** (0.002)	0.011*** (0.002)	0.010*** (0.001)	0.010*** (0.002)
FD	−1.446*** (0.079)			−2.465*** (0.898)
FD×MP	−0.001 (0.008)			
FI		−1.850*** (0.392)		
FI×MP		−0.016* (0.008)		
FM			1.694** (0.691)	
FM×MP			−0.057** (0.023)	
$gdppc^2$				−0.408*** (0.051)
FD^2				4.519*** (1.437)
Constant	−3.647*** (0.282)	−3.567*** (0.616)	−2.165*** (0.423)	−22.460*** (2.482)
Obs	418	418	418	418
N	32	32	32	32
Wald (p-value)	0.00	0.00	0.00	0.00
Sargan[p-value]	23.13[0.99]	25.20[0.99]	25.45[0.99]	26.31[0.98]
AR(1) test[p-value]	−3.86[0.00]	−3.81[0.00]	−4.02[0.00]	−3.47[0.00]
AR(2) test[p-value]	1.11[0.27]	1.25[0.21]	1.04[0.29]	1.52[0.13]

Table 4.
Results using sign restricted monetary policy shocks

Notes: This table presents the results from the regressions of income inequality on GDP per capita, monetary policy (MP), financial development (FD) and the interaction between monetary policy and financial development. The dependent variable is the net Gini coefficient. Columns 2 and 3 consider respectively, the financial institution (FI) and financial markets (FM) aspects of the financial system. Column 4 captures the hypothesized non-linear relationship between growth, financial development and inequality. The results reported in this table use monetary policy shocks identified by sign restrictions. *, ** and *** denote significance at the 10, 5 and 1% levels. Standard errors in parentheses. The results reported are for the two-step estimations and 3 maximum lags of the dependent variable are specified as instruments. For the estimation involving FI, the instrument specification includes 4 maximum lags of the dependent variables

redistributive effects of FD and find that while FI decrease income inequality, financial markets worsen the income gap. Both financial markets and FI, however, dampen the inequality effects of monetary policy.

The evidence from our sample presents important policy implications, as it highlights the critical role of the financial system in the transmission of MP shocks and the effectiveness of central bank actions. The results may suggest that less movement in policy positions is needed to achieve monetary objectives when the financial system is more developed. The findings of this paper may suggest that in a more developed financial system, central banks may accommodate adverse distributional consequences of MP actions as the reactions in the financial systems may alleviate such effects in the medium term. The evidence shows that both MP and FD contribute to the income gap. Notwithstanding, the impacts of the financial systems seem to becloud the inequality effects of MP and contribute more to the evolution of income inequality. The results of our framework indicate that a more market based financial system is most regressive. An economy with predominantly bonds and equity markets generates relatively high-income inequality. It does so because it raises the income of capital owners who usually form the top of the income ladder. A highly developed bank-based financial system produces the highest levels of aggregate welfare. The improved capital formation generates the highest levels of economic activity and enhances the incomes and welfare of each group.

Future work can build on these empirical results in several ways. First, by obtaining measures of stock and bond markets developments to ascertain which financial market arrangement is more regressive and how the interest rate exposure channel operates in these systems. Second, by performing the analysis across groups of agents or regions to enhance the debate on the role of the financial systems in the redistributive effects of monetary policy. On the nexus between income inequality and FD, the analysis can be performed for different periods for countries with data for longer periods, to evaluate if the evolution of the financial system shapes the moderating role of FD on the distributional consequences of monetary policy.

Notes

1. See Colciago, Samarina and de Haan (2019) for a detailed review of the literature.
2. Ahiadorme (2021) and Saiki and Frost (2014) find that using monetary base, broad money and central bank assets as measures of monetary policy produces very similar results in the impulse responses in SSA and Japan.
3. For notational convenience, deterministic terms are excluded from the model, as they do not affect and are not affected by the impulses hitting the system. Likewise, exogenous variables may be ignored for the present purpose, as they may not react to the stochastic shocks of the system (Lütkepohl, Krätzig and Phillips, 2004; Samarina and Nguyen, 2019)
4. Excluding the constant and the control variable (real GDP per capita) has little impact on the results.
5. See Svirydzenka (2016) for the details of the methodology applied in the index construction.
6. The reforms included mainly financial and interest rate liberalization, financial markets development and improved financial infrastructure.
7. We investigate the hypothesis that inequality is a non-linear function of income and financial development by estimating a quadratic model of the form:

$$Inq_{i,t} = \alpha_0 + \alpha_1 Inq_{i,t-1} + a_2 gdppc_{i,t} + \alpha_3 FD_{i,t} + \alpha_4 MP_{i,t} + \alpha_5 gdppc^2_{i,t}$$

This hypothesis implies that the income and financial development elasticities of the Gini coefficient – equal to $\alpha_2 + 2\alpha_5 gdppc$ and $\alpha_3 + 2\alpha_6 FD$ – are not constant but depend on the level of income and financial development, respectively.

8. The categorisation into low income and emerging economies is according to IMF income classification. Due to insufficient observations, the analysis is not performed for the emerging economies.
9. Benin, Burkina Faso, Cameroon, Central African Republic, Côte D'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo
10. The analysis is not performed for the countries within the CFA franc zone due to insufficient observations.
11. We test for the presence of a unit root in the series (Appendix – Table A4) and estimate the PVARX on stationary variables (with those of order 1 first differenced). Estimating the PVARX with p = *2* lags of endogenous variables leaves the results unchanged.
12. We exploit the MATLAB codes by Breitenlechner, Geiger and Sindermann (2018) to estimate the sign restricted model *à la* Uhlig (2005) *and* Rubio-Ramirez *et al.* (2010)

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Appendix

Table A1. Robustness to the exclusion of South Africa

Variable	1	2	3	4
Gini (t-1)	1.039*** (0.017)	1.024*** (0.015)	1.042*** (0.006)	1.074*** (0.015)
Gdppc	0.304*** (0.067)	0.332*** (0.057)	−0.045 (0.047)	5.264*** (1.291)
MP	0.032*** (0.004)	0.030*** (0.005)	0.006*** (0.001)	0.008*** (0.002)
FD	−3.341*** (0.438)			−4.031*** (0.875)
FD×MP	−0.200*** (0.021)			
FI		−2.265*** (0.219)		
FI×MP		−0.105*** (0.014)		
FM			2.717*** (0.756)	
FM×MP			0.053 (0.052)	
$gdppc^2$				−0.369*** (0.092)
FD^2				8.204*** (2.116)
Constant	−3.432*** (0.835)	−2.893*** (0.902)	−1.730*** (0.270)	−21.560*** (4.171)
Obs	403	403	403	403
N	31	31	31	31
Wald (p-value)	0.00	0.00	0.00	0.00
Sargan[p-value]	22.14[0.99]	25.62[0.98]	14.98[0.99]	26.42[0.99]
AR(1) test[p-value]	−4.12[0.00]	−3.81[0.00]	−3.71[0.00]	−3.68[0.00]
AR(2) test[p-value]	0.71[0.48]	0.88[0.38]	0.21[0.84]	0.86[0.38]

Notes: This table presents the results from the regressions of income inequality on GDP per capita, monetary policy (MP), financial development (FD) and the interaction between monetary policy and financial development. The dependent variable is the net Gini coefficient. Columns 2 and 3 consider respectively, the financial institution (FI) and financial markets (FM) aspects of the financial system. Column 4 captures the hypothesized non-linear relationship between growth, financial development and inequality. The results reported in this table exclude South Africa from the sample. *, ** and *** denote significance at the 10, 5 and 1% levels. Standard errors in parentheses. The results reported are for the two-step estimations and 2 maximum lags of the dependent variable are specified as instruments. For the estimation involving FM and square terms (Column 4), the instrument specification includes 3 maximum lags of the dependent variables

Variable	1	2	3	4
Gini (t-1)	1.057*** (0.014)	1.062*** (0.018)	1.055*** (0.013)	1.048*** (0.012)
Gdppc	0.295*** (0.078)	0.240** (0.093)	0.113* (0.061)	5.751*** (1.684)
MP	0.005 (0.014)	0.011** (0.005)	0.013** (0.005)	0.010*** (0.003)
FD	−2.100*** (0.755)			−6.172** (2.974)
FD×MP	0.035 (0.126)			
FI		−1.309*** (0.434)		
FI×MP		−0.010 (0.022)		
FM			0.188 (1.083)	
FM×MP			−0.260 (0.277)	
$gdppc^2$				−0.425*** (0.127)
FD^2				22.064* (13.264)
Constant	−4.236*** (0.703)	−4.075*** (0.916)	−3.192*** (0.794)	−21.089*** (5.491)
Obs	341	341	341	341
N	26	26	26	26
Wald (p-value)	0.00	0.00	0.00	0.00
Sargan[p-value]	13.47[0.99]	13.44[0.99]	18.67[0.99]	18.83[0.93]
AR(1) test[p-value]	−3.50[0.00]	−3.63[0.00]	−4.37[0.00]	−3.53[0.00]
AR(2) test[p-value]	0.29[0.77]	0.31[0.76]	0.93[0.35]	0.50[0.62]

Notes: This table presents the results from the regressions of income inequality on GDP per capita, monetary policy (MP), financial development (FD) and the interaction between monetary policy and financial development. The dependent variable is the net Gini coefficient. Columns 2 and 3 consider respectively, the financial institution (FI) and financial markets (FM) aspects of the financial system. Column 4 captures the hypothesized non-linear relationship between growth, financial development and inequality. The results reported in this table exclude middle-income countries from the sample. *, ** and *** denote significance at the 10, 5 and 1% levels. Standard errors in parentheses. The results reported are for the two-step estimations and 4 maximum lags of the dependent variable are specified as instruments. For the estimation involving FI and square terms (Column 4), the instrument specification includes 3 and 1 maximum lags of the dependent variables, respectively

Table A2. Results for low-income countries

Variable	1	2	3	4
Gini (t−1)	1.022*** (0.016)	1.001*** (0.021)	1.013*** (0.021)	1.023*** (0.014)
Gdppc	0.008 (0.085)	0.222** (0.092)	−0.068 (0.071)	−2.367 (1.747)
MP	0.012 (0.013)	0.014 (0.009)	0.002 (0.003)	−0.005 (0.004)
FD	0.512 (0.540)			−3.727* (2.234)
FD×MP	−0.089 (0.069)			
FI		−1.137** (0.510)		
FI×MP		−0.049*** (0.018)		
FM			1.564*** (0.601)	
FM×MP			−0.051*** (0.018)	
$gdppc^2$				0.172 (0.124)
FD^2				6.032* (3.297)
Constant	−1.169 (0.968)	−1.285 (1.094)	−0.237 (0.996)	7.309 (6.293)
Obs	300	300	300	300
N	22	22	22	22
Wald (p-value)	0.00	0.00	0.00	0.00
Sargan[p-value]	12.78[0.99]	11.41[0.99]	10.09[0.99]	9.47[0.99]
AR(1) test[p-value]	−2.91[0.00]	−3.06[0.00]	−3.18[0.00]	−3.21[0.00]
AR(2) test[p-value]	0.79[0.43]	1.17[0.24]	0.82[0.41]	1.32[0.19]

Notes: This table presents the results from the regressions of income inequality on GDP per capita, monetary policy (MP), financial development (FD) and the interaction between monetary policy and financial development. The dependent variable is the net Gini coefficient. Columns 2 and 3 consider respectively, the financial institution (FI) and financial markets (FM) aspects of the financial system. Column 4 captures the hypothesized non-linear relationship between growth, financial development and inequality. The results reported in this table exclude CFA countries from the sample. *, ** and *** denote significance at the 10, 5 and 1% levels. Standard errors in parentheses. The results reported are for the two-step estimations and 2 maximum lags of the dependent variable are specified as instruments

Table A3.
Results for non-CFA countries

	LLC		ADF-Fisher	
Variables	Level	First difference	Level	First difference
Gini	−3.99**	−2.64**	67.45**	31.73*
MP	−15.38**	−14.67**	191.92**	186.12**
FD	3.75	−11.37**	2.61	135.13**
GDP per capita	9.77	−5.49**	1.59	74.82**
MP*FD	−14.88**	−15.91**	185.02**	178.19**

Note: * and ** Indicate significance at the 1 and 5% level

Table A4.
Panel unit root tests

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