

The impact of macroeconomic factors on income inequality: Evidence from the BRICS

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Highlights

- The relationship between macroeconomic variables and income inequality is examined.
- Main emphasis is on Brazil, Russia, India, China and South Africa from 2001 to 2015.
- Increases in inflation and income growth lead to increases in income inequality.
- For BRICS nations, higher real interest rates increase income inequality post-2008.
- Monetary policy for macroeconomic stabilization alters the distribution of income.

Abstract

In this paper we investigate how the evolution of income growth, real interest rates, and inflation have driven income inequality across a variety of countries with particular focus on the BRICS economies (Brazil, Russia, India, China, and South Africa) during the period 2001 to 2015. Our work suggests that, when central banks of the BRICS economies use monetary policy for macroeconomic stabilization, they need to consider the impact monetary policy changes have on the distribution of income in their nations. Our estimates reveal that the unintended consequence of policies that induce economic growth and higher prices is higher income inequality. We find that the positive relationship between the three macroeconomic variables and income inequality for the BRICS economies is stronger during the post-2008 period.

Keywords

Monetary policy; Inflation; Income growth; Interest rates; Emerging economies; BRICS

JEL classification

D31; E40; O11

1. Introduction

Many studies have analyzed the impact of inflation, interest rates, and income growth on income inequality but rarely all together in a dynamic setting. Some recent studies, such as Jawadi et al. (2014a) and Jawadi et al. (2014b), have investigated monetary policy's effects on BRICS nations but did not focus specifically on income inequality. Further, relatively few papers have investigated developing countries and income inequality. Early work by Kuznets (1955) suggests that, during the course of a country's development, income inequality initially increases and then declines over time. Similarly, Paukert (1973) finds evidence that

intra-country income inequality rises and then falls with economic development. Summers et al. (1984) examine inter-country inequality and show that income inequality dropped sharply across industrialized countries from 1950 to 1980, declined slightly for middle income countries, and rose slightly for low income nations. Other authors have focused on financial development and income inequality. Greenwood and Jovanovic (1989) show that, as income levels rise within a country, the financial sector becomes larger, which supports economic growth but widens the income gap between rich and poor. They also show that, as the economy develops a fully formed financial sector, it will reach a more stable distribution of income and have a higher growth rate than in its early stage of development. Agnello et al. (2012) show that financial reforms, such as removal of subsidized directed credit, reductions in excessively high reserve requirements, and improvements in securities market policy support a more equal distribution of income. Work by Demirguc-Kunt and Levine (2009) also suggests financial development can help lower income inequality. In contrast, de Haan and Sturm (2017) find that increased financial liberalization increases income inequality.² Ang (2010) finds that financial development, by reducing financial market frictions, helped the economic well-being of the poor in India. However, Ang finds liberalization of the financial sector seems to have favored upper income earners. Based on recent data, income inequality across countries, particularly OECD countries, is at its highest level in the past half century.³ Given this information, we expect that the benefits of economic growth have not been equally distributed across countries, leading to higher income inequality.

This paper adds to the existing literature by investigating how the evolution of income growth, interest rates, and the price level have driven income inequality across a variety of countries during the period 2001 to 2015. We believe this is a substantial contribution as relatively few studies have focused on how macroeconomic variables influence income inequality across developing countries. We also contribute to the existing literature by specifically examining how the three variables impacted income inequality in Brazil, Russia, India, China, and South Africa (known as the BRICS economies). Since these five countries are the biggest and fastest growing emerging markets and have accounted for fully 56 percent of global growth since 2008, our analysis shows how changes in the three variables across the BRICS countries have impacted their distribution of income.⁴ We note that, recently, these five economies have experienced slowdowns in income growth due to structural problems that are likely to persist.⁵ We are also interested in potential differences in the impact of the three macroeconomic variables on the BRICS countries compared to the entire sample. We believe this broad focus and special attention to the BRICS nations is useful as the results compare developed and emerging economies.

To preview, our results suggest that increases in inflation and real income growth contribute to increases in income inequality. For the entire sample, we find some evidence that increases in real interest rates correspond with higher income inequality; however, not all of the results are statistically significant. The results also reveal that the positive relationship between the three macroeconomic variables and income inequality for the BRICS economies is stronger when compared to the full sample and after 2008. A variety of sensitivity tests were also conducted for robustness.

The rest of the paper is structured as follows. Section 2 covers the literature relating to the three macroeconomic variables and income inequality. Section 3 describes the data used and the modeling technique. Section 4 presents results. Section 5 contains additional sensitivity tests, and Section 6 concludes.

2. Literature review

Fisher (1933) explains the interaction of changes in income, interest rates, and the price level with the existing level of debt. Mason and Jayadev (2014) break down the contributions of inflation, income growth, and interest rates to the net levels of U.S. consumer debt. They show that, since 1980, the effective interest rate in the U.S. has been higher than income growth and inflation, increasing real debt burdens. Das (2011), using data from the United Kingdom and the United States, gets similar results to Mason and Jayadev (2014). Although these authors focus on how income growth, inflation, and interest rates affect debt levels, we expand the focus to income inequality.

The possible channels through which the interest rate, inflation, and income growth can impact income inequality are detailed below. First, if the interest rate increases, households face higher debt service on their mortgages and other liabilities. Since the top 1% in the income distribution typically have little debt and more savings, then increases in interest rates could harm those at the bottom and help those at the top of the income distribution (through a higher returns on savings and minimal effect on the lower debt service levels for higher income households).⁶ Also, lower-income households are more likely to be unemployed if monetary contractions occur and slow economic growth. This is known as the earnings heterogeneity channel through which monetary policy can impact income inequality (Coibion et al. (2017)). Colciago et al. (2019) show that low interest rates may increase income inequality by boosting capital gains. Auclert (2019) also claims that low rates can increase asset prices, which may exacerbate income inequality. This is known as the financial segmentation channel of monetary policy. The financial segmentation channel can increase income inequality when an expansionary monetary policy shock occurs.

Further, rising inflation means the real value of income is being eroded relatively faster. Romer and Romer (1999) show cross-sectional evidence that low inflation and stable aggregate demand growth are associated with the improved well-being of the poor in the long run. Easterly and Fischer (2001) find that inflation harms the well-being of the poor. They also document that the poor are more likely than the rich to mention inflation as a top concern. Bhattacharya et al. (2001) show that high income households have a larger share of their savings in real assets, so low income households are relatively more vulnerable to inflation. Li and Zou (2002) show that inflation worsens income inequality by increasing the income share of the rich. Albanesi (2007) also shows that rising inflation corresponds with increases in income inequality. The positive correlation between inflation and inequality remains strong even after controlling for GDP per capita. Further, Balcilar et. al (2018) show that, for U.S. states, inflation above roughly 3 percent is harmful to income inequality but levels below the 3 percent level can help reduce income inequality. Considering all the evidence, we expect that higher prices further exacerbate income inequality across the countries analyzed.

Lastly, economic growth could increase or decrease income inequality depending on one's perspective. As mentioned in the introduction, Kuznets (1955) suggests that income inequality initially increases in the early stages of development (when incomes are rising most rapidly) and then declines over time. Paukert (1973) reports a similar result to Kuznets. Greenwood and Jovanovic (1989) show, as income levels rise within a country, the financial sector becomes larger, which further supports economic growth and can widen the income gap between rich and poor. However, in many developed nations, such as the U.S. and U.K., income inequality has risen along with overall economic growth. Thus, it is not clear what the expected effect of economic growth may be on the BRICS nations' levels of income inequality.

3. Data and summary statistics

We build a country-level panel dataset that includes information on income inequality, real interest rates, inflation, and real income growth. The countries in the sample and the years covered are summarized in Table 1. The data are annual and span from 2001 to 2015, providing 480 country/year observations.⁷ We believe that cross-country data provides us with an adequate number of observations and allows us to use more recent data to understand the relationship between the three macroeconomics variables (inflation, income growth, and the real interest rate) and income inequality.

Our key measure of income inequality is the pre-tax national income share of adults in the Top 1% of the income distribution. This data is from the World Inequality Database. The measure is calculated as the sum of all pre-tax personal income flows accruing to the owners of the production factors, labor and capital, before taking into account the operation of the tax/transfer system (but including pension holdings). The population is individuals over the age of 20. From Table 2, we can see that, on average, 13.2% of pre-tax national income has gone to adults in the Top 1% of the income distribution. Fig. 1, Fig. 2 show time series of the Top 1% for the entire sample and specifically for the BRICS economies. Fig. 1 indicates that the income share of the Top 1%, on average, increased from 12% (in 2001) to almost 14% (in 2007). Due to the global economic crisis of 2008–2009, the income share of the Top 1% dropped to roughly 13.2% and remained steady at this level for almost 5 years. From 2014 to 2015, we observe increases in the income share of the Top 1%; however, the level was still below the pre-crisis level. Interestingly, from Fig. 2, the pre-tax national income share going to the Top 1% has been relatively larger for the BRICS economies. Particularly, the income share of the Top 1%, on average, was 19% and increased to 22% in 2007. The global economic crisis of 2008–2009 lead to slight decreases in the income share of the Top 1% for the BRICS nations. Since then, the income share for the Top 1% has remained relatively steady within the BRICS economies.

Table 1

Summary statistics for countries in the sample, 2001–2015.

Countries	mean(Top 1%)	mean(income)	mean(infl)	mean(rir)	sd(Top 1%)	sd(income)	sd(infl)	sd(rr)
Australia	8.55	1.46	2.77	1.73	0.53	0.94	0.86	1.10
Brazil	27.89	1.76	6.70	7.20	0.84	2.75	2.64	4.21
Canada	13.97	0.96	1.79	0.67	0.74	1.58	0.59	1.35
Chile	22.40	3.09	6.09	-1.27	1.86	2.18	2.22	0.96
China	14.00	9.07	2.38	0.93	1.20	1.99	2.02	1.91
Colombia	19.69	3.03	4.87	1.20	1.13	1.68	2.00	1.70
Czech Republic	9.26	2.53	2.19	-1.00	0.83	3.12	1.68	1.36
Denmark	6.00	0.49	1.83	0.00	0.40	1.99	0.84	1.36
Finland	8.06	0.79	1.58	0.73	0.71	3.26	1.27	1.49
France	11.10	0.54	1.51	0.27	0.45	1.34	0.80	1.28
Germany	12.73	1.23	1.49	0.27	1.15	2.56	0.68	1.28
Hungary	9.59	2.29	4.49	2.60	0.40	3.06	2.61	1.35
India	19.78	5.75	6.95	-0.13	1.86	2.08	2.90	2.88
Ireland	9.95	3.23	1.98	-0.40	0.70	6.86	2.61	1.80
Italy	9.43	-0.40	1.93	-0.13	0.17	2.15	1.00	1.25
Japan	10.45	0.77	0.07	0.27	0.57	2.11	1.01	0.96
Korea	10.77	3.39	2.76	0.53	1.22	1.74	1.12	0.99
Lebanon	22.66	0.52	3.98	1.73	0.97	4.96	2.52	2.99
Netherlands	6.58	0.74	1.94	-0.20	0.33	1.93	0.96	1.26
New Zealand	8.26	1.66	2.28	2.47	0.51	1.43	1.07	2.00
Norway	8.90	0.66	1.90	1.40	2.44	1.49	0.91	2.03
Poland	12.20	3.68	2.39	3.27	0.90	1.71	1.74	3.35
Portugal	9.65	0.17	2.10	-0.33	0.25	1.87	1.55	1.35
Russian Fed.	22.84	3.88	11.29	0.73	2.36	4.68	4.35	2.79
Slovenia	7.05	1.71	3.18	-0.13	0.23	3.73	2.58	1.19
South Africa	18.39	2.92	5.35	2.53	1.11	1.98	2.66	2.72
Spain	9.68	0.52	1.91	-0.13	1.21	2.29	1.26	1.13
Sweden	8.69	1.48	1.24	0.60	0.64	2.72	1.23	0.91
Switzerland	10.52	0.82	0.46	0.07	0.74	1.72	0.88	0.88
Turkey	20.05	3.66	14.72	5.73	1.66	4.82	14.75	10.74
United Kingdom	13.92	1.06	2.04	0.61	1.01	1.91	0.91	2.38
United States	19.16	1.03	2.16	-0.55	1.20	1.58	1.17	1.47

Table 2

Summary statistics for the entire sample.

Variable	N	Mean	SD
Top 1%	480	13.19	5.77
Inflation	480	3.38	4.30
Real Interest Rate	480	0.97	3.13
Income Growth	480	2.01	3.28

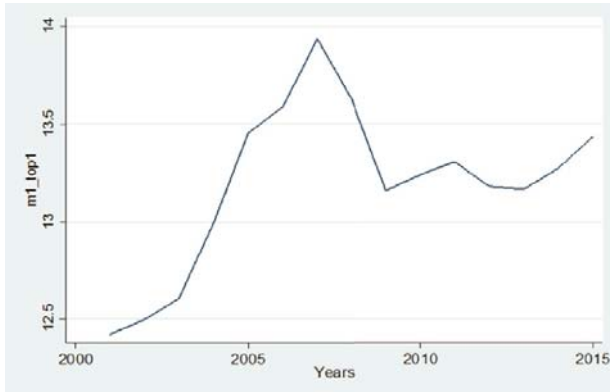


Fig. 1. Top 1% income share, entire sample.

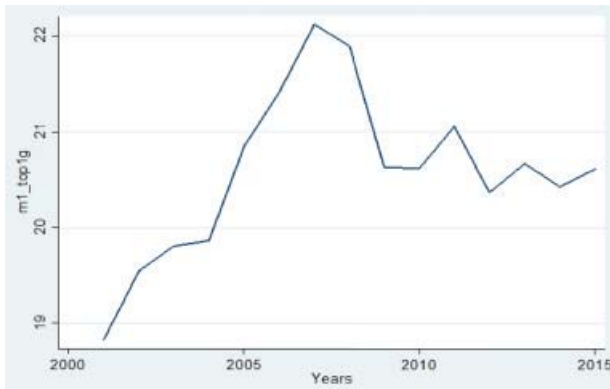


Fig. 2. Top 1% income share, BRICS only.

The real interest rate is calculated as the difference between the nominal interest rate and the inflation rate. *Immediate rates: Less than 24 Hours* is used as a measure for the nominal interest rate. We use this rate as it is the only interest rate measure available for all the countries in the sample. The percentage change in the *Consumer Price Index: All Items* is used to measure inflation. All the data used to calculate real interest rates and inflation were retrieved from FRED. From Table 2, we can see that, on average, real interest rates across the countries analyzed have been around 1%. Fig. 3, Fig. 4 present the time series of real interest rates from the entire sample and the BRICS economies, respectively. In both scenarios, we observe a downward trend in real rates from 2001 to 2010, where they reached negative values. The trend reversed for the entire sample, but rates remained relatively low and did not reach positive values until 2015. For the BRICS economies, real

interest rates reached negative values briefly but became positive more quickly than for the entire sample.

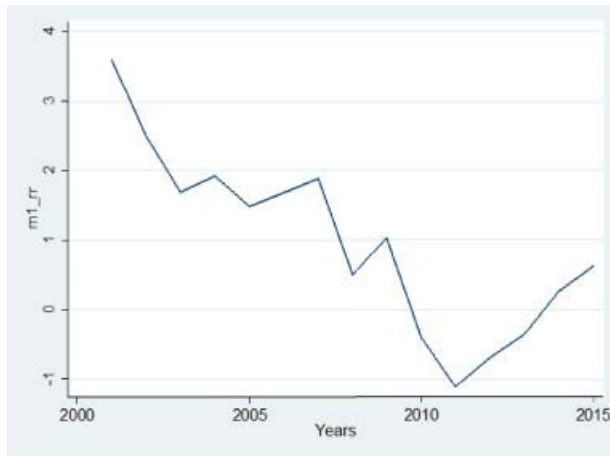


Fig. 3. Real interest rate, entire sample.

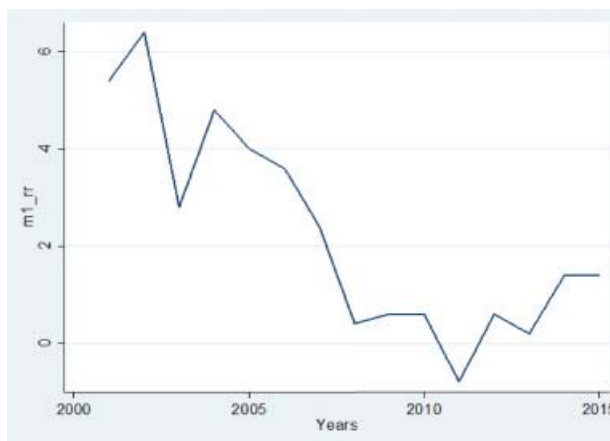


Fig. 4. Real interest rate, BRICS only.

Income growth is defined as the percent change in real GDP per capita. The data was retrieved from FRED. Table 2 indicates that income growth across the entire sample has been around 2%. From Fig. 5, Fig. 6, we can see that, prior to the Great Recession, economic growth was trending up for both the entire sample and the BRICS economies. Looking at Fig. 6, annual growth rates for the BRICS economies increased from 4% to 8%. Then, due to the Great Recession, we observe economic growth slowing, but the income growth rate never goes negative for the BRICS economies. However, the average annual income growth rate for all the countries included in the sample reached -2% in 2009, but the trend quickly reversed and has stayed around 2% since that time. Comparing Fig. 5, Fig. 6, we see some interesting differences in the patterns of income growth between the entire sample and the BRICS economies during the last five years of the sample period. Income growth for the entire sample trends upward; whereas, income growth for the BRICS is in a secular decline, indicating that they are facing common challenges that are not likely to go away.⁸ For

instance, Brazil, Russia, and South Africa's economies are growing slowly due to excessive dependence on commodities.⁹

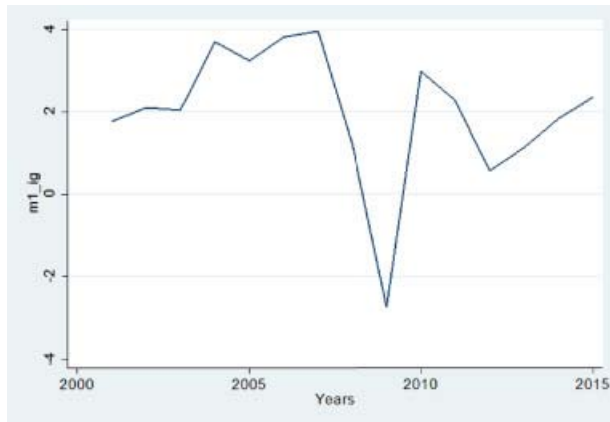


Fig. 5. Income growth, entire sample.

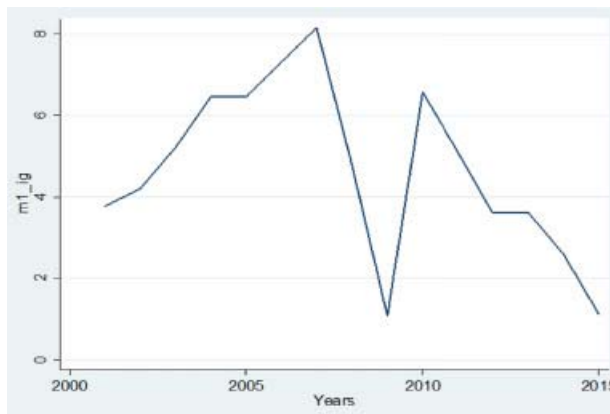


Fig. 6. Income growth, BRICS only.

As mentioned earlier, the percentage change in the *Consumer Price Index: All Items* is used to measure inflation. From Table 2, we can see that inflation, on average, has been around 3.4%. Fig. 7 shows inflation was in decline from 2001 to 2005. Then, there was an increase in prices from 2005 to 2008. After that, prices start to drop again, most likely due to the overall drop in aggregate demand from the Great Recession. Interestingly, looking at Fig. 8, we can see that the BRICS economies, right after 2010, experienced short-term disinflation. After that, inflation picks up again.

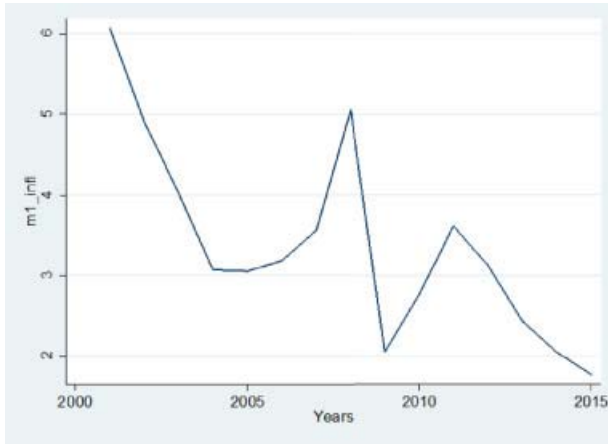


Fig. 7. Inflation, entire sample.

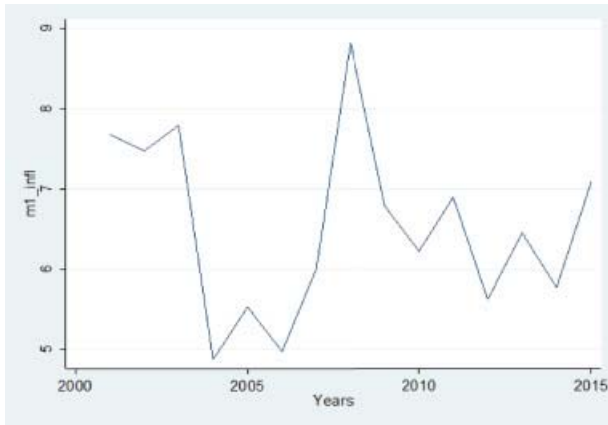


Fig. 8. Inflation, BRICS only.

4. Model specification and empirical results

4.1. Model specification

To examine the relationship between the three macroeconomic variables and income inequality, the following model is estimated:

$$Inequality_{i,t} = \lambda_i + \delta_t + \beta_1 Infl_{i,t} + \beta_2 Income_{i,t} + \beta_3 Realrates_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where $Inequality_{i,t}$ is the pre-tax national income share of adults in the Top 1% of the income distribution for country i in period t . $Infl_{i,t}$, $Income_{i,t}$ and $Realrates_{i,t}$ capture the inflation rate, real income growth, and the real interest rate for country i in period t . λ_i and δ_t are country and year-specific effects that measure unobserved heterogeneity across countries and years that might be correlated with the regressors in (1). In addition, δ_t

controls for a time trend in case such a trend drives the association among the variables analyzed in (1). As such, Model 1 allows us to analyze the within and cross-country variation of income inequality due to changes in inflation, real income growth, and real interest rates.

To accommodate any potential cross-country heterogeneity in the income inequality dynamics, we also estimate a mean group estimator as implemented by Pesaran and Smith (1995). The mean group estimator does not require that the dynamics of income inequality and the transmission mechanisms of changes in income growth, inflation, and the real interest rate in the model specification be the same, which could introduce estimation bias in specification (1). The method of Pesaran and Smith allows us to account for differences across countries in the transmission of changes in the three macroeconomics variables on the variation in income inequality. In addition, we use the common correlated effects estimator from Ditzgen (2018) and the package he created in STATA (xtdcce2). The common correlated effects (CCE) estimator is used to evaluate the following equation:(

$$y_{i,t} = \alpha_i + \beta_i x_{i,t} + u_{i,t} \quad (2)$$

$$u_{i,t} = \gamma_i f_t + e_{i,t} \quad (3)$$

where f_t is an unobserved common factor and γ_i is a heterogeneous factor loading (Ditzen, 2018). y is the income inequality measure and x includes the three macroeconomic variables. The heterogeneous coefficients are randomly distributed around a common mean such that $\beta_i = \beta + v_i$ where $v_i \sim IID(0, \Omega_v)$. Equation (2) can be estimated consistently by approximating the common factors with cross-section means \bar{x}_t assuming the strict exogeneity of the $x_{i,t}$. Further, to distinguish the impact of the three macroeconomic variables on income inequality for the BRICS economies specifically, in Model 1 we introduce an interaction term between the dummy variable (that take a value of 1 when the country is part of the BRICS group and zero otherwise) and the macroeconomic variables. Particularly, we estimated the following model:

$$\begin{aligned} Inequality_{i,t} = & \lambda_i + \delta_i + \beta_1 Inflation_{i,t} + \beta_2 Income_{i,t} + \beta_3 Realrates_{i,t} + \beta_4 (d_1 * Inflation_{i,t}) + \\ & + \beta_5 (d_1 * Income_{i,t}) + \beta_6 (d_1 * Realrates_{i,t}) + \epsilon_{i,t} \end{aligned} \quad (4)$$

Where d_1 takes a value of 1 when the country is part of the BRICS group, and zero otherwise. Thus, from the above model, the impact of the three macroeconomic variables on income inequality for the BRICS economies is as follows:

$$\frac{\partial Inequality}{\partial Inflation} = \beta_1 + \beta_4$$

$$\frac{\partial Inequality}{\partial Income} = \beta_2 + \beta_5$$

$$\frac{\partial Inequality}{\partial Realrates} = \beta_3 + \beta_6$$

Table 3

Macroeconomic Variables and Income Inequality: Including all countries in the sample.

<!--Col Count:11-->All countries using Top 1%	Dependent variable: $(Top\ 1)_{it}$									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$(inflation)_{it}$	0.083*** (0.0226)	0.0794** (3.48)	0.114*** (5.44)	0.128* (2.11)	0.168** (3.25)	0.080*** (0.022)	0.0454* (0.025)	0.043** (0.02)	0.084*** (0.018)	0.082*** (0.019)
$(real\ rates)_{it}$	-0.0145 (0.0224)	-0.015 (-0.67)	0.0354* (1.87)	0.0459 (0.66)	0.114** (2.15)	-0.018 (0.022)	0.0151 (0.017)	0.0157 (0.017)	0.051** (0.024)	0.0512** (0.024)
$(real\ income)_{it}$	0.086*** (0.030)	0.084** (2.80)	0.118** (2.82)	0.081*** (3.45)	0.065*** (3.81)	0.065** (0.030)	0.047*** (0.016)	0.047** (0.016)	0.078** (0.020)	0.077*** (0.019)
$(real\ income^2)_{it}$						0.0038 (0.0026)				
<i>BRICS_inflation</i>							0.179*** (0.056)	0.154** (0.021)	0.182*** (0.048)	0.162*** (0.0545)
<i>BRICS_real rates</i>							-0.089** (0.042)	-0.107** (0.045)	-0.025 (0.0473)	-0.0403 (0.051)
<i>BRICS_real income</i>							0.242*** (0.037)	0.237*** (0.039)	0.206*** (0.0507)	0.203*** (0.052)
Fixed Effects		✓	✓			✓		✓		✓
Time Effects			✓						✓	✓
DCCE				✓						
MG					✓					
Trend				✓	✓					
Observations	480	480	480	480	480	480	480	480	480	480
R-sq	0.23	0.22	0.25	0.66		0.21	0.26	0.34	0.33	0.33

Table 4

Macroeconomic Variables and Income Inequality: Including only emerging economies.

<!--Col Count:--11-->Emerging economies only using Top 1%		<i>Emerging Economies: Dependent variable: (Top 1)_{it}</i>								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	<i>(inflation)_{it}</i>	0.099** (0.025)	0.098*** (0.025)	0.138*** (0.021)	-0.023 (0.063)	0.041 (0.042)	0.094*** (0.024)	0.059** (0.025)	0.058** (0.025)	0.117** (0.011)
	<i>(real rates)_{it}</i>	-0.041 (0.029)	-0.0415 (0.0302)	0.0530** (0.018)	-0.168 (0.106)	-0.096 (0.079)	-0.049* (0.026)	-0.017 (0.021)	-0.016* (0.021)	0.038* (0.018)
	<i>(real income)_{it}</i>	0.098* (0.055)	0.0988 (0.0559)	0.170** (0.076)	0.137*** (0.046)	0.118** (0.047)	0.039 (0.055)	0.0157 (0.022)	0.0164 (0.022)	0.089** (0.039)
	<i>(real income^2)_{it}</i>						0.018*** (0.004)			
	<i>BRICS_inflation</i>							0.146** (0.062)	0.139* (0.065)	0.154** (0.051)
	<i>BRICS_real rates</i>							-0.068 (0.048)	-0.075 (0.048)	0.062 (0.041)
	<i>BRICS_real income</i>							0.267*** (0.044)	0.268*** (0.043)	0.239*** (0.066)
Fixed Effects			✓	✓			✓			✓
Time Effects				✓					✓	✓
	DCCE				✓					
	MG					✓				
	Trend				✓	✓				
	Observations	195	195	195	195	195	195	195	195	195
	R-sq	0.07	0.07	0.13	0.69		0.10	0.10	0.10	0.22

4.2. Empirical results

Table 3 shows how the three macroeconomic variables have impacted income inequality from the various specifications of Model 1. Unless otherwise noted, the estimations are done using ordinary least squares regression (OLS). Column 1 shows the magnitude of the association between the three macroeconomic variables and income inequality without controlling for country and year effects. Columns 2 and 3 show the magnitude of the association when we control for country effects (Column 2) and country and year effects (Column 3). Across all three specifications, the inflation rate corresponds with higher income inequality. Particularly, from Columns 1 and 2, we see that per one standard deviation (4.3%) increase in inflation, income inequality increases by about 0.3 percent. Once we control for both country and year effects (Column 3), the size of the association increases. Per one standard deviation increase in inflation, income inequality increases by approximately 0.5 percent. Even though, the results are not statistically significant across all four estimated models, there is some evidence that higher real interest rates correspond with higher income inequality across the countries analyzed. The results also show that increases in income growth are associated with higher income inequality, showing evidence that economic growth over the last two decades has mainly benefited individuals in the upper end of the income distribution. Per one standard deviation increase in income growth (3.3%), income inequality increases by about 0.3 percent. As before, the size of the association increases once we control for both country and year effects (Column 3). Since Kuznets (1955) suggests that income inequality initially increases in the early stages of development (when incomes are rising most rapidly) and then declines over time, in Model 1 we included income squared to capture the “Kuznets effect.” The estimated coefficient is not statistically significant (Column 6). As such, given our sample and time period, we do not find statistical evidence that advances in development drive income inequality down. In fact, the coefficient is positive.

MG and DCCE estimators from Columns 4 and 5, allow for cross-country heterogeneity and do not require that the dynamics of the economies in the panel be the same. Overall, the results are consistent with the earlier findings. Per one standard deviation increase in inflation, income inequality increases by 0.55 percent (Column 4). Similarly, per one standard deviation increase in income growth, income inequality increases by 0.26 percent (Column 4). The results, again, show that increases in real interest rates correspond with higher income inequality. Results from the MG estimator indicate that, per one standard deviation increase in real interest rates (3.1%), income inequality increases by 0.35 percent. However, the DCCE estimator is not statistically significant.

Columns 7 and 8 show the results for the BRICS economies. The results show that the size of the association between the three macroeconomic variables and income inequality within the BRICS economies is larger. Particularly, per one standard deviation increase in inflation, income inequality within the BRICS countries increases by almost 1 percent. Similarly, per one standard deviation increase in income growth, income inequality within the BRICS countries increases by about 0.95 percent. Interestingly, the results show that increases in real interest rates correspond with lower income inequality within the BRICS countries. So, it is lower real interest rates that have contributed to further increases in income inequality in the BRICS economies. Particularly, per one standard deviation increase in real interest rates,

income inequality decreases by about 0.3 percent. Columns 9 and 10 show the findings after controlling for year effects and both year and country effects. Similar to earlier results, inflation and income growth contribute to higher top income shares for the BRICS countries. However, the negative impact of the real interest rate becomes statistically insignificant. Note, controlling for year effects implies controlling for a common time trend between the three macroeconomic variables and income inequality. Since the negative impact of real interest rates on top income shares is significant when we remove the year effects (Columns 7 & 8), we can at least say that real interest rates and top income shares for BRICS countries are negatively correlated.

5. Sensitivity analysis

5.1. Sub-sample analysis

In this section, we present the evidence from estimating specifications of Model 1 only for countries that are considered emerging economies.¹⁰ Table 4 shows the results restricting the sample to emerging economies only. Overall, the results show that inflation and real income growth contribute to higher income inequality for emerging economies, which corresponds with previous results. Note that, for most specifications, the relationship between real interest rates and income inequality is negative. However, not all estimated parameters are statistically significant. Column 6 shows the results for the specification that includes income squared to capture the “Kuznets effect.” The estimated coefficient is statistically significant, but positive. As such, based on our sample and time period, the findings suggest that economic growth in emerging economies drives income inequality up. This is in contrast to what Kuznets (1955) suggested would happen in the development cycle. In regard to the specifications that capture the impact for the BRICS group (Columns 7, 8, and 9), the effects are both qualitatively and quantitatively in line with previous results. Inflation and income growth contribute to higher inequality within the BRICS economies. The main difference is that the impact of the real interest rate is not statistically significant across the three specifications.

5.2. Before and after the Great Recession

We now investigate the sensitivity of the results by performing the analysis for two sub-periods: 2001–2007 and 2008–2015. Table 5, Table 6 show the results for the entire sample. The findings reveal that the association between inflation and income growth with income inequality is larger during the period 2001 to 2007 (Table 5). After 2007, inflation and income growth contribute much less in terms of driving income inequality (see Table 6). Interestingly, for the BRICS economies, inflation contributes more strongly to income inequality during the period 2008 to 2015 (Table 6, Columns 7 through 10).

Table 7, Table 8 show the results for the emerging economies sample. Comparing the results across the two tables, we see that the positive impacts of inflation and income growth on income inequality for the emerging economies holds only for the period prior to 2008. Surprisingly, the three macroeconomic variables’ effects on income inequality become statistically insignificant for the period after 2007. However, for the BRICS economies, statistical significance holds across both periods. Interestingly, the results shown in Columns

Table 5

Macroeconomic Variables and Income Inequality: Including all countries in the sample over the sample period 2001-2007.

<!--Col Count:11-->All countries over 2001-2007										
	Dependent variable: $(Top\ 1)_{it}$									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$(inflation)_{it}$	0.134*** (0.013)	0.128*** (0.013)	0.134*** (0.011)	0.165 (0.209)	0.090 (0.086)	0.111*** (0.014)	0.124*** (0.016)	0.121*** (0.014)	0.134*** (0.013)	0.131*** (0.012)
$(real\ rates)_{it}$	0.049 (0.047)	0.0422 (0.049)	0.037 (0.037)	-0.094 (0.116)	-0.017 (0.102)	0.017 (0.0409)	0.041 (0.056)	0.045 (0.053)	0.027 (0.050)	0.030 (0.047)
$(real\ income)_{it}$	0.357*** (0.056)	0.343*** (0.054)	0.194*** (0.060)	0.030 (0.074)	0.117*** (0.032)	0.207*** (0.0739)	0.275*** (0.062)	0.284 (0.057)	0.149* (0.079)	0.158** (0.073)
$(real\ income\ 2)_{it}$						0.019*** (0.0057)				
<i>BRICS_inflation</i>							0.041 (0.041)	-0.043*** (0.017)	0.055 (0.034)	-0.018 (0.012)
<i>BRICS_real rates</i>							0.015 (0.064)	-0.092 (0.054)	0.079 (0.059)	-0.013 (0.051)
<i>BRICS_real income</i>							0.380** (0.104)	0.270*** (0.083)	0.293*** (0.100)	0.188*** (0.075)
Fixed Effects		✓	✓			✓		✓		✓
Time Effects			✓						✓	✓
DCCE				✓						
MG					✓					
Trend				✓	✓					
Observations	224	224	224	224	224	224	224	224	224	224
R-sq	0.25	0.25	0.26	0.85		0.22	0.29	0.19	0.37	0.28

Table 6

Macroeconomic Variables and Income Inequality: Including all countries in the sample over the sample period 2008-2015.

All countries over 2008–2015		Dependent variable: $(Top\ 1)_{it}$									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	$(inflation)_{it}$	0.091** (0.044)	0.076* (0.043)	0.031 (0.037)	0.159*** (0.045)	0.139*** (0.033)	0.074* (0.041)	0.029 (0.036)	0.025 (0.038)	-0.029 (0.048)	-0.047 (0.049)
	$(real\ rates)_{it}$	0.066* (0.038)	0.054 (0.036)	0.001 (0.041)	0.139** (0.064)	0.093* (0.047)	0.048 (0.034)	0.032 (0.039)	0.029 (0.0407)	-0.034 (0.037)	-0.047 (0.039)
	$(real\ income)_{it}$	0.049*** (0.014)	0.046** (0.014)	0.044** (0.020)	0.046* (0.026)	0.041** (0.017)	0.033** (0.014)	0.032 (0.014)	0.031 (0.014)	0.028 (0.019)	0.026 (0.020)
	$(real\ income\ 2)_{it}$						0.002*** (0.000)				
	BRICS_inflation							0.251*** (0.085)	0.214** (0.088)	0.276 (0.106)	0.247** (0.108)
	BRICS_real rates							0.144* (0.08)	0.111 (0.080)	0.184 (0.094)	0.158* (0.09)
	BRICS_real income							0.138*** (0.038)	0.126*** (0.039)	0.144 (0.031)	0.131*** (0.032)
Fixed Effects			✓	✓					✓		✓
Time Effects				✓						✓	✓
	DCCE				✓						
	MG					✓					
	Trend				✓	✓					
	Observations	256	256	256	256	256	256	256	256	256	256
	R-sq	0.4	0.4	0.16	0.78		0.36	0.35	0.34	0.34	0.26

Table 7

Macroeconomic Variables and Income Inequality: Including only emerging economies over the sample period 2001-2007.

Emerging economies only 2001-2007		<i>Emerging Economies: Dependent variable: (Top 1)_{it}</i>								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	<i>(inflation)_{it}</i>	0.136*** (0.015)	0.135*** (0.014)	0.137*** (0.010)	-0.0102 (0.105)	-0.044 (0.112)	0.111*** (0.018)	0.059** (0.025)	0.0589** (0.025)	0.117*** (0.011)
	<i>(real rates)_{it}</i>	0.0558 (0.058)	0.054 (0.059)	0.069* (0.036)	-0.2375 (0.151)	-0.0975 (0.092)	0.011 (0.054)	-0.0170 (0.021)	-0.016 (0.021)	0.038** (0.018)
	<i>(real income)_{it}</i>	0.392*** (0.083)	0.393*** (0.083)	0.236** (0.096)	0.0538 (0.064)	0.0836 (0.053)	0.195 (0.134)	0.015 (0.022)	0.0164 (0.022)	0.089** (0.039)
	<i>(real income 2)_{it}</i>						0.022** (0.0089)			
	<i>BRICS_inflation</i>							0.146** (0.062)	0.139* (0.065)	0.154*** (0.049)
	<i>BRICS_real rates</i>							-0.0681 (0.048)	-0.075 (0.048)	0.062 (0.041)
	<i>BRICS_real income</i>							0.267*** (0.044)	0.268*** (0.043)	0.239*** (0.067)
Fixed Effects			✓	✓			✓			✓
Time Effects				✓					✓	✓
	DCCE				✓					
	MG					✓				
	Trend				✓	✓				
	Observations	195	195	195	195	195	195	195	195	195
	R-sq	0.05	0.05	0.11	0.92		0.03	0.1	0.1	0.22

Table 8

Macroeconomic Variables and Income Inequality: Including only emerging economies over the sample period 2008-2015.

<!--Col Count:-10-->Emerging economies only 2008-2015		<i>Emerging Economies: Dependent variable: (Top 1)_{it}</i>								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	<i>(inflation)_{it}</i>	0.079 (0.066)	0.066 (0.065)	0.022 (0.057)	0.112 (0.097)	0.053 (0.042)	0.065 (0.061)	- 0.038 (0.050)	-0.041 (0.050)	-0.114 (0.086)
	<i>(real rates)_{it}</i>	0.031 (0.047)	0.020 (0.044)	-0.031 (0.072)	0.123 (0.142)	0.009 (0.081)	0.022 (0.040)	- 0.057** (0.023)	-0.059 (0.024)	-0.146 (0.057)
	<i>(real income)_{it}</i>	0.046 (0.027)	0.044 (0.027)	0.034 (0.036)	0.065** (0.028)	0.055 (0.028)	0.035 (0.027)	-0.0027 (0.0094)	-0.003 (0.009)	-0.020 (0.016)
	<i>(real income 2)_{it}</i>						0.0056 (0.004)			
	<i>BRICS_inflation</i>							0.291** (0.093)	0.281** (0.097)	0.299** (0.126)
	<i>BRICS_real rates</i>							0.211*** (0.076)	0.200** (0.076)	0.240** (0.106)
	<i>BRICS_real income</i>							0.163*** (0.038)	0.162** (0.039)	0.183 (0.035)
Fixed Effects			✓	✓			✓			✓
Time Effects				✓					✓	✓
	DCCE				✓					
	MG					✓				
	Trend				✓	✓				
	Observations	195	195	195	195	195	195	195	195	195
R-sq		0.26	0.23	0.01	0.78		0.19	0.16	0.15	0.1

7 through 9 of Table 8 reveal that real interest rates contribute to higher income inequality within the BRICS group from 2008 to 2015.

6. Conclusion

Many prior studies have analyzed the impacts of inflation, interest rates, and income growth on income inequality. However, relatively few papers have focused on developing countries. Early work by Kuznets (1955) suggests that countries initially experience increases in income inequality as they develop but, over time, income inequality should decrease. There is not a clear consensus on inflation's impact on income inequality although some studies such as Balcilar et al. (2018) suggest that inflation may be beneficial up to a certain level and worsen inequality at higher levels. Real interest rates may also either increase or decrease income inequality.

Our results show that increases in inflation and real income growth contribute to increases in income inequality. Across the entire sample, we find some evidence that increases in real interest rates correspond with higher income inequality; however, not all of the results for the real interest rate are statistically significant. The results also show that the positive relationship between the three macroeconomic variables and income inequality for the BRICS economies is stronger compared to the full sample and during the period after 2008.

Lastly, Jawadi et al. (2016) document that a monetary contraction in the BRICS economies has a negative effect on real economic activity and leads to a gradual fall in the price deflator. From a policy perspective, our work suggests that when central banks of the BRICS economies use monetary policy for macroeconomic stabilization, they need to consider the impact monetary policy changes have on the distribution of income in their nations. If central banks, through low rates, induce economic growth and higher prices, then, based on our results, the unintended consequence would be higher income inequality. This highlights trade-offs that policy makers may have to make between economic stabilization and the distribution of income when they change monetary policy.

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Notes

¹ This research was prepared by the author (Meszaros) in his personal capacity. The opinions expressed in this article are the author's own and do not necessarily reflect the views of the United States Postal Service or the United States government.

² Others such as Fidrmuc and Gundacker (2017) focus on how institutional settings (in their case Russia) can affect income inequality.

³ <http://www.oecd.org/social/inequality.htm>.

⁴ Reddy, S. (2018). "The Growing BRICS Economies: An INET Series" available at: <https://www.ineteconomics.org/perspectives/blog/the-growing-brics-economies-an-inet-series>.

⁵ We would like to thank one of the referees for this recommendation.

⁶ We note that debt-to-equity and debt-to-income ratios are not equally distributed across households at different levels of the income distribution. Wolff (2010) reports that the debt-to-equity and debt-to-income ratios for the top 1% of the income distribution in the U.S. declined from 1983 to 2007 but increased for the next 19% of the income distribution and the middle quintiles. Saez (2017) suggests that large increases in debt for U.S. households in the bottom 90% of the income distribution implies that these households have been saving 0% of their income over the last 30 years.

⁷ Due to data availability we could not analyze a longer sample.

⁸ We would like to thank an anonymous referee for this point.

⁹ Jim O'Neill (2018): "Time for BRICS to Consider Road Ahead."

¹⁰ Emerging Economies: Brazil, Czech Republic, Colombia, Chile, China, Hungary, India, Lebanon, Poland, Russian Federation, Slovenia, South Africa, Turkey.