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Does Restrictive Monetary Policy Worsen Income Inequality Across Emerging Economies ?

ZORE Mahamoudou*

Abstract

This paper examines the causal effect of monetary policy on income inequality in emerging economies using a dynamic panel analysis with the Generalised Method of Moments (GMM), specifically the two-step GMM system estimator. The sample consists of 46 emerging economies from 2000 to 2018. The results indicate that tight monetary policies contribute to an increase in income inequality. It is important to note that these policies have a minimal impact on income distribution until the third year after their implementation, indicating a delayed effect on inequality. When considering the transmission channels, it is evident that inflation, exchange rates, and the percentage of credit granted as a proportion of GDP are effective tools for monetary policy to influence income distribution. The study's results are robust, as confirmed by sensitivity analyses that take into account changes in sample composition, time horizon and inequality measurement methods. Further, heterogeneity analysis highlights that the impact of these policies on inequality depends on a number of factors, including the level of labour income, the existence of social protection policies and the condition of the economy.

Keywords : Monetary policy • Income inequality • Emerging countries

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1 Introduction

The 2008 financial crisis and the recent health crisis have led to the development of new ways of implementing monetary policy, such as unconventional measures, and taking financial risks into account through macroprudential measures. Due to the zero bound on interest rates, monetary authorities have had to resort to new instruments to boost growth and reduce unemployment. In recent years, economic research has heavily invested in assessing the consequences of these measures on the economy and the risks they could generate for the sustainability of the financial system. Additionally, the issue of inequality has resurfaced, which could be attributed to the growing inequalities observed in the wake of the financial crisis and the great recession (Atkinson, 2015; Piketty, 2015). This relative increase in inequalities has significant disadvantages for the countries most affected and even poses a problem for economic growth. (Berg et al., 2018; Ostry, Berg, and Tsangarides, 2014; Wilkinson and Pickett, 2010).

In this context marked by the rise of social inequalities worldwide and historically low interest rates, the question of the potential distributive effects of monetary policy has emerged as an unavoidable topic in economic policy discussions, sparking intense debates among researchers (Kappes, 2023; Lofaro, Matamoros, and Rochon, 2023). Inequalities have, however, been largely ignored in discussions of monetary policy. This was justified by the simple reason that the mission assigned to most central banks generally revolves around maintaining price stability and, at times, ensuring full employment. Thus, addressing issues of inequality and redistribution falls within the purview of fiscal policies rather than monetary policies. Nevertheless, the significance of accommodative measures taken in recent years by various central banks is such that several economists suspect them of further deepening the gap between the rich and the poor. This is particularly evident with the policies of massive asset purchases referred to as "Quantitative Easing." Indeed, these purchases could lead to the rise in asset prices, and since securities are typically held by wealthy households, these measures would favor them at the expense of poorer households (Saiki and Frost, 2014). Moreover, according to El Herradi (2019), "the policy of very low-interest rates would inexorably result in a reduction in returns on fixed-yield assets (such as the Livret A or housing savings), mainly held by low-income and middle-class households."

Finally, authors such as [Acemoglu and Johnson \(2012\)](#) and [Stiglitz \(2015\)](#) have endeavored to demonstrate that the expansionary orientation of monetary policy in advanced economies could negatively affect the distribution of income and wealth. However, it is worth noting that this view of the relationship between expansionary monetary policy and inequalities is not unanimous. Indeed, for some economists, expansionary policy contributes to reducing inequalities through its impact on employment. This is what [Draghi \(2016\)](#) sought to demonstrate in the conclusion of his paper, stating : "...Monetary policy has positive distributive effects through macroeconomic channels. More importantly, it reduces unemployment, which benefits the poorest households the most."

The controversies observed in the conclusions of various studies on the link between monetary policy and income inequalities could be explained by the existence of several transmission channels. Thus, accommodative monetary policy could be favorable to the poor, who are generally borrowers, through its negative impact on interest rates ([Doepke and Schneider, 2006](#)). This measure has a positive effect on economic activity, which, in turn, affects labor incomes and also leads to a reduction in income disparities. Thus, labor incomes at the bottom of the distribution scale are generally the most affected by changes in economic activity ([Heathcote, Perri, and Violante, 2010](#)). Furthermore, some transmission channels could predict the opposite effect of these policies. Indeed, through its effects on asset prices and inflation, expansionary policy could fuel inequalities and thus be favorable to the rich at the expense of the poor.

Empirically, there is an increasing number of studies focusing on the distributive effects of monetary policy. However, this literature remains incomplete. Most existing studies focus primarily on developed countries and rarely, if ever, on developing countries. Our decision to work on this topic is therefore driven by the scientific urgency for a better understanding of the potential distributive effects of monetary policy, enabling policymakers and monetary authorities in these countries to choose the policy that best suits their economic structure. Our research specifically addresses the relationship between monetary policy and income inequalities in emerging economies. We examine the impact of monetary policy on income distribution by reviewing some theoretical channels and examining the empirical evidence of their importance. Special attention is also given to the role of redistribution policies, economic cycles, and

macroeconomic conditions in determining the magnitude and direction of the effects of monetary policy on income inequalities. Monetary policy is measured by policy interest rates. Regarding the measurement of income inequalities, we primarily use the Gini index of disposable income developed by [Solt \(2020\)](#). Other inequality indicators such as the "20/20" ratio proposed by INSEE and the raw Gini index will be used to test the sensitivity of our results. ¹

We use the Generalized Method of Moments (GMM) method, specifically the system GMM estimator proposed by [Blundell and Bond](#) in 1998, to estimate our model. Our sample consists of 46 countries with a period from 2000 to 2018. Our results suggest that restrictive policy widens the gap between the rich and the poor in the long term. We found that it truly affects income distribution only from the third year onwards. Therefore, it has no short-term effect on inequalities. This effect is even higher if the increase in interest rates occurs simultaneously with an unexpected depreciation of the national currency or an increase in bank loans. Our study also indicates that in the presence of high inflation, tightening monetary policy benefits the poor and thus reduces inequalities. Our results are robust to changes in the sample, time horizon, and inequality measures. Finally, our analysis reveals that the effects of this policy depend on the importance of labor incomes and social protection policies.

To conduct our study, we organize the rest of our analysis as follows. In Section 2, we review existing literature. In the third section, we present the data used and provide some descriptive statistics. Section 4 outlines the model and estimation strategy. In Section 5, we present various results and review different transmission mechanisms. Sections 6 and 7 address the robustness of our results and heterogeneity, respectively. Finally, Section 8 concludes and offers recommendations.

2 Literature Review

This section discusses the literature on the subject, focusing on three main points. The first point examines the post-Keynesian theory of monetary policy and income distribution,

1. INSEE publishes an annual report called "20/20" : it is the ratio of the total income received by the richest 20% to the poorest 20%.

comparing theories with empirical studies and highlighting different transmission channels. The second examines the theoretical and empirical underpinnings of the link between conventional monetary policy and income disparities. Finally, the third point reviews the existing work on the relationship between unconventional monetary policy and income inequality.

2.1 Monetary policy and income distribution in post-Keynesian theory

The determinate impact of monetary policy on the distribution of income is a recurrent theme in post-Keynesian economics (Lofaro, Matamoros, and Rochon, 2023; Kappes, 2023). It stems from the foundational concepts established by economists such as Keynes and Robinson who explored the complex interplay between monetary policy instruments and the distribution of income across different segments of society. In his 1923 work 'A Tract on Monetary Reform', Keynes established the groundwork for understanding how changes in the real interest rate impact income distribution. In his writings, Keynes expressed concerns about biased policies that favored the rentier class. He highlighted the potential for social discontent during the interwar period. This concern persisted in his work Keynes (1937), where he advocated for a low interest rate to achieve the 'euthanasia' of the rentier. His aim was to achieve full employment and equitable income distribution. Drawing upon Keynesian principles, Robinson (1956) scrutinized the distributional repercussions of interest rates, highlighting the inherent tension between entrepreneurs and rentiers concerning profits. This inquiry laid the foundation for post-Keynesian economists in the 1980s to extend the discourse on monetary policy and income distribution (Rochon and Setterfield, 2007; Lofaro, Matamoros, and Rochon, 2023). During the late 1980s, post-Keynesians further investigated income distribution within the context of monetary policy. Lavoie and Seccareccia (1988) proposed that alterations in the interest rate exert both direct and indirect effects on income distribution between rentiers and the 'active earning class,' comprising workers and entrepreneurs. Concurrently, other post-Keynesian economists, such as Eicher (1987); Niggle (1989) and Moore (1989), emphasised the distributional impact of interest rates within their papers. Thus, this early wave of contributions marked the beginning of a robust tradition within post-Keynesian economics that linked monetary policy and income distribution. Post-Keynesians argue that policy responses to the challenges of the 1980s crisis exacerbated

income inequality, challenging mainstream views that downplayed the long-term impact of monetary policy on distribution (Kappes, 2023; Lofaro, Matamoros, and Rochon, 2023). In the years that followed, post-Keynesian economics maintained its focus on the intricate connections between monetary policy and income distribution, providing coherent explanations for the rise in income inequality. Although the acceptance by the mainstream of the importance of monetary policy in shaping the distribution of personal income came late, post-Keynesian economists continue to refine their understanding, contributing to a dynamic discourse at the intersection of economics, politics and social welfare (Rochon and Setterfield, 2008; Lofaro, Matamoros, and Rochon, 2023).

In essence, the post-Keynesian view of how monetary policy affects income distribution involves both direct and indirect channels. Direct impacts include changes in the wage share due to interest rate shifts and intra-worker redistribution, which affect overall output and employment through changes in consumption. Indirect effects arise from changes in income distribution driven by changes in the unemployment rate linked to interest rate movements (Matamoros Romero, 2023).

2.2 Conventional Monetary Policy and Inequality

Conventional monetary policy can be defined as a set of instruments available to a central bank to control the level of the money supply. Monetary authorities have three main options for conducting conventional monetary policy : open market operations, permanent facilities, and reserve requirements. It is generally used to boost economic growth, combat unemployment, and ensure price stability. Unfortunately, it is suspected of generating several adverse effects, especially in terms of wealth redistribution. Researchers such as (Acemoglu and Johnson, 2012; Stiglitz, 2015; Coibion et al., 2017), and many others have attempted to prove through theoretical and empirical work the existence of such a link between monetary policy and inequalities.

The literature has proposed several channels through which conventional monetary policy could influence income inequalities. These channels are grouped by Ampudia et al. (2018) into two major categories : the direct channel and the indirect channel. Mechanisms under the

direct channel can be understood as channels that allow monetary policy to have immediate effects on the distribution of wealth and household incomes. As for the indirect effect, it can be defined as the consequence of monetary policy on income distribution that passes through macroeconomic variables such as employment and wages. Indeed, an increase in interest rates will lead to a decrease in investments and consumption, which will have negative repercussions on employment and wage dynamics. This could result in a decrease in the average household income. It is important to note that the magnitude of this income decrease may vary depending on the household's position in the labor market, as low-skilled employment is more sensitive to changes in demand than highly skilled employment (Colciago, Samarina, and de Haan, 2019). In the following, we will try to list and explain the main transmission channels suggested for monetary policy to impact income inequalities. In order to make our discussion more comprehensive, we choose to categorize the channels into two groups : those transmitted through inflation and those transmitted through interest rates.

Channels transmitted through inflation : An increase in the general price level is likely to influence income inequalities because the poorest households hold more liquidity as a percentage of their total spending and are therefore more exposed to the adverse effects of inflation (Sintos, 2023). This is justified by the simple fact that the rich protect themselves against inflation risks by resorting to bonds or stocks, making them more resilient in case of inflation. This hypothesis is supported by Albanesi (2007) and Erosa and Ventura (2002). For the latter, the poor suffer more from inflation because it disproportionately reduces households' purchasing power, as they do not have the means to use financial assets to guard against potential inflation risks. This justifies the fact that they are the first victims of the inflation tax. Erosa and Ventura (2002) go further by suggesting that inflation can be perceived as a regressive consumption tax. However, this thesis is not shared by all researchers. Some economists believe that inflation could be favorable to the poor at the expense of the rich and thus reduce inequalities. This view is supported by Doepke and Schneider (2006), who studied these issues using American data and suggest that an increase in inflation leads to a transfer of income from wealthy households to poor households. They justify this result through the savings redistribution channel. Indeed, for them, poor and modest households generally hold long-term debts denominated in nominal terms and at fixed rates,

while wealthy households hold securities in currencies. They are thus more advantaged in case of inflation. This conclusion is supported and reinforced by the work of [Bricker et al. \(2017\)](#). For them, inflation acts as a tax on bondholders because it leads to a decrease in interest payments. Thus, expansionary monetary policy would be inequality-reducing since most government bonds are generally held by the wealthiest. Observing the role of household wealth ownership in the relationship between monetary policy and income distribution, [Ragot \(2014\)](#) concludes, unlike [Albanesi \(2007\)](#) and [Erosa and Ventura \(2002\)](#), that inflation is likely to reduce inequalities. They find in their investigations that in the case of rising inflation, households with the most wealth would be the most affected. [Menna and Tirelli \(2017\)](#) integrated the result of [Ragot \(2014\)](#) into a Dynamic Stochastic General Equilibrium (DSGE) model and argue that the main objective of central banks, which is to ensure price stability, is not compatible at all with policies to reduce inequalities. The results of studies on the impact of monetary policy through inflation are indeterminate and/or contradictory.

Channels transmitted through interest rates : A decrease in interest rates can have direct and indirect effects on household income distribution. These effects occur because this decrease modifies wage remuneration through its impact on production, asset prices, and the prices of goods and services ([Blot et al., 2017](#)). The first way through which changes in interest rates affect inequalities is the composition of household income. Indeed, there are several sources from which households derive their income (wages, dividends, profits, interest, etc.). The incomes of disadvantaged households are generally derived from labor. Therefore, if monetary policy positively affects economic activity, it will reduce unemployment and increase wages and profits. The sign of its effect on inequalities will depend in this case on the magnitude of its impact on profits compared to that on wages. If the effect of policy on wages is greater than that on profits, then it will be considered inequality-reducing ([Heathcote, Perri, and Violante, 2010](#)). Furthermore, the effect that policy will have on income also depends on the household's credit situation. If the household is a net creditor, it will see its income decrease because the decrease in interest rates leads to a decrease in interest received, while households that are net debtors will benefit from this decrease ([Amaral, 2017](#)).

Another channel generally discussed in the literature is that of *portfolio composition*. Theo-

retically, the impact of expansionary monetary policy resulting from the portfolio effect on income inequalities is positive because a decrease in interest rates leads to an increase in the value of stocks generally held by the wealthy. This channel has been examined empirically and confirmed by [Coibion et al. \(2017\)](#). However, [Adam and Tzamourani \(2016\)](#) point out that the increase in real estate asset prices can have an equalizing effect if property ownership is widely distributed in the population. They add that this could even reduce poverty if there are social policies that facilitate property ownership more for the poor than for wealthy households.

Moreover, it is important to note that conventional monetary policy could also influence the level of inequalities through the *macroeconomic situation*. Indeed, the impact of monetary policy on the level of employment could well influence income distribution in countries. For example, an expansionary monetary policy that stimulates economic activity will reduce the unemployment rate. Poor households may then find work or have better-paid jobs. This will result in a reduction in inequalities. These indirect effects are highlighted by [Colciago, Samarina, and de Haan \(2019\)](#) and [Blot et al. \(2017\)](#). By focusing on the roles of economic cycles, [Furceri, Loungani, and Zdzienicka \(2018\)](#) have shown that restrictive monetary policy has a greater impact on inequalities during economic expansion, while accommodative monetary policy is more effective during a recession.

In light of the empirical and theoretical studies mentioned, we can conclude that the impact of conventional monetary policy on inequalities depends on the observed channel, macroeconomic conditions, and fiscal policies.

2.3 Unconventional Monetary Policy

Unconventional monetary policy is generally defined as the set of measures taken by a central bank to address an exceptional economic situation. This policy was extensively used following the 2008 financial crisis. Indeed, after this crisis, authorities observed the inefficiency of traditional policy transmission channels and turned to new instruments. These instruments include mass purchases of assets, targeted long-term refinancing operations (TLTROs), and the application of negative interest rates. Banks resort to these measures during economic crises,

such as the Covid-19 pandemic, and in cases of deflationary risks. ²

The impact of these measures on inequalities is not clearly identified in the literature. In contrast to conventional monetary policy, the impact of unconventional monetary policy is relatively understudied due to its relatively recent history. Nevertheless, there are some works that have attempted to understand the distributive effects of these so-called non-traditional policies. There is no consensus in the conclusions of these studies. Based on the results, two groups emerge : those who argue that these measures are likely to reduce inequalities and those who believe they widen the gap between the rich and the poor. These results are obtained based on two transmission channels.

The heterogeneity of gains channel predicts that, due to the stimulus effect that quantitative easing policies have on economic activity, they are likely to reduce inequalities. This is mainly explained by the fact that the effects on employment benefit the poor more than the rich due to the extensive margin (Montecino, Epstein et al., 2015). Additionally, the increase in wages influences the incomes of low and poor households more because they are more dependent on labor income. Empirical studies conducted by Guerello (2018) in Europe, Bivens (2015) in the USA, and Casiraghi et al. (2018) in Italy confirm this assertion. In contrast, the income composition channel predicts the opposite effect. For this channel, unconventional monetary policy increases inequalities through its effects on asset prices and capital income. This position is supported by the works of Saiki and Frost (2014) in Japan, Mumtaz and Theophilopoulou (2017) in the UK, and Albert, Gómez-Fernández, and Ochando (2019) in the United States.

To determine the overall net effect, we should then compare the strength of the heterogeneity of income channel to that of the income composition. Using American data, Montecino, Epstein et al. (2015) show that the effect due to the increase in asset prices is greater than that of employment. They conclude that unconventional monetary policy increases income inequalities. In contrast to these findings, and using Italian data, Casiraghi et al. (2018) find that the distributive effects from economic activity are more significant than the imbalances caused by the increase in asset prices. A third position is advocated by authors such as Inui, Sudou, and Yamada (2017)

2. <https://www.centralcharts.com/fr/gm/1-apprendre/9-economie/35-banque-centrale/976-politique-monetaire-non-conventionnelle>

and [Bunn, Pugh, and Yeates \(2018\)](#), who show through empirical work that this policy has insignificant effects on income distribution. The effects due to economic stimulus would thus be exactly offset by effects that pass through income composition.

In summary, much like conventional monetary policy, the results from theoretical and empirical studies on the link between unconventional policy and inequalities are mixed. The magnitude and direction of effects depend on the channel, the country considered, and macroeconomic conditions.

3 Data and Methodology

This section will be dedicated to presenting and describing the data utilized in our study. This will facilitate a deeper comprehension of the approach employed to examine the connections between monetary policy and income distribution across various emerging countries.

3.1 Data

We employ a non-overlapping panel spanning from 2000 to 2018, comprising a study sample of 46 emerging countries. From an initial pool of 56 emerging economies, we excluded countries lacking any data on income inequality and monetary variables. The temporal scope of our study is delimited by data availability, particularly for inequality data, which is predominantly accessible from the 2000s onward. Most variables in our model have data limited to 2018; therefore, we confine the temporal scope of our study to this date. To identify emerging countries, we selected, based on the World Bank's latest classification in 2018,³ all countries classified as having an upper-middle-income level. Tables 5 and 6 in the appendix respectively provide the list of countries included in our final dataset and the list of variables used, along with their sources.

3. <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>

3.1.1 Inequality measurement

Income inequality is our dependent variable. We define inequality as the uneven dispersion of incomes across the entire income distribution within countries. We have access to a fairly comprehensive database on income inequality, "The Standardized World Income Inequality Database (SWIID)," implemented by Professor Fr derick [Solt](#). This database enables researchers to analyze and compare the state of income inequality worldwide. To date, SWIID is the database that provides the most comparable data between countries, covering a larger number of countries (196) and years. Hence, our choice naturally fell on this database. It includes measures of net income inequality (after tax, after transfers) and market income (before tax, before transfers). In our analysis, we will use, as in the literature ([Furceri, Loungani, and Zdzienicka, 2018](#)), the net Gini index because we believe it better reflects the actual situation of income disparities. However, we will also use the market Gini index to test the sensitivity of our results.

The SWIID database has faced numerous criticisms from researchers, who question its credibility and express limited confidence in the measures used by Professor [Solt](#) in constructing the database. The professor compiled income survey data from various sources, including the OECD, the World Bank, Eurostat, the Economic Commission for Latin America and the Caribbean, national statistical offices worldwide, and academic studies. He used a unique method to harmonize available estimates to obtain a figure per year. In cases where there is no estimation, he provides a figure extrapolated from neighboring years. These data are therefore prone to measurement errors ([Solt, 2020](#)). It is reasonable not to fully trust a database that itself makes extrapolations from indices extrapolated from partial information derived from income surveys.

Acknowledging the limitations of the SWIID database, we will reestimate our model using alternative measures to verify the validity of our results. We will use the "ratio 20/20" index developed by INSEE.⁴ This index is a ratio between the income received by the richest 20% and the poorest 20%, indicating how many times more income the former receive than the latter. We constructed this indicator using data from the World Bank website.

4. <https://www.insee.fr/fr/statistiques/4231288>

3.1.2 Monetary Policy Variables

Our variable of interest is conventional monetary policy. Conventional monetary policy is typically captured in the literature by policy rates set by central banks for refinancing secondary banks (Coibion et al., 2017; Furceri, Loungani, and Zdzienicka, 2018; Mumtaz and Theophilopoulou, 2017). Consistent with the literature, we will use *Central bank policy rates* as our main monetary variable. Our data for this variable come from "BIS Statistics" and the International Monetary Fund (IMF). Other monetary variables are also used as factors that may condition the distributive effects of monetary policy.

Nominal Exchange Rate : This variable is extracted from the "World Development Indicators" database of the World Bank. It can be defined as the price of one currency in terms of another. It is expressed in the national currency vis-à-vis the U.S. dollar and is calculated as an annual average based on monthly data collected. The nominal exchange rate is generally reported by national governments or legally fixed by the foreign exchange market. We assume that the exchange rate is a potential channel through which monetary policy could influence the real economy and income distribution (Mishkin, 1996). An expansionary monetary policy typically results in a depreciation of the national currency, which, all else being equal, would influence economic activity and the purchasing power of households.

Loan Interest Rate : This is the rate set by secondary banks when granting loans to their clients. The data for this variable come from the World Bank website. We assume here that this rate is directly impacted by the policy conducted by the central bank. This hypothesis was supported in 1995 by authors such as Kashyap and Stein; Saumitra and Toto. We will use the variable "lending interest rate" to examine the existence and effectiveness of the bank lending channel in transmitting the distributive effects of monetary policy. We will also use a variable of the amount of loans granted as a percentage of GDP. This latter variable is also from the "World Development Indicators" database of the World Bank.

3.1.3 Control Variables

Based on the literature on determinants of income inequality within countries, we have chosen to include several control variables. The first one is the inclusion of the lagged variable of income inequality in our model. We expect that the past level of inequality affects contemporary inequalities. In other words, we hypothesize that the current level of inequality is influenced by past income distribution outcomes.

Next, we control for the effects of trade openness on income distribution. The variable "trade" is obtained from the World Bank website, measured as the sum of exports and imports of goods and services as a percentage of Gross Domestic Product (GDP). Trade is often considered a driver of economic growth due to its favorable effects on competitiveness and efficiency. We support the idea, as mentioned by [Dabla-Norris et al. \(2015\)](#), that increased trade openness could influence income distribution. Trade flows are likely to modify demand and labor wages, potentially impacting the level of inequality.

Our third control variable measures the general price level. We consider inflation because, according to [Easterly and Fischer \(1999\)](#), an increase in the inflation rate leads to a reduction in purchasing power and can thus influence income distribution. As mentioned earlier, it is generally the poorest households that hold more cash as a percentage of their total expenditures, making them more exposed. However, inflation could also be favorable to the poor and therefore inequality-reducing. For instance, rising inflation could result in a transfer of income from the rich to the poor through savings distribution ([Doepke and Schneider, 2006](#)).

Another important determinant of inequality is demographics. We control for this by using the annual population growth rate and the dependency ratio. We anticipate a positive effect of the population growth variable on inequality because countries with rapidly growing demographics experience a faster increase in the demand for public services and increased government difficulties in providing these services. Given that income distribution generally depends on population structure, we choose to capture this dimension by including a variable for the population dependency ratio. This variable is obtained by taking the ratio of inactive individuals (<15 and >64) to the total active population. All our demographic variables come from the World Bank.

Likewise, the level of unemployment in a country influences income distribution. It is generally accepted in the literature that a high level of unemployment leads to an increase in income inequality (Martinez-Vazquez, Moreno-Dodson, and Vulovic, 2012; Dao and Godbout, 2014). This is because the risk of unemployment is higher among the poor. Unemployment deprives them of having an income that would enable them to maintain a good standard of living. We use the unemployment rate variable proposed by the World Bank.

Additionally, we capture the effects of economic development on income distribution by adding the variable GDP per capita. According to previous literature (Dao and Godbout, 2014), an increase in GDP per capita generally leads to an increase in inequality in poor countries and reduces poverty in rich countries due to the availability of resources. Since our study focuses on developing countries, we anticipate a positive effect of GDP per capita on income inequality. Furthermore, we believe that the level of social protection influences income distribution. A negative effect on inequality is expected. The social protection variable is expressed as a percentage of total expenditures. GDP per capita and social protection data are obtained from the "World Development Indicators" database and the "Statistics on Public Expenditures for Economic Development (SPEED)" database, respectively.

Finally, we introduce an institutional variable and a measure of human capital captured by government efficiency and the secondary education level. The "government efficiency" variable used is an indicator that assigns a score to states based on their efforts in public governance. Its construction takes into account perceptions that public power is exercised for private purposes, including small and large forms of corruption. The country scores range from -2.5 to 2.5. As for the education variable, we expect it to have a negative effect on income inequality. The education measure chosen is the secondary school completion rate, calculated as the ratio of admissions to the last year of lower secondary education to the population of age to enter the last year of lower secondary education. These last two variables included in our base model are both obtained from World Bank data.

3.2 Descriptive Statistics

The table 1 below presents the descriptive statistics of the main variables in our study. The average net Gini index is 41.935. Moreover, there is significant heterogeneity among regions based on the level of inequality. Our data show that sub-Saharan Africa is the most unequal region with an average Gini index estimated at 61.13. The Europe and Central Asia region appears to be the most egalitarian, with an average level of inequality assessed at 34.62 (figure 3). This substantial heterogeneity is also observed at the country level. Figure figure 2 shows that Namibia has the highest score (66.2) in terms of inequality, unlike Belarus, which records an average Gini index level of 23.2. This persistent inequality situation observed in Namibia, despite the country being relatively wealthy, is largely explained by its history. Namibia, initially colonized by Germany, came under South African trusteeship in 1920 following the Treaty of Versailles. It was then subjected to apartheid policies, justifying the fact that a minority of white individuals currently owns the majority of exploitable land and wealth. The current average interest rate is above 7%, which is a result of the high refinancing rates set by most central banks in the early 2000s. However, after the 2008 crisis, this rate experienced a sharp decline. In 2000, the average policy rate was estimated to be 12.20%, compared to 5.46% in 2009. The decrease is attributed to the authorities' intention to ease monetary policy in the aftermath of the crisis. This action was taken to assist businesses in mitigating the adverse impacts of the crisis and promoting growth. The average population growth rate is 1.20%, with relatively low dispersion compared to the mean. The low population growth rate is justified because most emerging countries, despite having a large population, have completed their demographic transition.⁵ Furthermore, table 1 shows that the countries in our sample have estimated social protection expenditure at around 16% of total expenditure. The allocation of expenditure towards social services in developing countries appears insufficient to address the basic needs of the population, which may contribute to the persistence of inequalities in these regions. The unemployment rate is estimated at 10.79%, with significant disparities between countries, with Kosovo having the highest proportion of unemployed individuals, with an average rate estimated at over 45%.

Taking a closer look at the evolution of income inequality and market interest rates between

5. <http://geoconfluences.ens-lyon.fr/glossaire/emergence>

TABLE 1 – Summary Statistics

| Variables | Observations | Moyenne | Ecart-type | Minimum | Maximum |
|---------------|--------------|-----------|------------|-----------|----------|
| gini_disp | 721 | 41.93537 | 8.02428 | 23.2 | 66.2 |
| CBrate | 614 | 7.717726 | 6.02021 | 0 | 44 |
| log_gdppc | 870 | 8.584141 | .4435187 | 7.24639 | 9.620394 |
| trade | 789 | 81.24798 | 32.43378 | 21.85225 | 220.4068 |
| inflation | 868 | 7.647816 | 12.09945 | -26.1 | 185.2908 |
| sp_pctexp | 466 | 15.98169 | 13.08307 | .1142731 | 55.69506 |
| Chômage | 606 | 10.7906 | 8.4021 | .2065 | 57 |
| exchange_rate | 834 | 517.6885 | 1780.691 | .087675 | 14236.94 |
| cont_corrupt | 828 | -.3207814 | .5847565 | -1.626686 | 1.218976 |
| pop_growth | 874 | 1.038628 | 1.205564 | -9.080639 | 7.78601 |
| ratio_dep | 817 | 55.67596 | 11.19305 | 31.32194 | 91.25533 |
| edu_sec | 512 | 82.77254 | 17.35167 | 28.622 | 141.8758 |

2000 and 2018, figure 1 show that both variables generally follow a similar downward trend. The variables had relatively high levels in the early 2000s, reaching their lowest points after the 2008 financial crisis. The data suggests a positive correlation between central bank interest rates and income disparities. Specifically, an increase in central bank interest rates appears to lead to an increase in income inequalities. An increase in central bank interest rates may widen the gap between the rich and the poor (figure 4).

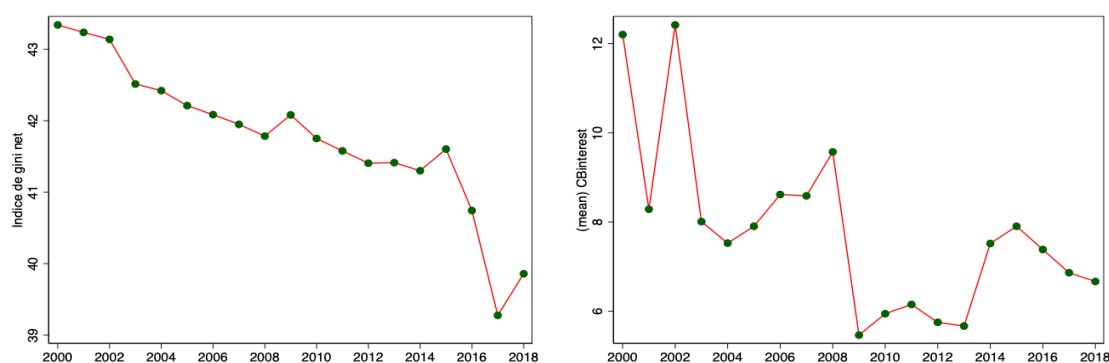


FIGURE 1 – Evolution of the Gini index and the central bank interest rates from 2000 to 2018

3.3 Estimation Strategy

To study the impact of conventional monetary policy on income disparity, we specify our model as follows :

$$Gini_{it} = \alpha + \beta Gini_{it-1} + \delta CBinterest_{it} + \sum_{k=1}^k \gamma_k X_{kit} + v_i + \epsilon_{it} \quad (1)$$

In equation 1, $Gini_{it}$ is our dependent variable, representing the net Gini index of country i in year t , while $Gini_{it-1}$ represents its value in $t-1$. α is a constant, $CBinterest_{it}$ is the central bank interest rate of country i in year t , and X_{kit} is a set of control variables related to economic, demographic and institutional factors that, as explained above, play an important role in explaining income inequality in the previous literature. The unobserved country-specific characteristics are denoted by v_i . Finally, ϵ_{it} represents idiosyncratic errors. Following the theoretical literature and the results of the Hausman test (see table 10), we have opted for a fixed effects specification of unobserved heterogeneity. The dynamic panel structure is justified by the persistence of income inequality over time. Indeed, income inequalities observed in period $t-1$ are expected to influence those estimated in t .

Research explicitly linking monetary policy and income disparities faces significant identification challenges. It is challenging to estimate the causal relationship between these two variables because monetary policy can also result from an increase in inequalities and vice versa. According to Cingano (2014), an increase in inequalities can slow economic growth, prompting a monetary reaction, while monetary policy can have its own effect on income distribution. Besides the plausible existence of simultaneity bias, proving causality can be difficult if monetary policy and inequalities have a common cause or are caused by the same phenomenon (Blot et al., 2017). Another challenge is the difficulty of distinguishing the effects of monetary policy from those produced by factors that initially motivated the intervention of monetary policy. A final problem commonly encountered in the empirical treatment of this subject is related to the frequency mismatch of policy changes and the fact that it can occur multiple times in a year. Coibion et al. (2017) attempted to address this issue in a recent study by isolating the true surprise component in the change of the federal funds rate using a measure of monetary policy

shocks developed in 2004 by [Romer and Romer \(2004\)](#).

To estimate this type of model, we need an estimator capable of accounting for the unobserved country characteristics and the lagged dependent variable. Standard estimation methods, including Ordinary Least Squares (OLS), are powerless because of the presence of the lagged endogenous variable among our explanatory variables. Their use would provide biased results due to the endogeneity of this lagged variable. The fixed effects estimator "within" is often presented as an alternative. Indeed, it provides consistent estimates by eliminating unobserved characteristics (v_i) and correcting the heterogeneity bias. However, for panels with a limited time dimension (19 years in our case), the use of this estimator introduces a bias called "Nickell bias." This bias is caused by the within transformation, generating a correlation between the lagged variable and the error terms. This estimator seems inappropriate for our study. To overcome this, we will use the generalized method of moments (GMM). GMM helps correct the endogeneity bias between our dependent variable and the variable of interest, the omitted variable bias, and the unobserved heterogeneity of our panel. There are two main categories of generalized method of moments : the generalized method of moments in first difference ([Anderson and Hsiao, 1981](#); [Arellano and Bond, 1991](#)) and the generalized method of moments in system ([Blundell and Bond, 1998](#); [Arellano and Bover, 1995](#)). Both methods provide unbiased and convergent estimators. However, the first method is criticized because it has two main limitations. The first criticism is related to the fact that it eliminates time-invariant effects that could influence the dependent variable. The second criticism concerns the quality of instruments. Level lagged variables being weakly correlated with the first difference equation variables, this method potentially suffers from weak instrument problems. To address this, [Blundell and Bond \(1998\)](#) proposes a method that enhances the relevance of instruments and maintains variables in level. This method, known as the system GMM, considers as instruments all lagged dependent variables of at least two periods, provided they are uncorrelated with the residuals. Our study will therefore rely on this latter method because, as asserted by [Blundell and Bond](#), it is the most appropriate estimator for handling dynamic panel models.

The use of this method requires certain conditions to be met for the results to be considered reliable. These conditions include : the coefficient of the lagged dependent variable must be

significant and less than 1, there must be autocorrelation of the error term at lag 1 (AR(1)), the autoregressive process AR(2) should not be significant. Moreover, a very large number of instruments can distort the result. To avoid this, we will use the collapse option. The last condition requires that the Hansen overidentification test is not significant.

4 Results

Table 2 summarises all the results of our estimations carried out with the GMM system model (BB), using the net Gini index developed by [Solt \(2020\)](#) as the dependent variable. The results of the AR1, AR2 and Hansen tests lead us to confirm the first-order autocorrelation of the error term, reject it at the second order and confirm the internal validity of our instruments. We gradually introduce each control variable into our model. In the first column, we run the regression using only the monetary variable, without any other control variable. It is important to note that the lagged dependent variable is included in all specifications. The coefficient on the lagged dependent variable retains its positive sign and remains significant in all columns of the Table 2. The coefficient of the " Central bank policy rate " variable, on the other hand, is positive and not very significant in the simple estimation in the first column. It retains its sign in all specifications, but its significance is not robust to the inclusion of certain variables. Following the work of [Coibion et al. \(2017\)](#), in columns (9), (10), (11) and (12) we have replaced the variable of interest with its lagged values of one, two, three and four years respectively. The results obtained suggest that the increase in interest rates does not really affect income inequality until the third year after its implementation. This implies that the observed impact of monetary policy on inequality is a long-term effect. Thus, a one percentage point increase in the lagged monetary variable from three years ago leads to an increase in the level of inequality by 0.0149 percentage points. This result is in line with the literature, suggesting that a tightening of monetary policy would benefit the rich at the expense of poor households. There are several possible explanations for this result. First, an increase in interest rates leads to higher interest on loans, which benefits net creditors, who are generally rich, and hurts net debtors, whose burden increases. Another plausible explanation for this result relates to its impact on economic

activity. It is generally accepted that restrictive monetary policy hampers economic activity and increases the unemployment rate. Since the poor are more vulnerable to unemployment, it is understandable that this policy further widens the gap between rich and poor. The introduction of the inflation variable as a control variable in our study does not alter the effect of the monetary variable. The results show that inflation has a significant impact on income inequality. The estimates in the last column suggest that a one percentage point increase in inflation reduces income inequality by 0.00236 percentage points. This result is in line with the work of [Doepke and Schneider \(2006\)](#), who conducted studies on these issues using US data and suggested that an increase in inflation leads to an income transfer from rich to poor households. They justify this finding through the savings redistribution channel. Indeed, according to them, modest households tend to hold long-term debt denominated in nominal terms and at fixed interest rates, while wealthy households are more likely to hold securities denominated in currencies. This puts the latter at a disadvantage in the event of inflation. This result is also confirmed by the paper by [Bricker et al. \(2017\)](#). For them, inflation acts as a tax on bonds and thus penalises the rich, who are the main holders. In the third column, we include the variable unemployment rate in our model. The inclusion of this variable does not affect the observed distributive effect of monetary policy. The coefficient on the unemployment rate is positive but insignificant in columns (4) and (5). However, it becomes significant and retains its sign in subsequent specifications. The results suggest that a one percentage point increase in the unemployment rate leads to an increase in inequality between 0.0389 and 0.0574 percentage points. This result confirms our hypothesis mentioned in the descriptive part of the data. Unemployment fuels inequality because the poor are the most exposed. In the third column, we include the unemployment rate variable in our model. The introduction of this variable does not affect the observed distributional effect of monetary policy. The coefficient on the unemployment rate variable is positive but insignificant in columns (4) and (5). However, it becomes significant and retains its sign in the remaining specifications. The results suggest that a one percentage point increase in the unemployment rate leads to an increase in inequality of between 0.0389 and 0.0574 percentage points. This result confirms our hypothesis mentioned in the descriptive section of the data. Unemployment feeds inequality because the poor are most exposed to it. Another result that

caught our attention is that obtained by including a measure of human capital. Recall that the measure of human capital used is the completion rate of the first cycle of secondary education. Our estimates show that the educational attainment rate significantly reduces income inequality. This result holds in all specifications used in the model. In fact, an increase in the education rate leads to a reduction in the Gini index from -0.0216 to -0.0144 percentage points. This is explained by the fact that education increases the chances of entering the labour market and of obtaining a skilled and better paid job. This could significantly improve the situation of the poor who have no other source of income than work. At the same time, social protection levels have a significant impact on income disparities. Our obtained coefficients support the notion that robust social policies reduce social disparities. These coefficients are negative and highly significant in all columns where the variable 'social protection expenditures' is included. Social protection expenditures are commonly understood as measures intended to assist populations in managing shared resources and accessing essential services. Social protection spending enables access to education, employment, and economic security, as well as retirement benefits. It also protects against risks such as unemployment, illness, and accidents. Palme (2002) notes that social protection expenditures result in income transfers from the rich to the poor. Those with low incomes are often the most exposed and struggle to cope with risks. Strengthening the social protection system has advantages for disadvantaged individuals and reduces inequalities. Finally, it has been found that trade openness has a negative impact on income inequality. This relationship is easily understood as trade flows increase employment opportunities in the labor market by diversifying job types and altering wage distributions. This effect is particularly evident in emerging economies, which have a relatively abundant and less skilled labour force.

TABLE 2 – Impact of monetary policy on measured income inequality
Dependent variable : Net Gini index

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|--------------|-----------------------|--------------------------|-------------------------|-----------------------|-------------------------|-------------------------|------------------------|------------------------|------------------------|------------------------|---------------------------|-------------------------|
| L.gini_disp | 0.9751*** (0.0509) | 0.918*** (0.0467) | 0.895*** (0.0448) | 0.916*** (0.0384) | 0.933*** (0.0277) | 0.909*** (0.0337) | 0.879*** (0.0437) | 0.857*** (0.0432) | 0.859*** (0.0468) | 0.864*** (0.0465) | 0.859*** (0.0454) | 0.878*** (0.0381) |
| CBrate | 0.0228** (0.00855) | 0.00943 (0.00778) | 0.0189* (0.00986) | 0.0139* (0.00787) | 0.00483 (0.00851) | 0.0153 (0.0121) | 0.0264* (0.0151) | 0.0170 (0.0135) | | | | |
| inflation_d | | -0.00751* (0.0038316) | -0.00854* (0.004357) | -0.00700 (0.00611) | -0.00985 (0.00583) | -0.00232 (0.00626) | 0.00663 (0.00810) | 0.00827 (0.00957) | 0.00370 (0.00570) | 0.00275 (0.00480) | -0.00156* (0.00079592) | -0.00236* (0.001204) |
| Chômage | | | 0.0307 (0.0219) | 0.0273 (0.0178) | 0.0256** (0.0120) | 0.0190 (0.0150) | 0.0442* (0.0180) | 0.0431* (0.0235) | 0.0422* (0.0239) | 0.0416* (0.0222) | 0.0389* (0.0212) | 0.0389* (0.019846) |
| log_gdppc | | | | 0.127 (0.221) | -0.0190 (0.195) | -0.257 (0.250) | 0.233 (0.279) | -0.0633 (0.232) | -0.0385 (0.239) | -0.0417 (0.243) | -0.00910 (0.266) | -0.0440 (0.262) |
| edu_sec | | | | | -0.0144*** (0.00522) | -0.0201*** (0.00667) | -0.0212** (0.00900) | -0.0216** (0.00979) | -0.0211** (0.0100) | -0.0198** (0.00907) | -0.0201** (0.00936) | -0.0174** (0.00798) |
| goveff | | | | | | 0.464** (0.199) | 0.140 (0.149) | 0.685 (0.409) | 0.614 (0.399) | 0.570 (0.396) | 0.403 (0.423) | 0.403 (0.349) |
| sp_pctexp | | | | | | | -0.0375** (0.0143) | -0.0367*** (0.0102) | -0.0364*** (0.0107) | -0.0354*** (0.0107) | -0.0385*** (0.0105) | -0.0363*** (0.0103) |
| trade | | | | | | | | -0.00986* (0.00547) | -0.00987* (0.00563) | -0.00933 (0.00572) | -0.00949* (0.00484) | -0.00729* (0.003719) |
| L.CBrate | | | | | | | | | 0.0137 (0.0106) | | | |
| L2.CBrate | | | | | | | | | | 0.0146 (0.00994) | | |
| L3.CBrate | | | | | | | | | | | 0.0149* (0.00800) | |
| L4.CBrate | | | | | | | | | | | | 0.0132** (0.00532) |
| Constant | 5.182* (2.607) | 3.444* (2.015) | 3.973** (1.929) | 2.057 (2.016) | 3.867 (2.328) | 7.369** (3.258) | 4.637* (2.445) | 9.105** (3.515) | 8.844** (3.561) | 8.489** (3.524) | 8.561** (3.945) | 7.639** (3.579) |
| Observations | 509 | 509 | 406 | 406 | 267 | 256 | 188 | 182 | 181 | 180 | 167 | 155 |
| Number of id | 35 | 35 | 33 | 33 | 31 | 31 | 25 | 24 | 24 | 24 | 24 | 24 |
| N_g | 35 | 35 | 33 | 33 | 31 | 31 | 25 | 24 | 24 | 24 | 24 | 24 |
| hansenp | 0.0248 | 0.0176 | 0.118 | 0.0276 | 0.101 | 0.0783 | 0.364 | 0.491 | 0.569 | 0.432 | 0.327 | 0.380 |
| j | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 20 | 20 | 20 | 20 |
| ar2p | 0.171 | 0.164 | 0.290 | 0.278 | 0.225 | 0.286 | 0.652 | 0.302 | 0.281 | 0.262 | 0.725 | 0.727 |
| ar1p | 0.0169 | 0.0345 | 0.0573 | 0.0728 | 0.0834 | 0.0987 | 0.0946 | 0.352 | 0.0954 | 0.0563 | 0.080 | 0.0715 |

Note : Robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

In researching the effects of monetary policy, it is crucial to focus on the study of channels in order to understand the mechanisms through which transmission takes place. In line with this approach, we aim to identify the channels through which monetary policy affects income distribution. Based on the theoretical and empirical literature (Coibion et al., 2017; Ampudia et al., 2018; Colciago, Samarina, and de Haan, 2019) and the results presented above, we have chosen to analyse the following channels : the inflation channel, the bank credit channel and the exchange rate channel. Some channels can also be treated as factors conditioning the effect of this policy transmission in the heterogeneity section. The results are summarised in table 7 below.

First, we include the cross-variable L3.CBrate*inflation to highlight the inflation channel. It should be noted that before introducing the cross-variable, we took care to add the inflation and interest rate variables with a lag of 3 years. We observe that the interest rate and inflation have opposite effects on income distribution. As already explained, inflation reduces inequalities, while an increase in interest rates stimulates them. The coefficient of the cross variable is significant, indicating that inflation is indeed a transmission channel of monetary policy. The

sign of the cross effect is negative. Thus, in the presence of inflation, the increase in interest rates reduces income inequality. This is in line with the literature, which suggests that restrictive monetary policy is more effective in periods of inflation or hyperinflation (Furceri, Loungani, and Zdzienicka, 2018). Since the obtained sign of the cross variable is opposite to that of the variable of interest, we can conclude that restrictive monetary policy is favourable to the poor at certain levels of inflation.

Second, we examined the bank credit channel as a mechanism through which monetary policy could affect the gap between the rich and the poor within a country. Our intuition to test this channel comes from the work of Kashyap and Stein (1995) and Saumitra and Toto (2012). For these authors, the bank credit channel is an effective mechanism through which monetary policy affects the real economy. In order to highlight this channel, we first used the interest rate on loans granted to households by second-tier banks and then crossed this variable with the monetary policy variable. The results in Table 7 show that the lending rate is not an effective channel through which monetary policy affects inequalities. This is due to the fact that lending rates in these countries are generally at a relatively high level, regardless of the monetary policy conducted. Since the lending rate channel is not effective, we decided to look at the amount of credit granted. We hypothesise that the increase in the cost of funding for commercial banks will lead them to ration customers or drastically increase the cost of lending. Banks will become more risk-averse. This behaviour of secondary banks has a negative impact on the income and living conditions of the poor, as they are highly dependent on loans, especially for project implementation, small business financing and/or consumption. In column (4) of table 7, we simultaneously introduced the variable "amount of loans granted as a percentage of GDP" and then crossed this variable with the 3-year lagged monetary policy variable. The results confirm our hypothesis. We observe that an increase in refinancing rates has a positive effect on inequality, and this effect is accentuated when this policy is accompanied by an increase in the share of loans as a percentage of GDP.

The last channel we have considered in this paper is the exchange rate channel. We used the exchange rate variable from the World Bank website. We then crossed it with the lagged monetary policy variable. The coefficient on the monetary policy variable remains positive and

significant. The exchange rate variable also has a positive and much more significant effect on inequality. This could be explained by the fact that the depreciation of the national currency negatively affects the purchasing power of households and economic activity (Mishkin, 1996). The results presented in the third column of the table 7 show that the cross effect between these two variables is positive and highly significant. In other words, an increase in the policy rate leads to an increase in inequality, and this effect is amplified when the tightening of monetary policy is accompanied by a depreciation of the currency against the dollar. We therefore conclude that the exchange rate is an effective transmission channel of monetary policy on income distribution.

5 Robustness Check

To evaluate the robustness of our findings, we will subject them to several tests. The results of these tests are recorded in Table 3 below.

5.1 Alternative Measures of Income Inequality

To test the robustness of our results, we replaced the net Gini index with two alternative inequality measures. Firstly, we used the market Gini index, which is extracted from the SWIID database, like the net Gini, and provides an estimate of income disparities before taxes and transfers. We aimed to ensure that our results were not driven by any specific fiscal policy by testing them with different inequality measures. The first column of Table 3 shows that our results are robust to this change in measurement, as they are not affected by tax and transfer policies.

Secondly, instead of the Gini index, we use an indicator published annually by INSEE : the 20/20 ratio. This ratio represents the relationship between the income held by the richest 20% and the poorest 20%. In other words, this ratio enables us to state that the top 20% receive 'x times' more income than the least privileged 20%. INSEE's aim is to focus more closely on what fuels debates about inequality, namely the richest and the poorest, without considering the middle classes. The estimation results using this indicator are recorded in column (2) of Table 3.

The coefficient for the monetary policy variable retains its positive sign and remains significant. An increase of one percentage point in the lagged variable of the central bank interest rate leads to a 0.0691 percentage point increase in the 20/20 ratio. This result is statistically significant at the 1% level.

5.2 Period from 2008 crisis to 2018 excluded

The 2008 financial crisis had significant implications for monetary policy. It not only introduced new approaches to its implementation but also brought about fresh perspectives on incorporating considerations of financial risks. Notably, market interest rates experienced a sharp decline in the aftermath of the 2008 crisis. The decrease in question resulted from a deliberate shift towards a more accommodating monetary policy by the authorities. The aim was to support businesses against the crisis and stimulate economic growth. To ensure the robustness of our findings during and after the crisis, we chose to exclude the years between 2008 and 2018. Subsequent analysis, specifically the coefficient associated with the monetary policy variable after this exclusion (Table 3), confirms the robustness of our findings to changes in the time frame. This ensures that our conclusions are not unduly influenced by the events of this tumultuous period.

5.3 Sub-Saharan Africa excluded

The data shows that the Sub-Saharan Africa region has the highest level of inequality, with an average Gini index of 61.13 (figure 3). Additionally, the three countries with the highest inequality values are located in Africa. It is worth noting that Namibia has the highest level of inequality, with a Gini index of 66.65. To ensure the accuracy of our results, we excluded all Sub-Saharan African countries from our sample. Estimating with this new sample produced results that were very similar to those provided by our baseline estimations. Therefore, our findings are robust to the exclusion of this region and, by extension, potential outlier data points. The results are presented in the last column of Table 3.

After testing the sensitivity of our results to changes in inequality measures, to the exclusion

of the crisis and post-crisis period from 2008 and to the exclusion of sub-Saharan Africa, which emerges as the most unequal region, it is clear that our results remain robust.

TABLE 3 – Robustness Check

| | (1) | (2) | (3) | (4) |
|-----------------|------------------------|------------------------|----------------------|-------------------------|
| | gini_mark | rapport_20_20 | Period_2000_2008 | whitout SSA |
| L.gini_mkt | 0.798*** (0.148) | | | |
| L3.CBrate | 0.00418* (0.00213) | 0.0691*** (0.0229) | 0.0189* (0.00965) | 0.0192** (0.00766) |
| inflation_d | 0.0523 (0.0322) | -0.0254 (0.0402) | 0.0136 (0.0118) | -0.000480 (0.00617) |
| Chômage | -0.264** (0.102) | 0.00544 (0.192) | 0.00204 (0.0141) | -0.0163 (0.0172) |
| log_gdppc | -2.200 (1.500) | -3.742* (1.999) | -0.470* (0.247) | -0.444** (0.189) |
| edu_sec | -0.0620 (0.0390) | -0.0918** (0.0360) | 0.00760 (0.00709) | -0.0129*** (0.00388) |
| goveff | 3.899*** (1.369) | 4.216** (1.969) | -0.276 (0.562) | 0.979*** (0.263) |
| sp_pctexp | -0.140** (0.0571) | -0.143*** (0.0462) | -0.00684 (0.0114) | -0.0214*** (0.00750) |
| trade | -0.0610*** (0.0151) | -0.0734*** (0.0180) | 0.00458 (0.00798) | -0.0129*** (0.00400) |
| L.rapport_20_20 | | 0.645*** (0.184) | | |
| L.gini_disp | | | 1.055*** (0.0829) | 0.861*** (0.0316) |
| Constant | 38.47** (13.81) | 83.25*** (16.06) | 0.594 (3.996) | 11.96*** (2.857) |
| N | 167 | 116 | 74 | 160 |
| N_g | 24 | 21 | 20 | 21 |
| hansenp | 0.240 | 0.205 | 0.510 | 0.191 |
| j | 10 | 10 | 10 | 10 |
| ar2p | 0.879 | 0.634 | 0.191 | 0.633 |
| ar1p | 0.0545 | 0.0422 | 0.0614 | 0.0601 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

6 Conditional Effects

In this section, we address the heterogeneity of our results. In other words, we examine the conditions that are likely to influence the impact of monetary policy on income inequalities in emerging countries. Specifically, we aim to condition the effect of interest rates on income disparities by dividing our sample based on criteria such as the significance of social protection

policies, the role of income from labor, and the economic context. This section is of great importance as it will enable us to identify the conditions and/or situations under which the findings presented in this thesis may evolve.

6.1 Role of Redistribution Policies

We examine whether the impact of monetary policy on income distribution depends on the level of social protection in countries. To do this, we split our initial sample into two subsamples : "countries with a high level of social protection" and "countries with a low level of social protection". We identified these groups on the basis of the importance of social protection expenditure in total expenditure, considering those with values below the median as observations with low social protection and vice versa. The results show that restrictive monetary policies significantly increase inequality in countries with low levels of social protection. This effect is absent in countries with high levels of social protection (see table 4). This result can be explained by the fact that the inequality-reducing effects of social protection spending offset the positive effects of rising market interest rates on income inequalities. Indeed, social protection, understood as a risk reduction system, involves a redistribution of wealth from the wealthy to the less privileged, as disadvantaged individuals generally face higher risks of illness, accidents at work and unemployment [Palme \(2002\)](#).

6.2 Role of the Economic Situation

We analyse the impact of monetary policy on income distribution based on the macroeconomic context. Empirical studies have shown that restrictive monetary policy has a greater impact on economic activity during periods of expansion. However, some researchers argue that the effects of monetary policy tightening are negligible during recessionary periods ([Barnichon and Matthes, 2014](#); [Furceri, Loungani, and Zdzienicka, 2018](#)). Does the distributive impact of monetary policy depend on the economic cycle ? To answer this question, we divided our sample into two periods : the recession period and the expansion period. We used GDP growth as a measure of the economic cycle, following [Furceri, Loungani, and Zdzienicka \(2018\)](#) research.

Positive GDP growth is associated with expansion, while negative growth is linked to the recession period. The data in columns (3) and (4) of Table 4 indicate that an increase in interest rates has a positive impact on income inequality during both recessionary and expansionary periods. [figure 5](#) in the appendix shows that there are no significant differences between the effects. Therefore, we conclude that our results are not dependent on the economic cycle.

6.3 The Role of Employment Income

As stated in the literature section, monetary policy affects income distribution through the heterogeneity of income sources. Tightening monetary policy generally has a significant impact on labor income, which affects the poor more heavily. Therefore, it is understandable that rising interest rates can lead to inequalities ([Kappes, 2023](#)). If this channel is effective, the impact of monetary policy would depend on the share of labour income in GDP. To test this, the sample was divided into two groups : countries with a high share of labour income and countries with a low share of wage income. The variable 'share of wages as a percentage of GDP' was used to identify these subgroups, with the median used for classification. The results are presented in columns (5) and (6) of table 4. The coefficient of the monetary variable shows a positive and significant distributive effect of monetary policy tightening for the subgroup with a 'High share of labor income'. However, monetary policy had no effect on income inequality in the group of countries with a low share of wages in GDP. The empirical studies by([Furceri, Loungani, and Zdzienicka, 2018](#); [Albanesi, 2007](#); [Blot et al., 2017](#); [Dabla-Norris et al., 2015](#)) support our hypothesis that the effect of restrictive monetary policy on income inequality in emerging markets depends on the share of wages in GDP.

TABLE 4 – Conditional Effects

| | (1) High social protection | (2) Low social protection | (3) Expansion | (4) Recession | (5) Low share of salaries | (6) High share of salaries |
|--------------|-------------------------------|------------------------------|------------------------|-------------------------|------------------------------|-------------------------------|
| L.gini_disp | 0.950*** (0.0303) | 0.923*** (0.0460) | 0.814*** (0.0741) | 0.919*** (0.0309) | 0.890*** (0.0552) | 0.835*** (0.0650) |
| L3.CBrate | 0.00537 (0.00906) | 0.112** (0.0463) | 0.0210* (0.01061) | 0.00999* (0.0050) | -0.0189 (0.0276) | 0.0196* (0.0185) |
| inflation_d | -0.00611 (0.00461) | 0.0269 (0.0191) | -0.00137 (0.00644) | 0.00535 (0.00819) | -0.00400 (0.0108) | -0.00258 (0.00632) |
| Chômage | 0.00143 (0.00938) | 0.0660* (0.0357) | 0.0526 (0.0329) | 0.0313 (0.0196) | 0.0577* (0.0311) | 0.0474 (0.0278) |
| log_gdppc | -0.211 (0.157) | 0.0327 (0.262) | 0.115 (0.324) | -0.352 (0.451) | -0.395* (0.190) | 0.0484 (0.301) |
| edu_sec | -0.00956* (0.00499) | -0.0179* (0.00934) | -0.0254* (0.0128) | -0.0207*** (0.00526) | -0.0253* (0.0128) | -0.0237** (0.0114) |
| goveff | 0.256* (0.142) | -0.0589 (0.374) | 0.736 (0.586) | 0.417 (0.398) | 0.721** (0.335) | 0.585 (0.486) |
| sp_pctexp | | | -0.0492*** (0.0151) | -0.0134 (0.0108) | -0.0319* (0.0158) | -0.0442*** (0.0136) |
| trade | -0.000562 (0.00276) | -0.00237 (0.00288) | -0.0131 (0.00835) | -0.00121 (0.00349) | -0.00851 (0.00700) | -0.0106 (0.00702) |
| Constant | 4.536 (2.705) | 4.754* (2.188) | 10.20* (5.211) | 7.912* (3.407) | 10.81*** (3.029) | 9.520* (4.762) |
| Observations | 162 | 75 | 154 | 13 | 110 | 164 |
| N_g | 24 | 13 | 24 | 13 | 18 | 24 |
| hansenp | 0.147 | 0.828 | 0.366 | 1 | 0.639 | 0.286 |
| j | 9 | 9 | 9 | 9 | 10 | 10 |
| ar2p | 0.122 | 0.0520 | 0.614 | 0.185 | 0.0595 | 0.516 |
| ar1p | 0.0170 | 0.0676 | 0.0240 | 0.0142 | 0.0471 | 0.0329 |

7 Conclusion and Recommendations

In this study, we sought to assess the impact of monetary policy on income inequality in emerging markets. Specifically, we examined the impact of an increase in the policy rate on income distribution, using the Generalised Method of Moments (GMM) proposed by (Blundell and Bond, 1998) to address several endogeneity challenges in a dataset of 46 countries. The study covers the period from 2000 to 2018. Our results suggest that restrictive monetary policy exacerbates pre-existing wealth inequalities in the long run. In particular, the discernible impact on income distribution only materialises from the third year after implementation, underlining the lack of short-term effects on inequality. This effect is particularly pronounced when the increase in interest rates coincides with an unexpected depreciation of the national currency or a surge in bank credit, suggesting that exchange rates and credit act as channels through which monetary policy influences income distribution. Moreover, our results suggest that monetary policy may be beneficial for disadvantaged households in the presence of inflation or hyperinflation. In particular, an increase in interest rates during inflation reduces income inequality, in

line with our hypotheses and the existing literature (Furceri, Loungani, and Zdzienicka, 2018; Barnichon and Matthes, 2014). These findings remain robust to variations in the sample, time horizon, and changes in inequality indicators in the outcome model. In addition, we examine whether the impact of monetary policy on income distribution depends on various economic and political factors. The results suggest that the impact of monetary tightening on income inequality depends on the importance of labour income in countries. Furthermore, in countries where social protection expenditure is a significant part of total expenditure, monetary policy has no effect on inequality. Regarding economic conditions, our results show that the effect is observed in both recessions and expansions, suggesting that the distributive effect of monetary tightening is not affected by economic conditions.

The study presented in this paper provides valuable insights to guide monetary policymakers in assessing the impact of their actions on the economy, particularly with respect to inequality. Central banks, which have sometimes overlooked inequality concerns in their policy conduct, should consider the distributional dimension of their policies, even if it is not their primary mandate. Coordination with government officials to align policy objectives is recommended. Policymakers should avoid tightening monetary policy during periods of low inflation and significant depreciation of the national currency against the US dollar. In addition, we recommend that policymakers in emerging markets implement measures to boost trade flows, improve education and strengthen social protection, which will directly contribute to reducing inequality. Efforts to tackle unemployment by providing real employment and investment opportunities are also essential.

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A Annexe

TABLE 5 – Sample

| | | | |
|------------------------|--------------------|------------|---------------|
| Albania | Costa Rica | Kazakhstan | Serbia |
| Argentina | Dominica | Kosovo | South Africa |
| Armenia | Dominican Republic | Lebanon | St. Lucia |
| Azerbaijan | Ecuador | Libya | Suriname |
| Belarus | Fiji | Malaysia | Thailand |
| Belize | Georgia | Maldives | Tonga |
| Bosnia and Herzegovina | Grenada | Mexico | Turkey |
| Botswana | Guatemala | Montenegro | Turkmenistan |
| Brazil | Indonesia | Namibia | Tuvalu |
| Bulgaria | Iraq | Paraguay | Venezuela, RB |
| China | Jamaica | Peru | |
| Colombia | Jordan | Samoa | |

TABLE 6 – Lists of variables

| Variable Name | Definition | Sources |
|----------------|--|----------------------|
| gini_disp | Net Gini index | SWIID |
| gini_mkt | Market Gini index (pre-tax and pre-transfer) | SWIID |
| rapport_20_20 | Share of the top twenty percent divided by the share of the bottom twenty percent | Author's calculation |
| top10 | Share of the top ten percent | World Bank |
| low20 | Share of the bottom twenty percent | World Bank |
| top20 | Share of the top twenty percent | World Bank |
| CBrate | Market interest rate | BSI |
| lintrate | Lending interest rate (%) | World Bank |
| Cr_M2 | Annual growth rate of the money supply | World Bank |
| gdp | Gross Domestic Product in constant 2010 US dollars | World Bank |
| Credit_To_priv | Share of credit to the private sector as a percentage of GDP | World Bank |
| exchange_rate | Nominal exchange rate | World Bank |
| Chômage | Unemployment rate, the proportion of the active population without work | World Bank |
| ratio_dep | Age dependency ratio is the ratio of dependents—people younger than 15 or older | World Bank |
| pop_growth | Annual population growth | World Bank |
| trade | Trade is the sum of exports and imports of goods and services measured as a share | World Bank |
| gdppc | Gross Domestic Product per capita | World Bank |
| log_gdppc | Logarithm of GDP per capita | World Bank |
| gdp_gr | Annual GDP growth | World Bank |
| edu_sec | Completion rate of the first cycle of secondary education | World Bank |
| cont_corrupt | Control of corruption | World Bank |
| IT | Dummy variable taking 1 if the country has adopted inflation targeting and 0 otherwise | IMF |
| assets | Net acquisition of financial assets as a percentage of GDP | World Bank |
| goveff | Government effectiveness | World Bank |
| wage_lcu | Wages | World Bank |
| wageP1 | Share of labor income in GDP | Author's calculation |
| inflation_d | General price level | World Bank |
| sp_pctexp | Social protection expenditure, percent of total spending | SPEED |
| CanalDeb | Policy interest rate multiplied by the loan rate | Author's calculation |
| CanalINfl | Policy interest rate crossed with inflation | Author's calculation |
| CanalChange | Exchange rate crossed with policy interest rate | Author's calculation |
| canaCrédit | Policy interest rate crossed with the variable credit granted to the private sector | Author's calculation |

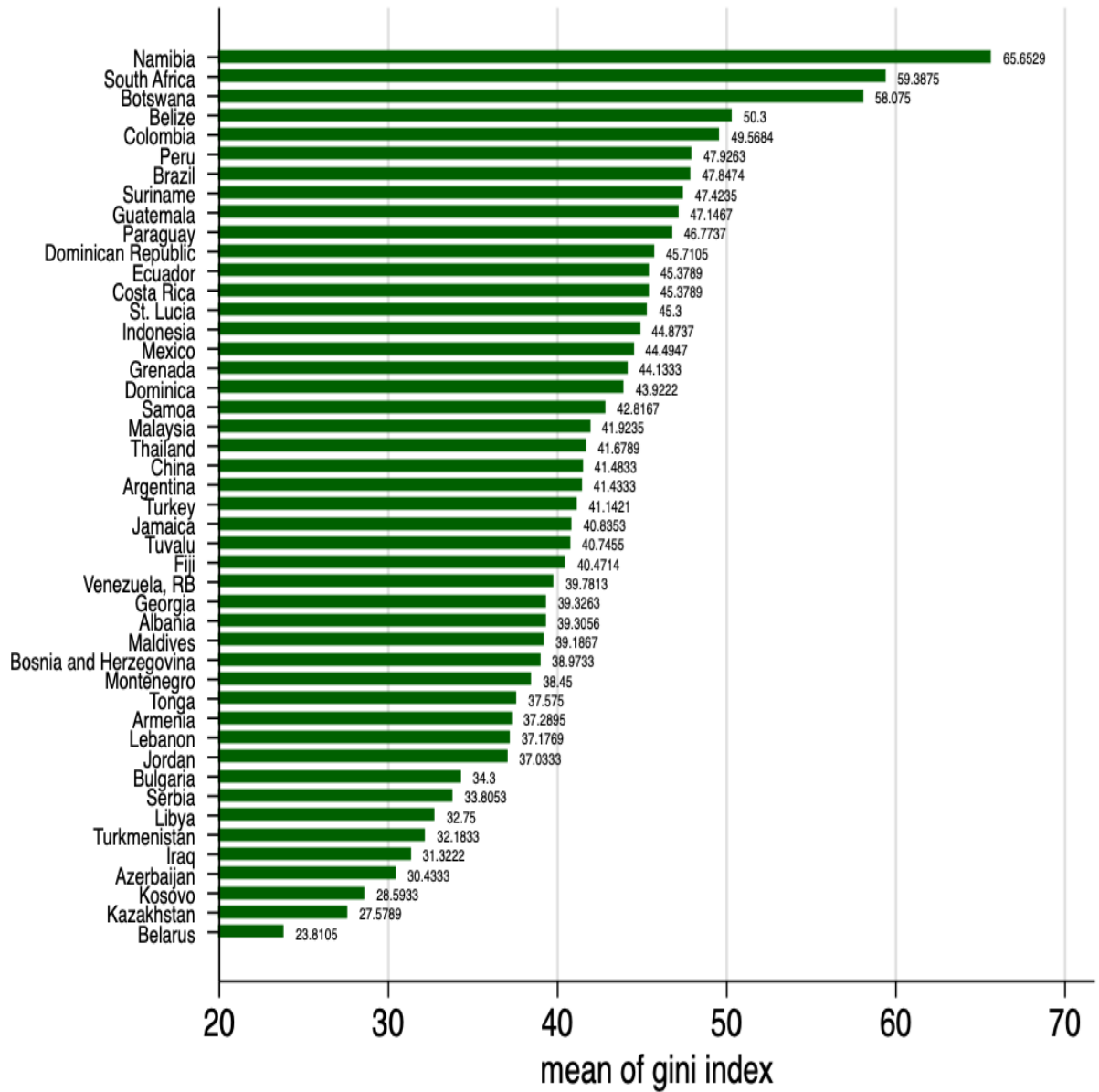


FIGURE 2 – Average level of inequality measured by the Gini index per country, 2000-2018

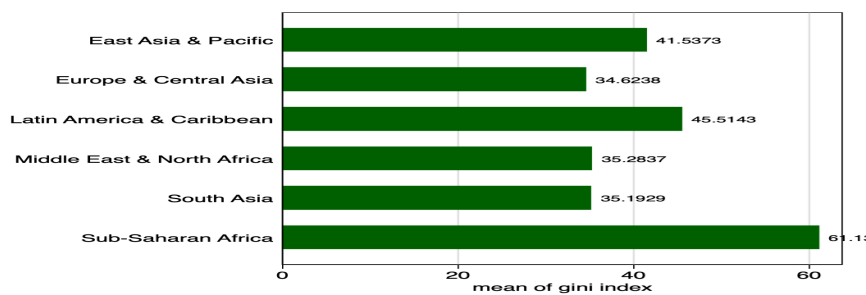


FIGURE 3 – Average income inequality by region, 2000-2018

A.1 Inclusion of cross variables

TABLE 7 – Inclusion of cross variables

| | (1) | (2) | (3) | (4) |
|---------------------|-------------------------|------------------------|---------------------------|-------------------------|
| L.gini_disp | 0.985*** (0.00878) | 0.996*** (0.0132) | 0.948*** (0.0190) | 0.978*** (0.0121) |
| L3.CBrate | 0.0108* (0.00596) | 0.00722* (0.00368) | 0.00587* (0.00299) | 0.0063112* (0.00322) |
| inflation_d | -0.00400* (0.002040) | -6.81e-06 (0.00344) | -0.00891 (0.00548) | -0.00155 (0.00333) |
| lintrate | | -0.00474 (0.00912) | | |
| CanalDeb | | 5.27e-05 (0.000258) | | |
| Chômage | 0.0134** (0.00640) | 0.0140** (0.00587) | 0.0240** (0.00966) | 0.0154** (0.00661) |
| log_gdppc | -0.170 (0.170) | -0.219 (0.182) | 0.113 (0.134) | -0.196 (0.171) |
| edu_sec | -0.00347 (0.00376) | -0.00198 (0.00444) | -0.0105** (0.00399) | -0.00490 (0.00417) |
| trade | 0.000896 (0.00138) | 0.00147 (0.00168) | 0.000787 (0.00151) | -0.000738 (0.00182) |
| L3.Cbrate*inflation | -0.0106* (0.00540) | | | |
| exchange_rate | | | 0.000105*** (1.34e-05) | |
| L3.CBrate*exchange | | | 5.56e-06*** (1.60e-06) | |
| Credit_tp | | | | 0.00308** (0.00137) |
| L3.Cbrate*Credit_tp | | | | 7.41e-05** (0.00175) |
| Constant | 2.117 (1.799) | 1.907 (2.218) | 1.625 (1.469) | 2.700 (2.137) |
| Observations | 240 | 228 | 240 | 240 |
| Number of id | 30 | 30 | 30 | 30 |
| N_g | 30 | 30 | 30 | 30 |
| hansenp | 0.101 | 0.153 | 0.134 | 0.1942 |
| j | 18 | 20 | 20 | 20 |
| ar2p | 0.120 | 0.130 | 0.105 | 0.116 |
| ar1p | 0.011 | 0.0892 | 0.0409 | 0.090 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A.2 OLS and Fixed Effect Estimation

TABLE 8 – Impact of monetary policy on the net Gini index : OLS, FE

| | (1) OLS | (2) OLS | (3) OLS | (4) FE | (5) FE | (6) FE |
|--------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| L.gini_disp | 0.9955*** (0.0033) | 0.9968*** (0.0036) | 0.9986*** (0.0030) | 0.8816*** (0.0190) | 0.9629*** (0.0207) | 0.9639*** (0.0207) |
| CBrate | -0.0034 (0.0030) | -0.0038 (0.0027) | -0.0026 (0.0036) | 0.0025 (0.0033) | 0.0014 (0.0030) | 0.0010 (0.0034) |
| log_gdppc | | -0.1418 (0.1012) | -0.1452 (0.1025) | | -0.3556* (0.1786) | -0.3589* (0.1807) |
| pop_growth | | | -0.0279 (0.0184) | | | 0.0279 (0.0248) |
| trade | | | 0.0010 (0.0011) | | | -0.0009 (0.0016) |
| _cons | 0.1230 (0.1401) | 1.2864 (0.8287) | 1.1718 (0.8925) | 0.9621 (0.8142) | 4.5454** (2.0970) | 4.5807** (2.1183) |
| Observations | 509 | 509 | 482 | 509 | 509 | 482 |

Note : Robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

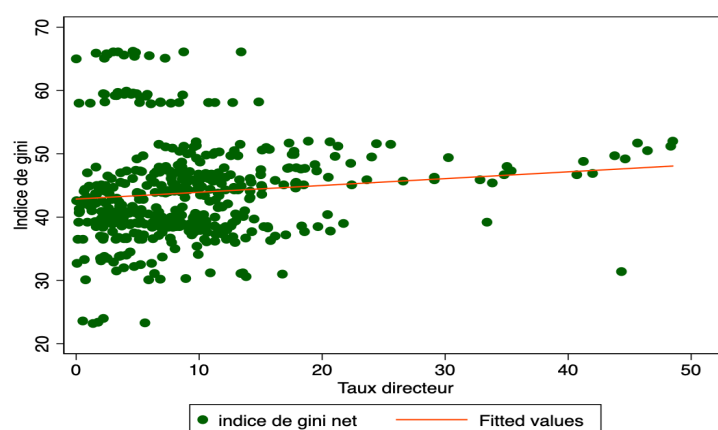


FIGURE 4 – Relationship between Central bank Interest Rates and Income Inequality

A.3 Econometric Tests

A.3.1 Test for Homoscedasticity

Ho= les erreurs sont homoscédastiques H1= Présence d'hétéroscedasticité

$$H_0 : \text{Sigma}(i)^2 = \text{Sigma}^2$$

pour tout i

$$\text{chi2 (34)} = 5.0\text{e}+29$$

$$\text{Prob}>\text{chi2} = 0.0000$$

TABLE 9 – Serial autocorrelation test

| | Coef. | Std. Err. | t | P>t [95% | [Conf. | Interval] |
|------------------|-----------|-----------|-------|----------|-----------|-----------|
| D.gini_disp | | | | | | |
| Cbrate D1. | .0106176 | .0062219 | 1.71 | 0.101 | -.0022237 | .0234589 |
| log_gdppc D1. | .5288704 | .9114615 | 0.58 | 0.567 | -1.352294 | 2.410034 |
| trade D1. | .0001783 | .0030645 | 0.06 | 0.954 | -.0061466 | .0065031 |
| inflation_d D1. | .0070393 | .0058182 | 1.21 | 0.238 | -.0049689 | .0190475 |
| Chômage D1. | .0243689 | .0245021 | 0.99 | 0.330 | -.0262009 | .0749387 |
| cont_corrupt D1. | .4339897 | .2386178 | 1.82 | 0.081 | -.0584934 | .9264727 |
| pop_growth D1. | .0026643 | .0029131 | 0.91 | 0.370 | -.0033481 | .0086766 |
| ratio_dep D1. | .1964354 | .0602085 | 3.26 | 0.003 | .0721711 | .3206996 |
| edu_sec D1. | -.0016569 | .0025924 | -0.64 | 0.529 | -.0070074 | .0036936 |

Wooldridge test for autocorrelation in panel data, H0 : no first order autocorrelation,

$$F(1, 21) = 452.344$$

$$\text{Prob} > F = 0.0000$$

Two-sample t test with equal variances

| Group | Obs | Mean | Std. Err. | Std. Dev. | [95% Conf. Interval] | |
|----------|-----|----------|-----------|-----------|----------------------|----------|
| 0 | 81 | 42.42222 | .6955747 | 6.260172 | 41.03798 | 43.80646 |
| 1 | 640 | 41.87375 | .325026 | 8.22258 | 41.2355 | 42.512 |
| combined | 721 | 41.93537 | .2988398 | 8.02428 | 41.34867 | 42.52207 |
| diff | | .5484725 | .9467639 | | -1.310279 | 2.407224 |

diff = mean(0) - mean(1) t = 0.5793
 Ho: diff = 0 degrees of freedom = 719

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 Pr(T < t) = 0.7187 Pr(|T| > |t|) = 0.5626 Pr(T > t) = 0.2813

FIGURE 5 – Test of Difference

TABLE 10 – Test of haussman

| | --- Coefficients --- | | | |
|---------------|----------------------|----------|------------|---------------------|
| | (b) | (B) | (b-B) | sqrt(diag(V_b-V_B)) |
| | EF | EA | Difference | S.E. |
| gini_disp L1. | .9751062 | .9921893 | -.0170831 | .0083199 |
| CBrate | .0024781 | .0004637 | .0020144 | .0008975 |

b = consistent under Ho and Ha; obtained from xtreg
 Test : Ho : difference in coefficients not systematic

$$\text{Hausman} = (b-B)'[(V_b-V_B)\hat{(-1)}](b-B) = 6.83$$

Prob>chi2 = 0.000

TABLE 11 – Dickey-Fuller Stationarity Test

| Variable | | Statistic | P_value | Décision |
|-------------|---------------------------|-----------|---------|-------------|
| gini_disp | Inverse chi squared (92) | 224.0261 | 0.0000 | Rejet H0 |
| | Inverse normal | -2.7439 | 0.0030 | Rejet H0 |
| | Inverse logit t (219) | -5.0085 | 0.0000 | Rejet H0 |
| | Modified inv. chi-squared | 9.7331 | 0.0000 | Rejet H0 |
| CBrate | Inverse chi squared (70) | 179.4107 | 0.0000 | Rejet H0 |
| | Inverse normal | -5.8797 | 0.0000 | Rejet H0 |
| | Inverse logit t (179) | -6.9740 | 0.0000 | Rejet H0 |
| | Modified inv. chi-squared | 9.2469 | 0.0000 | Rejet H0 |
| trade | Inverse chi squared (86) | 125.1948 | 0.003 | Rejet H0 |
| | Inverse normal | -1.7665 | 0.038 | Rejet H0 |
| | Inverse logit t (219) | -2.2619 | 0.012 | Rejet H0 |
| | Modified inv. chi-squared | 2.9886 | 0.001 | Rejet H0 |
| inflation_d | Inverse chi squared (92) | 506.3361 | 0.0000 | Rejet H0 |
| | Inverse normal | -14.6411 | 0.0000 | Rejet H0 |
| | Inverse logit t (219) | -20.2507 | 0.0000 | Rejet H0 |
| | Modified inv. chi-squared | 30.5453 | 0.0000 | Rejet H0 |
| sp_pctexp | Inverse chi squared (64) | 129.7822 | 0.0000 | Rejet H0 |
| | Inverse normal | 0.4863 | 0.6866 | Accepter H0 |
| | Inverse logit t (164) | -1.3022 | 0.0973 | Accepter H0 |
| | Modified inv. chi-squared | 5.8144 | 0.0000 | Rejet H0 |
| pop_growth | Inverse chi squared (92) | 224.3895 | 0.0000 | Rejet H0 |
| | Inverse normal | -4.6488 | 0.0000 | Rejet H0 |
| | Inverse logit t (234) | -6.1756 | 0.0000 | Rejet H0 |
| | Modified inv. chi-squared | 9.7599 | 0.0000 | Rejet H0 |
| gdppc | Inverse chi squared (92) | 80.3657 | 0.8015 | Accepter H0 |
| | Inverse normal | 3.0319 | 0.9988 | Accepter H0 |
| | Inverse logit t (234) | 3.0523 | 0.9987 | Accepter H0 |
| | Modified inv. chi-squared | -0.8577 | 0.8045 | Accepter H0 |
| Chômage | Inverse chi squared (68) | 120.7578 | 0.0001 | Rejet H0 |
| | Inverse normal | -2.9214 | 0.0017 | Rejet H0 |
| | Inverse logit t (159) | -3.7785 | 0.0000 | Rejet H0 |
| | Modified inv. chi-squared | 4.5239 | 0.0000 | Rejet H0 |
| edu_sec | Inverse chi squared (66) | 184.7080 | 0.0000 | Rejet H0 |
| | Inverse normal | 3.5990 | 0.0002 | Rejet H0 |
| | Inverse logit t (154) | -5.9526 | 0.0000 | Rejet H0 |
| | Modified inv. chi-squared | 9.3923 | 0.0000 | Rejet H0 |
| goveff | Inverse chi squared (92) | 126.8977 | 0.0093 | Rejet H0 |
| | Inverse normal | -0.4836 | 0.3143 | Accepter H0 |
| | Inverse logit t (234) | -0.6806 | 0.2484 | Accepter H0 |
| | Modified inv. chi-squared | 2.5727 | 0.0050 | Rejet H0 |