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Does Monetary Policy Affect Income Distribution? Local Projection Evidence from Turkey

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Abstract

The relationship between monetary policy and inequality has received limited attention in the economics literature. This study aims to contribute to the literature by examining the relationship between monetary policy and income inequality in developing countries, specifically by analysing the results of the Turkish experiment. The local projection method was used to determine the relationship between monetary policy shocks, obtained through the VAR model, and the calculated inequality measures. The main findings of the study suggest that monetary policy can potentially influence the distribution of total income, particularly when the monetary policy shock is significant. The results indicate that monetary policy has a significant impact on income distribution, favouring property income. Moreover, this effect is most pronounced among the highest-income group, highlighting the heterogeneous nature of the impact across different income groups. However, the middle 20% group experiences the sharpest deterioration in income distribution following monetary policy shocks.

Keywords: Income distribution, monetary policy shocks, local projection, Turkey

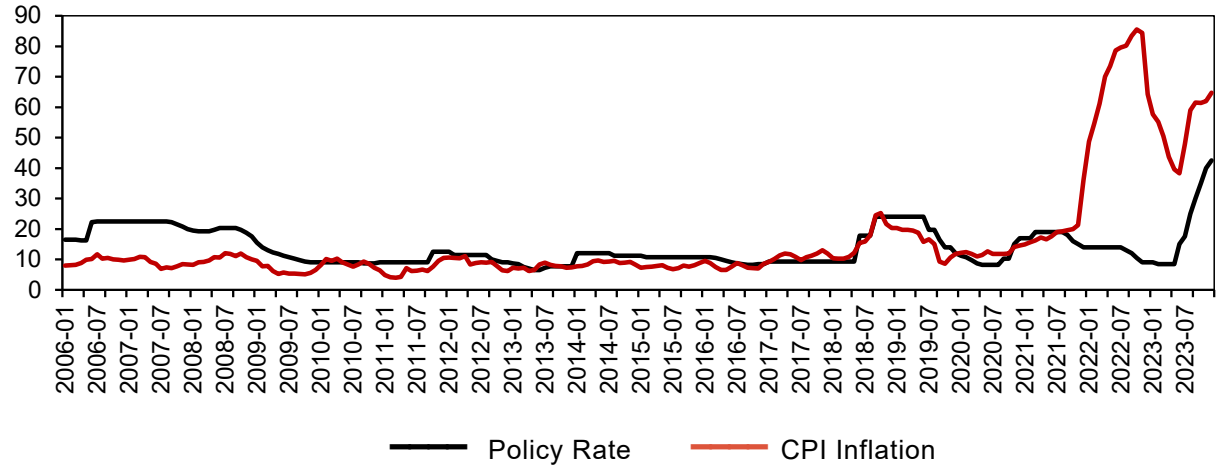
JEL Classification: D33, E52, E58

1. Introduction

Income inequality is a pressing issue that has far-reaching consequences for society and economic development. To address this problem, policymakers must examine its underlying causes and identify effective tools for combatting it. Previous studies from an economic perspective have primarily focused on the impact of government policies, such as fiscal, education and health policies, on income distribution. However, since the 2008 Global Financial Crisis, there has been increasing recognition of the need to consider the potential effects of monetary policy shocks on income distribution when formulating public policies (Bullard, 2014). Bernanke's evaluation further intensified research on this topic in the field of economics: "*... Monetary policy is a blunt tool which certainly affects the distribution of income and wealth, although whether the net effect is to increase or reduce inequality is not clear. More research will be needed to untangle and measure the many channels through which these effects are transmitted...*" (Bernanke, 2015). However, beyond unconventional policies such as quantitative easing or forward guidance, even there are uncertainties about how typical monetary policy decisions affect income inequality and through which channels (Coibion *et al*., 2017).

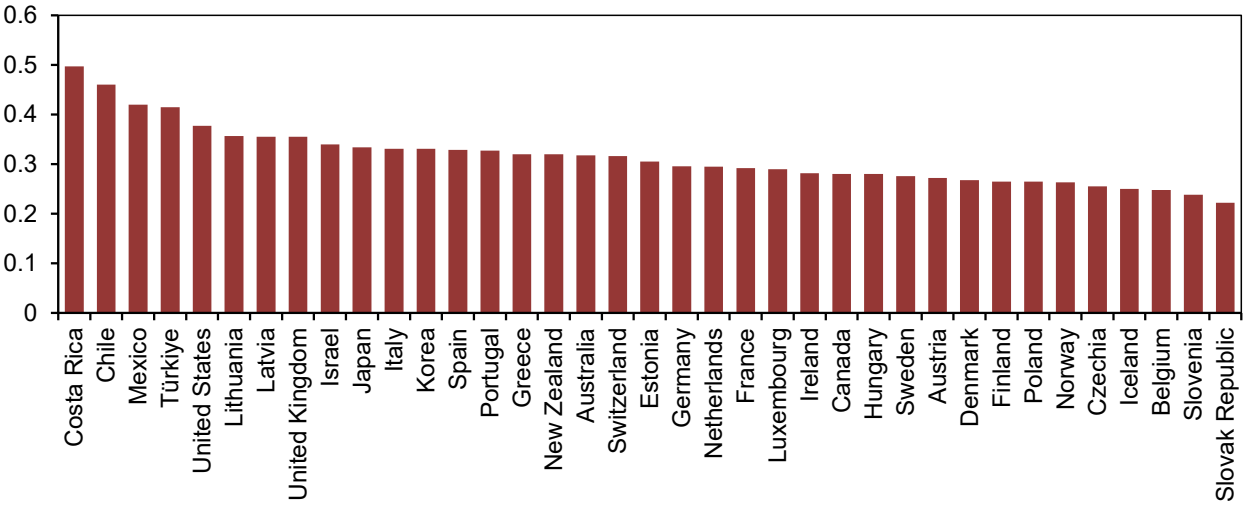
During the financial crisis, many central banks in developed countries reduced policy interest rates to zero as a precaution (Rossi, 2021). In response, developing countries, including Turkey, implemented a more moderate monetary policy and began reducing interest rates in December 2008. However, inflationary pressures in these countries prevented interest rates from reaching zero as seen in developed countries. Throughout this process, the Central Bank of the Republic of Turkey (CBRT) frequently adjusted the overnight repo rate, which served as the policy rate until June 2018, and the one-week repo rate used thereafter. The policy interest rate, which has been steadily decreasing since 2008, fell from 20% to around 9% by mid-2018 (See Figure 1). Among the countries that implemented inflation targeting, Turkey reduced its interest rate the most during the period from 2008 to 2018. However, due to political uncertainty, the policy rate started to increase again in June 2018 to control sudden increases in the exchange rate and inflation rate. Over the following year, the policy rate was gradually reduced to around 8%, thanks to the recovery of economic activity and the slowdown in the rate of price increases. Due to the negative impact of the COVID-19 pandemic on capital flows, financial conditions, commodity prices and foreign trade, there has been a need to increase the policy interest rate. Interest rate cuts, made by individual decisions independent of economic theory, over a period that started at the end of 2021 and lasted approximately two years, caused serious damage to foreign exchange reserves, exchange rates and inflation rates. As a result of this misguided policy, there is now a need for rapid and substantial interest rate hikes. The policy interest rate, which was lowered to 8% in May 2023, had risen to 42.5% by the end of the same year. However, despite this significant increase, it is clear that the desired outcome has not been achieved, given that the annual inflation rate measured by consumer prices in Turkey at the end of 2023 was 65%.

Figure 1: CBRT policy rate and annual OECD countries (2021–2022)



Source: Author's own elaboration

Figure 2: Gini coefficients of inflation rate (Jan 2006 – Dec 2023)



Source: Author's own elaboration

After the financial crisis (and subsequent pandemic), there was a rapid acceleration of wealth accumulation on a global scale, leaving a large segment of the population economically vulnerable (Stiglitz, 2012). This trend is particularly noticeable in Turkey, where income inequality has worsened. Rising inflation and unemployment rates during this period have caused the income of lower- and middle-income households to decrease, resulting in a widening gap between income groups. Even though the Gini coefficient improved in the 2000s, Turkey has still maintained its position

as the fourth most income-unequal country in the OECD since the mid-1990s (see Figure 2). Recent data on income inequality suggest that Turkey's level of income inequality is comparable to that of the most unequal countries in Latin America and Sub-Saharan Africa, and far from that of European Union countries (Kayıkçı, 2019).

There are numerous mechanisms and macroeconomic variables that affect income distribution, including inflation rate, interest rates, credit conditions, unemployment, financial stability and monetary and fiscal policies. This study aims to examine the impact of monetary policy shocks on income distribution in Turkey. Our first objective is to establish measures of income inequality and a basic indicator of monetary policy shocks. To measure income inequality, we utilize the Gini coefficient, Palma ratio and other measures specifically calculated for income categories. Additionally, we include alternative measures commonly used in the literature to ensure the robustness of our analysis. For the calculation of these inequality measures, we rely on micro-level data collected from household surveys conducted annually since 2006. To evaluate the impact of monetary policy shocks on income distribution and inequality, we employ the local projection method to obtain impulse-response functions.

While the literature on the distributional effects of monetary policy generally focuses on the individual distribution of income, there is another dimension of these studies that examines the functional distribution of income. This dimension looks at how income is distributed among different production factors. For example, in a study covering 39 countries, Daudey and García (2007) found that as the labour share in total income increases, the Gini coefficient, which measures income inequality, tends to be lower in the individual income distribution. Schlenker and Schmid (2015) analysed the relationship between capital income shares and the concentration of gross household income in 16 EU countries. They discovered that labour income tends to be concentrated in lower income percentiles, while capital income, which includes returns from financial assets, is concentrated in higher income percentiles.

The evidence on how monetary policy affects income distribution is mixed. Coibion *et al*. (2017) found that contractionary monetary policy increases economic inequality in the USA, while Dolado *et al*. (2021) stated that expansionary monetary policy increases earnings inequality between low- and high-skilled workers in the USA. Examining the impact of monetary policy on consumption and wealth inequality, Amberg *et al*. (2022) stated that expansionary monetary policy increases inflationary pressure and may also foster wealth inequality by increasing asset prices. On the other hand, Guerello (2018) determined that expansionary monetary policy reduces income inequality, while Mumtaz and Theophilopoulou (2020) found evidence that monetary policy in the same direction increases wealth inequality and its volatility in the UK. According to Auclert (2019), when monetary policy becomes tighter, households that have borrowed at a variable

interest rate will experience an increase in their interest payments. On the other hand, households without debt and with short-term assets will see an increase in their financial incomes, which will depend on the temporary increase in their real income. Ampudia *et al*. (2018) argued that monetary policy can affect nearly all aspects of net financial income and discussed how changes in interest rates affect interest income and debt payments. When interest rates are lower, both income and debt payments decrease. The study suggested that the effect on net financial income depends on the individual's net worth. In their study investigating the impact of the European Central Bank's unconventional monetary policies, Lenza and Slacalek (2018) used various micro simulations to calculate inequality measures and determine the overall impact on household income. The results demonstrate that these unconventional monetary policy measures reduce income inequality, as indicated by the Gini coefficient. In one of the most comprehensive studies on the relationship between monetary policy and income distribution, Furceri *et al*. (2018) found that unexpected contractionary monetary policy increased income inequality in a panel of 32 developed and developing economies, using the local projection method.

The literature on the Turkish economy is quite limited. Baydur and Süslü (2019) concluded that the CBRT cannot directly affect income distribution through monetary policy. Instead, it only affects the distribution of profit between the real sector and the financial sector through its interest policy. In contrast, Turel (2021) used the Gini coefficient and the P90/P10 ratio as measures of income inequality and provided evidence that contractionary monetary policy shocks increase income inequality in the short term and reduce it in the medium term. Additionally, the study found that the negative impact of monetary policy shocks on income distribution is felt more strongly in the middle-income group compared to other income groups.

2. Theoretical Framework

Monetary policy decisions are transmitted to the economy by influencing spending and saving decisions, redistributing income between borrowers and savers and affecting asset prices, including the exchange rate. The response of households and firms, within this transmission framework, leads to changes in output and prices.

For this study, the distributional effects of monetary policy on household income and wealth are determined by different channels. The empirical literature reveals that some of these transmission channels directly affect income distribution and inequality, while others have indirect effects (Gornemann *et al*., 2016; Ampudia *et al*., 2018; Kaplan *et al*., 2018; Luetticke, 2021). These transmission channels highlight the significance of households' decisions and behaviour in shaping the effects of monetary policy. Since households have varying income levels and occupations, changes in monetary policy affect their income and wealth in different ways. For example, when

the central bank lowers the policy rate, borrowers benefit from decreased interest expenses, entrepreneurs benefit from increased demand, the unemployed benefit from job creation and homeowners benefit from rising real estate prices. Understanding how monetary policy changes affect the distribution of gains and losses among income groups is crucial for decisionmakers for two reasons. Firstly, this understanding enables us to comprehend how monetary policy influences inequality in society (Bernanke, 2017). Secondly, since the marginal propensity to consume systematically changes with income, it is important to grasp the overall effects of monetary policy (Auclert, 2019). Consequently, some of these transmission channels suggest that expansionary monetary policy increases income inequality, while others indicate that such a policy improves it. In this context, it is possible to identify the existence of five distinct transmission channels (Davtyan, 2016; Gornemann *et al*., 2016; Coibion *et al*., 2012 and 2017; Ampudia *et al*., 2018; Kaplan *et al*., 2018; Luetticke, 2021): income composition, financial segmentation, portfolio, savings redistribution and earnings heterogeneity channels.

Households are heterogeneous in terms of their primary sources of income, as explained by the income composition channel. At the lower end of the distribution, households primarily earn wages or receive transfers, whereas the majority of households in higher-income groups generate income from profits or returns on financial assets. Consequently, an expansionary monetary policy could potentially boost income from financial assets more significantly than wages, due to the resulting expansion in financial activity. This shift in income distribution could benefit households at the top of the distribution. Therefore, monetary policy is likely to contribute to increased income concentration.

According to the financial segmentation channel, individuals' connection to financial markets causes interest rates to have a heterogeneous effect. For example, an expansionary monetary policy has both a stimulating effect on financial activity and a redistributive effect that favours individuals with stronger ties to financial markets. Since those who have more intensive contact with financial markets tend to be in higher-income groups, it is possible to argue that expansionary policies exacerbate income inequality.

In the portfolio channel, low-income households tend to hold a larger portion of their assets in cash. When an expansionary monetary policy leads to increased inflation, it greatly affects the purchasing power of these individuals and the value of their assets. Conversely, high-income households have access to more favourable banking options that help safeguard the value of their assets amidst inflation. As a result, the impact of monetary policy on these groups is asymmetrical, leading to an increase in inequality.

The savings redistribution channel suggests that when interest rates decrease as a result of expansionary monetary policy, borrowers will benefit while savers will suffer. This means that individuals in higher income brackets, who tend to be net savers, will be negatively affected, while

those in lower income brackets, who are generally net debtors, will benefit. As a result, monetary policy can be seen as a tool for reducing income inequality.

The final transmission channel to be discussed is the income heterogeneity channel. Wages, being the primary source of income for numerous households, respond asymmetrically to fluctuations in the economy. When unemployment decreases or increases, wages tend to fluctuate more significantly among lower-income groups. Consequently, an expansionary monetary policy that stimulates economic activity will benefit households in lower-income groups. In such instances, an expansionary monetary policy will contribute to reducing income inequality.

It should also be noted that there are alternative classifications that include these transmission channels. For instance, Bunn *et al*. (2018) and Davtyan (2023) have examined the transmission channels of monetary policy to income distribution under the headings of income and wealth channels, whereas Nakajima (2015) classified it based on the transmission of monetary policy to income and inflation.

The conclusion drawn from the aforementioned discussion on transmission channels is clear: the net effect of monetary policy on income distribution and inequality is uncertain. As a result, it requires empirical analysis on a country-specific and sample basis.

3. Data and Methodology

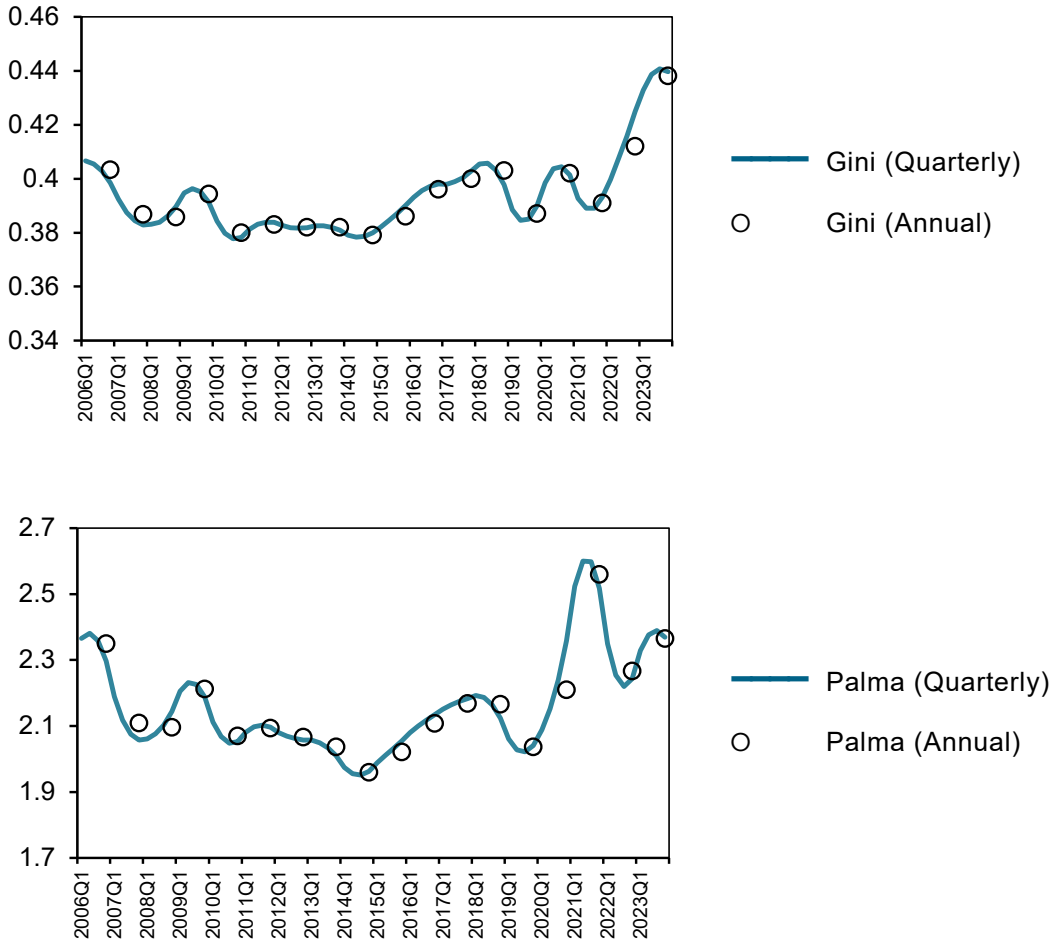
In this section, we first discuss the creation of our basic database and the acquisition of measures of inequality. Next, we delve into the estimation process of monetary policy shocks and the identification of the distributional effects of monetary policy.

3.1 Data

The examination of the impact of monetary policy on income distribution in Turkey is conducted using both traditional indicators (such as the Gini coefficient and Palma ratio) and newly developed criteria for income categories (such as labour, rent-interest, profit and transfer income). Therefore, it is necessary to not only utilize macro data but also micro-based data. The micro-based data are obtained from household surveys carried out by TurkStat (Turkish Statistical Institution). A detailed description of the data used for this purpose and the data sources is presented in Appendix 1. Income distribution is considered within the framework of two basic criteria: the Gini coefficient and the Palma ratio (P10/P40). In the case of income distribution worsening in a middle-income country such as Turkey, the Gini coefficient does not provide sufficient information about the situation of the middle-income group (Tahsin, 2013). Thus, it was necessary to include the Palma ratio, which is a more consistent indicator in this regard, in the base case estimates. The systematic

publication of the data used for these variables in Turkey began in 2006, and the most recent published data are from 2023. Therefore, the study covers the period from 2006 to 2023. These surveys are compiled annually. However, to examine the effects of monetary policy on income distribution, data with at least quarterly frequency are required to reveal the dynamic structure and achieve sufficient degrees of freedom in empirical analysis. Consequently, all annual data on income inequality were converted to quarterly frequency using Chow and Lin's (1971) method, which was determined to be superior by Silva and Cardoso (2001). After conversion, the data were subjected to seasonal adjustment using the Census X-12 method. Figure 3 below displays the quarterly and annual Gini coefficients and Palma ratios, allowing an assessment of whether the derived quarterly data produce results consistent with the annual data[1].

Figure 3: Annual and quarterly Gini coefficients and Palma ratios



Source: Author's own elaboration

1 The GDP per capita variable was used as an instrument in obtaining the quarterly Gini coefficients.

Macroeconomic data used to gauge monetary policy shocks are sourced from CBRT and TurkStat databases. The variables employed to measure these shocks include the policy interest rate, economic activity volume, general price level, monetary aggregate, risk indicator and international oil price. These variables are measured monthly, which aligns with the monthly timeframe of monetary policy decisions. Consequently, shocks are estimated using monthly data seasonally adjusted for the period 2006–2023. The resulting monthly shock data are then transformed into a quarterly frequency by aggregating the quarterly totals. As a result, the time series of monetary policy shocks are constructed for the period from 2006Q1 to 2023Q4.

3.2 Measurement of income inequality

The two main indicators used in the base case estimations in this study to assess income distribution and concentration are the Gini coefficient and the Palma ratio. These indicators are widely recognized as the primary measures of inequality in political and academic discussions. However, it is important to note that these basic indicators alone do not provide enough information about the transmission channels of monetary policy to income inequality. As previously mentioned, some of these channels operate through the financial system. Therefore, in addition to the two basic indicators, we divide household income into different categories – labour income, wealth income (physical and financial), capital income and transfer income – and calculate separate Gini coefficients for each category. In addition to the total Gini and Palma ratio, we also calculate separate Gini coefficients for labour income (*labour Gini*), wealth income (*wealth Gini*), profit income (*profit Gini*) and transfer income (*transfer Gini*). By examining the dynamic relationship between these calculated Gini coefficients and monetary policy, we can assess the transmission channel between monetary policy and income inequality. The Gini coefficients, which were calculated using household surveys, can be found in Appendix 2. Among the Gini coefficients based on income type, the lowest value belongs to the coefficient representing the total while the highest value belongs to the wealth income (sum of rental and interest income) coefficient. These coefficients also have the highest volatility. The Gini coefficient of labour income displays a middle course throughout the period.

The P90/P10 ratio, the P80/P20 ratio and the shares of the lowest, middle and highest 20% are used as alternative inequality measures to perform robustness checks on the estimation results. These three criteria are commonly used as alternative indicators for this purpose.

Table 1 displays the correlation between alternative inequality measures that are used for a robustness check and the Gini coefficient and Palma ratio, which we consider general inequality measures. The consistently high and significant correlation values indicate the reliability of the preferred indicators.

Table 1: Correlation between alternative and general inequality indicators

	Gini	Palma	P80/P20	P90/P10	Lowest 20%	Middle 20%	Highest 20%
Gini	1	–	–	–	–	–	–
Palma	0.590 (0.000)	1	–	–	–	–	–
P80/P20	0.967 (0.000)	0.560 (0.000)	1	–	–	–	–
P90/P10	0.956 (0.000)	0.586 (0.000)	0.971 (0.000)	1	–	–	–
Lowest 20%	0.215 (0.070)	0.588 (0.000)	0.142 (0.235)	0.121 (0.312)	1	–	–
Middle 20%	0.599 (0.000)	0.925 (0.000)	0.536 (0.000)	0.545 (0.000)	0.399 (0.000)	1	–
Highest 20%	0.391 (0.001)	0.940 (0.000)	0.350 (0.002)	0.363 (0.001)	0.660 (0.000)	0.930 (0.000)	1

Note: Numbers in parentheses indicate the probability of *t*-statistics for the relevant coefficient.
Source: Author's own calculations

3.3 Identification of monetary policy shocks

Another crucial aspect of studying the impact of monetary policy on income inequality involves identifying monetary policy shocks. This involves determining the monthly fluctuations in the policy interest rate and assessing them in light of the overall economic conditions and the expectations of economic agents (Jung and Uhlig, 2019). As stated by Romer and Romer (2004), this process entails establishing the time series of exogenous changes in monetary policy that arise from the endogenous relationships among macroeconomic variables.

The process is based on the behaviour of the $n \times 1$ vector of endogenous variables ($\boldsymbol{\Theta}_t$), and the dynamics of this process are represented by the structural form of the vector autoregressive model below:

$$\boldsymbol{\Gamma\Theta}_t = \boldsymbol{\Psi}(L)\boldsymbol{\Theta}_{t-1} + \varepsilon_t \tag{1}$$

where $\boldsymbol{\Gamma}$ is the $n \times n$ matrix defining the contemporaneous relations among the variables, $\boldsymbol{\Psi}(L)$ is the $n \times n$ polynomial matrix in the lag operator L, and ε_t is the $n \times 1$ vector of structural residuals. The corresponding reduced form of this structural model can be written as:

$$\boldsymbol{\Theta_t} = \boldsymbol{\Omega}(L)\boldsymbol{\Theta_{t-1}} + \xi_t \tag{2}$$

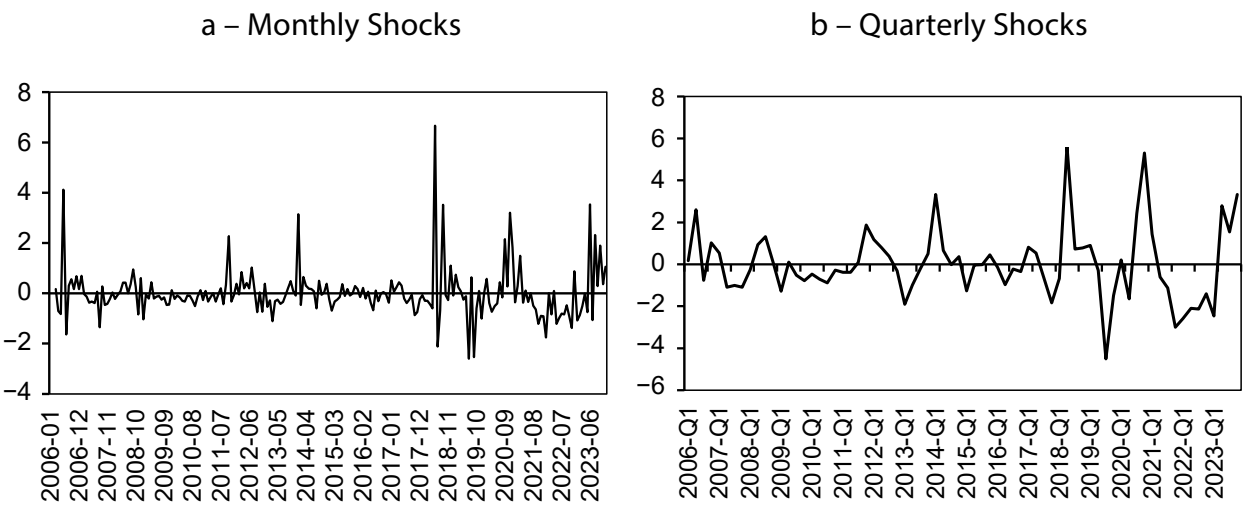
where $\boldsymbol{\Omega}(L) = \boldsymbol{\Gamma}^{-1}\boldsymbol{\Psi}(L)$ represents a polynomial matrix and $\xi_t = \boldsymbol{\Psi}^{-1}\varepsilon_t$ defines the relationship between the reduced form and structural form residuals.

According to Christiano *et al*. (1996) and Romer and Romer (2004), the $\boldsymbol{\Theta_t}$ endogenous variable vector for monetary policy should include at least the following macroeconomic variables:

$$\boldsymbol{\Theta_t} = \left\{P_t^{oil},\ Y_t,\ P_t^{cpi},\ P_t^{cds},\ i_t^p,\ M_t\right\} \tag{3}$$

In this vector, P_t^{oil} represents oil prices as an indicator of international raw material prices. Y_t is the industrial production index, which represents monthly economic activity. P_t^{cpi} is the consumer price index, representing the general level of domestic prices. P_t^{cds} is the CDS index, serving as an indicator of country risk. i_t^p is the monetary policy interest rate, and M_t is the $M1$ definition of money supply, representing the amount of money. The method used to identify monetary policy shocks is the Cholesky decomposition, as suggested by Christiano *et al*. (1996). For detailed information on the VAR model unit root tests and theoretical adequacy analysis, refer to Appendix 3. As mentioned above, monetary policy shocks are estimated monthly, while income distribution and inequality measures are at a quarterly frequency. Therefore, monthly monetary policy shock data were converted into quarterly frequencies by taking the cumulative sum of the months in the relevant quarter. Figure 4a shows estimates of monthly monetary policy shocks, which align with theoretical expectations (see Appendix 3B). Figure 4 displays the results of the quarterly conversion.

Figure 4: Monthly and quarterly monetary policy shocks



Source: Author's own elaboration

3.4 Identification of relationship between monetary policy and income distribution

The method we use to examine the effects of monetary policy on income distribution and inequality is the local projection method, recommended by Coibion *et al*. (2012; 2017), Kappes (2023) and Wiese *et al*. (2023), among others. The method widely used in the literature to examine these effects is the estimation of an SVAR model. After briefly explaining why we prefer the local projection method over the SVAR model, the estimation of the monetary policy shocks-income distribution relationship is discussed in detail.

3.4.1 Local projections and VAR models

Jordà (2005) is the pioneering work on the methodological debate between VAR and local projection modelling. The author discussed the construction of impulse-response functions using the local projection method and highlighted its advantages over traditional VAR models. Since his study, the debates in the literature have intensified with evidence both supporting and challenging the local projection methodology (Inoue *et al*., 2022; Plagborg-Møller and Wolf, 2021). Although no definitive judgment has been reached in the literature on this subject (Olea and Plagborg-Møller, 2021), the local projection method offers several important advantages when analysing the relationship between monetary policy and income distribution (Konstantinou *et al*., 2023).

Jordà (2005) provided a clear rationale for using local projection as an alternative estimation method. According to him, when the dynamic structure of a macroeconomic relationship is not known in the data-generating process, the local projection method allows a more efficient estimation of this relationship. If a VAR model (or its version) is estimated using an incorrect data-generating process, the results obtained will be biased and inefficient (Meier, 2005). Since the local projection method allows the estimation of impulse-response functions without relying on a specific functional form, it is superior to VAR models, at least in examining the monetary policy-income distribution relationship (Aye *et al*., 2019; Shagi, 2019; Jordà, 2023).

Jordà (2005 and 2023) has stated some additional advantages of the linear projections method as follows: The impulse-response functions can be estimated using basic regression techniques found in any statistical software. This makes it simple and practical to draw common analytical inferences from the results obtained. Additionally, complex estimation procedures in a multivariate environment can be easily and efficiently estimated using this method.

However, as Meier (2005) and Kilian and Kim (2009) have stated, confidence intervals for impulse-response functions are less effective in short samples with limited observations. Nevertheless, when the number of observations increases, evidence from Ronayne (2011), Olea and

Plagborg-Møller (2021), Plagborg-Møller and Wolf (2021) and Inoue *et al*. (2023) suggests that SVAR with properly defined structural systems and local projection models yields consistent results, including confidence intervals. The fact that the research period consists of 72 observations spanning 18 years is enough to ensure effectiveness in calculating confidence intervals for impulse-response functions (Jordà, 2009; Plagborg-Møller and Wolf, 2021).

3.4.2 Identifying monetary policy-income distribution relationship in local projections

To examine the relationship between monetary policy shocks and inequality indicators, the equations to be estimated using the local projection method are specified as follows (Coibion *et al*., 2017):

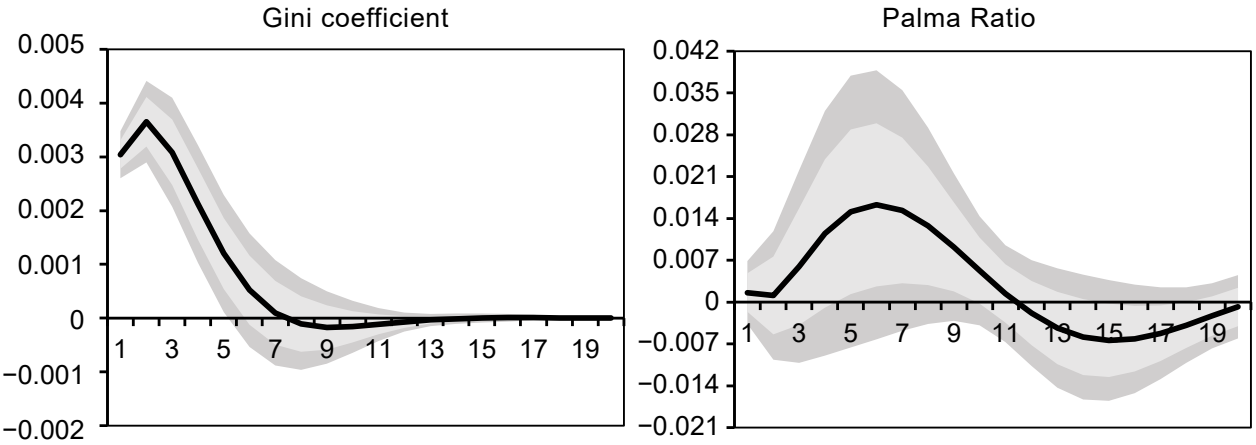
$$u_{t+k} - u_{t+k-1} = \alpha^{(k)} + \sum_{n=1}^{N} \beta_n^{(k)} \left(u_{t-n} - u_{t-n-1} \right) + \sum_{m=1}^{M} \gamma_m^{(k)} \xi_{t-m}^{p} + \vartheta_{t+k} \tag{4}$$

where $k = 0, \ldots, K$; u_t denotes one of the inequality measures used in each impulse-response function, ξ_t^p denotes the value of the previously estimated monetary policy shock, and ϑ denotes the error term. In the equation, M refers to the number of lags of the monetary policy shock when estimating its effect on the inequality indicator, N refers to the number of lags of the inequality indicator that is thought to be affected by the monetary policy, and K refers to the number of periods to be projected. The aim is to make the longest projection by using the longest lag value and to achieve the highest efficiency in the results (Inoue *et al*., 2023). When this method is used, there must be a lag for each period for which a projection is made. Since the data set we use cover an 18-year period, projections of up to five years are possible to provide appropriate degrees of freedom in the predictions. For this reason, $M = 20$, $N = 2$, $K = 20$ were accepted in the estimates. Estimation of local projection equations is carried out using the ordinary least squares method. Each projection period is estimated as a separate equation (for each $k = 0, \ldots, 20$) using the same set of explanatory variables. The series $\left\{ \hat{\gamma}_m^{(k)} \right\}_{k=0}^{20}$ is the parameter used to describe the dynamic relationship between the variables. To observe the dynamics of the relationship, we create impulse-response functions using simulations. These simulations involve a contractionary shock in monetary policy (increase in interest rate) of one standard deviation. Finally, we calculate confidence intervals for the impulse-response functions using the 1 and 1.65 standard deviation limits, as recommended by Jordà (2023). We discuss the results obtained in the following sections.

4. Estimation Results

In this study, we use the Gini coefficient and Palma ratio as the main indicators to examine the link between monetary policy and income distribution. By utilizing the monetary policy shocks obtained earlier and these indicators, we estimated the process described in Equation (4) and simulated the relevant impulse-response functions. The resulting impulse-response functions are depicted in Figure 5.

Figure 5: Response of base case inequality indicators to monetary policy shock



Note: Light and dark shaded areas indicate confidence intervals of 1 and 1.65 standard deviations, respectively.
Source: Author's own elaboration

Both inequality indicators initially exhibit a strong positive response to a contractionary monetary policy shock, and this response gradually decreases over time. The Gini coefficient, which reflects income distribution, continues to worsen for two years before stabilizing in the subsequent period. This indicates a permanent but limited concentration of income. Considering that the cumulative effect stabilizes at a maximum increase of 0.009 points, we can conclude that the extent of the monetary policy shock determines the degree of deterioration in income distribution. These effects are observed in the first two years and are statistically significant overall. The results for the Palma ratio support similar conclusions. The positive response indicates that the share of income received by the lower and middle-income groups decreases, or the share of the upper-income group increases at a faster rate. The response of the indicator stabilizes after the 10th quarter, indicating a permanent deterioration in income distribution. The consistent response of both base case indicators to a contractionary monetary policy shock can be summarized as follows: there is a limited increase in income inequality in the short term, which persists

in the long term. The extent of this increase depends on the magnitude of the monetary policy shock. Although most of the impulse-response functions are statistically insignificant, they should be regarded as indicative.

Examining the effects of a contractionary monetary policy shock on the distribution in the context of income types allows us to make inferences about the transmission mechanism of this relationship. To do this, we calculate the responses of Gini coefficients for different types of income – labour income, wealth income (sum of rental and interest income), profit income and transfer income – to the contractionary monetary policy shock. The results are shown in Figure 6.

Figure 6: Responses of inequality indicators by income types to monetary policy shock

Note: Light and dark shaded areas indicate confidence intervals of 1 and 1.65 standard deviations, respectively.
Source: Author's own elaboration

According to the response of the Gini coefficient for labour income, the monetary policy shock resulted in a rapid concentration of this type of income. This effect is permanent and reaches

its maximum in the 12th quarter following the shock, causing a cumulative increase in the labour Gini coefficient of approximately 0.002 points. In the subsequent period, this response loses its strength but maintains its statistical significance. In the short and medium term, monetary policy shocks have a limited impact on the distribution of wage income, favouring the higher-income group. This relationship, which loses its statistical significance in the long run, indicates that wages should be influenced by structural public policies, such as labour market regulations and financial regulations, rather than by monetary policy, which is inherently cyclical.

Among the income types we examined, the distribution of rental and interest income show the strongest response, which we refer to as wealth income. The Gini coefficient for the distribution of wealth income indicates a positive response to the contractionary monetary policy shock, with an increase of 0.0045 points. This positive response continues at a decreasing rate after the 4th quarter. Therefore, it can be concluded that contractionary monetary policy leads to a rapid and strong concentration of wealth income, which includes rental and interest incomes. This result requires closer examination as it shows the power of the transmission of monetary policy to asset prices in Turkey and increases the inequality in the distribution of wealth income. The following subsection addresses this issue.

It seems that contractionary monetary policy has a relatively weak impact on the distribution of profit and transfer incomes. Although there is a slight rise in the profit Gini coefficient over the long term, suggesting an increase in inequality in the distribution of profit income, the small decrease in the transfer Gini coefficient in the medium term indicates a reduction in inequality in the distribution of transfer income. However, it is important to note that these changes are not statistically significant based on both Gini coefficients. Therefore, it is not possible to conclude that monetary policy has a significant effect on the distribution of these incomes.

According to our analysis, monetary policy has a permanent but limited impact on income distribution and inequality. Specifically, we find that this impact primarily arises from the distribution of wealth and wage incomes, with profit and transfer incomes playing a smaller role. With the exception of the Gini coefficient calculated for transfer income, all the Gini coefficients indicate that a contractionary monetary policy increases income inequality and strengthens income concentration.

4.1 Composition of wealth income and transmission channel

Considering the results obtained in the previous section, we can gain insight into the transmission channel of monetary policy to income distribution by examining the impact of monetary policy on the distribution of wealth income in more detail. Table 2 displays the shares of income types in total income based on the household surveys used to calculate the inequality series in this study, for selected years during the sample period.

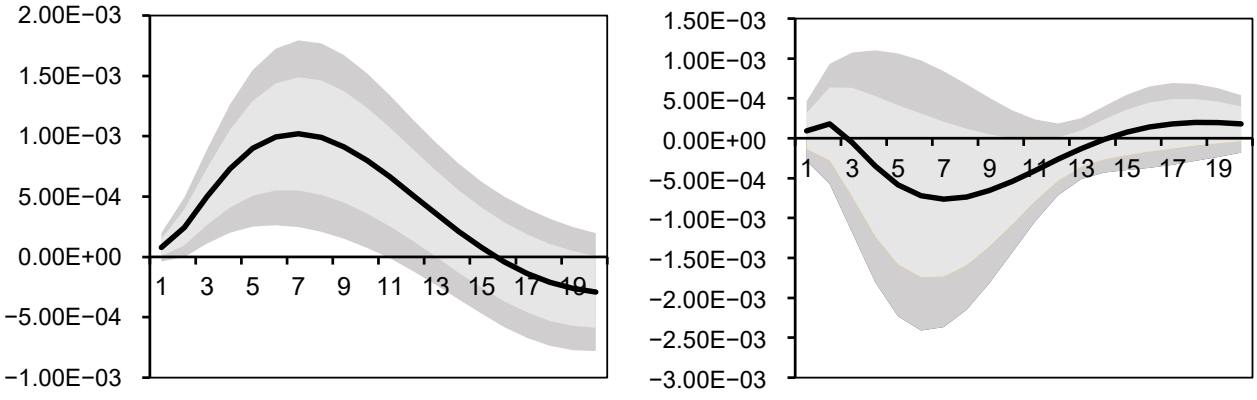
Table 2: Shares of income types in total income (%)

Income type	2006	2010	2015	2020	2023	2006–2023 average
Wage	44.48	47.38	52.50	49.60	51.20	49.23
Profit	24.21	20.17	18.80	17.70	22.14	20.19
Wealth	9.19	8.69	5.90	7.80	6.19	7.48
– Rent	3.10	4.18	3.30	3.50	2.80	3.58
– Interest	6.09	4.51	2.60	4.30	3.39	3.90
Transfer	20.66	23.56	22.60	24.70	20.26	22.73
Other	1.45	0.20	0.20	0.20	0.20	0.36

Source: Author's own calculations

The table reveals that the proportion of income derived from physical and financial assets is relatively low when compared to developed countries. On average, these income components account for only 7.8% of total income during the sample period. Interestingly, this particular indicator shows the most pronounced reaction to inequality when subjected to a monetary policy shock. Hence, we conclude that there must be an alternative transmission mechanism, aside from the traditional balance sheet channel, responsible for the impact of monetary policy shocks on income inequality. Based on this finding, we utilize the local projection method to simulate the responses of rent and interest income shares in total income to a contractionary monetary policy shock. These responses are illustrated in Figure 7.

Figure 7: Responses of rent and interest incomes to monetary policy shock



Note: Light and dark shaded areas indicate confidence intervals of 1 and 1.65 standard deviations, respectively.
Source: Author's own elaboration

A contractionary monetary policy leads to an increase in the proportion of rental income from physical assets, while simultaneously reducing the weight of interest income from financial assets in total income. While the response of rental income is statistically significant, that of interest income is not. Since the share of rental income increases while the share of interest income decreases, the increase in the concentration of wealth income following a contractionary monetary policy shock is largely due to the rental income of physical assets. Given that rents, like most non-financial prices, are sticky in the direction of decline (see Appendix 4), a change in the redistribution of income in favour of physical asset owners emerges in periods of monetary tightening.

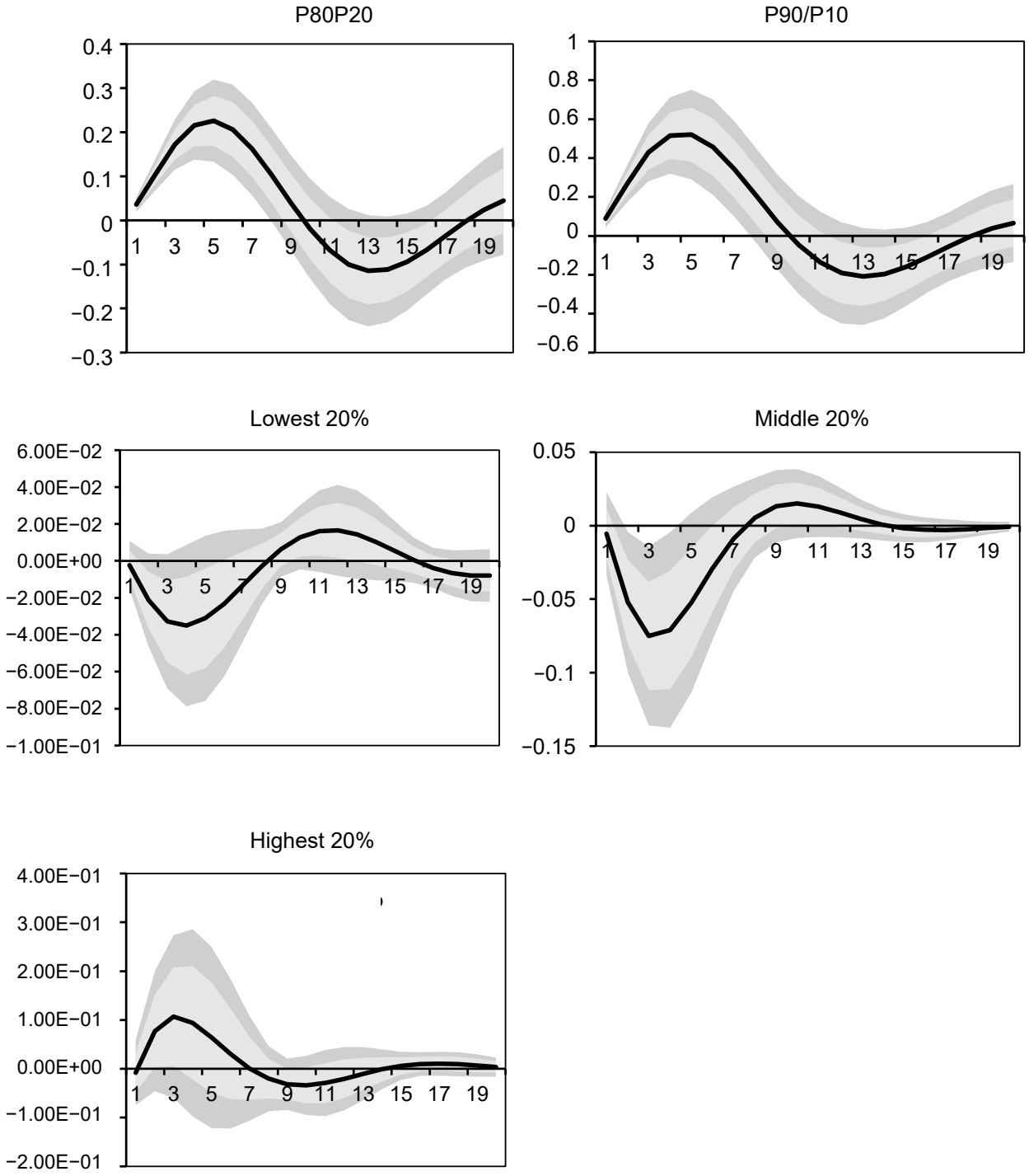
The above results regarding wealth income demonstrate the existence of an alternative transmission channel that is not accounted for in the traditional approach used for developed countries. In developing countries, income from physical wealth constitutes a significant portion of wealth income, unlike in developed countries. For example, in Turkey, around half of the wealth income comes from rental income (see Table 2). Therefore, the transmission channel of monetary policy to income distribution in Turkey operates through the income heterogeneity channel. A contractionary monetary policy shock affects income from financial assets differently compared to income from physical assets. The magnitude of the impact depends on the weight of income derived from financial assets. In Turkey, the redistributive effect of monetary policy on income manifests as an increase in the share of income from physical assets, which have rigid prices that resist decline. This channel explains how the monetary policy shock affects wealth income and its overall impact on income inequality depends on the magnitude of its effect on wealth income.

4.2 Robustness check

The results are subjected to a robustness check, which is conducted using three key indicators: the P80/P20 ratio, the P90/P10 ratio and the shares of the lowest, middle and highest 20% in total income. To assess the impact of a contractionary monetary policy shock on these indicators, the local projection method is employed, and the results are presented in Figure 8.

All of the alternative indicators examined show that income inequality deepens after a contractionary monetary policy shock. However, the magnitude of the responses, measured in terms of P80/P20, P90/P10 ratios and the shares of the lowest and highest 20% of total income, is limited. Among these indicators, the income share of the middle 20% exhibits the strongest response. After the contractionary monetary policy shock, the share of this income segment decreases rapidly in the short term, slows down after the 5th quarter and fades out by the 12th quarter. Therefore, the robustness analyses support the results obtained in the base case analysis. In Turkey, contractionary monetary policy changes are effective in increasing income inequality, and the extent of the impact on income distribution depends on the magnitude of the monetary policy shock.

Figure 8: Responses of alternative inequality indicators to monetary policy shock



Note: Light and dark shaded areas indicate confidence intervals of 1 and 1.65 standard deviations, respectively.
Source: Author's own elaboration

5. Conclusion

Academic interest in the impact of monetary policy on income distribution has significantly increased in the past decade. While numerous studies have been conducted to assess the presence and direction of this relationship, they have primarily concentrated on developed countries. However, income inequality is becoming a pressing issue in developing countries as well, and the monetary policy actions taken by central banks hold the potential to shape a country's economic future. This study aimed to enhance the existing literature by providing insights into the relationship between monetary policy and income inequality within the context of developing countries. To achieve this, the study focused on Turkey as an example, which is classified as a developing country in the upper middle-income group.

This study examined the relationship between monetary policy, income distribution and inequality in Turkey using data from 2006 to 2023. The study was based on income distribution and inequality measures derived from household surveys conducted by TurkStat during this period. To analyse the relationship between monetary policy shocks, as obtained through a VAR model, and inequality measures, the local projection method was employed. According to the main findings of the study, monetary policy shocks have a limited impact on distorting income distribution and increasing income inequality. This effect primarily occurs through labour income and wealth income (the sum of rental and interest income), with wealth income being the main determining factor. The concentration of wealth income is stronger when the share of rental income in total wealth income is higher and when contractionary monetary policy reduces activity on financial markets at a faster rate. This differential impact of monetary policy on different wealth incomes is referred to as the income heterogeneity channel. It is particularly significant that this channel was observed in a developing country with low financial deepening, as income from physical assets holds greater weight in total income compared to developed countries. While the robustness analysis generally confirmed this conclusion, it also revealed another interesting result: the sharpest deterioration in income distribution following monetary policy shocks is observed in the middle (3rd) 20% group. This indicates that middle-income households experience the income inequality problem most intensely after monetary policy shocks.

The results of this study provide valuable insights for decisionmakers involved in monetary policy implementation. According to current legal regulations, the primary objective of monetary policy in Turkey is to ensure and maintain price stability. The consensus in economic literature suggests that the most effective way to protect low-income households from the negative impacts of inflation is to reduce inflation and make monetary policy decisions that align with this goal. However, the main finding of this study is that contractionary monetary policies worsen income equality on a limited scale. This shows that the appropriateness of the policy would depend

on the macroeconomic conditions and development of the country. Therefore, it is crucial to consider this consequence when designing policies. The point emphasized here is not that monetary policy should aim to combat income inequality. On the contrary, it is to highlight that monetary policy can have large-scale economic and social consequences and to remind of the responsibilities of central banks. Our analysis is supported by studies in the literature finding results similar to ours, namely Coibion *et al*. (2017), Furceri *et al*. (2018), Guerello (2018) and Mumtaz and Theophilopoulou (2020).

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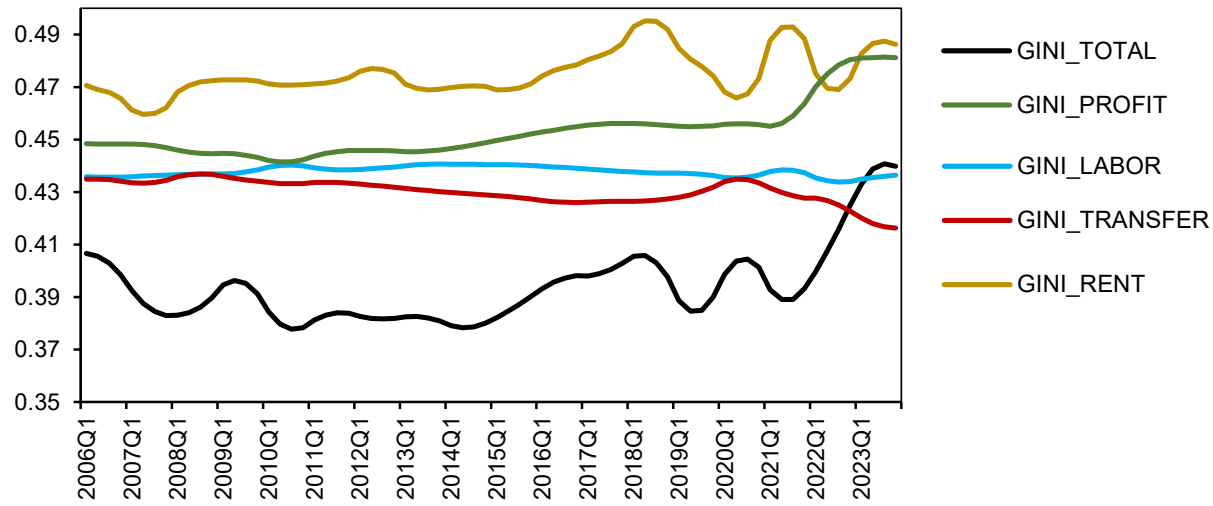
Appendixes

Appendix 1: Description of variables and data sources

Variable	Definition	Source
Gini total	Gini coefficient, based on the 20% shares of the population	TurkStat
Palma ratio	The ratio of 10% of households with the highest income to 40% with the lowest income	Own calculation based on TurkStat data
Labour Gini	Gini coefficient, based on labour income for 20% shares of income owners	Own calculation based on TurkStat data
Wealth Gini	Gini coefficient, based on the total rent and interest incomes for 20% shares of income owners	Own calculation based on TurkStat data
Profit Gini	Gini coefficient, based on profit income for 20% shares of income owners	Own calculation based on TurkStat data
Transfer Gini	Gini coefficient, based on transfer income for 20% shares of income owners	Own calculation based on TurkStat data
P80/P20 ratio	Ratio of top 20% income to low 20% income	TurkStat
P90/P10 ratio	Ratio of top 10% income to low 10% income	TurkStat
S1	Share of lowest 20% in total income	TurkStat
S3	Share of middle 20% in total income	TurkStat
S5	Share of highest 20% in total income	TurkStat
P^{oil}	International oil prices	FRED
Y	Industrial production index	TurkStat
P^{cpi}	Domestic consumer price index	TurkStat
P^{cds}	CDS index for Turkey	Bloomberg
i^{p}	Monetary policy interest rate	CBRT
M	M1 money supply	CBRT
Shock	Monetary policy shocks	Own estimation
Y	Gross domestic product	TurkStat
U	Unemployment rate	TurkStat
i	Interest rate for 1-year commercial loans	CBRT
P	Consumer price index	TurkStat
Rent	Rent price index	TurkStat

Source: Author's own elaboration

Appendix 2: Gini coefficients by income groups



Source: Author's own elaboration

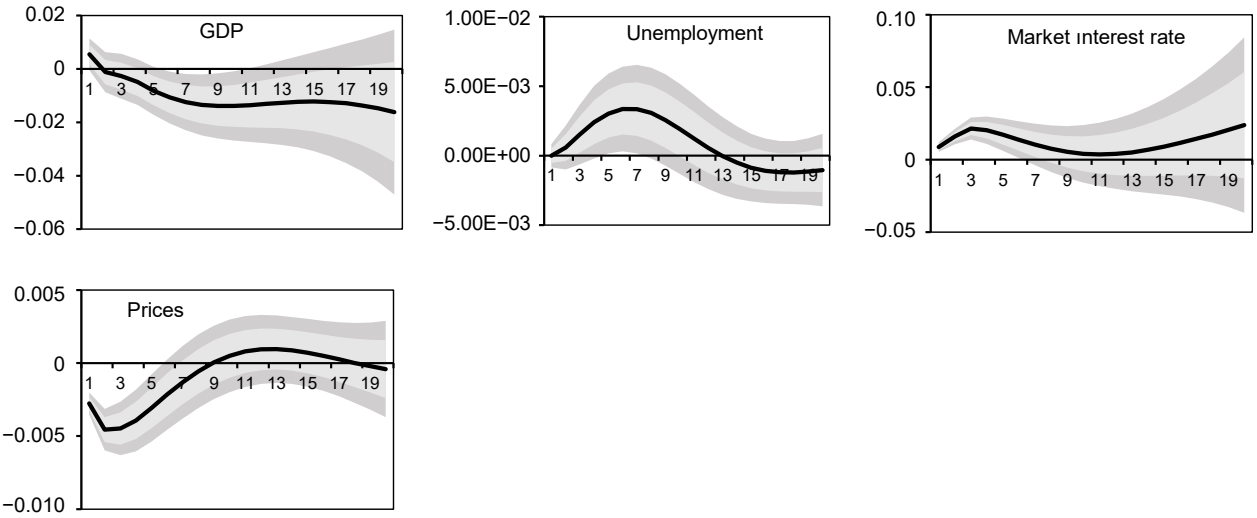
Appendix 3: Estimation results of unrestricted VAR

A. Unit root tests

	ADF test		PP test	
	Test statistic	**Probability**	**Test statistic**	**Probability**
lo	2.898*	0.165	2.852*	0.180
dlo	12.685	0.000	12.640	0.000
ly	0.593	0.868	0.653	0.855
dly	16.366	0.000	17.844	0.000
lp	2.657*	0.999	6.267	0.999
dlp	3.257	0.018	5.916	0.000
lc	2.439	0.132	2.428	0.135
dlc	4.815	0.000	14.920	0.000
i	2.398	0.144	1.347	0.607
di	3.550	0.008	10.933	0.000
lm	3.322	0.999	3.824	0.999
dlm	3.804	0.003	14.243	0.000

Note: (*) The optimal lag length is determined by using the modified Akaike information criterion.
Source: Author's own calculations

B. Consistency of monetary policy shocks

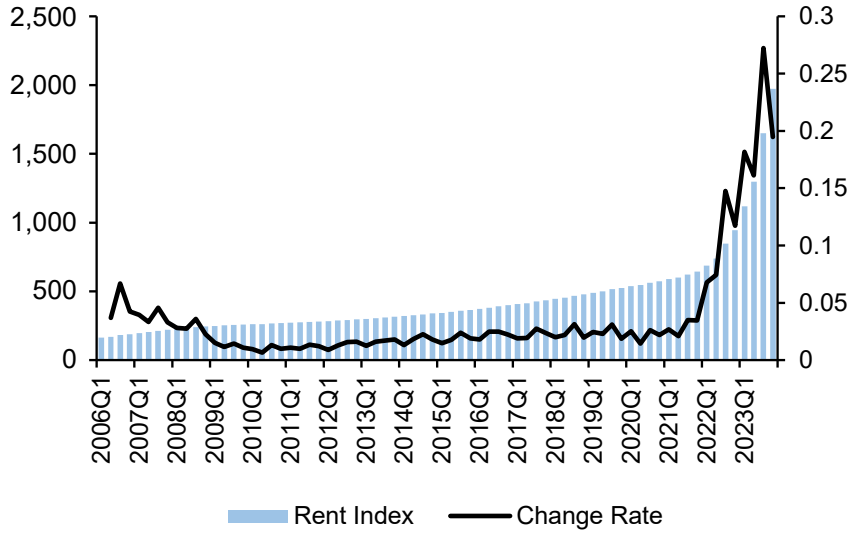


Note: In the case of a positive monetary policy shock, all the impulse-response functions produce results that economic theory predicts.

Source: Author's own elaboration

Appendix 4: Course of rental index

The chart below shows the housing rent index and quarterly change rate in Turkey in the sample period to get an idea about the stickiness of physical asset prices.



Source: Author's own elaboration