CHAPTER 8

THE IMPACT OF MONETARY POLICY ON INCOME INEQUALITY IN CHINESE TAIPEI

By
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1. Introduction

Western economies have been experiencing rising income inequality in the aftermath of the financial crises. Since then, researchers have focused on explaining the rising trend and identifying the determinants of income inequality. Fiscal policy is the primary tool for governments to improve income distribution, and has attracted considerable attention as one crucial factor of income inequality. For instance, Afonso et al. (2010) finds higher redistributive public spending and better educational achievements improve income distribution. Similarly, Doerrenberg and Peichl (2014) show that social expenditure policies reduce more income inequality than progressive taxation. However, monetary policy that may also impact the distribution of income has not been widely discussed (Coibion et al., 2012; Saiki and Frost, 2014; Villarreal, 2014), and the impact of monetary policy on income inequality in emerging economies remains unexplored. This paper aims to assess the impact of monetary policy on income inequality in Chinese Taipei.

Earlier studies have presented a contradictory view on the impact of monetary policy. Mumtaz and Theophilopoulou (2017), Furceri et al. (2018), and Aye et al. (2019), for example, have reported that contractionary monetary policy raises income inequality. However, opposite results have also been documented. Villarreal (2014) shows that contractionary monetary policy in Mexico has decreased income inequality. Moreover, Inui et al. (2017) point out that there is no significant relationship between income inequality and monetary policy changes. The uncertainty regarding monetary policy effects arises because different distributional transmission channels and effects may counteract each other. For example, tight monetary policy decreases income inequality through the income composition channel, the financial segmentation channel, and the portfolio channel, while it increases income inequality via the savings redistribution channel and the earnings heterogeneity channel (more details are described in the next section). Therefore, the total effects of monetary policy on income inequality can be an ambiguous. When we take into account sources of household income, the relationship is more complicated. For example, if contractionary monetary policy leads to a tight labor market and a corresponding fall in wages, the households for which wages are the primary source of income will be more affected. Meanwhile, if monetary policy substantially causes asset prices to slump, high-income households’ holding financial assets will be highly impacted. Income inequality may thereby be reduced.

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So far there has been no research on the impact of monetary policy on income inequality in Chinese Taipei. In this study, we investigate whether monetary policy shocks have any effect on income inequality in Chinese Taipei. We follow the approach proposed by Mumtaz and Theophilopoulou (2017), which implements a vector autoregressive (VAR) model and imposes sign restrictions for the identification of the monetary policy shock. Correspondingly, we interpolate the Gini index and the income share ratio series of an annual frequency into a quarterly series beginning from 1976 Q1 to 2017 Q4. This period includes a number of recessions and expansions, which allows clear identification of monetary policy shocks.

The results of the structural vector autoregression (SVAR) model, where the monetary policy shock is identified via a recursive Cholesky scheme, show that contractionary monetary policy does not affect income inequality, but does give rise to the well-known price puzzle, already recognized by Sims (1986). However, under sign restrictions, the model is able to estimate impulse response functions and demonstrate that a contractionary monetary policy shock would cause the Gini index and the income share ratio to significantly rise for a few quarters, with the income share ratio rising more markedly than the Gini index. In order to understand the possible reasons behind the income share ratio response, this paper considers how 10th – 90th percentile households’ income responds to monetary policy shocks. The empirical results show that contractionary monetary policy reduces the income of households with a significant impact on the 10th percentile of households. This is because the income of the poorest households is most susceptible to business cycle swings resulting from monetary policy.

Even when including wealth variables (e.g., stock returns) into the VAR model, a tight monetary policy shock still only leads to a significant increase in income inequality in the short-run. Moreover, the other robustness tests, such as reordering the variables in the Cholesky decomposition, also show that contractionary monetary policy has a limited impact on income inequality.

In accordance with these facts, there is insufficient evidence to support the idea that contractionary monetary policy will have a large effect on income inequality in Chinese Taipei. Therefore, the distributional effects of tight monetary policy should not influence policy decisions.

The remainder of this paper is structured as follows. Section 2 explains the distributional effects and reviews the relevant literature. Section 3 discusses monetary policy framework and income inequality in Chinese Taipei and data sources. Section 4 describes the identification of monetary policy shocks. Section 5 provides the main results. Section 6 is the conclusion.
2. Distributional Effects and Literature Review

2.1 Distributional Impacts of Monetary Policy

The total distributional effects of monetary policy are determined by different transmission channels that monetary policy can have on income inequality. Coibion et al. (2012) classify the total distributional effects into five specific channels, and define them as follows:

1. Income Composition Channel:
   The income composition effect reflects heterogeneity in income sources between households (Gornemann et al., 2016; Coibion et al., 2017; Luetticke, 2018). If the decrease in capital gains and profits caused by tight monetary policy is larger than that in labor income, the value of assets of the wealthy group (e.g., firm owners) would decline, i.e., tight monetary policy could reduce income disparities through this channel.

2. Financial Segmentation Channel:
   The financial segmentation effect refers to how the reallocation of income is advantageous to financial market participants who are able to benefit from expansionary monetary policy shocks. Agents involved in financial markets typically earn more than agents who are not engaged in financial markets. Hence, tight monetary policy decreases income inequality via this channel.

3. Portfolio Channel:
   The portfolio channel represents the redistribution of income based on the structure of assets owned. Low-income households mainly hold currency, while high-income households usually have many types of securities. Hence, when tight monetary policy causes deflation and the financial market slump, this effect benefits low-income households while hurting high-income households, i.e., contractionary monetary policy can decrease income inequality through this channel.

4. Savings Redistribution Channel:
   The savings redistribution effect reflects the impact of unexpected inflation on nominal contracts. If the inflation unexpectedly goes down, borrowers may become worse off while savers benefit. Because savers are usually wealthier than borrowers, tight monetary policy shocks increase income inequality through this channel.

5. Earnings Heterogeneity Channel:
   Normally, the income of poorest households is most susceptible to business cycles, i.e., tight monetary policy increases income inequality via this channel.

Because of these different channels, the total distributional effects of monetary policy are uncertain. Tight monetary policy decreases income inequality through the first three channels (the income composition channel, the financial segmentation channel, and the portfolio channel), but it also increases income inequality via the last two channels. Hence, the overall income distributional effects of monetary policy are ambiguous (O’Farrell et al., 2016).
Furthermore, Nakajima (2015) summarizes the five channels of monetary policy into two main distributional channels: the inflation and income channels. The inflation channel includes the financial segmentation channel, the portfolio composition channel, and the savings redistribution channel. The income channel comprises the income composition channel and the earnings heterogeneity channel. Hence, Davtyan (2017) captures the general distributional effects of monetary policy by using prices and real output in the VAR model.

2.2 Divergence of Empirical Evidence Regarding Monetary Policy Distributional Effects

The empirical results from the distributional effects of monetary policy still appear contradictory. For example, Villarreal (2014) shows that contractionary monetary policy in Mexico has decreased income inequality via the income composition channel, and that even if different methods are used to identify monetary policy shocks, the results are still robust. Mumtaz and Theophilopoulou (2017) impose sign restrictions on impulse responses and find that contractionary monetary policy has increased income inequality in the UK through the income composition and earnings heterogeneity channels; Coibion et al. (2017) find that contractionary monetary policy tends to increase income inequality in the US through the income composition and earnings heterogeneity channels. Other related literature is summarized in Table 1.

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Period</th>
<th>Shock</th>
<th>Effect on Income Inequality</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inui et al. (2017)</td>
<td>Japan</td>
<td>1981–2008</td>
<td>M -</td>
<td>Non-significant</td>
<td>Savings redistribution; Portfolio composition</td>
</tr>
</tbody>
</table>

Note: M – represents expansionary monetary policy; M + represents contractionary monetary policy.
Sources: Colciago et al. (2019) and author.
3. Monetary Policy Framework, Income Inequality and Data Sources

This section introduces the monetary policy framework, describes trends in income inequality in Chinese Taipei, and provides data sources.

3.1 Introduction of Chinese Taipei’s Monetary Policy Framework

Since the early 1990s, the Central Bank, Chinese Taipei (CBCT) has adopted a flexible monetary targeting regime. For monetary policy formulation, the CBCT selects the monetary aggregate M2 as the intermediate target, and implements interest rate and exchange rate policies, to achieve the objectives such as maintaining price stability, promoting financial system soundness, and fostering economic development within the scope of the aforementioned objectives.

![Chart 1
Basic Framework of Monetary Policy](chart1.png)

In December each year, the CBCT estimates money demand of M2 using variables such as GDP growth and inflation forecasts for the following year and future uncertainties that could affect M2 growth, to determine the appropriate target range of M2. Setting a target range of monetary growth rather than a single growth target not only offers greater flexibility for monetary policy operation, but also helps better anchor mid- to long-term expectations.

When setting the M2 target range, the CBCT also considers other important macroeconomic and financial indicators, including inflation expectations, the output gap, interest rate and exchange rate movements, and credit conditions, and asset prices.
In respect of the interest rate policy, the CBCT holds quarterly Board Meetings and considers economic and financial conditions at home and abroad, such as the current price level, inflation expectations, and the output gap, to make policy rate decisions and to help achieve the final goals.

Even though the monetary policy framework of the CBCT is based on a flexible monetary targeting regime, we use interest rates as the main monetary policy instrument in this paper. First, this is because interest rates could cover more distributional channels than the monetary aggregate M2. For example, lower interest rates make borrowers better off by reducing their interest payments on debt, while savers holding deposits receive lower returns. Second, the CBCT also utilizes interest rates as a monetary policy instrument to achieve the final goals.

3.2 Trends in Income Inequality

3.2.1 Measures of Income Inequality and Historical Trends

Household disposable income is the international standard for measuring the distribution of income. According to the OECD definition, disposable income excludes (1) capital gains from trading in real estate and stocks, (2) financial assets (such as deposits, stocks, and funds), and (3) real estate (such as lands and houses). In Chinese Taipei, capital gains are not included in the measurement of household property income.

According to a survey of family income and expenditure made by the Directorate-General of Budget, Accounting and Statistics (DGBAS), the household disposable income is equal to the sum of employee compensation, entrepreneurial income, property income, imputed rent income, current transfer receipts, and miscellaneous receipts minus interest expense and current transfer expenditures (Chart 2).
There are two primary ways to measure income inequality in Chinese Taipei: the Gini coefficient (or the Gini index) and the ratio of the income share of the highest 20% of households to that of the lowest 20% of households (hereafter referred to as the income share ratio, ISR). The latter is seldom adopted in other economies.

1. Gini Coefficient (or Gini Index):

   The Gini coefficient conducts a pairwise comparison of all households’ disposable income, adds up the absolute value of the difference, and then normalizes it between 0 and 1. A Gini coefficient of one (or 100%) expresses maximal inequality, while a Gini coefficient of zero refers to perfect equality. The Gini index is the Gini coefficient multiplied by 100.
2. Income Share Ratio:

The income share ratio is obtained by dividing the household disposable income of the 20% of households with highest income by that of the 20% of households with lowest income. The larger the ratio, the greater the income inequality is. This makes the income share ratio easier to understand than the Gini coefficient because it can be calculated easily. However, it has the disadvantage of ignoring the middle 60% of household data.

The trend for the Gini coefficient in Chinese Taipei is roughly in line with the income share ratio. The Gini coefficient peaked in 2001 and 2009, at 35% and 34.5% respectively. Although it has had an upward trend for a long time, it has remained below the international warning line of 0.4 and has slightly declined since 2009 (Chart 3).

Chinese Taipei’s income share ratio has been gradually increasing over the long-term. It reached its peaks during the dot-com bust of 2001 and the global financial crisis of 2009. The ratios for these periods were 6.39 and 6.34, respectively (Chart 3). Since the global financial crisis in 2009, the ratio has been on a downward trend, from 6.34 in 2009 to 6.07 in 2017.

Chart 3
Gini Coefficient and Income Share Ratio in Chinese Taipei

Source: DGBAS.
### 3.2.2 Sources of Household Income in Chinese Taipei

#### 3.2.2.1 Structure of Household Income in Chinese Taipei and the Historical Trend

Total income receipts of households are composed of employee compensation, entrepreneurial income, property income, imputed rent income, and current transfer receipts. Employee compensation is the most important income source, stably accounting for 60% of total income receipts (Chart 4). Entrepreneurial income, on the other hand, occupies a declining portion of the whole. With the trends in production offshoring and the deeper development of economic globalization, it has been difficult for small and medium enterprises to survive. Therefore, the proportion of entrepreneurial income has decreased year by year.

The shares of property income and imputed rent income have remained relatively stable over the years. Current transfer receipts accounted for less than 10% of household income sources in 1994 but have become the second-most important source of household income since 2004.

The rising trend in the proportion occupied by current transfer receipts has been due to the implementation of the National Health Insurance program, beginning in 1995, other social insurance programs, and pro-consumption policies and expanded transfer expenditures for underprivileged minorities in response to the 2009 global financial crisis.

According to the structure of household income quintiles in 2017, we find that as household income increases, the proportions of employee compensation, property income, and entrepreneurial income increase (Chart 5). In contrast, the proportions of current transfer receipts and imputed rent income decrease.

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2. The share of miscellaneous receipts is ignored in this paper because it is small.
3.2.2.2 Sources of Household Income for the Top and Bottom Quintiles

Because of the increase in government transfer payments, current transfer receipts for the lowest 20% of households have increased year by year (Chart 6). The proportion occupied by employee compensation has shown a downward trend. Since 1998, the proportion of current transfer receipts has even exceeded the proportion of employee compensation, and has become the main source of household income for the lowest-income households.

Source: The Survey of Family Income and Expenditure, DGBAS.
The household income source structure of the top 20% of households has been quite stable over the years, for which employee compensation has accounted for about 60% (Chart 7). Although the proportion of current transfer receipts was relatively low in the early period, it has gradually approached that of entrepreneurial income. However, the gap between these two income sources has stayed constant in recent years. Current transfer receipts for the highest 20% of households have risen because of the increase in benefits of social insurance programs (including benefits of government employees’ and school staffs’ insurance, labor insurance, farmers health insurance, military insurance, and national health insurance). Imputed rent income and property income both account for less than 10%.

**Chart 7**

**Main Sources of Household Income for the Top Quintile**

As an alternative measure of income inequality, the income share ratio is also considered.

3.3 Data Sources

This study selects the household Gini index, real GDP, consumer price index, central bank policy interest rate, real effective exchange rate to capture the effects of monetary policy on income inequality for the small open economy of Chinese Taipei. The sample period is from 1976Q1 to 2017Q4. This long period includes several recessions and expansions during which the central bank implemented a variety of policies, allowing a stronger identification of monetary policy shocks (see Mumtaz and Theophilopoulou, 2017).

As an alternative measure of income inequality, the income share ratio is also considered.
### Table 2
**Variables and Data Sources**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gini</td>
<td>Gini index</td>
<td>DGBAS</td>
</tr>
<tr>
<td>income share</td>
<td>ratio of income share of the highest 20% to that of the lowest 20%</td>
<td>DGBAS</td>
</tr>
<tr>
<td>ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP</td>
<td>real GDP</td>
<td>DGBAS</td>
</tr>
<tr>
<td>CPI</td>
<td>consumer price index</td>
<td>DGBAS</td>
</tr>
<tr>
<td>R</td>
<td>discount rate (policy rate)</td>
<td>CBCT</td>
</tr>
<tr>
<td>REER</td>
<td>real effective exchange rate</td>
<td>BIS</td>
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</table>

The Gini index and the income share ratio are available only on a yearly frequency. The annual frequency data may cause information omission owing to the contemporaneous occurrence of different events within the same period, especially central bank decision-making behavior, thus it is difficult to analyze the true relationship between income inequality and other macro-variables.

Following Davtyan (2017), we use the method proposed by Boot et al. (1967) to interpolate the Gini index and the income share ratio series of an annual frequency into a quarterly series.

### 4. Identification of Monetary Policy Shock

#### 4.1 VAR Model

To identify structural shocks using sign restrictions, we consider the following reduced-form VAR(P) model:

\[ y_t = A(1)y_{t-1} + A(2)y_{t-2} + \cdots A(p)y_{t-p} + \varepsilon_t \text{ for } t = 1,2,\ldots,T, \]

where \( y_t \) is an \( m \times 1 \) vector of endogenous variables. \( A(p) \) is an \( m \times m \) matrix of coefficients, and \( \varepsilon_t \) is a zero-mean independent white noise process with positive definite covariance matrix \( E[\varepsilon_t \varepsilon_t'] = \Sigma \).

Assume \( \varepsilon_t \), an \( m \times 1 \) vector of structural shocks (or innovations) following a standard-normal distribution with zero mean and unit variance. The forecast errors of a reduced-form VAR model are functions of innovations:

\[ \varepsilon_t = B\varepsilon_t^* \]

where \( B \) is an \( m \times m \) matrix of structural parameters.

The standard approach to this identification problem has been to use a Cholesky decomposition or to apply short-run or long-run restrictions to recover structural shocks.
We take log differences of all variables except for the policy interest rate and income inequality. Instead of income inequality level, the difference of inequality is used. Similar to the setting in Mumtaz and Theophilopoulou (2017), we set the lag length $p$ equal to 4 in the specifications above.

Following Feldkircher and Kakamu (2018), we impose the recursive ordering of the difference of income inequality, real GDP growth rate, inflation, policy rate, and REER growth rate. The ordering implies that income inequality does not react within the same quarter to an increase in the policy rate, and that the policy rate responds to real GDP deviation and changes in inflation. Moreover, the REER growth rate is allowed to react immediately to a monetary policy shock. The restrictions on the contemporaneous response of these variables help identify a monetary policy shock.

4.2 Sign Restrictions

In some cases, recursive structures and long-run zero restrictions can be justified by economic theory. However, they are inconsistent with most theoretical models. For example, DSGE models do not produce any zero restrictions or recursive structures. For more details, see Danne (2015).

Sims (1992) points out that the price puzzle results from monetary policy endogeneity. Policy authorities may be aware that inflationary pressure is going to arrive and tighten monetary policy to dampen the pressure, causing a rise in prices concomitant with monetary tightening. In other words, the price puzzle arises through the misspecification of the systematic part of monetary policy. Sims (1992) suggests incorporating a commodity price index into the VAR model because this then contains information about future inflation and solves the puzzle.

Instead of imposing hard restrictions on the model coefficients, sign restrictions do not require assumptions regarding relationships between variables and only impose relatively weak prior beliefs on variable x’s responses for a certain period, while leaving the response of the main variable of interest open. Uhlig (2005) avoids the price puzzle by imposing sign constraints on impulse responses.

In other words, sign restrictions are imposed on a set of orthogonalized impulse response functions (see Uhlig, 2005). In addition to limiting the sign of the responses, the duration of restrictions can also be set. In theory, the duration can be set for anything from the first period to the end of the impulse response functions.

There is no clear rule for choosing the restriction horizon. Imposing a shorter sign restriction horizon might cause spurious effects, while imposing a longer horizon exerts an implausibly long period effect following the monetary policy shock. Choosing a horizon of half a year is the most common.

3. Creel and Mehdi (2019) also assume that income inequality does not react within the same quarter to an increase in the interest rate.

4. The standard for the sign restriction horizon in the literature is half a year. Another common sign restriction horizon is one year (Melolnna, 2012). For example, Scholl and Uhlig (2008) chose half a year and one year as their sign restriction horizons to assess the impact of monetary policy on the exchange rate.
Following Mumtaz and Theophilopoulou (2017), we assume that a contractionary monetary policy shock does not lead to an increase in inflation or real GDP growth, or decreases in the policy rate or REER growth during the half-year after the shock, while imposing no restrictions on the response of the income inequality.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Sign Restrictions of the Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>$\Delta \ln \text{GDP}$</td>
</tr>
<tr>
<td>Sign Restrictions</td>
<td>$\leq 0$</td>
</tr>
</tbody>
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The identification of structural shocks given a set of sign restrictions can be summarized as follows (for further details, see Uhlig, 2005; Danne, 2015):

1. Run an unrestricted VAR and get $\hat{A}$ and $\hat{\Sigma}$.
2. Extract the orthogonal innovations from the model using Cholesky decomposition. The Cholesky decomposition here is just a way to orthogonalize shocks, rather than an identification strategy.
3. Calculate the impulse responses at horizon $k = 1, \ldots, K$.
4. Randomly draw an orthogonal impulse vector $\alpha$.
   $\alpha = \hat{B}a$ and $\|a\| = 1$, where $\hat{B}\hat{B}' = \Sigma$. $\hat{B}$ is obtained by a given rotation or QR decomposition of $\Sigma$.
5. Multiply the responses from Step 3 by $\alpha$; if the impulse response functions satisfy the sign restrictions, keep the draw. Otherwise, discard the draw.
6. Repeat Steps 2–5. Stop after obtaining 5,000 impulse response functions that satisfy the restrictions. Error bands are then calculated using the draws kept.

5. Empirical Results

This section primarily presents the impulse response functions of the recursive structural VAR model and sign restrictions; heterogeneity of responses to monetary policy shocks; and robustness test.
5.1 Impulse Response Functions of the Recursive Structural VAR Model and Sign Restrictions

First, we use a Cholesky decomposition for identification and observe the impact of monetary policy on the Gini index and income share ratio. Chart 8 and Chart 9 show that when the initial rise in the policy rate is above 20 basis points, the impact remains close to 40 basis points after one year. We see that the GDP growth rate gradually declines in the quarters following a contractionary monetary policy shock, but the response is not significant. The REER growth rate first rises, then becomes negative. Income inequality does not respond significantly to contractionary monetary policy shocks.\(^5\)

Moreover, the inflation rises significantly around one year. From this, there emerges a huge price puzzle. The long positive reaction of the price casts considerable doubt on the notion of successful identification of a monetary policy shock.

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Note: The blue line is the impulse response to a one standard deviation contractionary monetary policy shock; the gray shaded area is the 68% error band.

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\(^5\) We have tried to add the trend term into the VAR model, but the results remain the same.
Charts 10 and 11 show that under the sign restrictions, when the contractionary monetary policy shock occurs in the initial period, the policy rate increases by about 0.1 percentage points, the GDP and CPI quarterly growth rates decreases by about 0.3 and 0.2 percentage points, respectively, and the REER growth rate increases by about 1 percentage point. In addition, policy rate increases also cause Gini index and income share ratio differences to significantly increase around the 5th quarter following a shock. Moreover, the income share ratio is more significantly affected by contractionary monetary policy than the Gini index.
Chart 10

Impulse Responses of Sign-Restricted SVAR (The Difference of Gini Index)

Note: The blue line is the impulse response to a one standard deviation contractionary monetary policy shock; the gray shaded area is the 68% error band.
Chart 11
Impulse Responses of Sign-Restricted SVAR
(The Difference of Income Share Ratio)

Note: The blue line is the impulse response to a one standard deviation contractionary monetary policy shock; the gray shaded area is the 68% error band.

In addition to plotting the impulse response functions of the variables, we also determine the effect of monetary policy shocks on forecast error variances. Chart 12 shows, under the sign restrictions, the effect of the monetary policy shock on forecast error variance decompositions (FEVD) for each variable on the 4th, 8th, and 16th quarter forecast horizons. Monetary policy shocks have a great effect on the REER growth rate and policy interest rate, and account for about 17 percent and 12 percent of forecast error variance, respectively. The proportion of monetary policy shock within forecast error variances for the Gini index increases with forecast horizon, while the income share ratio does not change markedly.
5.2 Heterogeneity of Response to Monetary Policy Shocks

As mentioned earlier, the income share ratio is more affected by contractionary monetary policy than the Gini index. In order to understand the possible reasons behind responses to the income share ratio, we consider how the 10th - 90th percentiles of household disposable income growth respond to monetary policy shocks. Each shock is identified using the identification scheme discussed in the previous section. However, the response of household disposable income growth is left open by the identification procedure.

Chart 13 shows that the income of low-income households is more significantly affected by the contractionary effect of a rise in policy interest rates; the decline in disposable income growth is larger than that for high-income households and the statistical effect is significant at the 4th quarter. The 10th percentile household disposable income decreases more than 0.2 percentage points around one year, while that for the 90th percentiles decreases less than 0.1 percentage points. This deteriorates income distribution and increases income inequality. A possible reason for this result is that low-income households primarily engage in replaceable work. When a recession happens, they are more likely to be laid off and vulnerable to impacts from recession. Thus, low-income households are more affected by the contractionary effect of a rise in policy interest rates. High-income households, on the other hand, have better ability to respond to monetary policy shocks; and because they mostly engage in high-tech work, which is less replaceable, the impact is relatively moderate and insignificant.

In conclusion, the deterioration of low-income households’ disposable income contributes to the way (as we noted in the previous section) the income share ratio significantly responds to contractionary monetary policy for a few quarters.
Chart 13
Impulse Responses of 10th - 90th Percentile Households by Disposable Income to Contractionary Monetary Policy Shocks

Note: The blue line is the impulse response to a one standard deviation contractionary monetary policy shock; the gray shaded area is the 68% error band.

5.3 Structural Change Test

There were several economic episodes during the 1976-2017 period, such as the Asian Financial Crisis and the Global Financial Crisis. As a result, VAR regression coefficients may be unstable. Since the difference of the income share ratio in response to contractionary monetary policy is significant for a few quarters, we use an income share ratio regression equation in the VAR model to perform a recursive CUSUM structural change test for test robustness of the regression coefficient. At a 1% significance level, the results suggest that structural change may have occurred in 2000Q1, but this is not statistically significant (Chart 14).
Furthermore, we estimate a VAR model with the same sign restrictions from 1976Q1 to 1999Q4 and from 2000Q1 to 2017Q4, respectively. The results suggest that the pattern of income share ratio difference in monetary policy impulse responses is approximately similar, and the impulse responses reach the significance level at around 1 year (Chart 15). Furthermore, the impact of monetary policy on income share ratio became larger after 2000.

**Chart 15**

The Difference of Income Share Ratio Impulse Response Before and After 2000

Note: The blue line is the impulse response to a one standard deviation contractionary monetary policy shock; the gray shaded area is the 68% error band.
5.4 Robustness Test

Although capital gains are not included in the sources of household disposable income sources, property income (interest, dividends, rent income, etc.) appears to be closely related to the stock market. High-income households have more financial assets such as stocks. If interest rates rise, stock prices fall and companies’ willingness to pay dividends is dampened. Furthermore, if stock prices go down, property prices (like real estate) may fall as a result of a wealth effect which would also reduce rental income. All of these cause a decrease in high-income households’ property income, which may narrow the household disposable income gap and reduce income inequality.

This section further investigates the role that financial asset prices play in monetary policy. Considering a short housing price series and the absence of housing price wealth effect in Chinese Taipei (see Chen and Wang, 2011), this study aims to incorporate stock return into the VAR model, while not imposing any sign restrictions, to investigate the possible effects.

Chart 16 shows that contractionary interest rate policy does not cause significant stock market volatility. Therefore, the impact of a monetary shock on property income is negligible. Thus, the income share ratio and confidence interval responses are nearly identical when stock price variables are not taken into consideration (see Chart 11). As mentioned above, interest rate policy does not cause significant effects on income inequality via influencing asset prices. This is due firstly to the fact that the Gini index calculation excludes capital gains and secondly, to the fact that monetary policy effects on asset prices are limited.
Furthermore, following Mumtaz and Theophilopoulou (2017), we reorder the variables in the Cholesky decomposition as real GDP growth rate, inflation, Gini index/income share ratio, policy interest rate, and REER growth rate. We use the same sign restrictions mentioned earlier to investigate the effects of monetary policy on the Gini index and the income share ratio.

Charts 17 and 18 show that hikes in interest rates temporarily worsen the Gini index and income share ratio in some quarters, and the effect on the income share ratio remains relatively significant.

This result is robust, even if the recursive order is the same as in section 5.1. The monetary policy distributional effects are relatively limited in Chinese Taipei.

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6. We take the log differences of all variables except for policy rate and income inequality.
Note: The blue line is the impulse response to a one standard deviation contractionary monetary policy shock; gray shaded area is the 68% error band.
6. Conclusion

Past research has focused on the impact of fiscal policy on income inequality, while the distributional effects of monetary policy have not been widely discussed. This paper examines the impact of Chinese Taipei’s monetary policy shocks on income inequality using the recursive structural VAR model and sign restrictions.

The recursive structural VAR model shows that raising interest rates does not affect income inequality, but does cause a price puzzle to appear. However, after imposing the sign restriction, the price puzzle disappears. Our results indicate that a contractionary monetary policy shock leads to a significant increase in the income share ratio over a few quarters.
In order to understand the possible reasons behind the responses of income inequality, we further explore the response of the disposable income of the 10th to 90th percentile households to monetary policy tightening. The results show that the impact of monetary policy shocks on 10th percentile household income at around one year is significant. Low-income households are more sensitive to changes in monetary policy.

In addition, we consider the possible role of stock prices, and the results are similar. We also find that contractionary monetary policy has a slight impact on income inequality in our robustness check.

In summary, there is insufficient evidence to support the idea that monetary policy has a significant effect on income inequality in Chinese Taipei. Two policy implications can be drawn from the study. First, the distributional effects of monetary policy tightening should not influence policy decision. Second, because low-income households tend to have lower education levels and engage in lower-end jobs, they are more susceptible to the business cycle and economic structural changes. To reduce income inequality in Chinese Taipei, the government should consider policies that would promote education, reinforce the labor market system, and ensure more taxation fairness. Details of the measures are as follows:

1. Education policy: OECD (2011) shows that education is a more effective policy tool for reducing wage inequality. A more equitable distribution of educational opportunities has resulted in a more equitable distribution of labor income. Therefore, policies that increase the level of education and promote equal access to education help reduce inequality.

2. Labor market policy: The government could consider increasing fiscal expenditure on measures such as subsides for vocational training or enhancing job search support.

3. Tax policy: The tax system should be re-examined for equity; the government could re-assess tax measures that benefit mainly high-income groups.

Finally, an interesting area for future research would be to see if an expansionary monetary policy has any effect on income inequality since contractionary and expansionary monetary policy may have asymmetric effects.
References


