Economic Research-Ekonomska Istraživanja

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rero20

The impact of monetary policy shocks on income inequality: a tale of two countries

Lijin Xiang, Wenhao Wang, Jiameng Ren & Yang Zhao

To cite this article: Lijin Xiang, Wenhao Wang, Jiameng Ren & Yang Zhao (2023) The impact of monetary policy shocks on income inequality: a tale of two countries, Economic Research-Ekonomska Istraživanja, 36:2, 2106269, DOI: 10.1080/1331677X.2022.2106269

To link to this article: https://doi.org/10.1080/1331677X.2022.2106269

Published online: 05 Aug 2022.

ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA
2023, VOL. 36, NO. 2, 2106269
https://doi.org/10.1080/1331677X.2022.2106269

The impact of monetary policy shocks on income inequality: a tale of two countries

Lijin Xiang, Wenhao Wang, Jiameng Ren and Yang Zhao

School of Finance, Shandong University of Finance and Economics, Jinan, China

ABSTRACT

The easing monetary policy after the global financial crisis triggered wide concerns on the responses of income inequality. In this paper, we investigate impact of monetary policy shocks on income inequality. We propose a general equilibrium model and show that monetary policies could affect income inequality by affecting the earnings of high-income households in financial markets and business operations. Using a TVP-FAVAR model, we find contradictory distributional effects of monetary policy shocks in China and the US. Specifically, expansionary monetary policy shocks persistently increase income inequality in China but decrease income inequality in the US. Moreover, the impacts are volatile in the short-term, but stabilise after 10 periods. The investigation on the responses of top 1% and bottom 50% income share confirms the finding of contradictory distributional effects of monetary policy shocks.

ARTICLE HISTORY
Received 15 October 2021
Accepted 21 July 2022

KEYWORDS
Monetary policy shocks; income inequality; TVP-FAVAR; two country comparison

JEL CLASSIFICATION
C32; D31; E52

1. Introduction

The 2007 global financial crisis (GFC) heavily shocked the global economy. The easing monetary policies were implemented by central banks in most countries. For instance, in the US, three rounds of quantitative easing (QE) were implemented in 2008, 2010 and 2012, and the interest rates were approaching zero. In China, the stimulus package of 4 trillion Yuan was announced in November 2008, following by a steep fall in the real interest rates.[1] The expansionary monetary policies were intended to stimulate economic growth and recover the economy from the crisis. Textbook theory tells us that the expansionary monetary policies could boost economic growth, employment and inflation.

With the increasing interests on income inequality, a series of studies reported that economic growth, unemployment and inflation could affect income distribution. Kuznets (1955) described an inverted U curve relationship between economic growth and income inequality, stating that the income inequality is related to the level of economic development. Cysne (2009) and Mocan (1999) argued that the increase in

CONTACT Wenhao Wang andrew_wang9007@sdufe.edu.cn

structural unemployment enlarges income inequality. Albanesi (2007) and Bulíř (2001) provided evidence that the inflation and income inequality are positively correlated, implying that the high inflation hurts low-income households and widens the income inequality. Additionally, Wildowicz-Szumarska (2022) showed that fiscal instruments had significant effects on income distribution, and social transfers found most effective in combating income inequality.

In addition, monetary policy can also affect income inequality through income structure, savings redistribution and asset allocation (Mumtaz & Theophilopoulou, 2020). For example, Coibion et al. (2017) argued that the expansionary monetary policy shocks would increase income inequality by providing high-income households more income from business and financial investments but decrease inequality by affecting the labor income differently for high-income and low-income households. Berisha et al. (2018) employed historical household debt data published by Philippon (2015), verifying that the existence of income structure channels and the tightened monetary policy will generate a greater decline of capital gains income of high-income families than that of low-income families. McKinnon and Shaw (1973), the proposers of the theory of 'financial deepening', examined the channels of savings redistribution, and pointed out that the low interest rates caused by the regulation of the interest rate level produced the distribution effect that is adverse to savers and beneficial to investors, which would aggravate a country's income inequality. Additionally, Amaral (2017) found that financial assets were affected by interest rate changes, and the value changes of financial assets redistributed household income. For example, compared with low-income families, high-income families held a higher proportion of financial assets, thus, high-income families would benefit more when the expansionary monetary policy was implemented by the central bank.

However, it is worth noting that there is no consensus among scholars on the impact of monetary policy on income inequality even though the channels between monetary policy and income distribution have been tested by academia (Coibion et al., 2017; Davtyan, 2017; Hohberger et al., 2020; Liosi & Spyrou, 2022). The reason is that the sample countries selected by different studies are not the same, and the financial development level, domestic unemployment rate, inflation rate, savings rate and the proportion of high-income and low-income families in different economies exist obvious differences, which distorts the role of different channels of monetary policy affecting income inequality, so as to make the research conclusion difficult to completely unify. At the same time, as discussed in Ghossoub and Reed (2017) and Kuznets (1955), for counties at different stages of economic development, monetary policies impose heterogenous distributional effects on the macroeconomic factors, thereby having different effects on the income inequality. Developed and developing countries are two typical economic groups in different economic stages.

Accordingly, is there a strong heterogeneity in the impact of monetary policy on income inequality between developed and developing countries? Are there any significant differences in the role of different channels in the two kinds of economies? Answering the above questions can identify the effects of different channels, clarify the heterogeneity of the relationship between monetary policy and income inequality, and reduce the differences in the distribution effect of monetary policy to a certain

extent. This paper proposes a simple general equilibrium model by utilising the asset allocation channel and the income composition channel to explore how monetary policy affects income inequality. The model assumes the high-income households smooth the consumptions by investing on financial market and participating into enterprise operation, and the low-income households only have labour earning. The model suggests that the expansionary monetary policy shocks increase income inequality by providing more operating income but reduce income inequality by shrinking the future financial returns.

However, it cannot be ignored that if the sample countries include more countries, it will also cover up the unique relationship between monetary policy and income inequality in some countries. Therefore, the representatives of developed and developing countries, namely the US and China, are selected as research samples. Moreover, another important reason for taking the two countries as research samples is that there are significant differences in the degree of financial market development between China and the US, for example, compared with the US financial market, the financial market of China has still undergone continuous development; Meanwhile, after the accession of China to the WTO, the increasing export demand has led to the participation of many Chinese enterprises and families in production and management, thus there are also significant differences in the degree of operation participation between China and the US; In addition, the level of savings rate between China and the US has also formed a sharp contrast, so it is reasonable and representative to take the two countries as research samples.

This paper puts forward the following research hypotheses: for China and the US, given the different degrees of financial market development, the interest rate level and savings rate level, there exists a significant discrepancy in the impacts of monetary policy shocks on income inequality between the two countries.

It is worth noting that the formulation of monetary policy rules often depends on the overall macroeconomic operation state, and the impact of monetary policy on the income distribution of residents under different economic operation states will be different, which is mostly ignored in existing research literature. At present, some scholars represented by Bernanke et al. (2005) have introduced factor-augmented vector autoregression (FAVAR) and other models in monetary policy-related research to incorporate the macroeconomic state into the analysis. However, few scholars take the dynamic macroeconomic factors into account in the process of exploring how interest rate fluctuations affect income inequality. Based on this, in order to separate monetary policy shocks from macroeconomic shocks and accurately capture the relationship between monetary policy shocks and income inequality, we adopt time-varying parameter factor augmented vector autoregressive model (TVP-FAVAR) to construct the impulse responses of inequality to monetary policy shocks on the basis of theoretical model, so as to make an empirical study about the impact of monetary policy shocks on income inequality in our sample countries, which owns vital theoretical significance. The TVP-FAVAR model is efficient to isolate the impact of monetary policy shocks from the effects of other economic fundamentals by estimating a 'small' size model. And it

could capture the time-varying property in the changing economic environment (Koop & Korobilis, 2014).

The impact of monetary policy shocks exhibits contradictory patterns in China and the US. Expansionary monetary policy shocks persistently increase income inequality in China, but decrease income inequality in the US. Short-term responses of inequality change dramatically, but the responses stabilise after the 10th periods. The impacts of monetary policy shocks in both China and the US are non-uniform over time, and the global financial crisis is an important structural break. In recent years, the distributional effect of monetary policy shocks has become more prominent.

To further illustrate how the income inequality reacts to monetary policy shocks, we employ the TVP-FAVAR model to estimate the impulse responses of the top 1% and bottom 50% income share to monetary policy shocks. The results further confirm the finding that the expansionary monetary policy could increase the income of high-income households but reduce the income of low-income households in China, but display an opposite pattern in the US.

This paper contributes to the literature in two ways. First, we provide empirical evidence that the monetary policy shocks have contradictory effects on income inequality. The distributional effects of monetary policy shocks are heterogenous across countries. The policy mix should be country-specific. Second, the adoption of TVP-FAVAR helps to isolate the effects of monetary policy shocks from the economic fundamentals. It circumvents the dimensional problem when estimating a large model.

The rest of the paper is organised as follows: Section 2 presents the theoretical analysis; Section 3 discusses the empirical model and the data; the empirical results based on Gini coefficient is shown in Section 4; the further study based on top and bottom income share is discussed in Section 5; and Section 6 concludes.

2. Theoretical analysis

To explain how monetary policy shocks affect income inequality, we propose a simple model.[2] The model consists of high-income households, low-income households, a producer and a central bank. We assume central banks implement monetary policies and alter interest rates following the Taylor rule. The theoretical framework is a general equilibrium model by incorporating heterogenous household sectors and income structures.

2.1. Model setup

We follow the setup in Motta and Tirelli (2012), and employ the fraction ω of high-income households, and 1-ω of low-income households. High-income households could smooth the consumptions by investing on financial markets. Furthermore, high-income households are entrepreneurs and earn dividends from corporate operation. Both high-income and low-income households are engaged in producing, and earn wages by providing labour. Low-income households do not participate in

investment, and the income is all used in the consumption. We use r and p to denote high-income and low-income households.

For high-income households, the optimisation problem is

$$\begin{aligned} \max U^r &= E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{1}{1-\sigma} \left(C_t^r\right)^{1-\sigma} - \frac{1}{1+\varphi} \left(L_t^r\right)^{1+\varphi} \right) \\ s.t. \quad & P_t C_t^r + E_t(Q_{t,t+1} B_{t+1}) \leq B_t + W_t^r L_t^r + \Pi_t \end{aligned} \tag{1}$$

where β is the discount factor; σ is the risk aversion; φ is the inverse of elasticity of labor supply; P_t is the price index; B_t denotes the bonds invested; $Q_{t,t+1}$ is the stochastic discount factor, which satisfies $E_t(Q_{t,t+1}) = 1/R_t = 1/(1+r_t)$, and r_t is the risk-free interest rates; the wage rate is denoted as W_t^r; and the dividend income is Π_t.

For low-income households, the optimisation problem is:

$$\begin{aligned} \max U^p &= E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{1}{1-\sigma} \left(C_t^p\right)^{1-\sigma} - \frac{1}{1+\varphi} \left(L_t^p\right)^{1+\varphi} \right) \\ s.t. \quad & P_t C_t^p \leq W_t^p L_t^p \end{aligned} \tag{2}$$

The consumptions are assumed to be constant elasticity of substitution consumptions, which can be written as:

$$C_t^k = \left[\int_0^1 C_t^k(z)^{(\varepsilon-1)/\varepsilon} dz \right]^{\varepsilon/(\varepsilon-1)} \tag{3}$$

and the price index is constructed as:

$$P_t = \left(\int_0^1 P_t(z)^{1-\varepsilon} dz \right)^{1/(1-\varepsilon)} \tag{4}$$

where ε is the elasticity of substitution.

For producers' decision, we follow the assumptions in Areosa and Areosa (2016), and employ the fraction of λ high-income households and the fraction of 1-λ low-income households to produce heterogenous goods, which can be written as:

$$Y_t(z) = A_t \left[L_t^r(z)\right]^{\lambda} \left[L_t^p(z)\right]^{1-\lambda} \tag{5}$$

where z denotes the heterogenous goods, and λ is the fraction of high-income households employed in the production.

Based on Christiano et al. (2005) and Ravenna and Walsh (2006), We incorporate monetary policy shocks by assuming producers borrow in risk-free interest rate to pay wages. Therefore, the wage costs are $W_t^r R_t$ and $W_t^p R_t$.

For the central bank, the monetary policy is determined by the Taylor rule, which is

$$r_t = \rho r_{t-1} + (1-\rho)(\phi_\pi \pi_t + \phi_y \hat{y}_t) + \kappa_t^m \tag{6}$$

where ρ is the smooth parameter in the Taylor rule; π_t is the inflation rate which is calculated based on Equation (4); $\hat{y}_t$ is the output gap; and $\kappa_t = \rho_k \kappa_t + \xi_t^k$, $\xi_t^k \sim N(0, \sigma_k^2)$ represents exogenous shocks.

Marker clearing conditions are on two markets: labor market and goods market. In labor market, labor supply equals labor demand, which means $L_t^r = \int_0^1 L_t^r(z)dz/\omega$ and $L_t^p = \int_0^1 L_t^p(z)dz/(1-\omega)$. In goods market, total consumption is equal to production, which is $\omega C_t^r(z) + (1-\omega)C_t^p(z) = Y_t(z)$.

2.2. Gini coefficient and impact of monetary policy shocks

The production function of Equation (5) suggests the output elasticity of labor is

$$\frac{\partial Y_t}{\partial L_t^r}\frac{L_t^r}{Y_t} = \lambda, \quad \frac{\partial Y_t}{\partial L_t^p}\frac{L_t^p}{Y_t} = 1-\lambda \tag{7}$$

We assume $\lambda > 1-\lambda$ which is the same with Areosa and Areosa (2016).[3] Given the wage rates to two kinds of households, the first order condition of the producers' optimisation problem finds that:

$$R_t \frac{W_t^r L_t^r(z)}{\lambda} = R_t \frac{W_t^p L_t^p(z)}{1-\lambda} = MC_t Y_t(z) \tag{8}$$

Substitute the corresponding parts in Equation (5), and the marginal cost of producers is

$$MC_t = \frac{R_t}{A_t}\left(\frac{W_t^r}{\lambda}\right)^{\lambda}\left(\frac{W_t^p}{1-\lambda}\right)^{1-\lambda} \tag{9}$$

The first order conditions of high-income and low-income households' optimisation problem give the labor supply equations:

$$\begin{cases} L_t^r = \dfrac{1}{\omega}\displaystyle\int_0^1 L_t^r(z)dz = \dfrac{1}{\omega}\left(\dfrac{1-\lambda}{\lambda}\right)^{\lambda-1}\left(\dfrac{W_t^r}{W_t^p}\right)^{\lambda-1}\int_0^1 \dfrac{P_t(z)}{P_t}dz\dfrac{Y_t}{A_t} \\ L_t^p = \dfrac{1}{1-\omega}\displaystyle\int_0^1 L_t^p(z)dz = \dfrac{1}{1-\omega}\left(\dfrac{1-\lambda}{\lambda}\right)^{\lambda}\left(\dfrac{W_t^r}{W_t^p}\right)^{\lambda}\int_0^1 \dfrac{P_t(z)}{P_t}dz\dfrac{Y_t}{A_t} \end{cases} \tag{10}$$

Given Equations (8) and (10), we can find

$$\frac{W_t^r L_t^r}{W_t^p L_t^p} = \frac{\lambda}{1-\lambda}\frac{1-\omega}{\omega} \tag{11}$$

which suggests that wage income of high-income households is larger than the low-income households.

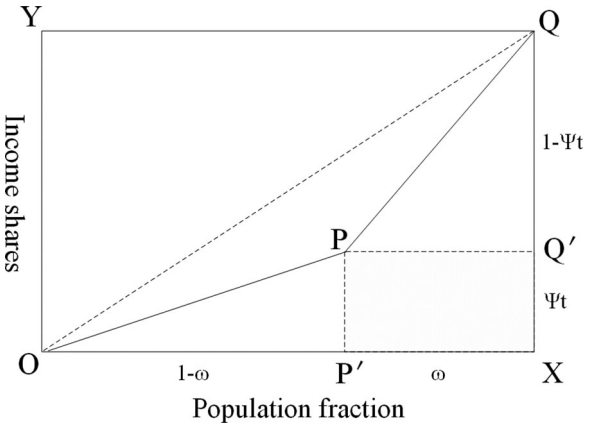


Figure 1. Lorenz curve based on binary classified households.
Source: drawn by authors.

The Gini coefficient measures income inequality referred to the Lorenz curve. In our model, we simply spilt the society into two kinds of households. The Lorenz curve becomes simplified. Figure 1 illustrates the Lorenz curve of two kinds of households. According to the figure, the income share of low-income households is

$$\Psi_t = \frac{(1-\omega) W_t^p L_t^p}{\omega(D_t + \Pi_t + W_t^r L_t^r) + (1-\omega) W_t^p L_t^p}, \tag{12}$$

where the bond yield in high-income households is $D_t = r_{t-1} B_t / (1 + r_{t-1})$, and the dividend benefit is $\Pi_t = \left[P_t Y_t - (1 + r_t)(\omega W_t^r L_t^r + (1-\omega) W_t^p L_t^p)\right] / \omega$.

The Gini coefficient is the ratio of the area of the triangle OPQ to the area of the triangle OXQ, which is

$$Gini = \frac{(1-\omega)\left[\omega r_{t-1} B_t + (1 + r_{t-1})\left(P_t Y_t - r_t \omega W_t^r L_t^r - (1 + r_t(1-\omega)) W_t^p L_t^p\right)\right]}{\omega r_{t-1} B_t + (1 + r_{t-1})\left[P_t Y_t - r_t \omega W_t^r L_t^r - r_t (1-\omega) W_t^p L_t^p\right]}. \tag{13}$$

Equation (13) suggests that the Gini coefficient is related to the fraction of high-income households and the income share of low-income households. A lower fraction of high-income households is associated with a larger Gini coefficient, and implies a greater income inequality. The income share of low-income households have similar effects on the income inequality.

Note that we assume the fraction of high-income households is exogenous in the model. The shares of bonds return and dividend benefits are determinants of the Gini coefficient, and both these returns are related to the monetary policy shocks. The bonds returns are determined by lagged interest rates, and the dividends are determined by contemporaneous interest rates. This implies that the monetary policy shocks would persistently affect income inequality.

According to Equation (12), the expansionary monetary policy shocks which decrease interest rates would reduce the future income of high-income households

from bonds investment and lower the income inequality in the future. However, the expansionary monetary policy shocks would also increase the income of high-income households from dividends, and thus increase the income inequality at the current stage. This makes it complex to predict how income inequality reacts to monetary policy shocks. Specifically, the proportion of high-income households and level of interest rates in the US are significantly different from that in China, which would lead to discrepant conclusions for these two countries.

In addition, according to Equation (13), the Gini coefficient is affected by the price of consumption and labor income from both types of households are determinants, which are determined by income inequality and other factors. Considering the interaction among income inequality, lagged and current interest rates and other macroeconomic variables, it is unable to reach an analytical solution representing an explicit relationship between monetary policy shocks and income inequality. As a result, we implement a time-varying vector autoregression framework to disentangle the real effect of monetary policy shocks on income inequality under different economic environment, empirically.

3. Methodology and data

As aforementioned, the contradictory impact of monetary policy shocks on contemporaneous and future income inequality makes it difficult to predict how income inequality dynamically react to monetary policy shocks. Due to the fractions of high-income households and degrees of participation in financial markets are diverse in different countries, the synthetic impact of monetary policy shocks should be heterogenous across countries. Accordingly, the empirical analysis is employed in this paper to further investigate the impact of monetary policy shocks on income inequality. In this paper, we mainly focus on the impact of monetary policy shocks in China and the US which are the largest emerging market country and the largest developed country.

3.1. Time-varying parameter factor augmented VAR

To isolate the impact of monetary policy shocks, it is needed to control the latent effects from other economic fundamentals. The theoretical analysis implies the lagged monetary policy shocks would display influence on income inequality. Accordingly, a vector autoregressive (VAR) model is an appropriate candidate model to conduct the empirical analysis. However, a potential issue is that the number of estimates in VAR explodes with the increasing dimensions of the model. To circumvent this problem, we adopt the FAVAR model proposed by Bernanke et al. (2005). FAVAR incorporates factor model to reduce the dimension of VAR.

In addition to the dimensional problem discussed above, the economic environment in China and the US has changed dramatically in the last two decades. The changing economic environment suggests the distributional effect of monetary policy would be non-uniform. To capture this changing effect, we implement a time-varying property on the FAVAR model.

In this study, we first extract common factors from a bunch of economic fundamentals using principal component analysis. These common factors contain information about the economic environment, which are used to control the potential impacts from factors other than monetary policies.

Then, we construct a VAR model with common factors, proxies of income inequality and monetary policies, and allow the parameters in VAR to be time-varying. By controlling the potential impacts, the model could isolate the effect of monetary policy shocks on income inequality. To be specific, the TVP-FAVAR (3) could be summarised as

$$X_{i,t} = \mathbf{\Gamma}_i \boldsymbol{F}_t + e_{i,t}, \tag{14}$$

$$\mathbf{\Phi}_{t,p}(L)\begin{pmatrix} \boldsymbol{F}_t \\ \boldsymbol{Z}_t \end{pmatrix} = \boldsymbol{\mu}_t + \boldsymbol{v}_t, \tag{15}$$

$$\boldsymbol{v}_t = \boldsymbol{A}_t^{-1}\boldsymbol{\varepsilon}_t, \tag{16}$$

where $X_{i,t}$ is the i-th economic fundamental, $\boldsymbol{F}_t$ is the vector of common factors, $\boldsymbol{Z}_t$ is the vector of exogenous variables, $\mathbf{\Phi}_{t,p}(L)$ is polynomials in the lag operator indicating the parameters are time-varying and the VAR system is with p lags, $\boldsymbol{\mu}_t$ is a constant vector, $\boldsymbol{v}_t$ states the structure of the time-varying heteroscedasticity, and $\boldsymbol{A}_t$ is a lower triangular matrix.

We follow Primiceri (2005) setup, and assume the parameters in $\mathbf{\Phi}_{t,p}(L)$ and $\boldsymbol{A}_t$ are random walk and $\boldsymbol{\varepsilon}_t$ follows a stochastic volatility process. The dynamics of the model's time-varying parameters is specified as

$$\begin{cases} \varphi_t = \varphi_{t-1} + \tau_t \\ a_t = a_{t-1} + \zeta_t \\ \log\sigma_t = \log\sigma_{t-1} + \eta_t \end{cases}, \tag{17}$$

where φ_t is a representative parameter in $\mathbf{\Phi}_{t,p}(L)$; a_t is an element in $\boldsymbol{A}_t$; σ_t^2 is an element in the variance matrix of $\boldsymbol{\varepsilon}_t$. τ_t, ζ_t and η_t are jointly normally distributed. Primiceri (2005) show that this time-varying parameter VAR system could be estimated based on Gibbs sampling. The detailed estimation procedure is discussed in Primiceri (2005) and Koop and Korobilis (2014).

As we are interested in the behaviour of impulse responses, the Wold representation of Equation (15) is used to construct the impulse response functions. The time-varying impulse responses provide information about the changing distributional effect of monetary policies.

3.2. Data

We choose income Gini coefficients as the proxy of income inequality. A large Gini coefficient suggests the economy suffers a severe inequality, and vice versa. The annual Gini coefficients in China and the US are collected from the WIND database.

Table 1. Descriptive statistics (%).

	China					USA				
	Mean	SD	Max	Min	ADF	Mean	SD	Max	Min	ADF
Gini	0.25	0.91	3.40	−0.99	−6.37[(a)]	0.08	0.25	0.62	−0.39	−4.63[(a)]
Top 1%	0.05	0.13	0.46	−0.25	−2.04[(d)]	0.03	0.17	0.37	−0.44	−4.00[(a)]
Bot. 50%	−0.05	0.11	0.16	−0.34	−4.58[(a)]	−0.02	0.06	0.15	−0.11	−3.33[(a)]
Interest rate	−0.07	0.50	1.49	−1.94	−4.94[(a)]	−0.04	0.41	0.59	−1.44	−3.87[(a)]
GDP	2.90	1.44	7.04	−3.25	−3.28[(a)]	1.08	2.61	4.80	−4.76	−3.93[(a)]
CPI	0.50	1.07	3.57	−1.80	−3.30[(a)]	0.53	0.67	2.17	−2.87	−5.37[(a)]
GOV	3.68	4.36	12.30	−4.91	−9.62[(a)]	1.18	4.17	17.95	−12.44	−5.05[(a)]
M0	2.31	1.56	6.56	−1.41	−2.10[(d)]	2.23	7.45	60.53	−5.95	−5.74[(a)]
M1	3.28	3.47	9.55	−4.27	−2.50[(d)]	1.51	1.85	9.13	−1.88	−4.31[(a)]
M2	3.53	1.58	11.04	−0.62	−1.30[(d)]	1.51	0.69	4.17	−0.09	−5.24[(a)]
Export	2.82	5.29	11.59	−19.61	−5.24[(a)]	0.99	3.69	8.47	−15.65	−6.00[(a)]
Import	3.00	7.20	22.11	−27.27	−6.20[(a)]	1.11	4.62	9.88	−24.35	−6.93[(a)]
REER	0.22	2.18	7.42	−5.55	−3.35[(a)]	0.00	2.21	8.49	−3.94	−6.13[(a)]

Note: 'Top 1%' is the income share of top 1%. 'Bot. 50%' is the income share of bottom 50%. 'GOV' means the government expenditure. The variables except income shares and interest rates are taken the first difference on the logarithm, and the income shares and interest rate take the first difference on the level rate. The superscripts '(a)', '(b)' and '(c)' indicates the ADF test reject the null hypothesis of unit root at 1%, 5% and 10% level, and the superscript '(d)' indicates the ADF test cannot reject the null hypothesis.
Source: calculated by authors.

The quarterly data of Gini coefficients are constructed based on the cubic match interpolation.

In addition to the Gini coefficients, we also collect top 1% and bottom 50% income share from world inequality database. The income top shares provide information about the income distributions in China and the US. The income share is corresponding to the Lorenz curve drawn in Figure 1.

The changes in interest rates are caused by monetary policy shocks. Accordingly, we choose interest rate changes as the proxy of monetary policy shocks (Bivens, 2015). For China, we choose the weighted inter-bank rate collected from CEInet Statistics database.[4] For the US, we collect effective Federal fund rate from the Federal Reserve System.[5] The quarterly data are obtained by taking the average of the observations in each quarter.

Inspired by the existing literature, we collect data of GDP, CPI, government expenditure, M0, M1, M2, export and import, and real effective exchange rate from the IFS, the WIND database and the National Bureau of Statistics in China. The details of the data source and variable construction are shown in the Appendix.[6] All these variables are seasonally adjusted on the level rates. The sample spans the period of 1998Q1-2019Q4.[7]

We take the change rates for all the variables except interest rates and top income share, and we take the first difference on the level rate for interest rate and income share.[8]

Table 1 presents the descriptive statistics of the variables. We could find that compared with the US, the Gini coefficient and the difference between the highest income share and the lowest income share of China are larger, which shows that the difference between the highest income share and the lowest income share is representative of the Gini coefficient, and there is a certain positive relationship between the difference and the Gini coefficient. In the sample period, interest rates in China and the US showed a downward trend, at the same time, economic status indicators in both

Table 2. Correlations across income inequality and interest rate.

		Gini	Top 1%	Bot. 50%
China	Top 1%	0.424		
	Bot. 50%	−0.553	−0.660	
	Interest rate	−0.066	−0.035	−0.019
USA	Top 1	0.872		
	Bot. 50%	−0.854	−0.523	
	Interest rate	0.477	0.470	−0.349

Note: see note to Table 1.
Source: calculated by authors.

countries showed varying degrees of growth, which indicates that both China and the US have viewed a great change of economic environment during the sample periods.

Table 2 illustrates the correlations between income inequality and interest rate. An interesting observation is that the correlation between Gini coefficient and interest rate has different signs in China and the US. In China, the negative correlation suggests that the contractionary monetary policy shocks help to reduce the income inequality. However, the opposite distributional effect of contractionary monetary policy shocks is observed in the US. This means that the impact of monetary policy shocks on income inequality is complicated. Another observation in Table 2 is that the Gini coefficient is positively correlated with the top 1% income share and negatively correlated with the bottom 50% income share. This finding is associated with Equation (13) which implies that the income share of low-income households could negatively affect Gini coefficient.

The correlations between income shares and interest rate in the US are in accordance with Avery et al. (1987) and Romer and Romer (2020) who argue that expansionary monetary policy shocks would benefit the low-income households. We could find that the top 1% income share is positively correlated with interest rate in the US, implying that an expansionary monetary policy shocks would increase the bottom income shares, but decrease the top income shares. However, in China, the correlation between top 1% income share and interest rate is negative, suggesting an opposite pattern of the impact of monetary policy shocks in the US. The correlations between the income share of bottom 50% and interest rate are positive in both China and the US, suggesting the expansionary monetary policy shocks could reduce the incomes of low-income households.

4. Empirical results

The eigenvalues in principal component analysis suggest that the first two components could explain around 75% of the total variance of economic fundamentals for both China and the US. Therefore, we employ the first two components extracted from economic fundamentals to control the economic factors. According to AIC, three lags in the VAR system are the best for both China and the US. The final model is a TVP-FAVAR (3). To estimate the model, we follow Koop and Korobilis (2014) and employ Minnesota prior as the initial conditions. We choose the first 10,000 draws as the burn-in period, and the posterior estimates of the parameters are estimated based on the next 50,000 draws.[9]

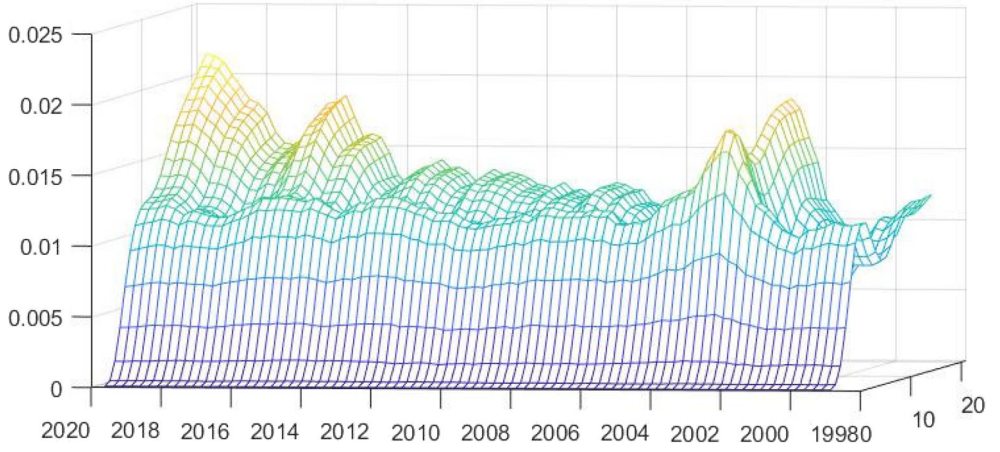


Figure 2. Time-varying impulse responses of income inequality in China.
Note: The impulse response of income inequality is constructed by assuming 100 basis points decrease of interest rate.
Source: drawn by authors.

As the model is time-varying, the parameters are assumed to change over time. A natural way to read the results is to plot the impacts of the key variables. Accordingly, we calculate the impulse responses of income inequality to a monetary policy shock in each period. The shock is normalised that the interest rate decreases by 100 basis points to make the responses comparable over time.[10]

Figure 2 plots the impulse responses of income inequality to the monetary policy shocks in China. Obviously, the impulse responses were all positive, indicating an expansionary monetary policy would polarise income and widen income inequality in China. This finding is in line with Liosi and Spyrou (2022) and Berisha et al. (2020) who find similar evidence in Eurozone area and in BRICS. It also accords with theoretical prediction from Albanesi (2007). A few troughs could be observed in the figure. In early 2003, the income inequality was more sensitive to the monetary policy shocks. In 2003, the people's bank of China (PBOC) raised the interest rates and reduced the money supply. This change makes the economy more sensitive to monetary policy shocks. After 2015, the impulse responses of income inequality seem to be more positive, and the impacts of monetary policy shocks were greater than those in history. In China, the interest rate liberalisation started in 1996, but the process sped up in middle 2015. In 2015, PBOC liberalised the deposit rates in China, and this was a big step to interest rate liberalisation. Along with the interest rate liberalisation, the changes of interest rate responded to the monetary policy shocks, and the income inequality became more sensitive to interest rate changes.

In contrast to the negative impulse responses in China, as shown in Figure 3, the US observed negative impulse responses of income inequality to expansionary monetary policy shocks. This finding suggests that the expansionary monetary policies would mitigate the income inequality. This finding is in accordance with Coibion et al. (2017), Furceri et al. (2018) and Hohberger et al. (2020). In Figure 3, the impulse responses have three phases. Before the QE in 2008, the impulse responses were mild, and the impact of monetary policy shocks reached the peak in a very short

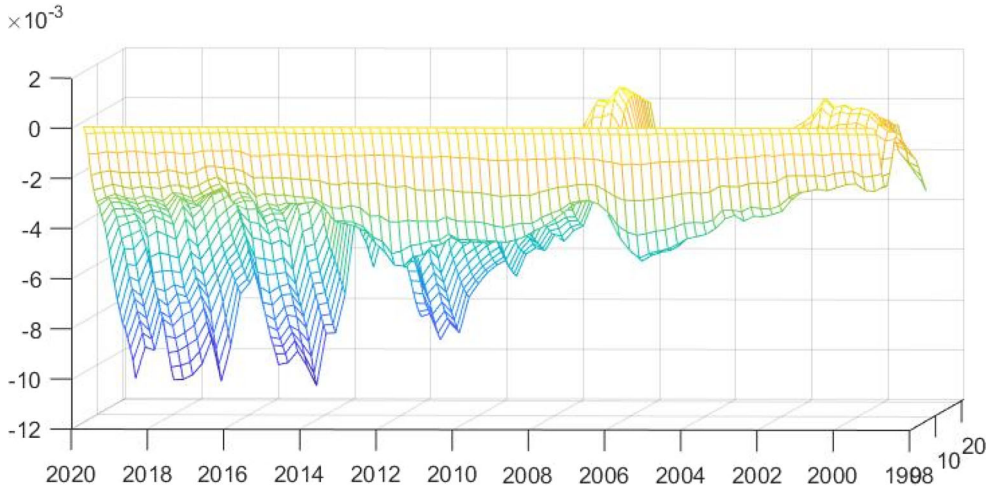
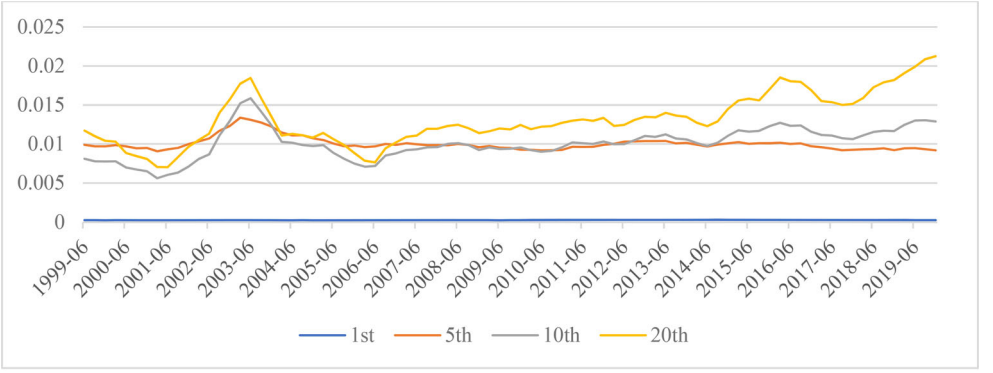


Figure 3. Impulse responses of income inequality in the US.
Note: see note to Figure 2.
Source: drawn by authors.

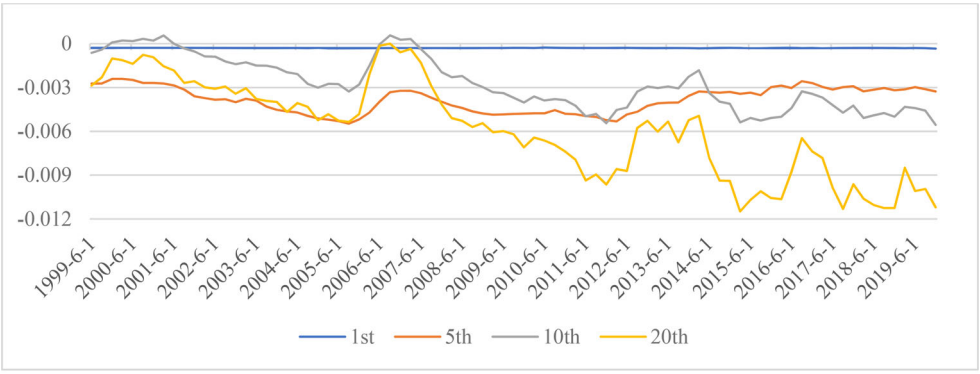


(a)

Figure 4.(a) Selected impulse responses in China.
Note: see note to Figure 2.
Source: drawn by authors.

period. During the three rounds of QE from 2008 to 2014, the impact of monetary policy shocks became persistent and long-lasting. After 2017, the long-run effect of monetary policy shocks on income inequality became surprisingly large. US federal reserve raised interest rates for several times in 2017 and 2018.

In Figures 1 and 2, a common feature of the impulse responses across time is they increase dramatically in the first few periods and locally peak at around the 5th period, then quickly decrease and reach the bottom at the 10th period. This suggests that the impact of monetary policy shocks is not consistent in the short-run. However, in the long-run, the impact of monetary policy shocks is consistently negative in China and positive in the US. Inspired by this finding, we plot the responses at the 1st, 5th, 10th and 20th periods over the sample period. In China, as shown in Figure 4.(a), the short-term lines are twisted, but the long-term lines deviate to be



(b)

Figure 4.(b) Selected impulse responses in the US.
Note: see note to Figure 2.
Source: drawn by authors.

more negative after the GFC. For the US, Figure 4.(b) suggests that the short-term responses are larger than the long-term responses before 2007, but after the GFC, the 20^{th} lines overpass the short-term lines. The distributional effects of monetary policy shocks indicate that the GFC is a crucial structural break for both China and the US.

As discussed in the theoretical framework, investing on financial market leads the negative responses of income inequality to the expansionary monetary policy shocks, and engaging in corporate operation causes the positive response of income inequality. In fact, this perfectly explains the different patterns in China and the US. In China, the financial market is still a young market, and the participations of individuals and households are not pervasive. However, the rapid economic growth in China was supported by the manufacture industry and service industry. The negative effects from financial market were overwhelmed by the positive effects from operation behaviours in China. In the US, the well-developed financial market provides numerous opportunities and financial products, thus, the negative effects from financial market led the negative responses of income inequality to monetary policy shocks.

To ensure the robustness of the model estimation results, we choose money multiplier change as proxy of monetary policy shocks to test the robustness of the model estimation results. The estimation results are shown in Figure 5c and d, which can be found that the test results support the above conclusions, thus, the original model passes the robustness test.

5. Further analysis

As we know, Gini coefficient is constructed based on income distribution. If the total income of the society is polarised at the high-income households, the Gini coefficient would be large, the high-income shares would increase, and low-income shares would decrease. Accordingly, the responses of income shares to monetary policy shocks further provide some insights on how the monetary policy shocks affect the income distribution. To shed lights on this consideration, we also employ TVP-FAVAR (3) to conduct the analysis on how the income shares react to monetary policy shocks.

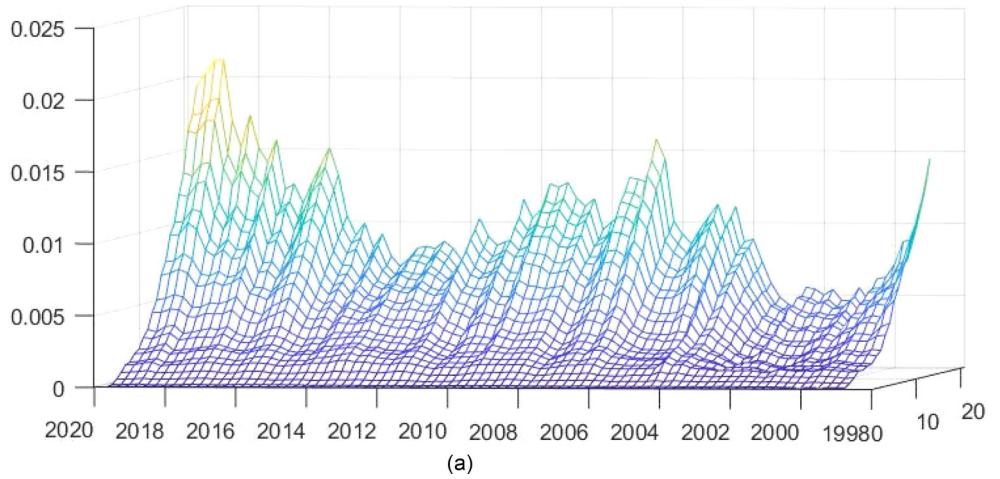


Figure 5.(a) Impulse responses of top 1% income shares in China.
Note: The impulse response of top 1% income shares is constructed by assuming 100 basis points decrease of interest rate.
Source: drawn by authors.

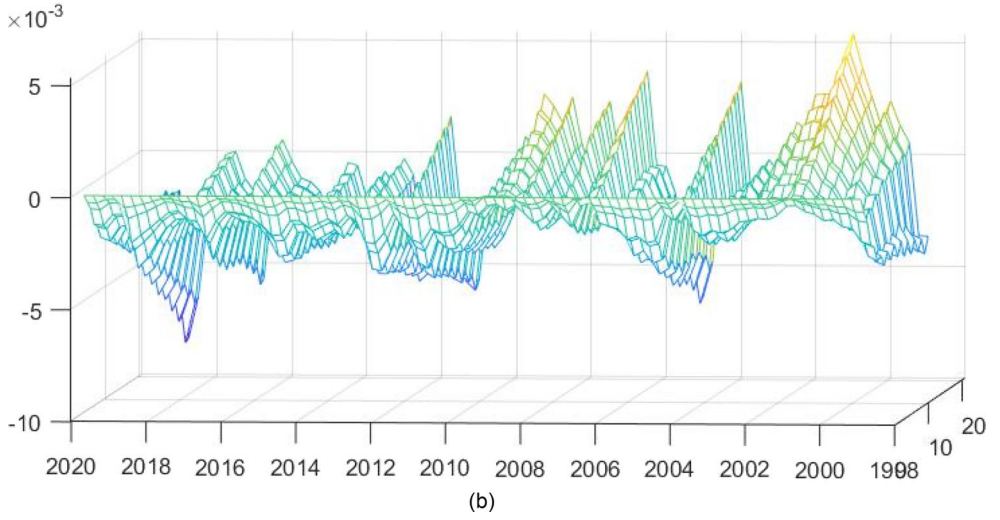


Figure 5.(b) Impulse responses of bottom 50% income shares in China.
Note: The impulse response of bottom 50% income shares is constructed by assuming 100 basis points decrease of the interest rate.
Source: drawn by authors.

Figure 5.(a) shows the impulse responses of the top 1% income shares to expansion monetary policy shocks in China. An obvious observation from the figure is that the impulse responses are all positive, which indicates that under the impact of expansionary monetary policy, the income obtained by high-income families in China is higher than the loss of bond investment income. The main reason is that the decline in interest rates will effectively alleviate the cost and financing pressure of enterprises, thereby reduce the investment cost of enterprises, which is an important means to thicken the profits of enterprises and business operators, and can also

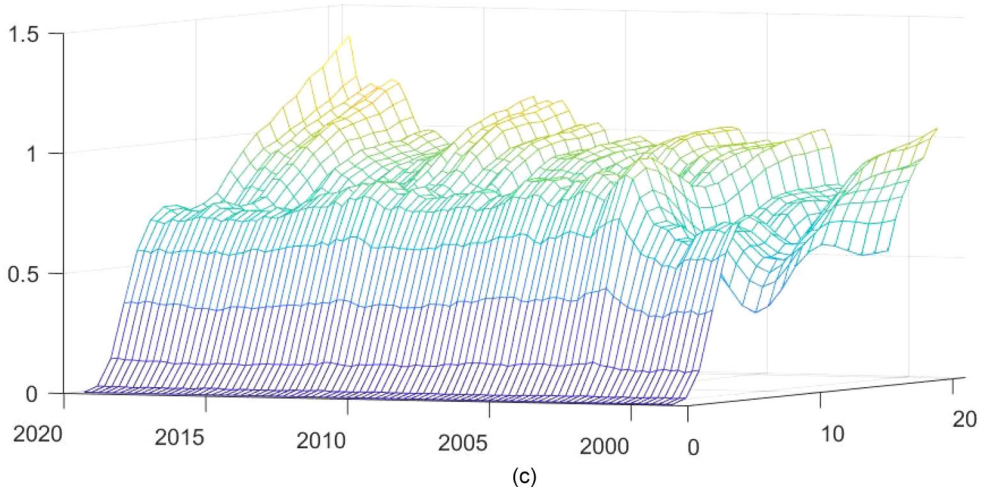


Figure 5.(c) Impulse responses of income inequality in China.
Note: The impulse response of income inequality is constructed by assuming 1% increase of the money multiplier.
Source: drawn by authors.

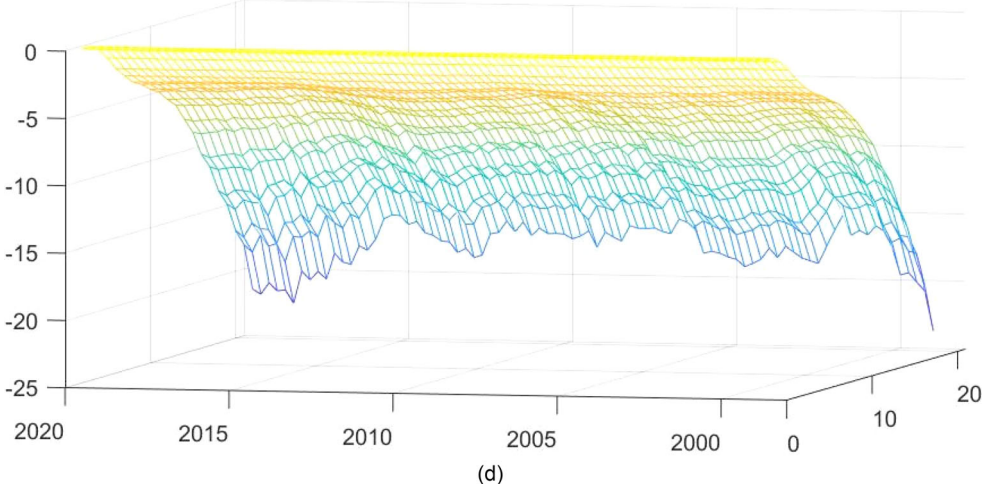


Figure 5.(d) Impulse responses of income inequality in the US.
Note: See note to Figure 5c.
Source: drawn by authors.

increase the dividend income of shareholders, while the business operators and corporate shareholders are mostly among the high-income groups in China. Therefore, a decrease in interest rate leads to an increase of the top 1% income share. This implies that the expansionary monetary policy shocks would boost the incomes of high-income households in China. The increase of the top income shares is associated with the widening of income inequality. By contrast, as illustrated in Figure 5.(b), the bottom 50% income share in China negatively reacts to the decrease of interest rate in most of the time. This suggests that the expansionary monetary policies hurt the low-income households in China. The main reason is that loosen monetary policy

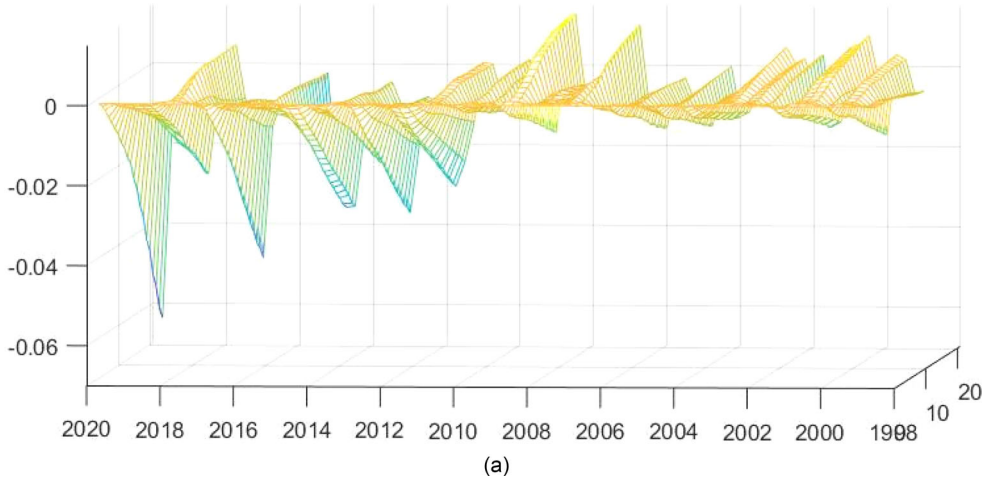


Figure 6.(a) Impulse responses of top 1% income shares in the US.
Note: See note to Figure 5a.
Source: drawn by authors.

will increase inflationary pressures, and low-income households that rely on labor own more liquid assets than high-income households, thus low-income households tend to be the ultimate bearers of inflation taxes. The reactions of the top 1% and bottom 50% income shares consistently support the results in Section 4 which find that the easing monetary policy shocks increase the income inequality in China.

The impulse responses in Figure 5.(a) and (b) also show that the impact of monetary policy shocks is varying over time. There are a few troughs in Figure 5.(a). In around 2000, it observes the first trough in the top 1% income share reaction, and the second trough is found in around 2007. The impulse responses of the top 1% income share have been more sensitive since 2016, and the recent trough is observed in 2019. In Figure 5.(b), the impulse responses are more complicated. In the early sample period, the bottom 50% income share is negatively responded to interest rate changes, but the impulse response become negative in 2003. In 2007, the responses of the bottom 50% income share turn to be positive again. After 2010, the responses became negative, and the spike is observed in 2019. The changing effects observed for these two income shares are associated with the findings in Figure 2. Note that the increase in the bottom 50% income share is associated with the decrease of income inequality, and the increase in the top 1% income share polarises the income distribution. Accordingly, the positive impulse responses of the bottom 50% income share offsets the rise in the top 1% income share in the early period and around 2007. The trough in the responses of top income share reinforces the spike in the responses of bottom income share in 2019, and the reactions of the top and bottom income shares contribute to the high sensitivity of Gini coefficients to monetary policy shocks in 2019.

It is quite different in the US. Figure 6.(a) and (b) displays the impulse responses of top 1% and bottom 50% income shares in the US. As we can find, the reactions of these two income shares to monetary policy shocks in the US are largely different with those in China, and sometimes display opposite effects. In Figure 6.(a), the top

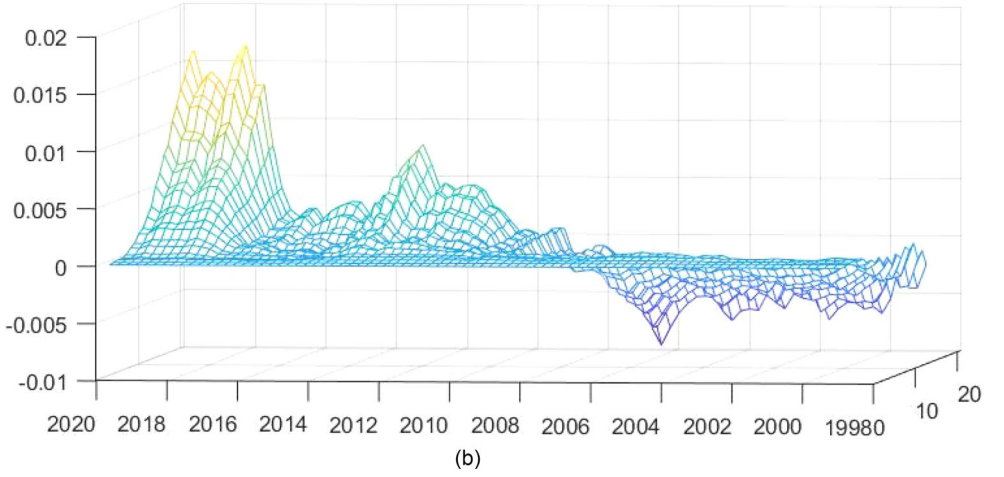


Figure 6.(b) Impulse responses of bottom 50% income shares in the US.
Note: See note to Figure 5b.
Source: drawn by authors.

income share is negatively responded to the decrease of interest rate, implying the expansionary monetary policies hurt the high-income shares. In Figure 6.(b), the impulse responses can be split into two patterns. The decreased interest rates hurt the bottom 50% income share before 2008, but turns to benefit the bottom 50% income share after that. The US Federal Reserve implemented the QE in November 2008. The QE dramatically affected the distributional effects of monetary policy shocks.

In Figure 6a, the dynamics of impulse responses show that the responses of top 1% income share were reduced after 2010 in the US. Considering that the bottom income share negatively responds to monetary policy shocks after 2008, the increased sensitively of top income share and bottom income share to monetary policy shocks jointly contribute to the high sensitively of Gini to monetary policy shocks in the US.

Additionally, the change trend of the response of income share to the monetary policy shocks of the US in Figure 6a and b shows that over time, the impact of monetary policy shocks on income inequality gradually changes from aggravation to inhibition, and the two-way force of expansionary monetary policy shocks on income inequality before and after the sample period is likely to offset each other. Therefore, it is just a reasonable explanation for the conclusion of Albert et al. (2020) that expansionary monetary policy shocks have no significant impact on income inequality.

The distinct patterns of the impulse responses of top and bottom shares in China and the US are in accordance with the theoretical analysis and the findings in Section 4. The easing monetary policy shocks cut the interest rate in two countries. The decreased interest rate increases the top income share but decrease the bottom income share in China, and the increased top income share and decreased bottom income share widened the income inequality in China. In the US, the story is on the contrary. The reduced interest rate hurts the high-income households and benefits the low-income households, and decreases the income inequality in the US.

6. Conclusion

The increasing income inequality has attracted much attention from scholars. Existing literature proposes a series of determinants to income inequality. Empirical evidence suggests that economic growth, inflation and unemployment would affect income distribution. Textbook theory tells us that monetary policies influence economic growth, inflation and unemployment, which implies that monetary policies should be a potential determinant of income inequality. However, the discussions on the distributional effects of monetary policies do not reach a consensus.

This paper proposes a simple equilibrium model and incorporates the ideas of interest rate exposure and income composition channels of monetary policy shocks. The model assumes heterogenous income sources of households. The model predicts that an expansionary monetary policy shocks would reduce the financial income of high-income households but raise the operational income of high-income households. Thus, the final impact of monetary policy shocks is uncertain. We further employ a TVP-FAVAR model and empirically analyse the distributional effects of monetary policy shocks in China and the US. The results indicate that the Gini coefficient negatively responds to interest rate changes in China, but positively responds to interest rate changes in the US. This implies that the expansionary monetary policy would enlarge the income inequality in China but decrease the income inequality in the US. The analysis on the top and bottom income shares further confirms this finding. The top income shares increase with the decrease of interest rate in China, but the bottom income shares decrease. In contrast, the opposite responses of income shares are observed in the US. The different distributional effects of monetary policy shocks in China and the US are associated with different levels of financial market development in two countries.

Our results provide some policy implications. First, the results suggest that monetary policy shocks do have impacts on income inequality. Therefore, the implementation of expansionary monetary policy in China and austerity monetary policy in the US should be accompanied with policies that could offset the impact of monetary policies on income inequality. Second, we show that the distributional effects of monetary policies are heterogenous across countries. Therefore, the policy mix should be country-specific. Third, the comparison between the distributional effects of monetary policies in China and the US suggests that the financial development is crucial in the impact of monetary policy shocks, thus, Chinese and American governments should steadily, prudently and pertinently promote the improvement and development of domestic financial markets.

Notes

1. The data of real interest rate in China could be obtained from the World bank.
2. We admit that there are some more sophisticated models in the existing literature, such as the HANK model. In this paper, we aim to empirically investigate the relationship between monetary policy shocks with income inequality, and the different patterns in China and the US. Compared with those sophisticated models, our simple model provides better insights on the design of the empirical analysis. Those sophisticated

models illustrate more information on the mechanisms which are out of the scope of this paper.

3. In fact, this assumption implies that high-income households provide skilled labors and low-income households provide unskilled labors. The skilled labors have higher productivity than unskilled labors.
4. Even though the weighted inter-bank rate is not the central bank policy rate in China, it provides information about the liquidity in Chinese financial market which is directly affected by the monetary policy shocks. Furthermore, it is relatively volatile which is crucial in VAR model.
5. See https://www.federalreserve.gov/releases/h15/.
6. There is a large number of studies relating the income inequality to economic fundamentals. (1) For economic growth, Kuznets (1955) was the seminal paper and described an inverted U curve in the relationship between economic growth and income inequality. (2) Siami-Namini and Hudson (2019) and Zheng et al. (2020) investigated how the inflation affects income inequality. (3) Anderson et al. (2017) and Sidek (2021) provided evidence about the distributional effect of government expenditures. (4) Jin (2009) discussed the negative effect of money supply growth on the income inequality. (5) Chakrabarti (2000) and Furusawa et al. (2020) discussed the different mechanisms through which trade could reduce or enlarge income inequality. (6) Calderón and Chong (2001) provided evidence that real effective exchange rate is associated with income inequality. These studies motivate the choices of the control variables in our study.
7. The choice of this sample period is subject to the data availability. The observation of Gini coefficient in 2020 is not available when collecting the data.
8. We take this data transformation to deal with the unit roots in the level rates. As we see later, the change rates of money supply in China cannot reject the unit root test. However, this would not be an issue for two reasons. First, we find that the change rates of money supply are stationary if we split the sample by the crisis in 2007. Second, we employ principal component analysis to extract common factors and construct the model by using these common factors. The VAR model is valid if the common factors are stationary.
9. To reduce the autocorrelation in Gibbs sampler, we treat every tenth draws as effective draws. In total, we have 5,000 effective draws.
10. We treat the decrease of interest rates as an expansionary monetary policy shock.

Disclosure statement

The authors report there are no competing interests to declare.

Funding

This work was supported by Shandong Provincial Natural Science Foundation (Grant Number: ZR2020QG032).

References

Albanesi, S. (2007). Inflation and inequality. *Journal of Monetary Economics*, *54*(4), 1088–1114. https://doi.org/10.1016/j.jmoneco.2006.02.009

Albert, J. F., Peñalver, A., & Perez-Bernabeu, A. (2020). The effects of monetary policy on income and wealth inequality in the US Exploring different channels. *Structural Change and Economic Dynamics*, *55*, 88–106. https://doi.org/10.1016/j.strueco.2020.07.002

Amaral, P. (2017). Monetary Policy and Inequality. Economic Commentary, (2017-01). https://doi.org/10.26509/frbc-ec-201701Manythanks!

Anderson, E., Jalles D'Orey, M. A., Duvendack, M., & Esposito, L. (2017). Does government spending affect income inequality? A meta-regression analysis. *Journal of Economic Surveys*, *31*(4), 961–987. https://doi.org/10.1111/joes.12173

Areosa, W. D., & Areosa, M. B. (2016). The inequality channel of monetary transmission. *Journal of Macroeconomics*, *48*, 214–230. https://doi.org/10.1016/j.jmacro.2016.03.004

Avery, R. B., Elliehausen, G. E., Kennickell, A. B., & Spindt, P. A. (1987). Changes in the use of transaction accounts and cash from 1984 to 1986. *Federal Reserve Bulletin*, *73*, 179.

Bernanke, B. S., Boivin, J., & Eliasz, P. (2005). Measuring the effects of monetary policy: A factor-augmented vector autoregressive (FAVAR) approach. *The Quarterly Journal of Economics*, *120*(1), 387–422.

Berisha, E., Gupta, R., & Meszaros, J. (2020). The impact of macroeconomic factors on income inequality: Evidence from the BRICS. *Economic Modelling*, *91*, 559–567. https://doi.org/10.1016/j.econmod.2019.12.007

Berisha, E., Meszaros, J., & Olson, E. (2018). Income inequality, equities, household debt, and interest rates: Evidence from a century of data. *Journal of International Money and Finance*, *80*, 1–14. https://doi.org/10.1016/j.jimonfin.2017.09.012

Bivens, J. (2015). Gauging the impact of the Fed on inequality during the Great Recession. Hutchins Center Working Papers. Brookings Institution.

Bulíř, A. (2001). Income inequality: Does inflation matter? *IMF Staff Papers*, *48*(1), 139–159.

Calderón, C., & Chong, A. (2001). External sector and income inequality in interdependent economies using a dynamic panel data approach. *Economics Letters*, *71*(2), 225–231. https://doi.org/10.1016/S0165-1765(01)00374-3

Chakrabarti, A. (2000). Does trade cause inequality? *Journal of Economic Development*, *25*(2), 1–22.

Christiano, L. J., Eichenbaum, M., & Evans, C. L. (2005). Nominal rigidities and the dynamic effects of a shock to monetary policy. *Journal of Political Economy*, *113*(1), 1–45. https://doi.org/10.1086/426038

Coibion, O., Gorodnichenko, Y., Kueng, L., & Silvia, J. (2017). Innocent bystanders? Monetary policy and inequality. *Journal of Monetary Economics*, *88*, 70–89. https://doi.org/10.1016/j.jmoneco.2017.05.005

Cysne, R. P. (2009). On the positive correlation between income inequality and unemployment. *Review of Economics and Statistics*, *91*(1), 218–226. https://doi.org/10.1162/rest.91.1.218

Davtyan, K. (2017). The distributive effect of monetary policy: The top one percent makes the difference. *Economic Modelling*, *65*, 106–118. https://doi.org/10.1016/j.econmod.2017.05.011

Furceri, D., Loungani, P., & Zdzienicka, A. (2018). The effects of monetary policy shocks on inequality. *Journal of International Money and Finance*, *85*, 168–186.

Furusawa, T., Konishi, H., & Tran, D. L. A. (2020). International trade and income inequality. *The Scandinavian Journal of Economics*, *122*(3), 993–1026. https://doi.org/10.1111/sjoe.12360

Ghossoub, E. A., & Reed, R. R. (2017). Financial development, income inequality, and the redistributive effects of monetary policy. *Journal of Development Economics*, *126*, 167–189. https://doi.org/10.1016/j.jdeveco.2016.12.012

Hohberger, S., Priftis, R., & Vogel, L. (2020). The distributional effects of conventional monetary policy and quantitative easing: Evidence from an estimated DSGE model. *Journal of Banking & Finance*, *113*, 105483. https://doi.org/10.1016/j.jbankfin.2019.01.002

Jin, Y. (2009). A note on inflation, economic growth, and income inequality. *Macroeconomic Dynamics*, *13*(1), 138–147. https://doi.org/10.1017/S1365100508070491

Koop, G., & Korobilis, D. (2014). A new index of financial conditions. *European Economic Review*, *71*, 101–116. https://doi.org/10.1016/j.euroecorev.2014.07.002

Kuznets, S. (1955). Economic growth and income inequality. *The American Economic Review*, *45*(1), 1–28.

Liosi, K., & Spyrou, S. (2022). The impact of monetary policy on income inequality: Evidence from Eurozone markets. *Journal of Economic Studies*, *49*(3), 522–540. https://doi.org/10.1108/JES-07-2020-0328

McKinnon, R. I., & Shaw, E. M. (1973). *Financial deepening in economic development Oxford*. Oxford University Press.
Mocan, H. N. (1999). Structural unemployment, cyclical unemployment, and income inequality. *Review of Economics and Statistics*, *81*(1), 122–134. https://doi.org/10.1162/003465399767923872
Motta, G., & Tirelli, P. (2012). Optimal simple monetary and fiscal rules under limited asset market participation. *Journal of Money, Credit and Banking*, *44*(7), 1351–1374. https://doi.org/10.1111/j.1538-4616.2012.00535.x
Mumtaz, H., & Theophilopoulou, A. (2020). Monetary policy and wealth inequality over the great recession in the UK. An empirical analysis. *European Economic Review*, *130*, 103598. https://doi.org/10.1016/j.euroecorev.2020.103598
Philippon, T. (2015). Has the US finance industry become less efficient? On the theory and measurement of financial intermediation. *American Economic Review*, *105*(4), 1408–1438. https://doi.org/10.1257/aer.20120578
Primiceri, G. E. (2005). Time varying structural vector autoregressions and monetary policy. *The Review of Economic Studies*, *72*(3), 821–852. https://doi.org/10.1111/j.1467-937X.2005.00353.x
Ravenna, F., & Walsh, C. E. (2006). Optimal monetary policy with the cost channel. *Journal of Monetary Economics*, *53*(2), 199–216. https://doi.org/10.1016/j.jmoneco.2005.01.004
Romer, C. D., & Romer, D. H. (2020). Monetary policy and the well-being of the poor. In Jack Rabin (ed.), *Handbook of monetary policy* (pp. 887–912). Routledge.
Siami-Namini, S., & Hudson, D. (2019). Inflation and income inequality in developed and developing countries. *Journal of Economic Studies*, *46*(3), 611–632. https://doi.org/10.1108/JES-02-2018-0045.
Sidek, N. Z. M. (2021). Do government expenditure reduce income inequality: evidence from developing and developed countries. *Studies in Economics and Finance*, *38*(2), 447–503. https://doi.org/10.1108/SEF-09-2020-0393
Wildowicz-Szumarska, A. (2022). Is redistributive policy of EU welfare state effective in tackling income inequality? A panel data analysis. *Equilibrium*, *17*(1), 81–101. https://doi.org/10.24136/eq.2022.004
Zheng, Z., Mishra, T., & Yang, Y. (2020). Inflation and income inequality in a variety-expansion growth model with menu costs. *Economics Letters*, *194*, 109373. https://doi.org/10.1016/j.econlet.2020.109373

Appendix

Table A.1. Data source and variable construction.

	China	US
Gini	WIND	WIND
Top 1%	WID	WID
Interest rate	CEInet	FOMC
GDP	NBS	IFS
CPI	WIND	IFS
Government expenditure	NBS	WIND
M0	WIND	WIND
M1	WIND	WIND
M2	WIND	WIND
Export	IFS	IFS
Import	IFS	IFS
REER	IFS	IFS

Note: 'WIND' means WIND database (Wind terminal), 'WID' means world inequality database (https://wid.world/), 'CEInet' means CEInet Statistics database (https://db.cei.cn/), 'NBS' means National Bureau of Statistics in China (https://data.stats.gov.cn/easyquery.htm?cn=A01), 'IFS' means IMF International Financial Statistics database (https://data.imf.org/?sk=4c514d48-b6ba-49ed-8ab9-52b0c1a0179b), and 'FOMC' means Board of Governors of the Federal Reserve System (https://www.federalreserve.gov/releases/h15/).
Source: calculated by authors.