

# Understanding the Interaction of Chinese Fiscal and Monetary Policy

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**Abstract:** Interaction of fiscal and monetary policy is crucial for macroeconomic stability, especially for an economy with downward pressure as well as a tightened space for macro policy, like China. In this paper, we use a time-varying-parameter (TVP-VAR) model to study Chinese fiscal-monetary interaction and divide it into three periods. We claim that China goes through a monetary dominant regime from 1996Q to 2017Q4 since the response of CPI to a fiscal expansion is negative in the short run and about zero in the long run, while the monetary expansion has positive effects on CPI. During this period, the response of government spending and money supply to each other's shock have the same sign, indicating that the two policies act as complements. However, we argue that 2008Q4 is a turning point that divide this period to be two different periods. The response level of M2 growth rate to a fiscal expansion keeps rising from 1996Q1 to 2008Q4, indicating the central bank's increasingly active cooperation with fiscal policy, while decreases from 2009Q1 to 2017Q4. Since 2018Q1, the economy is going through a fiscal dominant regime for that the response of GDP growth rate and CPI to the fiscal expansion sharply increase. We also argue that the relative change of the role between the two policies should be mainly attributed to the variation in fiscal authority's characteristic because fiscal response to a monetary shock remains at a similar level all time, even if there have been changes in the characteristic of the central bank.

**Keywords:** TVP-VAR; Fiscal-Monetary Interaction; Time-varying impulse response; FTPL Theory

**Citation:** . 2021. Understanding the Interaction of Chinese Fiscal and Monetary Policy. *Journal of Risk and Financial Management* 1: 0. <https://doi.org/>

Received:

Accepted:

Published:

**Publisher's Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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## 1. Introduction

Fiscal and monetary policy have long been the main policy instruments for stabilizing macroeconomy. However, the 2008 Global Financial Crisis depressed economic development all over the world and made it hard for a single policy to realize recovery or stabilization because policy space has been compressed by the recession. For example, the US was facing a 'Zero Lower Bond' after the crisis. Thus, coordination of the macro policies has become more necessary (Blanchard et al. 2010) and people have strengthened concern on the significance of policies' interaction. In recent years, government debt to GDP ratio in China has been increasing, and the interest rate has been falling, indicating that the space to apply stabilization policies is not as sufficient as before. Hence, interaction between Chinese fiscal and monetary policy should be given more concern.

The characteristic and mechanism of such interaction, however, are not constant. Cogley and Sargent (2005) point out that interior structural changes would happen in an economy. In fact, fiscal-monetary interaction in China should have undergone changes because both fiscal and monetary policy have been reformed and the preference and characteristic of the authority have varied over time. According to Guo and Li (2021), fiscal policy in China has experienced several transformations and they are strongly correlated with economic development. Yi (2009) reviews the interest rate marketization

in China, asserting that the central bank keeps improving regulation methods in this process. China has experienced rapid development in fields like technology, education, poverty-reducing etc. All of these elements would potentially change the characteristic of the interaction between macro policies. Hence it is reasonable to believe that the way in which fiscal and monetary policy interact with each other has gone through changes in these years.

In this paper, we aim to find out the aforementioned features in China, so we use a TVP-VAR model to examine the characteristic of fiscal-monetary interaction in China. Figures of time-varying impulse responses to fiscal and monetary shocks are given to show how fiscal and monetary policy affect the Chinese economy as well as their interaction. We divide the fiscal-monetary interaction into three periods, 1996Q1 to 2008Q4, 2009Q1 to 2017Q4 and 2018Q1 to 2020Q3. During these periods characteristics of the interaction is quite different.

We claim that 1996Q1 to 2017Q4 represents a monetary dominant (MD) regime since the response of CPI is negative to a fiscal expansion in the short run and about zero in the long run, while the monetary expansion has a positive effect on both GDP and CPI. During this period, the monetary and fiscal policy's response to each other's shock are positive, implying that they act as complements. However, we argue that 2008Q4 is a turning point. The M2 response to the fiscal expansion keeps increasing from 1996Q1 to 2008Q4, showing the central bank's increasingly active cooperation with fiscal policy. While the response level decreases from 2009Q1 to 2017Q4, though remaining at a relative high level. This indicates central bank's effort to enhance its role after the 2008 crisis, but it is forced to cooperate with fiscal sides because of the high debt and leverage induced by the intensive fiscal policies after the recession. We also find that since 2018Q1, China is going through a fiscal-dominant regime where the effects that fiscal expansion have on GDP and CPI are positive and significantly increase compared to the time before.

In addition, we find that the response of government spending to a monetary expansion does not undergo a huge change during the whole sample period from 1996Q1 to 2020Q2, implying that even if there have been changes in the role or channel of monetary policy, the fiscal authority always operates in its own way. In other words, the fiscal policy may ignore the monetary policy. We conclude that changes in the relative role between monetary and fiscal policy should be mainly attributed to the variation of fiscal authority's (government) characteristic or preference. What's more, we recommend that the fiscal policy should give more concern to monetary policy and both policies should pay more attention to the debt and macro leverage.

In fact, fiscal-monetary interaction is so important and there already have been some pieces of literature discussing it, especially from the theoretical aspect, though they do not reach a consensus. [Sargent and Wallace \(1981\)](#) put forward monetarist arithmetic. By applying transversality on the government (fiscal authority) present value budget constraint (PVBC), they obtained  $d_t = K_{cb,t} + K_{gov,t}$ , where the three terms respectively refer to the inherited government debt, central bank's collection of seigniorage and government surpluses. Thus, they described the interaction between monetary and fiscal policy as a non-cooperative game. If the central bank gain the initiative, set the path of inflation, then  $K_{cb,t}$  is determined; the government must set the path of surpluses to maintain PVBC. Similarly, if the government goes first, the central bank is forced to set inflation to maintain PVBC. [Woodford \(1996\)](#) claimed that seigniorage is just a small part of revenue in developed countries, thus the mechanism above remains to be discussed. Meanwhile, the fiscal theory of the price level (FTPL) that developed since the 1990s provides us with another perspective to understand the interaction between monetary and fiscal policy. FTPL, being different from the monetarist arithmetic, takes the government bonds as a nominal variable, thus the PVBC can be written as:

$$\frac{M_{t-1} + (1 + r_{t-1})B_{t-1}}{P_t} = K_{cb,t} + K_{gov,t}$$

The basic idea of FTPL is that only with the suitable coordination of monetary and fiscal policies can we obtain an equilibrium. According to [Woodford \(1995\)](#) and [Canzoneri et al. \(2001\)](#), when considering budget constraints, if primary surpluses are determined independently of the debt, the path of monetary policy and price must respond to satisfy the PVBC, and it can be called fiscal dominant (FD) or non-Ricardian Regime for the false of Ricardian Equivalence. If monetary policy and prices are determined by the supply and demand for money, and primary surpluses respond to satisfy the PVBC, it can be called monetary dominant (MD) or Ricardian Regime. [Leeper \(1991\)](#) defined active policy as paying no attention to the state of government debt and being free to set its variable. He proved that a unique saddle-path exists in either Active monetary policy (AM) combined with passive fiscal policy (PF), similar to MD, or AF combined with PM, which is similar to FD.

Although FTPL provides us with a new aspect to consider the monetary and fiscal policy's interaction and coordination, criticisms towards FTPL have also emerged. [Buiter \(2002\)](#) argued that PVBC is a real constraint which government must follow and otherwise are invalid. [Canzoneri et al. \(2010\)](#) summarized as a coordination problem: how do the central bank and government know which policy regime or state to switch to? [Davig et al. \(2006\)](#), [Davig and Leeper \(2011\)](#) allow for the random switching of monetary and fiscal policy between active and passive. They combine regime-switching process with a DSGE model. In their work in 2006, despite there being periods with MP/FP and MA/FA, they find an equilibrium. In short, the theories of interaction between monetary and fiscal policy, or the policy trade-off as discussed in [Bianchi and Melosi \(2017\)](#), are inconclusive.

Besides theoretical discussions above, some empirical papers also study on the interaction between fiscal and monetary policy. [Muscatelli et al. \(2004\)](#) suggests that the fiscal-monetary interactions are not consistent over time by applying a NK model. [Fragetta and Kirsanova \(2007\)](#) finds that the model of fiscal dominance fits for the UK better than Sweden. [Reade \(2011\)](#) emphasises the importance of fiscal-monetary policy interaction for the US after the 2008 recession. [Gornemann et al. \(2012\)](#) match their DSGE model to the American economy and make an interest rate shock to observe its effect. [Zhang and Jin \(2011\)](#) used the MS-VAR model to figure out the structural change of fiscal policy and monetary policy from 1980 to 2009. [Cogley and Sargent \(2005\)](#) demonstrates that autoregressive coefficients of VARs could evolve systematically over time and then they introduced time-varying-parameter VAR (TVP-VAR) model to solve the problem. [Gerba and Hauzenberger \(2013\)](#) use the TVP-VAR method with a sign restriction to investigate interaction of US fiscal and monetary policy and they point out that there are significant differences between the Volcker period and the Great Recession. As we have discussed before, characteristic of Chinese fiscal-monetary interaction might go through changes. Thus in this paper, we apply the TVP-VAR model to study the characteristic of Chinese fiscal-monetary interaction.

## 2. The TVP-VAR Model

To make a brief introduction to the TVP-VAR model, firstly we consider a structural VAR model:

$$Ay_t = F_1y_{t-1} + \cdots + F_sy_{t-s} + u_t, \quad t = s+1, \dots, n \quad (1)$$

Where  $y_t$  is a  $k \times 1$  vector consisting of the variables we observed and  $A, F_1 \cdots F_s$  are  $k \times k$  coefficients matrices.  $u_t$  represents a  $k \times 1$  structural shock which follows  $u_t \sim N(0, \Sigma)$ .

$$\Sigma = \begin{pmatrix} \sigma_1 & 0 & \cdots & 0 \\ 0 & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \cdots & 0 & \sigma_k \end{pmatrix}$$

Also, we adopt the recursive identification, meaning that  $A$  is lower-triangular.

$$A = \begin{pmatrix} 1 & 0 & \cdots & 0 \\ a_{21} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ a_{k1} & \cdots & a_{k,k-1} & 1 \end{pmatrix}$$

Then the structural-form VAR can be written as a reduced-form VAR:

$$y_t = B_1 y_{t-1} + \cdots + B_s y_{t-s} + A^{-1} \varepsilon_t, \quad \varepsilon_t \sim N(0, I_k)$$

$$B_i = A^{-1} F_i, \quad i = 1, \dots, s$$

Define  $k^2 s \times 1$  vector  $\beta = (\beta_1, \dots, \beta_k)'$  where  $\beta_i$  is formed by stacking the elements in the rows of  $B_i$ , and  $X_t = I_k \otimes (y'_{t-1}, \dots, y'_{t-s})$ , where  $\otimes$  denotes the Kronecker product. Thus we obtain:

$$y_t = X_t \beta + A^{-1} \Sigma \varepsilon_t \quad (2)$$

Allowing parameters in equation 2 to be time-variant, we can write the TVP-VAR model with stochastic volatility:

$$y_t = X_t \beta_t + A_t^{-1} \Sigma_t \varepsilon_t, \quad t = s+1, \dots, n \quad (3)$$

Following Nakajima (2011), we stack the elements of  $A_t$  to form

$$a_t = (a_{21}, a_{31}, a_{32}, a_{41}, \dots, a_{k,k-1})$$

Set  $h_t = (h_{1t}, \dots, h_{kt})$  where  $h_{it} = \log \sigma_{it}^2$  for  $i = 1, \dots, k$  and  $t = s+1, \dots, n$ . To reduce the parameters need to be estimated, we assume that:

$$\beta_{t+1} = \beta_t + u_{\beta_t}, \quad a_{t+1} = a_t + u_{a_t}, \quad h_{t+1} = h_t + u_{h_t}$$

$$\begin{pmatrix} \varepsilon_t \\ u_{\beta_t} \\ u_{a_t} \\ u_{h_t} \end{pmatrix} \sim N \left( 0, \begin{pmatrix} I & O & O & O \\ O & \Sigma_{\beta} & O & O \\ O & O & \Sigma_a & O \\ O & O & O & \Sigma_h \end{pmatrix} \right), \quad t = s+1, \dots, n$$

where  $\beta_{s+1} \sim N(u_{\beta_0}, \Sigma_{\beta_0})$ ,  $a_{s+1} \sim N(u_{a_0}, \Sigma_{a_0})$ ,  $h_{s+1} \sim N(u_{h_0}, \Sigma_{h_0})$ .

Nakajima (2011) pointed out that whether  $\Sigma_{\beta}$ ,  $\Sigma_a$ ,  $\Sigma_h$  taking the diagonal assumption has no significant influence on empirical results, so we take them as diagonal matrices. The TVP-VAR is estimated based on Bayesian inference and the MCMC sampling method. The core idea is to sample the conditional posterior distribution recursively based on the most recent values of the conditioning parameters. We do not list more details about the algorithm here and more specific procedure can be seen in Nakajima (2011).

### 3. Empirical Results and Discussion

Five Chinese macroeconomic variables at quarterly frequency included in our TVP-VAR model are growth rate of government spending, growth rate of money supply M2, nominal interest rate, which is represented by 7-day CHIBOR, the growth rate of nominal GDP and CPI, from 1996Q1 to 2020Q3. Quarterly CHIBOR is the weighted average of monthly CHIBOR based on its trading volume. All of the variables reject the hypothesis of having a unit root, so we can take them as stationary series.

To estimate the model, we let MCMC sample 20000 times and discard the 4000 samples in the burn-in period. According to Table 1, the posterior mean of the parameters all drop in the 95 percent credible intervals. The 'Geweke' column is the CD statistic

value, proposed by Geweke (1992), which shows the convergence of Markov Chain, and can be calculated by:

$$CD = \frac{\bar{x}_0 - \bar{x}_1}{\sqrt{\hat{\sigma}_0^2/n_0 + \hat{\sigma}_1^2/n_1}}, \quad \bar{x}_j = \frac{1}{n_j \sum_{i=m_j}^{m_j+n_j-1} x^{(i)}}$$

where  $x^{(i)}$  is the  $i$ -th draw and  $\sqrt{\hat{\sigma}_j^2/n_j}$  is the standard deviation of  $\bar{x}_j$  for  $j = 0, 1$ . Its distribution will converge to a standard normal when MCMC sampling is a stationary series. The 'Inef' column shows the value of the inefficiency factor, which is calculated by (Chib et al. 2002):

$$Inef = 1 + 2 \sum_{s=1}^{B_m} \rho_s$$

where  $\rho_s$  is the sample autocorrelation at lag  $s$ . We set  $m_0 = 1, n_0 = 1000, m_1 = 5001, n_1 = 5000$ . Values in the last two columns show that only one parameter rejects the hypothesis of convergence to the posterior distribution and only one inefficiency factor larger than 100 (just 102.7), indicating that the MCMC procedure is credible.

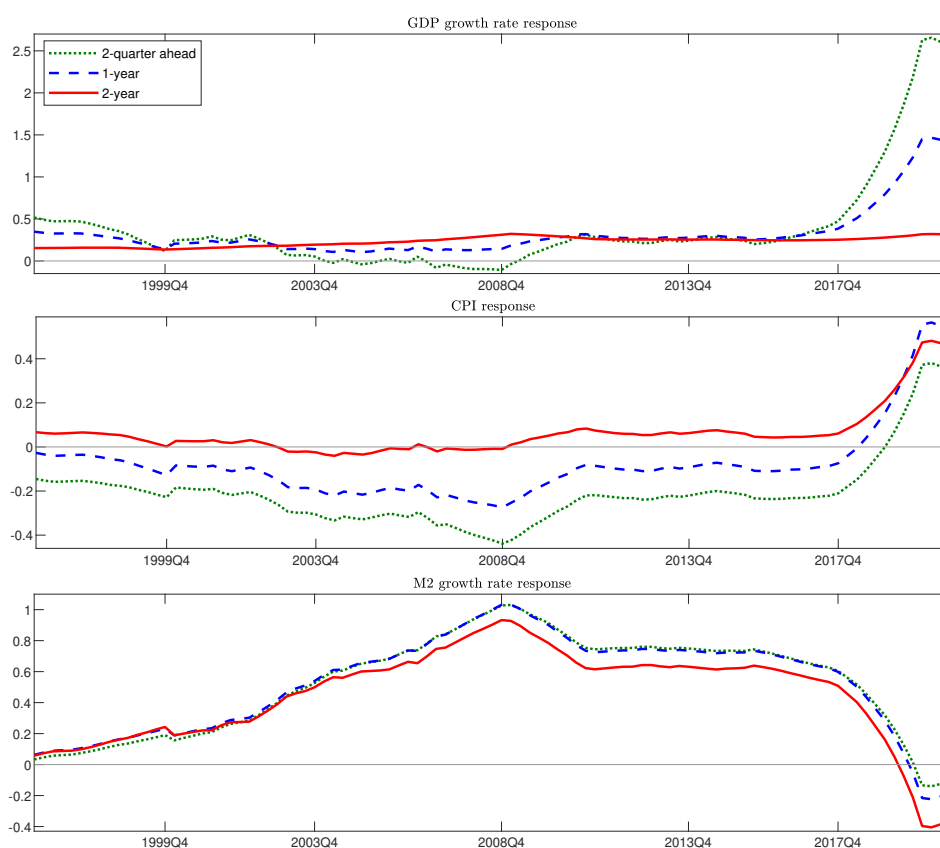
**Table 1.** TVP-VAR estimation results

Parameter	Mean	Stdev	95%U	95%L	Geweke	Inef
sb1	0.0023	0.0003	0.0018	0.0029	0.039	6.40
sb2	0.0023	0.0003	0.0018	0.0029	0.834	5.35
sa1	0.0082	0.0038	0.0038	0.0182	0.076	102.70
sh1	0.0055	0.0016	0.0033	0.0095	0.604	32.62
sh2	0.0055	0.0016	0.0033	0.0096	0.472	31.53

Being different from a typical VAR model, the impulse response of the TVP-VAR model can be drawn in a new dimension, where responses are computed at all points during the sample period, and we can treat it as a time-varying response, representing the (perhaps heterogeneous) responses to the same shock at different times. Specifically, we draw 2-quarter, 1-year and 2-year ahead responses respectively. Our analysis mainly relies on these time-varying responses since we can gain an insight into the time-variant reaction of the variable to an exogenous shock.

### 3.1. Government Spending Shock

Figure 1 shows the time-varying impulse responses to a positive government shock or fiscal expansion. In terms of GDP growth rate, we find that since 2018Q1, both the 2-quarter and 1-year ahead response increase sharply from about 0.4 to 2.5 and 1.5, respectively, which is quite different from its previous reaction. At about the same time (2018Q2), the response of CPI turns from negative to positive and continues to increase, which is also radically different from its response before. Combining the two features, we argue that fiscal policy, since 2018Q1, begins to play a role in stimulating short-term economic by expanding the aggregate demand for that we have seen a positive and sharply increasing response of CPI as well as GDP growth rate. Meanwhile, the response level of M2 growth rate to a government spending shock goes through a huge decline since 2018q1 and turns from positive to negative at about 2019Q4.



**Figure 1.** Response to a Positive Government Spending Shock

When there comes a fiscal expansion, according to the FTPL theory, under a FD regime, either the central bank will increase the money supply to raise the seigniorage for PVBC, which is inconsistent with our finding that the level of M2 response decreases and its sign has changed, or the fiscal policy will show its wealthy effect and the GDP as well as the price level increases, which is similar to our finding after 2018Q1. The fiscal authority has made up its mind to enhance the dominance of fiscal policy since 2018Q1 and we assert that the economy is going through a fiscal dominant (FD) regime. What's more, although this pattern seems to be desirable in the short-run, we keep in mind that fiscal expansion alone will not be enough for long term growth because the 2-year ahead response show that the relative long-run GDP growth rate is stationary, with a level of about 0.25 for the whole sample period. We also emphasise that the FD regime does not mean the absence of monetary policy. The large decline of the response level of M2 growth rate to government spending shock since 2018Q1 and the change of its sign (even in the long-run, as the red line shows) show the central bank's effort to avoid an increasing debt, since the central bank will not support the deficits by issuing money simply. For example, in the mid 2020, the Chinese central bank clearly states that it will not support the monetization of fiscal deficits.

To be more intuitively, compare the responses to the government spending shock from 1996Q1 to 2017Q4 with responses from 2018Q1 to 2020Q3. The response of CPI keeps negative in the short run, reaching its bottom at 2008Q4, and keeps at about zero in the long run, which is not consistent with FTPL's definition of FD regime. Thus, we conclude this period as a monetary dominant (MD) regime. In fact, the effect of monetary expansion on GDP and CPI (a positive response of GDP and CPI) also confirms our claim, which we will put forward in section 3.2. In addition, a potential explanation for the negative short-run response of CPI to a fiscal expansion is the imperfect substitutability of private and public sector investment (Mountford and Uhlig 2002). For example, public investment may offer cheaper housing than private sector and thus CPI falls. What's



more, the Chinese government lies emphasis on the infrastructure investment, expecting to improve the economic structure and distribution of goods, which may show its effects on GDP in the long run and lead to a price level not increase currently. The positive sign of 2-year ahead response of GDP growth rate provides the evidence for this idea.

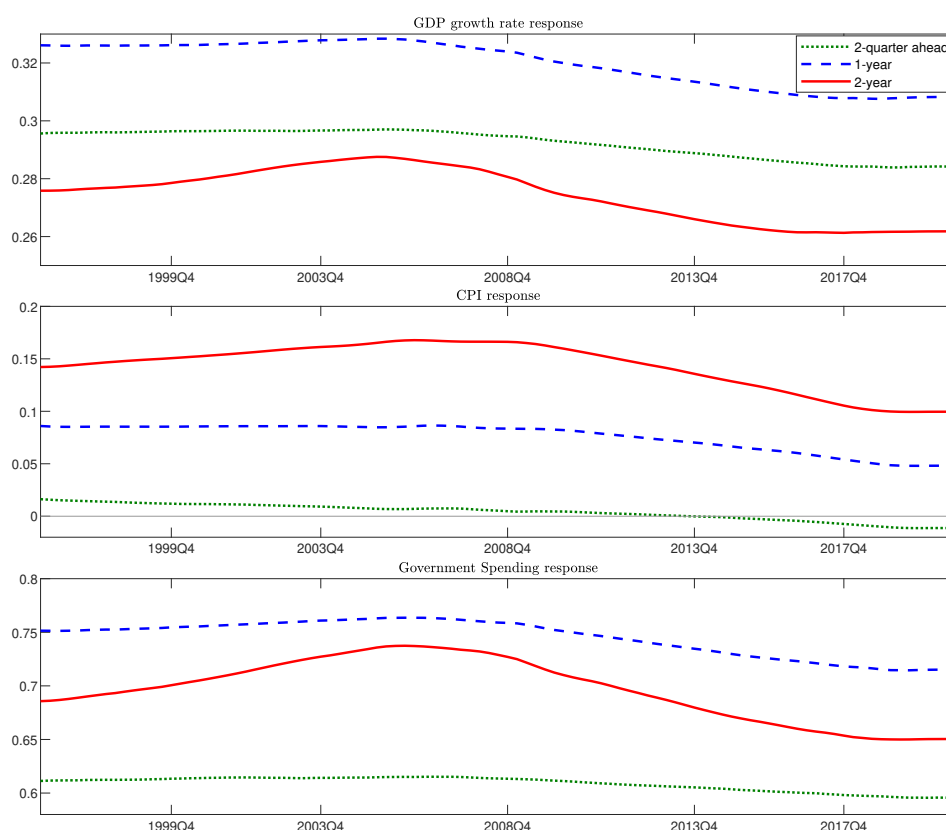
However, we find that 2008Q4 is a turning point since that the response level of M2 growth rate keeps rising from 1996Q1 to 2008Q4, indicating its increasingly active cooperation with fiscal side, while decreases since 2009Q1, implying that the central bank enhances its role after the crisis. In terms of the level of the M2 response, however, it keeps at a relatively high level from 2009Q1 to 2017Q4, in contrast to the period after 2018Q1. In fact, for the pressure of intensive fiscal policy after the crisis, such as Chinese ‘Four Trillion Fiscal Stimulus’, the M2 response is, to some extent, forced not to decline too dramatically and persistently to avoid default induced by the fiscal side. Also, recovery from recession requires the sustain of liquidity in the market. Thus, the reaction of the central bank is key for economic stability during this period (2009Q1 to 2017Q4). Moreover, both the 2-quarter and 1-year ahead response level of GDP growth rate goes through a decline from 1996Q1 to 2008Q4 and reaches its bottom at 2008Q4, implying that the effect of fiscal policy government on economy, at least in the short run, gradually decline in this period. The short-run GDP response increases right after 2008Q4, which implies the stimulus of fiscal expansion after the recession, however, at the cost of high leverage. The CPI response also increases right after 2008Q4, implying a short-term fiscal stimulus, while overall, it remains negative, which is the reason we conclude this period as MD regime.

### 3.2. Monetary Policy Shock

In section 3.1, we divide the sample period into three parts, 1996Q1 to 2008Q4, 2009Q1 to 2017Q4 and 2018Q1 to 2020Q3, based on the response of CPI and the FTPL theory, as well as the response of macro variables. However, we haven’t analyzed the interaction of fiscal-monetary in depth because interaction refers to the reaction of fiscal and monetary policy to each other’s behavior. In this section, combining the response of monetary shock with the analysis before, we try to gain an insight into the characteristic of fiscal-monetary interaction and its evolution.

We first analyse the responses to the monetary shock. Figure 2 shows the time-varying impulse responses to a positive M2 growth rate shock. It turns out that the shock has a durable effect on GDP, with long term GDP growth rate response remains over 0.26 during the sample period (as shown by the red line). When it comes to inflation (CPI), although it does not show an obvious instant response to the M2 shock, with the 2-quarter ahead response is quite near zero, the 1-year ahead and 2-year ahead response show that the shock’s effect on inflation is more obvious in the long run, around 0.15 during the sample period, as depicted by the blue-dashed line and red line. Thus, we assert that has a more significant effect on CPI in the long run than in the short run, which can be described as a time-lag feature. Also, the response of GDP growth rate and CPI to a monetary expansion is consistent with our judgment in section 3.1 that both 1996Q1 to 2008Q4 and 2009Q1 to 2017Q4 belong to a MD regime.

The response of GDP growth rate and CPI, on the whole, do not go through a huge change through sample period, which implies that the influence of money supply on macroeconomy is quite stationary. This is quite intuitive because according to Chinese central bank report, the general principle of monetary policy is stabilized and it adjusts according to the market demand for liquidity, to avoid huge volatility of GDP and CPI. Then, what is the characteristic of the fiscal-monetary interaction and what lead to the change of it?



**Figure 2.** Response to a Positive M2 Growth Rate Shock

268 The third figure in figure 2 shows that the response of government spending to  
 269 monetary expansion keeps positive during the sample period. This indicates that when  
 270 it comes to a monetary shock, the government tends to take similar reaction, a fiscal  
 271 expansion. Recall that from 1996Q1 to 2017Q4, the response of M2 growth rate to a fiscal  
 272 expansion keeps positive, so we claim that during both periods, the fiscal and monetary  
 273 policy act as complements. Since 2018Q1, the response level of M2 to fiscal expansion  
 274 decreases sharply, indicating that the two policies' complementarity is declining. After  
 275 2019Q4, the response of M2 turns from positive to negative and continues to decline,  
 276 while the response of fiscal policy to a monetary shock keeps being positive, implying  
 277 the asymmetry of the two policies. Moreover, the GDP response to a fiscal expansion  
 278 hugely increase after 2018Q1 while keeps stationary to a monetary expansion, indicating  
 279 that the fiscal-monetary interaction since 2018Q1 significantly promotes the effect of  
 280 fiscal policy under the FD regime, especially compared with the two periods before  
 281 when monetary policy cooperate with the fiscal side, whether actively or passively.

282 We also find that the response level of government spending is quite stationary  
 283 during the sample period. This indicates that even if there have been changes in the role  
 284 or characteristic of monetary policy, the government always operates in its own way,  
 285 or ignores the central bank. Thus, we assert that the variation of the characteristic or  
 286 preference of fiscal authority (for example, it begins to take control since 2018Q1) should  
 287 mainly accounts for the change of the relative role between fiscal and monetary policy.

### 288 3.3. Further discussion about the turning points

289 In previous sections, we have claimed that the characteristic of the fiscal-monetary  
 290 interaction has gone through changes during the sample period. Here, we are going to  
 291 talk about more details. A new tool we use is the impulse response function at a given  
 292 time, it is different from the time-varying response function in which shocks happen at  
 293 every point and responses are given after a certain time period. Inversely shocks happen

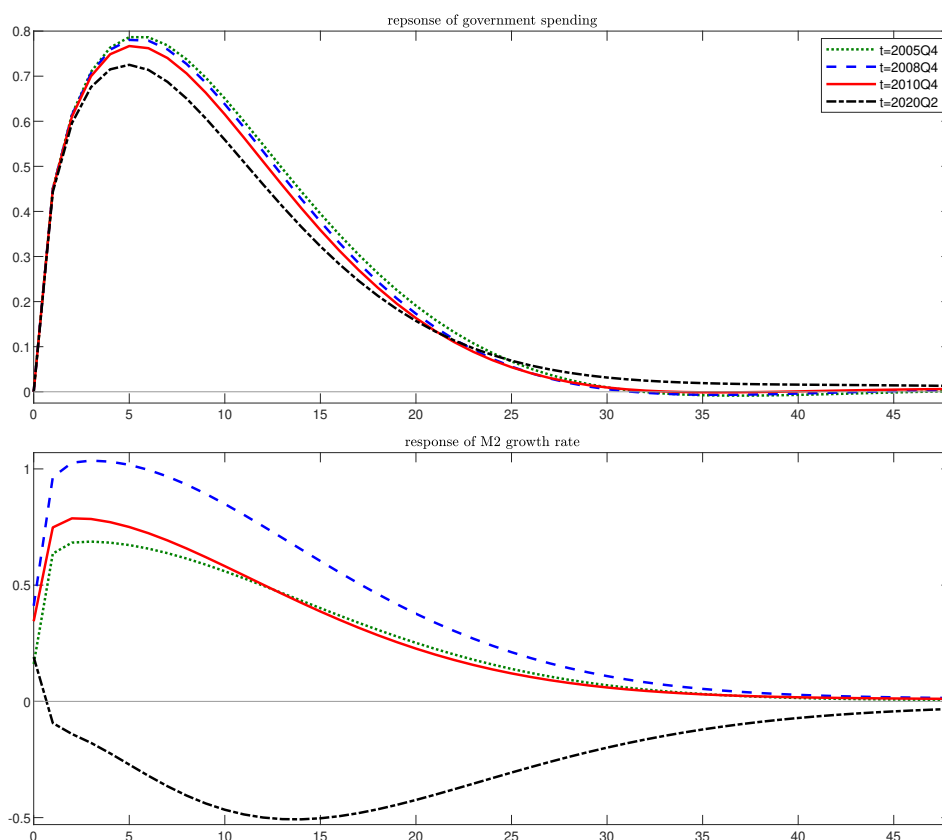


at given quarters and responses are reported within a long time period. We use this new tool to analyze the evolution of a shock's effect.

We choose four time points, 2005Q4, 2008Q4, 2010Q4 and 2020Q2, giving a shock at each time point to observe the path of the response. These time points are selected for their social backgrounds. In 2008, the Global Economic Crisis broke out. Since 2010, Chinese government debt problem started to aggravate. In 2020, the Covid-19 pandemic broke out and shocked the Chinese economy. On top of that, we choose 2005Q4 for comparison. Comparison between these time points can help us go deep to understand characteristic of different periods we conclude before. Figure 3 depicts the response of M2 growth rate to a fiscal shock and government spending's response to a monetary supply shock.

Figure 3 shows that not only the level, but also the evolution of the responses of government spending to a monetary expansion at different time points are close to each other, which corresponds with our finding that the reaction of fiscal authority (government) to a monetary shock is stationary during the sample period, implying the a similar fiscal authority's reaction to a monetary expansion. Specifically, all responses of government spending peak at fifth quarter after the monetary shock and then gradually decline to zero. From this finding, we can draw the fact that monetary policy has a time-lag feature, its work usually gets to maximum after a year.

M2 growth rate shows a relative medium level of positive responses to a government spending shock at 2005Q4 and 2010Q4. The responses peak after two quarters and then gradually decline to zero. The response to a fiscal shock given at 2008Q4 is higher than others until all of them converging to zero, confirming our previous conclusion that monetary policy's cooperation with a fiscal policy are increasingly active before this time. Besides, around this time point, China was faced with a large pressure, such as exports decreasing induced by the global financial crisis. To avoid aggregate demand falling sharply, Chinese central bank poured four trillion yuan into market alternately, supporting the higher curve at 2008Q4. The response at 2020Q2, however, is much different from those at other time points. It turned to negative at the first quarter after the shock, decreasing to bottom after 14th quarter and finally converged to zero. This result colludes with the fact that the response of M2 to a government spending shock turns negative at about 2019Q4, even after a long time, implicitly showing that when there comes to a positive fiscal shock, the central bank will not finance the government by issuing money. For one thing, it shows the enhancement of the role of the central bank. In fact, Chinese central has laid more emphasis on risk management and the role of monetary policy since the recession and it has realized that monetary policy should not focus on too many goals, such as financing the fiscal debt. For another, as is shown in figure 1, the response of CPI to government spending shock surged to be positive at about 2018Q2 and continues to increase quickly, which can bring about inflation pressure under a fiscal expansion. Thus, the decline in M2 growth rate is desirable since it avoids inducing a higher inflation in the future. What is more, in 2020, housing prices in most Chinese cities go up at a distinctly faster pace, so the Chinese economy faces a trend of increasingly relying on real estate. To prevent more money from flowing into real estate, it is reasonable for the central bank to slow down the increase of money supply under a fiscal expansion.



**Figure 3.** Government Spending and M2 growth rate response to each other's shock at given time

339 In addition, another interesting thing we have pointed out in section 3.1 is that  
 340 although the response of M2 growth rate to a fiscal expansion declines in the period from  
 341 2009Q1 to 2017Q4, it remains at a relatively high level. We argue that the intensive action  
 342 of fiscal policy limits the enhancement in the role of the central bank. For example, 'Four  
 343 Trillion Stimulus' added to fiscal burden and the increasing macro leverage since 2010  
 344 in China, force the M2 response not to decrease dramatically, thus limit the role of the  
 345 central bank. We claim that during this period, the interaction of fiscal-monetary policy  
 346 is undesirable since monetary policy is forced to keep pace with fiscal policy to some  
 347 extent, accompanied by a growing leverage. However, since 2018Q1, the M2 response  
 348 turns down again, rapidly. An explanation is that when the central bank always satisfies  
 349 the fiscal side (for example, maintains PVBC), then the government might continue to  
 350 implement an expansion because the government believes that the monetary policy will  
 351 react accordingly as it used to be, which could induce an increasingly higher leverage  
 352 rate. Thus, since 2018Q1, the central bank strengthens its role and management of macro  
 353 leverage. Although the central bank's reaction since 2018Q1 is different from its behavior  
 354 before, the rapid increasing response of GDP and CPI shows that under this pattern,  
 355 fiscal policy turns out to be more effective in stimulating the economy. The reason is that  
 356 the decline in the level of M2 response makes people believe authority's mind to control  
 357 the high leverage. The transform of people's expectations smoothed the channel through  
 358 which policy works, hence the efficiency of the policy was enhanced. The improved  
 359 efficiency, which fiscal-monetary interaction brings about since 2018Q1 is important for  
 360 China because the downward pressure is serious, especially after 2016.

#### 361 4. Conclusion

362 In this paper, we use the TVP-VAR model to gain an insight into the characteristic  
 363 of Chinese fiscal-monetary policy interaction and the potential changes in it. One of the  
 364 most crucial advantage of the TVP-VAR model is that it captures the time-varying feature

of the parameters and the change of the interaction's characteristic. Relying mainly on the time-varying impulse response function, this paper makes a comprehensive discussion of Chinese fiscal-monetary policy interaction. By combining the time-varying response of fiscal and monetary policy to each other's shock, as well as the responses of other macro variables, we divide the characteristic of the fiscal-monetary interaction into three periods, 1996Q1 to 2008Q4, 2009Q1 to 2017Q4 and 2018Q1 to 2020Q3.

We find that from 1996Q1 to 2017Q4, the response of CPI is negative to a fiscal expansion in the short-run and about zero in the long run, while the monetary expansion has a positive effect on both GDP and CPI. Thus, we conclude this period to be a monetary dominant regime. Also, both monetary and fiscal policy's response to each other's shock are positive, implying that they act as complements. However, we argue that 2008Q4 is a turning point that divides this period to be two different periods. From 1996Q1 to 2008Q4, the level of the monetary response to a fiscal expansion keeps rising, indicating the central bank's increasingly active cooperation with fiscal authority. While from 2009Q1 to 2017Q4, the response level of M2 growth rate goes through a decline, although still remains at a relative high level. This indicates that the central bank tries to enhance its role after the crisis, while to some extent it's still forced to cooperate with fiscal side. Since 2018Q1, the economy is going through a fiscal dominant regime (FD) for that the response of GDP and CPI to a fiscal expansion are positive and increase sharply. During this period, the complementarity of fiscal and monetary policy decreases and since about 2019Q4, the two policies won't act as complements any more.

We also claim that variation in the fiscal authority's characteristic should mainly account for the relative change of the role between fiscal and monetary policy because the fiscal response to a monetary shock is quite stationary during the whole sample period, regardless of the changes in the characteristic of central bank. We recommend that fiscal policy should give more concern to monetary policy and both policies should pay more attention to the macro leverage.

**Author Contributions:** Conceptualization, Z.L., X.M. and X.Z.; methodology and software, Z.L. and X.M.; formal analysis, Z.L., X.M. and X.Z.; writing—original draft preparation, Z.L. and X.M.; writing—review and editing, Z.L., X.M. and X.Z. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Data Availability Statement:** Data used in this study is available on <https://www.ceicdata.com/zh-hans> for GDP growth rate, CHIBOR and CPI, <http://www.mof.gov.cn/gkml/caizhengshuju/> for government spending and <https://www.atlantafed.org/cqer/research/china-macroeconomy.aspx> for M2 growth rate.

**Conflicts of Interest:** The authors declare no conflict of interest.

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