Faster fiscal stimulus and a higher government spending multiplier in China: Mixed-frequency identification with SVAR

Mingyang Li[a] and Linlin Niu[b, c, d, *]

[a] International School of Business and Finance, Sun Yat-sen University, China.
[b] The Wang Yanan Institute for Studies in Economics, Xiamen University, China.
[c] Key Laboratory of Econometrics (Xiamen University), Ministry of Education, China.
[d] Gregory and Paula Chow Center for Economic Research, School of Economics, Xiamen University, China.

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Abstract

Motivating with two scenarios in which the government spending in China timely reacted to output shock within a quarter, this letter points out a downward bias in the estimation of Chinese government spending multiplier using the classical lag restriction for shock identification in a quarterly SVAR framework à la Blanchard and Perotti (2002). By relaxing the lag-length restriction from one quarter to one month, we propose a mixed-frequency identification (MFI) strategy by taking the unexpected spending change in the first month of each quarter as an instrument. The estimation results show that the Chinese government significantly reacts to output shock counter-cyclically within a quarter, with the resulting government spending multiplier being 0.546 on impact and 1.849 at the maximum. A comparison study confirms that results based on the identification strategy of Blanchard and Perotti (2002) suffer severe downward bias in such a case.

Keywords: government spending multiplier; inside lag; mixed-frequency identification; SVAR model.

JEL classification: C32; C36; E23; E62.

* Correspondence to: Room A306, Economics Building, Xiamen University, Xiamen, 361005 Fujian, China. Email: llniu@xmu.edu.cn (L. Niu).

1 Introduction

Blanchard and Perotti (2002) (hereinafter BP2002) propose to study fiscal multipliers with a quarterly structural vector autoregressive (SVAR) model and impose a key identification assumption that the inside (recognition and decision) lag of government spending policy to output shock is **longer than one quarter**. This method has become a benchmark in estimating aggregate government spending multipliers not only for developed countries, but also for developing countries such as China (Wang and Wen, 2019; Zhang, 2020).

However, this lag length assumption of BP2002 does not necessarily hold in China. For example, in response to the global economic crisis signaled by the bankruptcy of Lehman Brothers on September 15, 2008, the State Council of China announced an RMB4 trillion stimulus package on November 9, 2008, of which RMB120 billion was to be invested in the fourth quarter of 2008 (Wong, 2011). Another example is in combating the COVID-19 pandemic which caused a global economic downturn. The earliest documented case of the disease in China was on December 1, 2019 (Huang et al., 2020), though it did not attract wide public attention until late January 2020. On January 20, 2020, the Chinese president Xi Jinping gave instructions for anti-epidemic efforts[①]. By January 29, 2020, China's central and local governments had spent RMB27.3 billion to fight COVID-19[②]. In both scenarios, the inside policy lag was shorter than one quarter.

Ignoring the fact that the government may quickly react to an output shock within a quarter, such as in the above cases of negative shocks, the resulting spending multipliers based on BP2002 identification from the SVAR approach may induce bias. A related finding in the U.S. in Schendstok (2021) is that the fiscal spending tends to be completed more quickly during recessions, which suggests a potentially larger fiscal multiplier in bad times.

Considering that the macroeconomic data of the current month is usually not available in the same month, we make a more realistic and less restrictive assumption that the inside lag is only **longer than one month**. Subsequently, we propose a mixed-frequency identification (MFI) strategy to utilize monthly data of government spending to construct an instrument for the structural government spending shock in

① Source: http://en.qstheory.cn/2020-07/15/c_523881.htm
② Source (in Chinese): http://www.gov.cn/xinwen/2020-01/30/content_5473047.htm

the quarterly SVAR and thereby estimate the government spending multiplier in China. We compare empirical results under our strategy and that of BP2002 and find the latter to be associated with a substantial downward bias in the resulting spending multiplier.

In existing studies on fiscal multiplier, various ways to enrich information efficiency has been explored. One way is to construct strong instrument with cross section information. For example, Li and Zhou (2021) achieve government spending shock identification in China at the local level using political connections, but their analysis is only suitable for short horizon inference. Alternatively, mixed-frequency information has been included, but mainly for enlarging the sample span (Cimadomo and D'Agostino, 2016; Mumtaz and Sunder-Plassmann, 2021). We show the usefulness of mixed-frequency information for identifying the government spending shock from a low-frequency SVAR framework.

1.1 The SVAR model

The following bi-variate quarterly SVAR model is used in this study:

$$Z_t = C + \gamma D_t + \sum_{s=1}^{p} \Phi_s(L) Z_{t-s} + U_t \tag{1}$$

where $Z_t = (log\, G_t\,, log\, Y_t)'$; G_t and Y_t are government spending and output, respectively; C is a constant; D_t is a linear deterministic trend term; and $U_t = (u_t^g, u_t^y)'$ is the vector of reduced-form residuals. Following BP2002, U_t is modeled as follows:

$$u_t^g = b_1 u_t^y + e_t^g \tag{2}$$

$$u_t^y = b_2 u_t^g + e_t^y \tag{3}$$

where e_t^g and e_t^y are the structural government spending shock and the output shock, which are uncorrelated with each other. To identify e_t^g and e_t^y, it is necessary to pin down b_1 and b_2.

1.2 Mixed-frequency identification strategy

BP2002 proposes to identify government spending shock by directly restricting b_1 to be zero, which is not valid in the case of China. We propose the more relaxed and realistic assumption that the inside lag in China is only longer than one month. With this assumption, it is reasonable to take the unexpected government spending change in the first month of each quarter as an instrument for u_t^g and estimate b_1

and b_2 as follows:

1. Let $G_{t,m}$ $(m = 1, 2, 3)$ denote the government spending of month m in quarter t and perform the following regression[③] with the same quarterly lag order p as in the SVAR model:

$$log\,G_{t,1} = c + \gamma t + \sum_{s=1}^{p}(\alpha_{s,3}\,log\,G_{t-s,3} + \alpha_{s,2}\,log\,G_{t-s,2} + \alpha_{s,1}\,log\,G_{t-s,1}) + \sum_{s=1}^{p}\beta_s\,log\,Y_{t-s} + \varepsilon_t^{g1} \quad (4)$$

2. Take ε_t^{g1} as an instrument for u_t^g and estimate b_2 with an instrumental variable regression of Equation (3).

3. Define $\tilde{u}_t^y = u_t^y - \hat{b}_2 u_t^g$, where $\hat{b}_2$ is the estimated value of b_2. Parameter b_1 can be estimated by running an instrumental variable regression of Equation (2) using $\tilde{u}_t^y$ as the instrument for u_t^y, and the result is denoted as $\hat{b}_1$.

Given our constructed instrumental variable in Step 1, the rest can be regarded as the Proxy-SVAR model proposed in Mertens and Ravn (2013).

2 Data

The quarterly and seasonally adjusted nominal GDP, nominal government consumption, consumer price index (CPI), and population data for China were downloaded from the data set constructed by Chang et al. (2016)[④]. In the SVAR analysis, Y_t and G_t are obtained by adjusting the nominal GDP and government consumption to real per-capita terms using CPI and population.

The monthly nominal government spending data were initially downloaded from Wind financial database and seasonally adjusted[⑤] and converted into real per-capita term. As the spending data of the Chinese government for the month of January have not been published since 2019, we use data from Q1 of 1992 to Q4 of 2018 to execute our empirical study.

The three series used in our regressions are displayed in Figure 1. The augmented Dickey–Fuller test shows that all series are integrated with order 1. The Johansen test rejects the existence of a cointegration relationship between Y_t and G_t, indicating

③ Thanks to a valuable suggestion of the referee, to alleviate possible measurement errors in $G_{t,1}$, such as errors in the measured timing in high frequencies (Auerbach et al., 2020), we include lagged monthly government spending to form a more precise forecast of $G_{t,1}$, instead of only using the quarterly lagged data from the original SVAR.

④ The data are available from the website of the Center for Quantitative Economic Research (CQER) of the Federal Reserve Bank of Atlanta: https://www.atlantafed.org/cqer/research/china-macroeconomy.aspx?panel=1.

⑤ Adjustment with R package “seasonal”, which provides an interface to X-13ARIMA-SEATS developed by the United States Census Bureau.

that the SVAR model fits the data better than a vector error correction model.

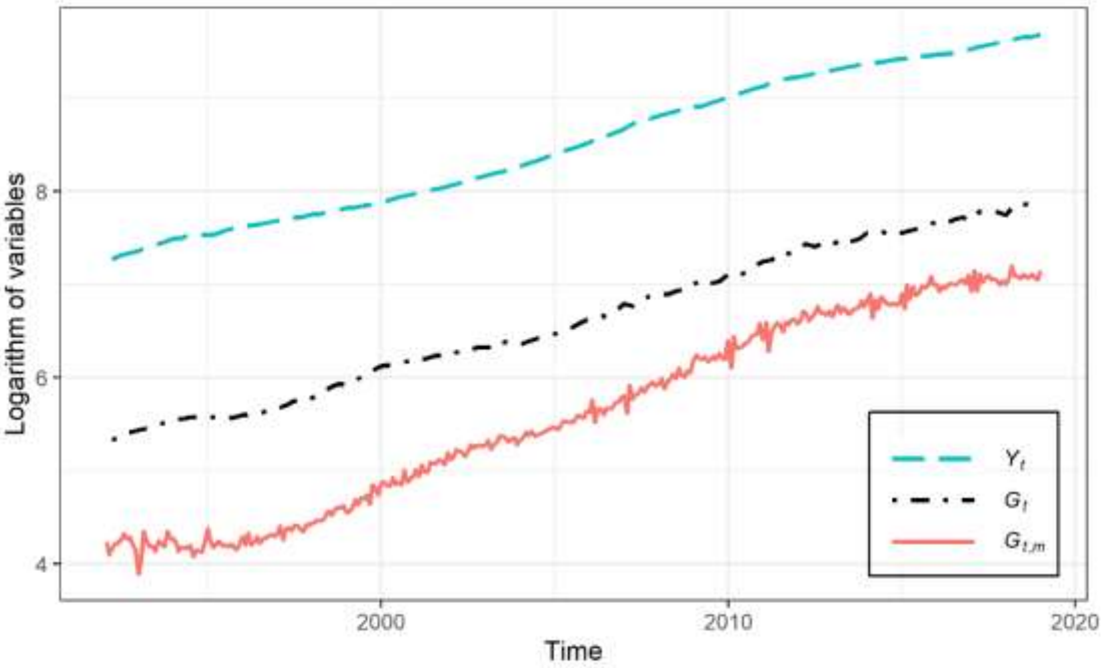

Figure 1: Quarterly output (Y_t), quarterly government spending (G_t), and monthly government spending ($G_{t,m}$)

3 Empirical results

3.1 Identification of structural shock

The reduced-form VAR model in Equation (1) is estimated with lag order $p = 3$ selected by the Akaike information criterion. After obtaining the reduced-form residuals u_t^g and u_t^y, we estimate b_1 and b_2 following the procedure in Section 1.2 and report the results in Table 1. The parameter b_1, which measures the discretionary spending adjustment to the output shock of the same quarter, is estimated to be -0.926 and significant at the 5% confidence level, indicating an almost one-for-one counter-cyclical adjustment of Chinese government spending to output shock within a quarter. The first-stage F-statistics are significant, showing no evidence of weak instruments problem in the IV regression. This empirical evidence strongly invalidates the BP2002 identification method to restrict $b_1 = 0$.

Table 1: The estimated values of parameters b_1 and b_2.

	Equation (2)	Equation (3)
b_1	−0.926** (0.367)	
b_2		0.083 (0.067)
First-stage F-statistics	1246.129***	24.686***

Note: Standard errors are shown in brackets. *: p<0.1; **: p<0.05; ***: p<0.01.

3.2 Government spending multiplier

We calculate the spending multiplier as follows:

$$M_k = \frac{\sum_{s=0}^{k} \Delta Y_s}{\sum_{s=0}^{k} \Delta G_s} = \frac{\sum_{s=0}^{k} \Delta \log Y_s}{\sum_{s=0}^{k} \Delta \log G_s} / (\frac{G}{Y}) \tag{5}$$

where $\Delta \log G_k$ and $\Delta \log Y_k$ are the responses of the log terms of the government spending and the output in the kth quarter after the shock. $G/Y = 0.152$ is the average ratio of government spending to output during the sample.

Figure 2 contrasts the estimated government spending multipliers using our MFI strategy and using BP2002. It shows the multiplier resulting from MFI has a value of 0.546 on impact, increases to a maximum of 1.849. The 90% confidence bands, which were obtained via a wild bootstrap method following Mertens and Ravn (2013), indicate that the multipliers are significant up to the fifth quarter. In comparison, the multiplier identified under BP2002 is substantially biased downward, with only 0.035 on impact and a maximum of 0.115 in the fourth quarter without significance at all horizons.

4 Conclusion

This letter proposes a mixed-frequency identification strategy based on a less restrictive and more realistic assumption of one-month lag length from government spending change to output shock, as a suitable method when the inside lag of government spending policy is shorter than one quarter and the popular identification method of BP2002 in a quarterly SVAR becomes invalid. The empirical study with Chinese data demonstrates that: 1) the Chinese government strongly adjusts its spending within the same quarter as the shock hits and exerts a significant impact on output; 2) the BP2002 approach severely underestimates the spending multiplier in China.

Our method also provides a way to test whether the inside lag of fiscal policy is indeed less than one quarter for developed economies with a potentially longer political process and serves as a meaningful robustness check in such cases.

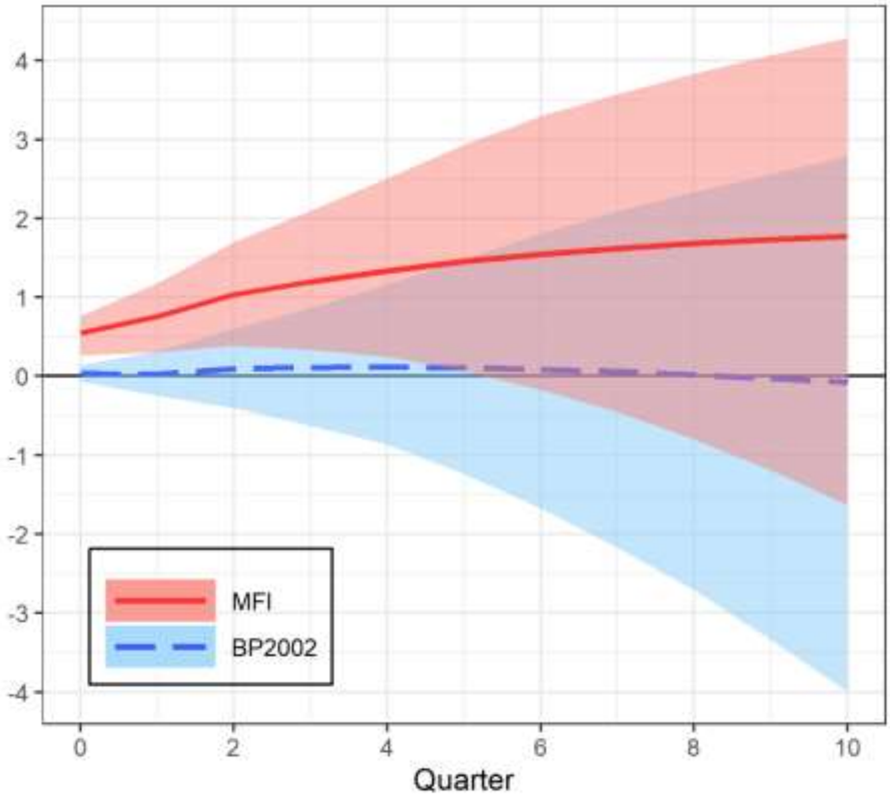

Figure 2: The government spending multiplier estimated using the mixed-frequency identification (MFI) strategy and BP2002 identification. The shaded areas indicate the corresponding 90% confidence bands.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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