Discussion Papers In Economics And Business

Long-Run Fiscal Multiplier for Autonomous Prefectures in China

Yingxin SHI and Mototsugu FUKUSHIGE

Discussion Paper 13-10

Graduate School of Economics and
Osaka School of International Public Policy (OSIPP)
Osaka University, Toyonaka, Osaka 560-0043, JAPAN

Long-Run Fiscal Multiplier for Autonomous Prefectures in China

Yingxin SHI and Mototsugu FUKUSHIGE

Discussion Paper 13-10

June 2013

Graduate School of Economics and
Osaka School of International Public Policy (OSIPP)
Osaka University, Toyonaka, Osaka 560-0043, JAPAN

Long-Run Fiscal Multiplier for Autonomous Prefectures in China

Yingxin SHI
Department of Economics & Management, Dalian Nationalities University
18, Liaohe West Road, Jinzhou New Area, Dalian 116600, China

Mototsugu FUKUSHIGE[1]
Graduate School of Economics, Osaka University
1-7, Machikaneyama-cho, Toyonaka, Osaka 560-0043, Japan

Abstract

We overcome the problems of data availability and investigate the fiscal multipliers in autonomous prefectures in China. We first estimate the long-run elasticity of gross regional production with respect to fiscal expenditure in autonomous prefectures, using autoregressive distributed lag models. The estimated long-run elasticity is much less than unity, however, and the estimated fiscal multipliers for prefectures are between 0.61 and 4.93, with an average of 1.93. These results indicate that additional fiscal expenditure is still effective in increasing local income and promoting economic growth for most of the autonomous prefectures.

Keyword: Fiscal Multiplier; Autonomous Prefecture; China; autoregressive distributed lag model

JEL Classification: O11, E62, H72.

[1]Corresponding author.
E-mail address: mfuku@econ.osaka-u.ac.jp (M. Fukushige)
Phone & Fax: +81-6-6850-5248 (M. Fukushige).

1. Introduction

There are 56 nationalities in the People's Republic of China, with the Han ethnicity accounting for more than 90% of the population; the remaining population constitute ethnic minorities. A national minority regional autonomy system is practiced in places where ethnic minorities gather and live. These autonomous areas are classified into top three levels of the national administrative divisions: five provinces, 30 prefectures and third level 117 counties and 3 banners. Gustafsson and Shi (2001) and Gustafsson and Sai (2009) estimate the income gaps between ethnic areas and the areas where the Han ethnicity is in the majority; the former authors investigate at the provincial level and the latter at the village level. Kajitani and Hoshino (2009) also investigate the gaps in per capita gross regional product (GRP) and the disposable income of ethnic regions between provinces and within provinces (prefectural level). They point out that the income inequality between provinces is smaller than that within provinces (between prefectures).

In this paper, we focus on the autonomous prefectures. These prefectures account for only 4.2% of the population but 24.8% of the area of the country. Geographically, there is one such prefecture in the Eastern Region, two in the Central Region and the other 27 are in the Western Region. Of course, the Western Region has focused on "Western Development" since 2000 and the Law of Promoting Western Development was enacted in 2004. Construction of a "Harmonious Society" and boosting domestic demand, which are recent political issues in China, also focus on the autonomous prefectures not only by its cultural variations but also by their rich natural resources. However, these areas are still less developed and face several problems: poverty, environmental problems, and lack of educational infrastructure, health services and so on. Therefore, the central government and provincial government provide fiscal subsidies to these prefectures to increase their fiscal expenditures. To evaluate the effectiveness of this fiscal policy, we need to investigate the effects of fiscal expenditures on local income or production. In other words, we should examine

the magnitude and significance of the fiscal multipliers.

Several studies have examined the relationship between fiscal policy and economic growth in China. For example, Batisse (2002) and Hsing and Hsien (2005) analyze national level economic growth and the effects of macroeconomic policies. He, Zhang and Zhang (2009) and Liu (2009) estimate national-level fiscal multipliers. Huang and Chen (2012) shed light on another side of fiscal policy. They study intergovernmental transfer equalization effects. Studies on fiscal expenditures themselves have also been carried out. Chen (2013) and Yu and Tsui (2005) investigate the determinants of provincial-level local government size and prefectural- and county-level government expenditures, respectively. Additionally, Zheng et al. (2013) point out that special and political factors are important in determining investment in regional infrastructure. However, there are no studies on the effects of subsidies from the central or provincial government to prefectural- or subprefectural-level governments and economies.

We obtained our data from each autonomous prefecture's Statistical Office. We then investigate the fiscal multipliers in each autonomous prefecture. We first estimate the long-run elasticity of fiscal expenditures with respect to GRP in autonomous prefectures, using an autoregressive distributed lag (ARDL) model. The estimated long-run elasticity is considerably less than unity, however, and the prefecture-level multipliers are between 0.61 and 4.93, with an average of 1.93. This result indicates that additional fiscal expenditure is effective in increasing local income and promoting economic growth for most of the autonomous prefectures.

The outline of the paper is as follows. In Section 2, we discuss recently used estimation methods for fiscal multipliers. We then consider the limitations of the data for the autonomous prefectures and develop the ARDL model. In Section 3, we present the estimation results and examine the fiscal multiplier for individual autonomous prefectures. Lastly, in Section 4, we conclude the paper and discuss the remaining research issues.

2. Model for Estimating Fiscal Multipliers

Recently, most of the studies on fiscal multipliers estimate time series models such as vector autoregressive (VAR) models or structural vector autoregressive (structural VAR) models and their impulse response functions. For example, Ilzetzki, Mendoza and Végh (2013) estimate structural VAR models for 44 countries and estimated the impact multipliers and cumulative multipliers. Their results show that the fiscal multipliers in industrial countries are larger than those in developing countries. Tang, Liu and Cheung (2013) estimate time-varying VAR models for the ASEAN countries and find causal relationships from tax collections to GDP, whereas there is no significant causality from government expenditure to GDP. Nijkamp and Poot (2004) conduct meta-analysis and conclude that government consumption multipliers are not significant, whereas those from government infrastructure spending are significant.

For China, neither the simple VAR approach nor structural VAR approach has been used to examine fiscal multipliers. Other approaches, however, have been use to estimate fiscal multipliers. For example, He, Zhang and Zhang (2005) estimate national-level short-run and medium-term fiscal multipliers using an input–output table and a DSGE model. Their estimates of the short-run multipliers are between 0.80 and 0.84, but that of the medium-term multiplier is about 1.10. Liu (2009) uses a Keynesian model and estimates fiscal multipliers at the national and provincial levels; those estimates are between 1.53 and 5.15.

In this paper, we focus on the fiscal multipliers in autonomous prefectures in China. We use data for 30 prefectures between 2005 and 2010 with some missing observations. To estimate the effects of fiscal expenditures on gross regional products (GRP), we assume that fiscal expenditure is an exogenous variable in determining GRP. Therefore, we pool the 30 prefectures and estimate an ARDL model with a dummy variable for each prefecture to control for the

idiosyncratic differences among prefectures.

First, we set up the following ARDL model (note that the subscript *i* denotes individual autonomous prefectures and the subscript *t* denotes time),

$$lnY_{it} = \alpha + \sum_{s=1}^{K} \beta_s lnY_{i,t-s} + \sum_{s=0}^{K} \gamma_s lnG_{i,t-s} + \sum_{s=0}^{K} \delta_s Infl_{t-s} + \epsilon_{it}$$

where Y and G are GRP and fiscal expenditure in each autonomous prefecture, respectively. *Infl* is the national-level inflation rate, which is calculated using the consumer price index for rural households from the 2012 Statistical Yearbook of China. In this paper, because we have only six years of data, we set a maximum lag length K of two and select the model that minimizes Schwarz's Bayesian information criterion (SBIC). In the estimation, we transform the model to estimate the long-run effect of the autoregressive parameters and distributed lags as follows,

$$lnY_{it} = \alpha + \beta^* lnY_{i,t-s} + \sum_{s=1}^{K-1} \beta_s^+ \Delta \ln Y_{i,t-s} + \gamma^* lnG_{i,t-s} + \sum_{s=1}^{K-1} \gamma_s^+ \Delta \ln G_{i,t-s} + \sum_{s=0}^{K} \delta_s Infl_{i,t-s} + \epsilon_{it}$$

where $\Delta \ln Y_{i,t-s} = lnY_{i,t-s} - lnY_{i,t-s-1}$ and $\Delta \ln G_{i,t-s} = lnG_{i,t-s} - lnG_{i,t-s-1}$. In this model, *Infl* was not transformed because we do not need to estimate it long-run effect. The relationships between the coefficients of the original model and transformed model are as follows,

$$\beta^* = \sum_{s=1}^{K} \beta_s \qquad \text{and} \qquad \beta_s^+ = -\sum_{k=s}^{K} \beta_k .$$

This transformation is also useful when we estimate the long-run elasticity of fiscal expenditure (ε) with respect to GRP; we can estimate it as follows,

$$\varepsilon = \gamma^{*} \Big/ (1 - \beta^{*}).$$

Of course, other economic variables may be candidates for explanatory variables. For example, an international trade flow variable may be a candidate. Poncet (2003) investigates the trade flows of Chinese provinces and Jiang (2011) points out the importance of openness for TFP growth at the provincial level. However, we cannot access these data and autonomous prefectures are less connected to international trade systems, so we do not include these variables.

3. Empirical Results

Most of the data are provided by each autonomous prefecture's Statistical Office: government expenditures and nominal GRP between 2005 and 2010 in each autonomous prefecture. Missing observations are fiscal expenditures for Ganzi Autonomous Prefecture in 2005 and those for Huangnan Autonomous Prefecture between 2005 and 2008. The total number of observations is 173 and we use 115 for estimation because we set the maximum lag length equal to two in the model selection process. All the variables except the inflation rate are deflated by the national-level consumer price index for rural households, which is obtained from the 2012 Statistical Yearbook of China and the base year is 2005. If local price indexes were available, we could pay attention to local price differentials and deflate the nominal data by these indexes. For example, Brandt and Holts (2006) constructed local price index by the provincial level prices and consumption baskets in China. However, as we cannot access the data to construct a price index for each prefecture, we adopt the national-level consumer price index for rural households as a proxy for prefectural prices. We use the index for rural households instead of that for urban areas because most autonomous prefectures are in rural areas. As for the estimation method, we pool all the observations and apply

the least squares with dummy variables (LSDV) method. This is a estimation method for panel data and its estimator is consistent estimator even when the assumptions that the estimator of the random effect model is efficient and consistent does not hold.

We select the explanatory variables, apart from the dummy variables, for the LSDV method to minimize SBIC. The estimated results are shown in Table 1. We call the model before model selection the "Full model" and that after selection by SBIC the "Selected model by SBIC." In the selected model, the variable *Infl* and its lagged values are omitted, and only lagged GRP and instantaneous fiscal expenditures are included as explanatory variables in addition to the prefecture dummy variables. The estimated R-squared for the selected model is high at 0.9958 and diagnostic tests for missspecification (RESET), using squared and cubic fitted values as explanatory variables, are not significant. Next, using this selected model, we investigate the effects of fiscal policy.

The calculated elasticity of GRP with respect to fiscal expenditure is 0.497, which means that a 1% increase in fiscal expenditure increases GRP by about 0.5%. To evaluate the effects of fiscal expenditures on GRP we use this elasticity to calculate the fiscal multiplier. We can approximate the fiscal multiplier for each prefecture as,

$$m = \varepsilon \cdot \frac{Y}{G}.$$

This approximation is also used in Liu (2009). Using averages of the ratios of GRP to fiscal expenditure for each prefecture during the sample period, we estimate the average fiscal multiplier for each prefecture in Table 2. The estimated long-run elasticity of GRP with respect to fiscal expenditure is considerably less than unity, however, and the estimated fiscal multipliers for prefectures are between 0.61 and 4.93, with an average of 1.93. Apart from six prefectures (Gannan, Linxia, Golog, Qizilsu, Ganzi and Aba) the other 24 prefectures have fiscal multipliers that

are larger than unity. This result means that GRP increases by more than the associated increase in fiscal expenditure in most prefectures. Compared with previous studies, the estimated fiscal multipliers are larger than those of He, Zhang and Zhang (2009) and marginally smaller than those of Liu (2009).

4. Conclusion

We estimated long-run fiscal multipliers for the autonomous prefectures in China, using an ARDL model with panel data. The estimated long-run elasticity of GRP with respect to fiscal expenditure is less than unity, however, and the estimated fiscal multipliers for prefectures are between 0.61 and 4.93 Additionally, there are six prefectures whose fiscal multipliers are less than unity. This result indicates that additional fiscal expenditure is effective in increasing GRP and promoting economic growth for most autonomous prefectures. This result is also informative for reconsidering fiscal subsidies from central and provincial governments for autonomous prefectures in China because those subsidies increase the fiscal expenditures in autonomous prefectures. In other words, the results shed new light on the effects of fiscal policy that have not been investigated previously because of data limitations.

Finally, there are some remaining problems. First, the coefficients of the model are constant across the 30 autonomous prefectures. This assumption is somewhat restrictive because these 30 prefectures might face different natural and economic environments and their elasticity GRP with respect to fiscal expenditure might vary. In such situations, we should estimate a separate model for each autonomous prefecture. However, in this paper, we only have six years of data, so we had no choice but to apply the LSDV method to obtain stable estimates. In the future, if suitable data are available, we will estimate separate prefectural models to obtain fiscal multipliers. Furthermore, to evaluate the size of the fiscal multipliers for the autonomous prefectures, they

should be compared across prefectures. Furthermore, in considering subsidies for ethnic regions generally, we should focus not only on economic development but also on the conformability or happiness of residents, e.g., as investigated by Knight et al. (2009). However, such a topic is beyond the scope of this paper.

Acknowledgments

We are very grateful to the Statistical Office in each autonomous prefecture for providing data on fiscal expenditure, tax collections and GRP. Shi is also grateful to SEAC (2013-GM-022) and DLNU (ZJ13RWYB002) for their financial support of the joint research on this topic with Fukushige.

References

Batisse, C. (2002) Dynamic externalities and local growth: A panel data analysis applied to Chinese provinces. China Economic Review 13, 231-251.

Brandt, L. & Holz, C.A. (2006) Spatial price differences in China: Estimation and implications. Economic Development and Cultural Change 55, 43-86.

Chen, C.-H. (2013) Fiscal decentralization, collusion and government size in China's transitional economy. Applied Economic Letters 11, 699-705.

Gustafsson, B. & Sai, D. (2009) Villages where China's ethnic minorities live. China Economic Review 20, 193-207.

Gustafsson, B. & Shi, L. (2003) The ethnic minority-majority income gap in rural China during transition. Economic Development and Cultural Change 51, 13-86.

He, D., Zhang, Z. & Zhang, W. (2009) How large will be the effect of China's fiscal stimulus package on output and employment? Pacific Economic Review 14, 730-744.

Hsing, Y. & Hsien, W.-J. (2005) Impact of monetary, fiscal and exchange rate policies on output in China: A VAR approach. Economics of Planning 37, 125-139.

Huang, B. & Chen, K. (2012) Are intergovernmental transfers in China equalizing? China Economic Review 23, 534-551.

Ilzetzki, E., Mendoza, E.G. & Végh, C.A. (2013) How big (small) are fiscal multipliers? Journal of Monetary Economics 60, 239-254.

Jiang, Y. (2011) Understanding openness and productivity growth in China: An empirical study of the Chinese provinces. China Economic Review 22, 290-298.

Kajitani, K. & Hoshino, M. (2009) Determinants of intergovernmental fiscal transfers in internal China and redistribution effect. Asian Studies 55(1), 19-39.

Knight, J., Song, L. & Gunatilaka, R. (2009) Subjective well-being and its determinants in rural

China. China Economic Review 20, 635-649.

Liu, L. (2009) Impact of the global financial crisis on China: Empirical evidence and policy implications. China and World Economy 17, 1-23.

Nijkamp, P. & Poot, J. (2004) Meta-analysis of the effect of fiscal policies on long-run growth. European Journal of Political Economy 20, 91-124.

Poncet, S. (2003) Measuring Chinese domestic and international integration. China Economic Review 14, 1-21.

Tang, H.C., Liu, P. & Cheung, E. (2013) Changing impact of fiscal policy on selected ASEAN countries. Journal of Asian Economics 24, 103-116.

Yu, Q. & Tsui, K. (2005) Factor decomposition of sub-provincial fiscal disparities in China. China Economic Review 16, 403-418.

Zheng, X., Li, F., Song, S. & Yu, Y. (2013) Central government's infrastructure investment across Chinese regions: A dynamic spatial panel data approach. China Economic Review, forthcoming.

Table 1. Estimation Results

	Full model	Selected model by SBIC
Variables	Coefficient/t-value	Coefficient/t-value
$Y_{i,t-1}$	.310091*/2.214	.481187** /6.334
$\Delta Y_{i,t-1}$	.076980/.731	
$G_{i,t}$	.248764*/2.513	.257662** /7.946
$\Delta G_{i,t}$	–.064820/–.677	
$\Delta G_{i,t-1}$	–.013492/–.434	
$Infl_t$	.00955741/.538	
$Infl_{t-1}$	.00226542/.207	
$Infl_{t-2}$	.023547/.661	
Constant & dummy variables	Yes	Yes
Adjusted R^2	.9959	.9958
S.E.	.06546	.06645
SBIC	–84.892	–93.145
Log likelihood	172.673	166.692
RESET	.901	.179

Note: ** and * mean statistically significant at 1% and 5%, respectively.

Total number of observations is 115.

Log likelihood is reported from the results of the ML calculation in TSP 5.0.

Table 2. Estimated Fiscal Multipliers

Prefecture	Nationality	Region	Province	Estimated fiscal multiplier
Yanbian	Korean	Northeast	Jilin	1.96
Gannan	Tibetan	Northwest	Gansu	0.66
Linxia	Hui	Northwest	Gansu	0.93
Yushu	Tibetan	Northwest	Qinghai	1.29
Hainan	Tibetan	Northwest	Qinghai	4.21
Huangnan	Tibetan	Northwest	Qinghai	1.39
Haibei	Tibetan	Northwest	Qinghai	1.33
Golog	Tibetan	Northwest	Qinghai	0.63
Haixi	Mongolian & Tibetan	Northwest	Qinghai	4.02
Bayingolin	Mongolian	Northwest	Xinjiang	4.93
Boertala	Mongolian	Northwest	Xinjiang	2.35
Qizilsu	Qirghiz	Northwest	Xinjiang	0.61
Changji	Hui	Northwest	Xinjiang	3.67
Ili	Kazak	Northwest	Xinjiang	2.05
Xiangxi	Tujia & Miao	Central	Hunan	1.83
Enshi	Tujia & Miao	Central	Hubei	1.96
Qiandongnan	Miao & Dong	Southwest	Guizhou	1.45
Qianxinan	Buyi & Miao	Southwest	Guizhou	1.94
Qiannan	Buyi & Miao	Southwest	Guizhou	1.80
Xishuangbanna	Dai	Southwest	Yunnan	2.42
Dehong	Dai & Jingpo	Southwest	Yunnan	1.43
Nujiang	Lisu	Southwest	Yunnan	1.13
Dali	Bai	Southwest	Yunnan	2.43
Diqing	Tibetan	Southwest	Yunnan	1.14
Honghe	Hani & Yi	Southwest	Yunnan	2.40
Wenshan	Zhuang & Miao	Southwest	Yunnan	1.93
Chuxiong	Yi	Southwest	Yunnan	2.21
Ganzi	Tibetan	Southwest	Sichuan	0.72
Aba	Tibetan & Qiang	Southwest	Sichuan	0.80
Liangshan	Yi	Southwest	Sichuan	2.30