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The Effectiveness of Government Expenditures during Crisis: Evidence from Regional Government Spending in Japan 1990-2000

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The Effectiveness of Government Expenditures During Crisis: Evidence from Regional Government Spending in Japan 1990-2000

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Abstract: We use a rich dataset of regional government expenditures for Japan during the 1990-2000 period to estimate from within-prefecture variation the multiplier of government investment and government consumption expenditures. Our main finding is that government spending did not have multipliers effects that are on average larger than one. Government investment had a positive and significant effect on output that was quantitatively larger than the effect of government consumption expenditures. Government personnel expenditures and transfers to households had significant negative output effects while transfers to firms produced positive multiplier effects that were significantly larger than one. Our findings are consistent with macro model that emphasize the supply-side effects of fiscal policy during times of financial crisis.

Key words: Fiscal policy, fiscal multipliers

JEL codes: E62, H30

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1. Introduction

There is a fierce debate about the effects that government spending has on the economy during times of crisis. Both in academic and policy circles are the views split on how effective government spending is in resuscitating the economy. Fiscal conservatives warn that the unprecedented increases in government spending have led to an unsustainable increase in the stock of public debt and caution therefore about the adverse effects that an expansionary fiscal stance can have on the economy in the medium to long run.[1] Yet even from a short-run, business-cycle perspective is there little consensus among macroeconomists on whether fiscal policy is effective in stimulating the economy.[2] Most of the academic debate is theoretical in nature, and so far, there exists little evidence from rigorous econometric analysis on the size of the government spending multiplier during times of financial crisis.

In this paper we seek to make an empirical contribution to the debate on whether government expenditures are effective in stimulating economic activity during times of crisis by exploiting a rich dataset of regional government expenditures in Japan during the 1990-2000 period. As in the recent crisis of 2008/2009, many elements of the Japanese crisis and fiscal stimulus responses share similarities. During the 1990s, a period frequently referred to as the "lost decade", economic growth in Japan declined sharply to an average of less than 1 percent from an average growth rate of 4 percent in the decade earlier. The economic slowdown was precipitated by a bursting of the asset bubble as the stock market declined by more than 40 percent between 1989 and 1991. In response to the financial distress, monetary policy responded with the Bank of Japan lowering the policy rate until hitting the zero lower bound. On the fiscal front, the Japanese government introduced numerous stimulus packages that were continued over the course of the decade (see Figure 1).

Our estimation strategy is based on using the within-prefecture variation in government expenditures to estimate regional multiplier effects that government investment and government consumption expenditures had on output in Japan during the 1990s. The use of regional data allows us to deal with important identification issues of the effects of fiscal policy that are related to the non-passiveness of monetary policy. We deal with these issues by using panel fixed effects regressions that account for both prefecture-specific unobservables as well as time-specific shocks that are common across prefectures in a given year.

Based on the within-prefecture variation of the data we find that the output multiplier of government expenditures is on average not larger than one. For public investment, our fixed

1 See, for example, Auerbach and Gale (2010).

2 See Hall (2009) and Cogan et al. (2010) for an overview of the literature.

effects estimates yield an average impact multiplier of 0.79, with a standard error of 0.16. This multiplier estimate is highly significantly different from zero, but it is not significantly different from one. It is also interesting to note that investment projects that were carried out by the city government were more productive than investment projects that were carried out by the central government: the multiplier on city government investment projects was 1.03, while for prefecture (central) government investment projects it was 0.68 (0.37). Thus, while a more detailed analysis that distinguishes public investment by level of administration yields that decentralized government investment was more effective in stimulating economic activity in Japan during the 90s than centralized government investment, the multiplier on decentralized public investment was on average not significantly larger than one.

Our second main finding is that different *types* of government spending had very different effects on output. Transfers to firms produced an average multiplier of about 2.8, followed by public construction that produced an average multiplier of about 1.0. These are relatively large multipliers. Statistically the multiplier on transfer to firms is significantly larger than one -- a result that is consistent with models that examine the effects of fiscal policy when firms face financing constraints, such as e.g. Angeletos and Panousi (2009) or Christiano and Ikeda (2010). But our fixed effects analysis also yields multipliers that are significantly negative. The multiplier on transfers to households is -3.25 and the multiplier on increases in government personnel expenditures is -3.58. Hence, when we look at the average effect that total local government expenditures had on output we find a multiplier that is positive and significantly different from zero, but not significantly larger than one.

Recent theoretical macro models that focus on the effects of fiscal policy in a constant (zero lower bound) monetary policy rate regime predict large multiplier effects that, depending on parameter values, can exceed one (e.g Woodford, 2010; Eggertson, 2010; Christiano et al. 2010). In our estimation framework, a constant interest rate regime is certainly an appropriate benchmark case. Yet it is important to note that in Japan during the 1990s financing constraints were a real issue.[3] The New Keynesian models that predict large fiscal multipliers in the presence of a constant monetary policy rate regime assume complete financial markets. Such an assumption is unlikely to hold for Japan during the 1990s as asset and land prices declined substantially. In a world of incomplete financial markets, where the ability of firms to borrow depends on firms' wealth, government spending can have small and even negative output effects. This is formally shown in a general equilibrium model by

3 For empirical evidence that a disruption in the financial system was a major problem in Japan during the 1990s, see, e.g. Bayoumi (2001), or Woo (2003). For a theoretical model that emphasizes the importance of asset (land) prices in affecting firms' ability to obtain finance, see e.g. Kiyotaki and Moore (1997).

Angeletos and Panousi (2009). Angeletos and Panousi do not consider an environment where the monetary policy rate is constant, but their analysis indicates that in the presence of financing constraints the output effects of government spending are much smaller than in a model where, for simplicity, financial markets are assumed to be complete. The findings in this paper are therefore consistent with macro models that emphasize the supply-side effects of fiscal policy in an environment where there is distress in the financial markets.

The remainder of the paper is organized as follows. Section 2 discusses the related literature. Section 3 provides a background on the fiscal stimulus packages. Section 4 describes the empirical strategy and the data. Section 5 presents the main empirical results. Section 6 concludes.

2. Related Literature

There exists a small empirical literature on the multiplier effects of fiscal policy in Japan that is predominantly based on country-level data of government expenditures. Estimates for the short-run multiplier, derived from VAR models over long time-periods have ranged from 0.4 (Matsuoka (1996) and Kalra (2003)) to 0.7 (Bayoumi (2001)). Kuttner and Posen (2002) use a structural VAR model based on an identification strategy developed in Blanchard and Perotti (2002) and find a spending multiplier—calculated as the cumulative impact on output after four years—of 2.0.

Several studies have also examined the impact of public investment spending on output in Japan. Most of these papers have used the VAR methodology and generally found low multiplier effects of public investment spending. Miyazaki (2007) using a structural VAR model finds that public investment in construction have an insignificant impact contemporaneously on output, although central government investment has a persistent and positive impact over time. Ihori et al. (2003), using non-structural VAR analysis, finds that public investment marginally stimulates private consumption in the 1990s, but crowds out private investment more so than prior to the 1990s. Afonso and Aubyn (2008) evaluate the macroeconomic effects of public and private investment through VAR analysis for 14 European Union countries, plus Canada, Japan and the United States and find relatively low multiplier effects of public investment in Japan.

Our empirical paper differs from the above mainly in the use of regional data. As we will discuss in further detail in Section 4, the use of regional data has several advantages in terms of identifying the effects of fiscal policy when monetary policy is non-passive. For the US, several recent studies have used state level data to examine the effects of fiscal policy

(e.g. Clemens and Miran, 2010; Fishback and Kachanovskaya, 2010; Nakamura and Steinsson, 2010; Shoag, 2010; Serrato and Wingender, 2010). The time periods and types of government spending that these studies analyze differ, and so do their identification and estimation strategies. A concise summary of these studies is that they find positive and significant multiplier effects that range between 0.6 to 2.2.

3. Background on the Fiscal Stimulus Packages

The Japanese government introduced numerous fiscal stimulus packages to address the economic impact of the financial crisis and the slowdown in growth during the 90s. The key components of the packages (about 28 percent of GDP in total), included:

- public works and social infrastructure related projects, including land acquisition (14.2 percent of 2000 GDP);
- credit guarantees and augmentation of credit lines to banks for loans to small and medium-sized enterprises and for the housing sector, (8.5 percent of GDP);
- employment assistance and cash transfers (2.1 percent of GDP);
- and tax measures (3.3 percent of GDP).

Appendix 1 provides details of the stimulus packages implemented. Public works projects and land acquisition constituted the main component of the stimulus packages in the early part of the decade, comprising nearly half of the total stimulus spending. The stimulus packages were introduced through supplementary budgets at the level of both the central and local governments. A large share of public works programs were financed by local governments in the early nineties. However, this share declined over time due to financing difficulties experienced by the local governments. Public investment also changed in the second half of the nineties away from public works towards other sectors such as science and technology and education. Similarly, land purchases by the government, which constituted an important part of the stimulus package in the early half of the decade were later abandoned.

Policy loans, including credit guarantees, played a more prominent role later in the decade.[4] Cash transfers through employment support, social security spending, and cash vouchers for households accounted for a relatively small share of the stimulus package. Income tax cuts were first implemented in 1994, with a sunset clause and a VAT increase in 1997. However, following a sharp economic contraction in 1998, the income tax increase was quickly reversed and a series of temporary tax cuts were implemented.

4 The size of the policy loans in the stimulus plans reflect the planned augmentation of credit line by the banks. As such, it overstates the budgetary allocation to increase capital of the lending agencies and the underlying subsidies.

It is important to note that contrary to the headline figures in the announced packages, actual fiscal stimulus was limited. The stimulus packages, which were included in the supplemental budgets, did not represent the actual fiscal stance because the initial budgets were usually contractionary when compared with the outturn in the previous year. Structural balances indeed deteriorated from a surplus of about 1/5 percent of GDP in 1990 to a deficit of 6 percent of GDP in 2000. But the main contributors to the increase in the fiscal deficit were declining taxes (3 percentage points) and increases in social security costs (3½ percentage points). The remaining 1 percent of GDP was due to government spending on land and capital transfers (Kalra, 2003). Public investment increased only between 1990–95 and subsequently declined, as concerns about rising public debt led to retrenchment of public spending particularly by the local government on self-financed projects.

4. Estimation Strategy and Data

We use annual time-series data available at the prefecture level during the 1990-2000 period to estimate the effect that government expenditures had on regional output. Our dataset contains detailed data on the different components of both public investment as well as public consumption expenditures for 47 different prefectures. The prefecture level data are from the Japan Statistical Yearbook. The Yearbook provides detailed data at the prefecture level on government investment that is obtained from the annual report on administrative investment from the Ministry of Home Affairs. The public investment data are expenditure based and cover expenditures on the maintenance and repair of facilities, improvement projects (including cost of land and compensation), office expenses, and planning and surveys. The Yearbook also provides detailed local government finance data on government expenditures and government tax revenues from the ordinary accounts of local governments. These data are from the annual statistical report on local government finance of the Ministry of Home Affairs and are based on the reports submitted by the local public bodies. For some summary statistics see Table 1.

We use the following econometric model to estimate from within-prefecture variation the effect that fiscal policy has on regional output:

(1) $$Y_{c,t} = \varphi Y_{c,t-1} + a_c + d_t + p*G_{c,t} + D^T X_{c,t} + u_{c,t}$$

where $Y_{c,t}$ is value added of prefecture c in year t and $G_{c,t}$ are government expenditures of prefecture c in year t. $X_{c,t}$ is a vector of control variables varying at the prefecture-year level; a_c are unobserved, time-invariant prefecture fixed effects; and d_t are year-specific fixed effects.

All variables are in real per capita terms and are expressed in logs of the levels.[5] The elasticity expenditure multiplier estimate is given by the parameter estimate p. Following common practices in the literature, we obtain and report dY/dG multiplier estimates by multiplying the elasticity estimate p with the inverse of the sample average G/Y using the Delta method.

One of the key advantages of the above model is that it fully accounts for year-specific shocks, d_t. Accounting for these shocks is important because it allows us to take care of identification problems that arise due to the non-passiveness of monetary policy during the 90s. Because the monetary policy rate is the same across prefectures in a given year it will be fully accounted for by the year fixed effects. In contrast to standard VAR analysis, our estimates of the impact that fiscal policy has on output will therefore be immune to biases that arise due to the inconsistent estimation of the effect that monetary policy has on output. Moreover, since the year fixed effects account for the overall size of the announced spending packages the fixed effects regressions control for prefecture-wide anticipation effects that are associated with the announcement of the fiscal stimuli.[6]

Our estimation framework also allows us to circumvent to a certain extent an endogeneity bias that is due to fiscal policy responding to changes in the economic environment. If government expenditures increase during times of recession, it could introduce negative simultaneity bias between left-hand and right-hand-side variables that downward biases the estimates on the fiscal multiplier. Note however that in our estimation framework the overall response of government expenditures to recessions is fully accounted for by the year fixed effects. For there to be a remaining downward bias it would have to be the case that fiscal policy is countercyclical at the prefecture level.[7] If government expenditures are allocated in a given year randomly across prefectures (conditional on prefecture and year fixed effects) then there would be no endogeneity bias.

To be on the safe side, we also apply system-GMM estimation techniques that treat government expenditures as a potentially endogenous regressor. The system-GMM estimator uses lagged first-differences of the government expenditure series as instruments for the equation in levels. The identifying assumption made in the system-GMM estimation is that,

5 The main advantage of the log-log specification is that it can be viewed as a first-order approximation of a potentially nonlinear (and highly complex) relationship between government spending and output that a linear level specification would be ill-suited to capture.

6 The use of annual data, rather than quarterly data where differences in the timing between announced and actual spending shocks can be substantial, further reduces the concern that anticipation effects of fiscal policy are a major problem. For a discussion of the implications when fiscal shocks are anticipated see e.g. Leeper et al. (2008), Mertens and Ravn (2010), or Ramey (2011).

7 The size of the downward bias can be expected to be relatively small because regional governments faced de jure budget constraints: The Local Finance Law restricts ad hoc financing for prefecture governments to 5 percent of general resources and to 20 percent for municipalities.

conditional on past prefecture output, past first-differences of prefecture government expenditures are not systematically correlated with contemporaneous changes in prefecture output. This condition is satisfied if prefecture governments were to (approximately) base their current expenditures on future output forecasts since equation (1) explicitly controls for lagged output. Hence, contemporaneous (residual) changes in prefecture output are surprise changes that cannot be forecasted by the prefecture governments based on past per capita GDP levels.[8] To check on our instrument quality, we report the F-statistic on the significance of the first-stage estimates and we also report the standard tests of first and second-order serial correlation of the residuals.

5. Main Results

5.1 Public Investment

Table 2 presents our dynamic panel data estimates of the public investment multiplier that are based on data of general public investment expenditures. In column (1) we report least-squares estimates where the control variables are prefecture-specific fixed effects only. The estimated coefficient on the government investment multiplier is 0.36 and this estimate is significantly different from zero at the 1 percent level. In column (2) we add year fixed effects to account for common year shocks, such as changes in the monetary policy rate. This bears the result that the least-squares estimate of the public investment multiplier increases slightly to 0.5.

It is possible that the least-squares estimate suffers from an endogeneity bias. Moreover, the presence of prefecture fixed effects in the dynamic panel regression creates a bias on the dynamic estimates (e.g. Wooldridge, 2002). To address these issues we report in column (3) system-GMM estimates where we treat government expenditures as a potentially endogenous regressor, instrumenting with the first lag of the difference. The use of the system-GMM estimation bears the result that the estimate of the public investment multiplier increases to 0.89. The implication of this estimates is that on impact a 1 Yen increase in public investment increased output on impact by almost 0.9 Yen on average. Note that since the standard error associated with this estimate is 0.16 we cannot reject the hypothesis that the multiplier estimate reported in column (3) is significantly different from one. The AR(1) coefficient on GDP per capita is 0.53 and this implies that the cumulative long-run multiplier of a permanent increase in public investment is 1.9 (calculated as 0.89/(1-0.53)). The null hypothesis that this cumulative multiplier is equal to one is comfortably rejected at the 1 percent level with a p-value of 0.004. The first-stage F-statistic on the significance of our

8 Higher order lags in the prefecture GDP series are not statistically significant.

instruments is 26.24 and the p-value on the hypothesis of no second-order serial correlation in the residuals is 0.75. Hence, these test statistics indicate that the GMM estimates are based on reasonable instruments.

In column (4) we add tax revenues to the right-hand side of the estimating equation.[9] This changes the size of the multiplier on public investment little. Interestingly the estimate implies a larger multiplier for tax revenues than for public investment. The multiplier on tax revenues is -1.25 and the null hypothesis that in absolute size this estimate is larger than the estimate on public investment is rejected a the 10 percent level (p-value 0.099). The implication of these estimates is that on average a balanced budget increase in public investment had a negative multiplier, a result that is echoed by other recent empirical studies (see e.g. Barro and Redlick, 2009).

A relevant policy question that is of particular interest from a public finance point of view is whether investment projects carried out by the city and prefecture governments were more effective in stimulating economic activity than investment projects carried out by the central government. In Table 3 we explore this question by estimating the multiplier effects of investment spending by administrative level (central government, prefecture government, city government). We find that government investment undertaken by the cities had a multiplier that is more than twice as large as the investment multiplier on projects carried out by the central government. The impact multiplier on investment projects carried out by the city government is approximately 1.0, while the impact multiplier on investment projects carried out by the prefecture and central government is 0.7 and 0.4 respectively.

These estimates suggest that decentralized government investment was more effective than centralized government investment in stimulating regional output in Japan during the 90s. This could possibly reflect shorter implementation lags in project implementation as spending is focused on maintenance of existing projects and better targeting of projects. Moreover, the fact that local governments had greater financial constraints particularly as the local (property) tax revenues declined sharply, meant that transfers from the central government could be more effectively spent.

5.2 Local Government Expenditures

In Table 4 we repeat the empirical analysis for public expenditures of the local (prefecture-level) government. Local government spending comprise a significant share of total public

9 We use cyclically adjusted tax revenues following the procedure outlined in Blanchard and Perotti (2002). We use an elasticity response of tax revenues to GDP of 2 which is based on the tax revenue elasticity estimate reported in Nord (2000) for Japan.

spending. For example, in 1990 public expenditures from the ordinary accounts of the local government constituted 65 percent of the net expenditures of the general account of the national government and the ordinary account of the local government. Column (1) of Table 3 presents the estimates of the government expenditure multiplier without distinguishing by type of government spending. The control variables (not shown) beyond the prefecture and year fixed effects are lagged GDP and tax revenues. The main result from column (1) is that the average multiplier on local government expenditures, 0.74, is positive and significantly different from zero at the 1 percent level but not significantly larger than one.

Next we examine the multiplier effects of local government expenditures distinguishing between the different components of government spending. Our data provides us with a breakdown of government expenditures in key areas such as ordinary construction, social assistance (subsidy to households), transfers to firms and government personnel. We find that there are substantial differences in the multiplier effects of these different components of government spending (see columns (2) to (5) of Table 4). Transfers to firms produced an average multiplier of about 2.8, followed by public construction that produced an average multiplier of about 1.1. These are quite large multipliers, and in fact, the multiplier on transfers to firms is significantly larger than one. Nevertheless, some of the other components of government expenditures had significant negative output multipliers, such as transfers to households (-3.25) and expenditures on government personnel (-3.58). This may explain why on average we find a multiplier on overall government expenditures that is not significantly larger than one.[10]

In Table 5 we seek to shed further light on the mechanism behind these results by reporting estimates of the total employment response (Panel A), the private investment response (Panel B) and the private consumption response (Panel C). Consistent with the large output multiplier on transfers to firms documented in Table 4, column (2) of Table 5 shows that increases in government transfers to firms had a significant positive effect on employment and private investment. Although the private consumption response is insignificant, the negative point estimate indicates that private consumption decreased in response to increases in transfers to firms. Column (3) in turn shows that increases in public construction had a significant positive effect on employment, an insignificant positive effect on private investment, and an insignificant negative effect on private consumption. Thus, columns (2) and (3) indicate that transfers to firms and construction had significant positive output per

10 For an empirical study of OECD countries that finds similar adverse effects of government personnel expenditures, see for example Alesina et al. (2002).

capita effects by significantly increasing employment and, in particular for transfers to firms, by significantly increasing private investment.

In contrast to these results, column (4) of Table 5 shows that increases in social assistance were associated with a significant decrease in total employment and private investment. The decrease in total employment is consistent with increases in social assistance representing a positive wealth effect for households that increases the marginal utility from leisure, thus reducing the incentives to supply labor. Because the decrease in the supply of labor negatively affects the return to capital, private investment decreases. Interestingly, Panel C of column (4) shows that increases in social assistance had a positive effect on private consumption, although we note that the estimate is associated with a large standard error and is not significant at conventional confidence levels.

From a labor economics point of view it is also interesting to note that column (5) shows that increases in government personnel expenditures did not produce significant overall increases in employment. We do not have (annual) data that allow us to separate public sector salaries from public sector employment and, therefore, are unable pin down this insignificant total employment response to increases in public sector employment crowding out (by an equal amount) private sector employment. For example, increases in public personnel expenditures could also be triggered, at least in part, by increases in public sector salaries that in turn trigger increases in private sector salaries and hence decrease private sector employment (as firms find it more costly to hire workers). Still it is interesting to note that private investment significantly decreased in response to increases in government personnel expenditures, which suggests that increases in government personnel expenditures were on net a burden for the private sector.

5.3 Prefecture Heterogeneity in the Marginal Effect

The reported estimates of the government expenditure multiplier reflect the average marginal effect that government expenditures had on output across prefectures. An important econometric issue is whether cross-prefecture parameter heterogeneity leads to an inconsistent estimate of this average marginal effect. To check this, we use the mean-group estimator developed by Pesaran and Smith (1995) that computes estimates prefecture-by-prefecture and then takes a linear average of the obtained coefficients. Figure 2 plots the kernel density function of the prefecture-specific slope estimates that are obtained from using the lagged first-difference of government expenditures as an instrumental variable. The mean (median) value of the prefecture-specific slope estimates is 0.48 (0.59). This mean-group estimate is not

significantly different from the average marginal effect reported in column (1) of Table 4 that is based on the homogeneous panel fixed effects model. We therefore conclude that from an econometric point of view cross-prefecture parameter heterogeneity does not lead to an inconsistent estimate of the average marginal effect.

Beyond providing an important robustness check on the average multiplier effect, the prefecture-specific slope estimates provide useful information on the extent to which the effect of government expenditures on output varied across prefectures. The interquartile range of the prefecture-specific multiplier estimates is [-0.14,1.12], with a sample minimum (maximum) of -2.39 (2.89). Hence, there is quite a bit of variation in the marginal effect that government expenditures had on output across prefectures.

While this variation in the prefecture-specific multiplier estimates reflects in part the statistical uncertainty associated with the estimates, Table 6 shows that these multiplier estimates are significantly correlated with prefecture characteristics that, from an economic point of view, could drive the cross-prefecture heterogeneity. Column (1) shows that the multipliers were significantly higher in prefectures with a higher unemployment rate, although this statistical association disappears once regional dummies are included as control variables (see column (2)). More robust is the association between the prefecture-specific multipliers and GDP per capita: in prefectures with a higher (average) income per capita the multiplier was significantly smaller. It is also interesting to note that, consistent with the model in Angeletos and Panousi (2009), the multiplier was significantly lower in prefectures that experienced large declines in commercial land prices during the 1990s. Declines in the price of commercial land imply a decrease in the asset side of firms' balance sheets. This decrease arguably led to a tightening of firms' collateral constraints as the value of collateral against which they could borrow decreased. Last but note least, it is worth noting that increases in the price of residential land were associated with a lower multiplier. Increases in the price of residential land represent a positive wealth effect for households that increases the marginal utility of leisure. This positive wealth effect in turn reduces the incentives to supply labor as a means of buffering the negative wealth effect associated with increases in government expenditures and thus could interact in reducing the overall effect that government expenditures have on output.

6. Conclusion

How effective was government spending in stimulating economic activity in Japan during the crisis of the 1990s? The similarities of the current crisis and the policy response by national

governments with the Japanese experience make this an interesting question. We revisit this issue and seek to assess the size of the regional multiplier effects of government expenditures in Japan using a rich dataset of local public spending. Our first main finding is a significant positive government investment multiplier that on average is not significantly larger than one. While we find that decentralized government investment was more effective in stimulating the economy than centralized government investment, the effects from decentralized government investment on output were not significantly larger than one.

Textbook Keynesian models predict a particularly large output effect of fiscal policy when monetary policy has hit the zero lower bound. Our empirical findings may therefore appear at first hand somewhat surprising. It is important to remember however that in a financial crisis many more things are going on than simply the monetary policy rate approaching the zero lower bound. The credit crunch that occurred in Japan during the 90s indicates that financial markets were in severe distress. With asset prices decreasing rapidly, the value of collateral against which entrepreneurs could borrow to finance their projects decreased. As Angeletos and Panousi (2009) show in a model where financial markets are incomplete, the output effects of government spending can be substantially dampened because the negative wealth effect induced by government spending implies that borrowing constraints become more severe. Our first main empirical finding of an average spending multiplier that is not significantly larger than one is therefore consistent with general equilibrium models that emphasize the supply-side effects of government spending. Our second main finding that the multiplier effects on different types of government spending differ substantially is further consistent with these supply-side models as we find that transfer to firms had a large output multiplier that is significantly larger than one while social assistance and government personnel expenditures had significant negative effects on output per capita.

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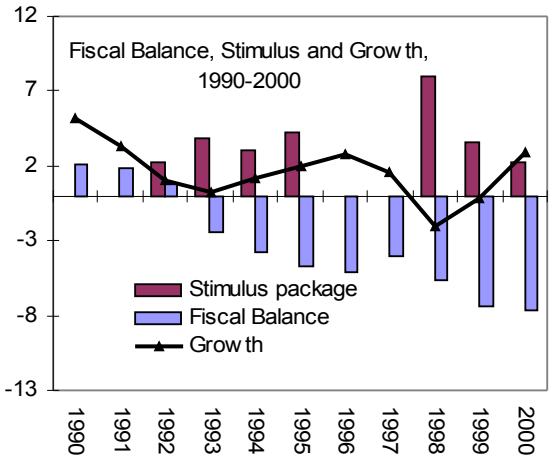
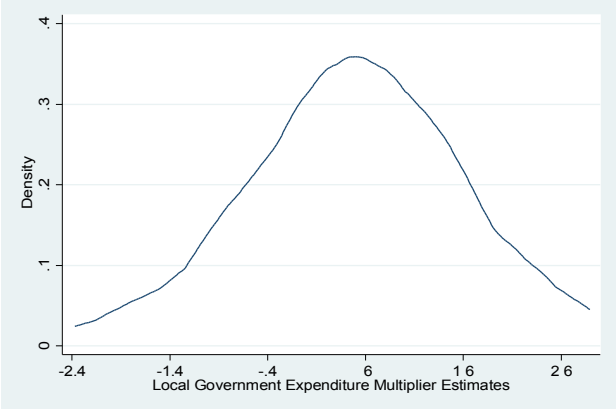
Figure 1. Fiscal Balance, Stimulus, and Economic Growth



Source: Nakagawa (2009); and WEO.

Figure 2. Distribution of Prefecture-Specific Multipliers



Note: The figure shows the density function of the prefecture-specific multiplier estimates that are obtained by applying the Pesaran and Smith (1995) mean-group estimator and instrumenting the government expenditure series with the first lag of the difference. The density function is estimated using an Epanechnikov kernel. The mean (median) is 0.48 (0.59).

Table 1. Summary Statistics

Share of GDP	Mean	Median	Min	Max	Std. Dev.
Total Public Investment	0.121	0.119	0.053	0.209	0.035
Central Government	0.043	0.039	0.011	0.134	0.019
Prefecture Government	0.036	0.035	0.009	0.093	0.014
City Government	0.042	0.041	0.007	0.077	0.010
Total Local Government Expenditures	0.137	0.133	0.056	0.296	0.049
Construction	0.047	0.047	0.009	0.129	0.022
Personnel	0.039	0.037	0.019	0.066	0.011
Transfer Firms	0.013	0.012	0.007	0.027	0.003
Transfer Households	0.004	0.003	0.001	0.012	0.002

Table 2. The Government Investment Multiplier

	(1)	(2)	(3)	(4)
	LS	LS	GMM	GMM
Government Investment	0.36*** (4.15)	0.50*** (5.53)	0.89*** (5.40)	0.79*** (4.91)
Lagged GDP	0.58*** (15.81)	0.63*** (14.27)	0.53*** (8.35)	0.57*** (8.16)
Tax Revenue				-1.25*** (-6.13)
AR(1) Test, p-value	.	.	0.00	0.00
AR(2) Test, p-value	.	.	0.75	0.58
First-Stage F-Statistic	.	.	26.24	29.24
Prefecture FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes
Observations	470	470	470	470

Note: The method of estimation in columns (1) and (2) is least squares, columns (3) and (4) system-GMM (Blundell and Bond, 1998). T-values (shown in parentheses) are based on Huber robust standard errors that are clustered at the prefecture level. Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 3. Estimates of the Government Investment Multiplier by Administrative Level

	(1) Central Government	(2) Prefecture Government	(3) City Government
Government Investment	0.37** (2.13)	0.69** (2.24)	1.03*** (2.70)
AR(1) Test, p-value	0.00	0.00	0.00
AR(2) Test, p-value	0.63	0.63	0.63
First-Stage F-Stat	52.51	39.39	40.10
Prefecture FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	470	470	470

Note: The method of estimation is system-GMM (Blundell and Bond, 1998). The regression controls for lagged GDP and tax revenues (estimates not shown). T-values (shown in parentheses) are based on Huber robust standard errors that are clustered at the prefecture level. *Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 4. Estimates of the Local Government Expenditures Multiplier

	(1) All Local Gov. Expenditures	(2) Transfers to Firms	(3) Construction	(4) Social Assistance	(5) Government Personnel
Government Expenditures	0.74*** (2.72)	2.84** (2.15)	1.09*** (4.77)	-3.25*** (-2.96)	-3.58*** (-2.43)
AR(1) Test, p-value	0.00	0.00	0.00	0.00	0.00
AR(2) Test, p-value	0.21	0.31	0.31	0.31	0.31
First-Stage F-Statistic	11.25	48.47	44.43	41.40	9.65
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	470	470	470	470	470

Note: The method of estimation is system-GMM (Blundell and Bond, 1998). The regression controls for lagged GDP and tax revenues (estimates not shown). T-values (shown in parentheses) are based on Huber robust standard errors that are clustered at the prefecture level. *Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 5. Response of Employment, Private Investment and Consumption

Panel A: Total Employment

	(1) All Government Expenditures	(2) Transfers to Firms	(3) Construction	(4) Social Assistance	(5) Government Personnel
Government	0.03	0.04***	0.01*	-0.02***	0.06
Expenditures	(1.45)	(2.73)	(1.87)	(-3.60)	(0.06)
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	470	470	470	470	470

Panel B: Private Investment

	(1) All Government Expenditures	(2) Transfers to Firms	(3) Construction	(4) Social Assistance	(5) Government Personnel
Government	0.23	2.76**	0.20	-2.11***	-6.25***
Expenditures	(0.82)	(2.17)	(0.80)	(-2.77)	(-3.31)
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	470	470	470	470	470

Panel C: Private Consumption

	All Government Expenditures	Transfers to Firms	Construction	Social Assistance	Government Personnel
Government	-0.24	-0.97	-0.29	3.92	2.05
Expenditures	(-0.50)	(-0.48)	(-0.95)	(1.05)	(0.62)
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	470	470	470	470	470

Note: The method of estimation is system-GMM (Blundell and Bond, 1998). The dependent variable in Panel A is total employment; Panel B private investment; Panel C private consumption. All regressions control for the lagged dependent variable and tax revenues (estimates not shown). T-values (shown in parentheses) are based on Huber robust standard errors that are clustered at the prefecture level. *Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 6. Relationship Between Prefecture-Specific Multiplier Estimates and Prefecture Characteristics

	Dependent Variable: Estimates of Prefecture-Specific Expenditure Multipliers	
GDP Per Capita	-1.943*	-1.939*
(1990-2000 Average)	(-1.83)	(-1.91)
Unemployment	0.245*	-0.001
(1990-2000 Average)	(1.85)	(-0.03)
Commercial Land Price	2.473**	4.250***
(1990-2000 %Change)	(2.05)	(2.97)
Residential Land Price	-2.028	-3.624**
(1990-2000 %Change)	(-1.26)	(-2.09)
Regional Dummies	No	Yes
R-Squared	0.197	0.502
Observations	47	47

Note: The method of estimation is least-squares. The dependent variable is the prefecture-specific multiplier estimates that are obtained from a mean-group regression (Pesaran and Smith, 1997) where the dependent variable is prefecture GDP per capita and the coefficient on the local government expenditures per capita explanatory variable varies across prefectures. Reported t-values are based on Huber robust standard errors. The eight regional dummy indicators are for Hokkaido, Tohoku, Kanto, Chubu, Kansai, Chugoku, Shikoku, Kyushu. *Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Appendix I. Fiscal Stimulus Package in Japan since 1990s

Table Fiscal stimulus packages in Japan since 1990s

(JPY trillion)

	1	2	3	4		5	6			7	8	9	10	11	12	13	14	15	
	1992 Aug Stimulus Package	1993 Apr Stimulus Package	1993 Sep Stimulus Package	1994 Feb Stimulus Package	1995 Tax Reform	1995 Apr Stimulus Package	1995 Sep Stimulus Package	1996 Tax Reform	1997 Tax Reform	1998 Apr Stimulus Package	1998 Nov Stimulus Package	1999 Nov Stimulus Package	2000 Oct Stimulus Package	2001 Oct Stimulus Package	2001 Dec Stimulus Package	2002 Dec Stimulus Package	2008 Aug Stimulus Package	2008 Oct Stimulus Package	TOTAL
Tax cut		**0.2**		**5.9**	**2.0**			**2.0**	**2.0**	**4.6**	**6.0**								**22.6**
Ad hoc personal income tax cut				5.5	2.0			2.0	2.0	4.0									**15.5**
Permanent tax cut in personal and corporate income tax											6.0								**6.0**
Other tax cuts included in the stimulus package		0.2		0.4						0.6									**1.1**
Cash transfer to households											**0.7**							**2.0**	**2.7**
Government investments (Ig) to build up social infrastructure	**6.3**	**7.2**	**2.0**	**3.7**		**5.4**	**9.1**			**7.7**	**8.1**	**6.8**	**5.2**		**4.2**	**3.4**	**1.9**	**2.2**	**73.1**
Public works involving central government	4.5	5.6	1.5	3.4			6.7			1.6	3.6	2.9	2.6		2.3	2.6		1.0	**38.2**
Public works by local governments	1.8	1.6	0.5	0.3			1.0			1.5									**6.7**
Science and technology						0.3				1	1.1	1.2	1		1.2	0.3	0.2	0.1	**6.4**
Education and social welfare										1	1.1	0.6	0.5		0.7	0.5		0.7	**5.1**
Alternative energy and environment										1.6	1	0.6	0.6						**3.8**
Natural disaster relief						5.1	1.4			1	1.3	1.6	0.5				1.7	0.4	**13.0**
Other government measures for;	**4.5**	**5.8**	**4.0**	**5.7**		**1.5**	**5.2**			**4.4**	**9.1**	**11.3**	**5.8**	**5.8**	**0.0**	**11.8**	**9.6**	**22.7**	**107.1**
Acquisition of land for public use	1.6	1.6	0.3	2.3			3.2			1.1									**10.1**
Employment support		0.0		0.0			0.0			0.1	1.0	1.0	1.3	1.3		0.9		0.3	**5.9**
Expansion of policy lending for housing sector	0.8	1.8	2.9	1.2			0.5				1.2	2							**10.4**
Expansion of policy lending and government guarantees for non-financial sector (small and medium size businesses)	1.2	1.9	0.8	1.4		1.4	1.4			2.0	5.9	7.4	4.5	4.5		10.9	9.1	21.8	**74.2**
Others	0.9	0.5		0.8		0.1				1.2	1	0.9					0.5	0.6	**6.5**
Total size of stimulus package	**10.8**	**13.2**	**5.9**	**15.2**	**2.0**	**7.0**	**14.2**	**2.0**	**2.0**	**16.7**	**23.9**	**18.1**	**11.0**	**5.8**	**4.2**	**15.2**	**11.5**	**26.9**	**205.5**
Total size/ GDP (%)	2.2	2.7	1.2	3.1		1.4	2.9			3.3	4.7	3.6	2.2	1.2	0.9	3.1	2.2	5.1	**2.3 (avarage)**
of which (Ig + Tax cuts + Cash transfer)	**6.3**	**7.4**	**2.0**	**9.6**	**2.0**	**5.4**	**9.1**	**2.0**	**2.0**	**12.3**	**14.8**	**6.8**	**5.2**	**0.0**	**4.2**	**3.4**	**1.9**	**4.2**	**98.4**
(Ig+Tax cuts+Cash transfer) / GDP (%)	1.3	1.5	0.4	2.0	0.4	1.1	1.8	0.4	0.4	2.4	2.9	1.4	1.0	0.0	0.9	0.7	0.4	0.8	**1.1 (avarage)**
Nominal GDP	483.8	480.7	480.7	487.0	496.5	496.5	496.5	508.4	513.3	503.3	503.3	499.5	504.1	493.6	493.6	489.9	526.9	526.9	
Central government bond issuance in supplementary budgets	2.3	2.2	3.6	2.2		2.8	4.7			6.1	12.3	7.6	2.0	1.7	0.0	5.0	0.4	n.a.	**52.9**

Note 1) There was an economic package in June 1999 to boost employment by 700 thousand jobs by deregulations and so on, involving almost no additional budgetary outlays. Therefore, this package is not listed in the table.
Note 2) Nominal GDP for 2008 is an estimation by the Japanese government.

Source: Nakagawa (2009).