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

by

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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 fiscal multiplier of government investment and government consumption expenditures. Our main finding is a small but significantly positive multiplier on government investment. The multiplier on government consumption expenditures is on the other hand insignificant and even negative for government personnel expenditures. Decentralized government spending was more effective than centralized government spending but still yielded small output effects. To explain the overall small multipliers we document that government spending had substantial crowding out effects on private investment and private consumption and that the government spending multiplier was more than four times larger during the 70s and 80s than during the 90s, a period when Japan entered into a long-lasting recession with the monetary policy rate hitting the zero lower bound.

Key words: Fiscal policy, fiscal multipliers

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1. Introduction

The financial crisis of 2008/09 and the national governments' endeavours to stimulate the economy has rekindled interest in the Japanese experience with fiscal stimulus plans. Like in the ongoing economic crisis, 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 1.2 percent from an average growth rate of 3.9 percent in the decade earlier. The economic slowdown was precipitated by a bursting of the asset and credit bubble as the stock market declined by 41 percent and credit flow declined by 71 percent between 1989 and 1991. In response, the Japanese government introduced numerous stimulus packages which were continued over the course of the decade. Yet, despite large and repeated fiscal stimulus packages, the cost effectiveness of these packages has been questionable. Growth remained stagnant amidst deflationary pressures and public deficits and debts rose rapidly reflecting both tax revenue slowdown and the increase in government expenditures.

We contribute in this paper 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 to estimate from within-prefecture variation the multiplier effects that government investment and government consumption expenditures have on output. The use of regional data allows us to circumvent important identification issues that arise in country-level VAR analysis of the effects that fiscal policy has on output due to the non-passiveness of monetary policy as well as other "big shocks" that are often difficult to control for. 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 our regional data we find that the output multipliers of government expenditures are generally smaller than one. While government investment expenditures did have a significant positive effect on output, government consumption expenditures had either an insignificant ouput effect or, if government spending was on personnel, a significant negative effect. We also distinguish in our empirical analysis between government investment spending undertaken by the different levels of government administration. There we find that projects undertaken by the city government were about twice as productive as projects undertaken by the central government. While this points towards decentralized government investment being more effective in stimulating economic activity than centralized government investment, the multiplier on city level investment was still smaller than one.

To explain the small magnitude of the multipliers we examine the response of private consumption and private investment to government expenditure shocks. We find that both private consumption and private investment declined substantially as a consequence of increases in government consumption expenditures. Increases in government investment expenditures on the other hand led to substantial crowding out of private consumption but had a positive though insignificant effect on private investment. Hence, on the demand side we find that government expenditures were associated with the crowding out of private demand, both in terms of private investment as well as private consumption.

We also document using the regional data a strong decline in the government expenditure multiplier over time. While over the course of the 70s and 80s a 1 percent increase in government expenditures was associated with an increase in output by about 0.4 percent, an expenditure shock of similar magnitude increased output during the 90s by only about 0.1 percent. Hence, the size of the government expenditure multiplier during the 90s was only about one-fourth of the size of the multiplier during the 70s and 80s. This decline in the multiplier fits well with the decline in the marginal product of public capital that we document to explain why government expenditure increases had relatively small output effects in Japan during the 1990-2000 period from a supply-side point of view. The decline in the marginal product of public capital resonates Hayashi and Prescott (2002) who argue that the "lost decade" in Japan was associated with a strong decline in total factor productivity.

There exists a fairly large empirical macro literature that has estimated the effects of government expenditures on output using VAR techniques.[1] Our paper differs from these studies in mostly three aspects. First, we use prefecture data on total public investment as well as local government expenditures to calculate the multiplier. Local governments play an important role in Japan as they comprise 60 percent of spending and an even larger share in public investment. About 80 percent of public works projects were implemented by local government and about 65 percent were financed by the local government during the nineties. The availability of a rich dataset allows us to explore various dimensions of fiscal policy including the different types of spending and regional allocation during the nineties. Secondly, we use Generalized Method of Moments (GMM) to estimate the multiplier effects, which allows us to obtain consistent estimates even if government expenditures are affected on impact by changes in the regional economic environment. Finally, by extending the analysis of the marginal productivity of capital beyond the so-called "lost decade", we complement the analysis of multiplier effects with the longer-term productivity of public

1 See for example Edelberg et al. (1999); Fatas and Mihov (2001); Blanchard and Perotti (2002); Burnside et al. (2004); Perotti (2005); Gali et al. (2007); or Afonso and Aubyn (2008) among many others.

investment spending.

The remainder of the paper is organized as follows. Section 2 provides a background on the fiscal stimulus packages and a review of the literature on the effectiveness of public spending in Japan. Section 3 describes the empirical strategy and the data. Section 4 presents the results on the estimation of multiplier effects of public spending. Section 5 assesses in further detail the possible reasons for the size of the multipliers with a focus on crowding out effects and the declining multiplier over time. Section 6 concludes.

2. Background

2.1 Overview of 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 due to low productivity.

Policy loans, including credit guarantees, played a more prominent role later in the decade and in the recent financial crisis[2]. Cash transfers through employment support, social security spending, and cash vouchers for households accounted for a relatively small share of the stimulus

2 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.

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.

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.

2.2 Empirical Literature on the Expenditure Multiplier in Japan

There exists a small empirical literature on the multiplier effect 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 (2000)). Kuttner and Posen (2002) on the other hand use a structural VAR model based on an identification strategy developed in Blanchard and Perotti (2002) and find a much higher 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.

3 Empirical 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 output. Our dataset contains detailed data on the different components of both public investment as well as public consumption expenditures for 47 different prefectures. This provides us with a unique opportunity to study the effects that different types of government spending have on economic activity by focusing on the link between within-prefecture variation of output and within-prefecture variation of government expenditures. For details on the data sources, please see the Data Appendix.

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

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

where $Y_{c,t}$ is value added of prefecture c in year t and $G_{c,t}$ is government expenditure 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. The error term $u_{c,t}$ is allowed to be heteroskedastic and possibly autocorrelated. All variables are expressed in logs of the levels. Hence estimates can be interpreted as capturing prefecture-specific (relative) deviations from steady state. The expenditure multiplier is given by the parameter estimate p.[3]

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 course of the 90s. Because monetary policy affects economic activity in prefectures in a similar way it will be fully accounted for by the year-specific 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.

Our model also allows us to circumvent to a certain degree an endogeneity bias that is due to fiscal policy responding to changes in the economic environment. If government expenditures increase during times of recessions, 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 the overall response of government expenditures to recessions is fully captured by our year fixed effects. It would therefore have to be the case that fiscal policy is countercyclical at the prefecture level in order for our estimates to be downward biased due to the endogenous response of

3 Note that the multiplier is estimated as an elasticity. To obtain the absolute effect on output for an absolute increase in government expenditures (e.g. dY/dG) the elasticity estimates need to be multiplied by the inverse of the share of government expenditures in GDP, which is $(0.14)^{-1}$ for local government expenditures and $(0.12)^{-1}$ for general government investment.

(prefectural) government expenditures to (prefectural) changes in output. To deal with this expectedly small, though not implausible bias we use system Generalized Method of Moments (SYS-GMM) estimation (Blundell and Bond, 1998). The SYS-GMM estimator uses lagged first-differences of the series as instruments for the equation in levels. To the extent that these past first-differences are uncorrelated to contemporaneous changes in the economic environment the SYS-GMM estimator will provide consistent estimates of the fiscal multiplier, even if government expenditures react countercyclically to output at the prefectural level. In addition, we use cyclically adjusted fiscal variables, following the procedure outlined in Blanchard and Perotti (2002) to identify the effects that fiscal shocks have on regional output.

4. Main Results

4.1 The Government Investment Multiplier

Table 1 presents our panel data estimates of the public investment multiplier based on data of general public investment expenditures in a prefecture-year.[4] In column (1) we show the ordinary least squares estimates where the control variables are prefecture-specific fixed effects as well as year-specific fixed effects. The estimated coefficient on the government investment multiplier is 0.124 and the estimate is statistically significant at the 1 percent level. In column (2) we present the corresponding SYS-GMM estimate that uses past first-differences as instruments for the levels. The SYS-GMM estimate is somewhat larger than the least squares estimate yielding a multiplier estimate of 0.131 that is also statistically significant at the 1 percent level.[5]

Introducing additional control variables does not change the point estimate on the government investment multiplier significantly. In columns (3) and (4) we control for tax revenues and public debt, in addition to the prefecture and year fixed effects. While tax revenues enter as significantly negative, public debt turns out to be insignificant.[6] In columns (5) and (6) we control for private investment and employment in order to capture supply and demand-side effects from the capital and labor markets. In this case, the estimate on the government investment multiplier decreases to about 0.098 but is still significantly different from zero at the 1 percent level.

To account for intra-regional trade effects column (7) includes prefecture exports as an

4 The general public investment expenditures data include investment spending by the city government, the prefecture government, and the central government in a given prefecture-year. The share of city (prefecture) government investment spending in total investment spending is 0.36 (0.30).

5 These estimates assume that the marginal effect of government investment expenditures on regional output is homogenous across prefectures. To check this we plot in Figure 1 the kernel density estimate of the distribution of prefecture-specific multipliers obtained by estimating equation (1) with p varying across prefectures. As can be seen from the figure, there does not appear to be large heterogeneity in these multipliers across prefectures.

6 The insignificance of the debt variable is consistent with the theoretical literature on the neutrality of debt (see for instance Barro (1989)).

additional regressor in the estimating equation. Increases in exports have a significant positive effect on output and controlling for exports implies that the point estimate on the government investment multiplier decreases to about 0.08. It could however be that our panel estimates miss out on important spill-over effects of government investment undertaken by other prefectures. To check this we construct a government investment externality series computed as the sum of all government investment undertaken by other prefectures. It turns out that this investment externality series enters with a coefficient of 0.065 (column (8)), suggesting that government investment undertaken in other prefectures has positive spill-over effects. Yet, the coefficient is very imprecisely estimated so that in the statistical sense these spill-over effects are not significant.[7]

In column (9) we show the dynamic panel estimates where lagged GDP is included as an additional right-hand-side regressor. The estimated AR(1) coefficient on the lagged GDP series is 0.5 indicating that there is quite a bit of persistence in GDP but that this persistence is far from being unit root. The dynamic specification allows us to distinguish between the short-run and long-run effects of government investment on GDP. The short-run elasticity of a permanent increase in government investment is 0.054 as reported in column (9). The long-run effect, which can be interpreted as the cumulative effect of a permanent increase in government investment is 0.108 (calculated as 0.054 times the inverse of the characteristic polynomial $(1-0.5L)^{-1}$). The estimates imply that a one-time increase in government investment increases GDP on impact by 0.054 percent and that after one year already half of this effect will have washed out.[8]

An interesting policy question is whether investments in public infrastructure projects—a key focus of numerous fiscal stimulus packages—yield higher multiplier effects than other investments such as in livelihood investments. To address this question, we repeat the above analysis for specific government investment multipliers, distinguishing government investment by purpose (livelihood, industry, agriculture, land, and other investment).[9] Contrary to expectations, we find that the multiplier for industry which covers highways, harbours and other infrastructure investments, comprising nearly a quarter of the public investment spending, is among the lowest, confirming anecdotal evidence of lack of effectiveness of government's investment policies. We also find that the multiplier for livelihood investment, which comprise nearly half of the public investment, is much higher. These represent primarily investments in tertiary roads, educational

7 Summing up the individual effect and externality effect of public investment on output in column (8) yields a total cumulative multiplier of 0.14. Note that this larger multiplier is not significantly different from the multiplier obtained in column (7) where we did not account for potential externalities in public investment on output.

8 Figure 2 plots the impulse response functions from a bivariate panel VAR regression. The bottom left-hand-side figure shows that the peak effect of government investment on GDP is in fact on impact (e.g. in the same year) and steadily declines thereafter.

9 See Data Appendix Table 1 for details on the coverage of the different types of investment.

facilities, public sewerage which are implemented by city, town and village level governments. We also repeat the regression including all four types of investments (not reported) and find that the coefficients are of a similar magnitude but only livelihood and agricultural investments are significant.

We further examine the multiplier effects of investment spending by administrative level (central government, prefecture government, city government). Consistent with the findings above, we find that government investment undertaken by the cities had multipliers that were almost twice as large as the investment multiplier on projects carried out by the central government and the prefectures. The estimates are suggestive of decentralized government investment being more effective than centralized government investment. 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.

4.2 The Government Expenditure Multiplier

We repeat the empirical analysis for public expenditures of the local (prefecture-level) government. Local government spending comprise a significant share of total public 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) presents the least squares estimates, followed in column (2) by the SYS-GMM estimates. The control variables are prefecture fixed effects and year fixed effects, which are jointly significant at the 1 percent level. For the least squares regression the estimated expenditure multiplier is 0.168 and for the SYS-GMM regression 0.218. Hence, we find that similarly to the previous estimates that SYS-GMM estimates produce somewhat larger coefficients on the government expenditure multiplier than least squares estimates, which is consistent with least squares estimates being downward biased if government investment and government consumption expenditures increase (decrease) during times of recessions (booms).

We repeat the estimations using the same control variables as above, except for the externality effects where we include a measure of total government spending undertaken in other prefectures. In contrast to the government investment estimates above which were insignificant, we find that there are significant positive spillover effects coming from government expenditures undertaken in other prefectures (column (8)). This continues to be the case when taking into account

dynamics in GDP although significance on the externality series drops to the 10 percent level (column (9)). It is also interesting to note that tax multipliers are significant and the multipliers tend to be generally larger than the spending multipliers.

Next, we compare the multiplier effects of public investment to that of public consumption by examining the different components of government expenditures. The dataset provides a breakdown of government expenditures in key areas such as ordinary construction, social assistance, transfers to non-households (firms) and government employment. We find that there are substantial differences in these multipliers (Table 4): government expenditures on investment such as ordinary construction has a positive and statistically significant multiplier effect while that of subsidy expenditures in form of transfers to low income households turns out to be negative and insignificant. Furthermore, we find that government expenditures on personnel has a significant negative effect on GDP, which is consistent with theoretical macro models predicting a negative effect on aggregate output when employment shifts from the private to the public sector (Finn, 1998; van der Ploeg, 2006).[10] While consistent with the literature that public investment yields higher multipliers than consumption, the magnitude of the estimates are still quantitatively small.

5. Factors Contributing to the Low Multipliers

5.1 Crowding Out of Private Demand

To gain an understanding for why the estimated multipliers were quantitatively small, though statistically significant we begin by examining the effects of public expenditures on private investment and private consumption (Table 5). Panel A presents estimates for the effects of government investment, while Panel B presents the corresponding estimates for local government expenditures. All regressions control for prefecture and year fixed effects, prefecture-year changes in tax revenues, public debt, exports, employment, and output as well as private investment where appropriate.

Our first main finding is that public investment had a positive but statistically insignificant effect on private investment. This can be seen by looking at column (1) in Panel A of Table 5 where the point estimate on the government investment variable is 0.04 with a standard error of 0.05. While quantitatively this estimate suggests that public investment is complementary to private investment the total effect is not significant. Hence, the estimate shows that public investment had neither a (strong) crowding in nor a (strong) crowding out effect on private investment.

10 For an empirical study of OECD countries that finds similar adverse effects of government personnel expenditure, see Alesina et al. (2002). On the other hand, Pappa (2009) documents for the US that private employment significantly increases due to government expenditure increases.

A quite different picture arises when looking at local government expenditures. Column (1) of Panel B shows that private investment declined substantially due to government expenditure increases: a 10 percent increase in government expenditures decreased private investment by more than 4.3 percent on average. This effect is statistically significant at the 1% level. Hence, we find that government expenditures had strong crowding out effects on private investment, which is consistent with the theoretical macro literature predicting a decrease in private investment in response to increases in government expenditures due to households buffering negative wealth effects by depleting savings, requiring a higher real interest rate for the capital market to clear (Baxter and King, 1993).

In Table 5, column (2) we also show that there were strong crowding out effects of local government expenditures and general government investment on private consumption. Specifically, we find that a 10 percent increase in government investment decreased private consumption by 0.8 percent and that a 10 percent increase in local government expenditures decreased private consumption by about 1.6 percent. The empirical macro literature on crowding out effects remains divided with some papers finding similar to our results a negative effect of government spending on private investment (see for example Blanchard and Perotti, 2002; or Mountford and Uhlig, 2008) as well as a negative effect on private consumption (see for example Edelberg et al., 1999) while others have found private consumption and private investment to weakly increase in response to positive government expenditure shocks (see for example Fatas and Mihov, 2001; Burnside et al., 2004; or Gali et al., 2007).

5.2 Declining Marginal Product of Public Capital and Declining Fiscal Multiplier Over Time

Another strand of literature approaches the issue from the supply-side. Accordingly, the low multiplier effect is explained by a low marginal productivity of public capital. Several studies have documented that the marginal product of public capital has been on the decline over the years in Japan due to overinvestment in the economy.[11] To examine this with our panel set up, we compute the elasticity of capital across prefectures by estimating the production function for regional output. Following Aschauer (1979) and Munnell (1990), we assume that public capital is productive and enters the production function, which allows us to assess the productivity of public capital. Assuming a generalized Cobb Douglas production function and translating the equation in logarithms in the spirit of Blundell and Bond (2000), we consider the following equation:

11 Japan's public investment ratio, in the early nineties, was nearly the double that of other advanced industrial countries and the capital stock was among the highest in the OECD (Kamps (2004)).

(2) $$Y_{c,t} = a_c + d_t + \beta_k K_{c,t} + \beta_g G_{c,t} + \beta_L L_{c,t} + u_{c,t}$$

where the elasticity of private and public capital are denoted by β_k and β_g respectively, and β_L is the elasticity of output with respect to labor. An important constraint is the calculation of the capital stock for the prefectures. For this estimation, we obtained the data on the public and private capital stock from Doi (1998) covering the period 1975-1998. Following Munnell (1990), the stock of public capital is apportioned to each region by the level of public investment in each region and the share of private capital by the various types of activities undertaken in the region.

In Table 6 we report our estimates of the capital-output elasticity of both private and public capital. Columns (1) and (2) impose constant returns to scale in all three factors of production and this yields estimates of the private and public capital elasticity of 0.35 and 0.37, respectively, when using least squares (see column (1)), and 0.28 and 0.32 respectively when using GMM (see column (2)). In columns (3) and (4), we relax the constant returns to scale assumption and this yields somewhat larger point estimates of the capital elasticity (0.58 for private capital and 0.46 for public capital).

In Figure 2 we document the decline of the marginal product of public capital for the 1975-2000 period by plotting the output to capital ratio multiplied by the estimated elasticity of public capital. As can be seen there is strong evidence of a declining marginal product of capital. The decline was particularly strong for the 1975-1985 period and the 1990-2000 period. Hence, this points towards a substantial decline in the productivity of public investment that contributed to the low fiscal multiplier in the 1990s (see here also Hayashi and Prescott, 2002).

In Table 7 we show that indeed the fiscal multiplier was much larger during the pre-1990 period, which fits well with the declining marginal product of public capital documented in the above figure. According to the estimates in columns (1) and (2) a 1 percent increase in government expenditures increased output in Japan during the 70s and 80s by about 0.4 percent. In contrast, columns (3) and (4) show that during the 90s the effectiveness of government spending on output was much smaller as a 1 percent increase in government expenditures increased output by about 0.1 percent.[12] Hence, the government expenditure multiplier declined substantially in Japan over time, a phenomenon that has also been documented for other OECD countries (see for example Perotti (2005)).

6. Conclusion

How effective was government spending in stimulating the economy in Japan during the economic

12 Note that these estimates are for local government expenditures that include both government investment and government consumption expenditures as we do not have information for the pre-1990 period on prefecture-level government investment expenditures only.

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 multiplier effects of government expenditures using a rich dataset of regional public spending. We find low government investment multipliers, and even negative or statistically insignificant multipliers on government consumption. While we find that decentralized government investment was more effective in stimulating the economy than centralized government investment, in absolute terms the effects from decentralized government investment on output were still quantitatively quite small.

To understand the cause for the low multipliers we examined potential crowding out effects of government expenditures on private demand. We found that both private investment as well as private consumption significantly decreased due to increases in government expenditures. The increase in public sector demand therefore led to a significant reduction in private sector demand, which contributed to a small overall output effect of government expenditures. From the supply side point of view, we documented a substantial decline in the marginal product of public capital over time, which possibly reflects the substantial decline in total factor productivity in Japan during the 90s (e.g. Hayashi and Prescott, 2002). We also showed that the multiplier on government expenditures was much higher during the 70s and 80s than it was during the 90s, thus pointing to a decline over time in the effectiveness of government expenditures in stimulating economic activity.

As a concluding remark we would like to point out that we are well aware of the substantial differences in multipliers across countries (see for instance Perotti, 2005). To us, these differences in multipliers across countries reflect to a large extent the cross-country differences in deep structural parameters, such as the rigidity of the labor market or the quality of public administration. From the policy point of view, our paper therefore does not claim -- nor does it intend to predict -- a general ineffectiveness of government expenditures. Rather, we see our paper as contributing to a better understanding of the substantial differences and uncertainty of the effects that fiscal policy can have on the macroeconomy during times of severe economic crisis.[13] Such an understanding we believe is important because it calls for prudence and caution when pushing for a more expansionary fiscal policy. This is particularly true in light of the tremendous build-up of public debt that will haunt future generations and possibly call for drastic policy acts in the future. As the data become available a promising line for future research will therefore be to assess the effectiveness of the enormous government expenditures undertaken during the current crisis.

13 See Christiano et al. (2009) for a recent theoretical paper on the effectiveness of government expenditures when the zero lower bound on the nominal interest rate is binding. The main prediction of their theoretical model is that when the zero lower bound on the nominal interest rate is binding government expenditures should have a particularly large output effect.

References

Afonso, A., and M. Aubyn, 2008, "Macroeconomic Rates of Return of Public and Private Investment: Crowing-In and Crowding-Out Effects." ECB Working Paper No. 864.

Alesina, A., S. Ardagna, R. Perotti, and F. Schiantarelli, 2002, "Fiscal Policy, Profits and Investment," *American Economic Review* 92: 571–89.

Barro, R.,1989, "The Ricardian Approach to Budget Deficits," *Journal of Economic Perspectives* 3: 37–54.

Baxter, M., and R. King, 1993, "Fiscal Policy in General Equilibrium," *American Economic Review* 83: 315–35.

Bayoumi, T., 2000, "The Morning After: Explaining the Slowdown in Japanese Growth," in *Post Bubble Blues: How Japan Responded to Asset Price Collapse*, ed. by T. Bayoumi and C. Collyns (Washington: International Monetary Fund).

Blanchard, O., and R. Perotti, 2002, "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output," *Quarterly Journal of Economics* 117: 1329–368.

Blundell, R., and S. Bond, 1998, "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models," *Journal of Econometrics* 87: 115-43.

Blundell, R., and S. Bond, 2000, "GMM Estimation with Persistent Panel Data: An Application to Production Functions," *Econometric Reviews,* Vol. 19, pp 321-40.

Burnside, C., M. Eichenbaum, J. Fisher, 2004, "Fiscal Shocks and their Consequences," *Journal of Economic Theory* 115: 89-117.

Christiano, L., M. Eichenbaum, and S. Rebelo (2009). "When is the Government Spending Multiplier Large?" mimeo Northwestern University.

Doi, T., 1998, "Policies, Business Cycles, and Elections in Japan," *Journal of Economic Studies* 40: 29-45.

Edelberg, W., M. Eichenbaum, and J. Fisher, 1999, "Understanding the Effects of a Shock to Government Purchases," *Review of Economics Dynamics* 2:166-206.

Fatas, A. and I. Mihov, 2001, "The Effects of Fiscal Policy on Employment and Consumption: Theory and Evidence," CEPR Discussion Paper No. 2760.

Favero, C.,and F. Giavazzi, 2007, "Debt and the Effects of Fiscal Policy," NBER Working Paper No. 12822.

Finn, M., 1998, "Cyclical Effects of Government's Employment and Goods Purchases," *International Economic Review* 39: 635–57.

Gali, J., J. Lopez-Salido, and J. Valles, 2007, "Understanding the Effects of Government Spending on Consumption," *Journal of the European Economic Association* 5: 227-270.

Hayashi, F., and E. Prescott, 2002, "The 1990s in Japan: A Lost Decade," *Review of Economic Dynamics* 5: 206–35.

Ihori, T., T. Nakazato, and M. Kawade, 2003, *Japan's Fiscal Policies in the 1990s*. Blackwell Publishing Ltd., Oxford.

International Monetary Fund, 2009, "Revisiting Japan's Lost Decade," Regional Economic Outlook: Asia and Pacific, May 2009, (Washington: International Monetary Fund).

Kalra, S., 2003, "Fiscal Policy: An Evaluation of its Effectiveness," in *Japan's Lost Decade: Policies for Economic Revival*, ed. by Tim Callen and Jonathon Ostry (Washington: International Monetary Fund).

Kamps, C., 2004, "New Estimates of Government Capital Stocks for 22 OECD Countries 1960-2001," IMF Working Paper WP/04/67 (Washington: International Monetary Fund).

Kuttner, K. and A. Posen, 2002, "Fiscal Policy Effectiveness in Japan," *Journal of the Japanese and International Economics* 16: 536–58.

Love, I. and L.Ziccino, 2006, "Financial Development and Dynamic Investment Behaviour: Evidence from Panel VAR," *Quarterly Review of Economics and Finance* 46: 190-210.

Matsuoka, M., 1996, “Measuring the Effects of Fiscal Policy in Japan,” (unpublished; Daiwa Institute).
Miyazaki, T., 2009, “Public Investment and Business Cycles: The Case of Japan,” *Journal of Asian Economics* 20: 419–26.
Mountford, A. and H. Uhlig, 2008, “What are the Effects of Fiscal Policy Shocks,” NBER Working Papers No. 14551.
Munnell, A., 1990, “How Does Public Infrastructure Affect Regional Economic Performance?” *New England Economic Review* (Federal Reserve Bank of Boston, September/October), 11–32.
Nakagawa, M., 2009, “Note on Stimulus Packages in Japan Since 1990s,” (unpublished IMF).
Perotti, R, 2005, “Estimating the Effects of Fiscal Policy in OECD Countries,” CEPR Discussion Paper 4842.
OECD(2000), *OECD Economic Surveys*, 1999-2000: Japan, OECD, Paris.
Pappa, E. (2009). "The effects of fiscal shocks on employment and the real wage." *International Economic Review* 50: 217-244.
van der Ploeg, R., 2006, “Rolling Back the Public Sector: Differential Effects on Employment, Investment, and Growth.” *Oxford Economic Papers* 58: 103–22.

Table 1. The Government Investment Multiplier

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	LS	GMM	GMM	GMM	GMM	GMM	GMM	GMM	GMM
Government Investment	0.124***	0.131***	0.136***	0.133***	0.098***	0.096***	0.081***	0.082***	0.054***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Tax Revenue			-0.086**	-0.107***	-0.143***	-0.130***	-0.164***	-0.164***	-0.141***
			(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.02)
Public Debt				-0.011	-0.021	-0.025	-0.022	-0.022	-0.006
				(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Private Investment					0.115***	0.118***	0.086***	0.086***	0.049***
					(0.04)	(0.03)	(0.03)	(0.03)	(0.02)
Employment						0.222***	0.167***	0.167***	0.067*
						(0.07)	(0.05)	(0.05)	(0.04)
Exports							0.051***	0.051***	0.032**
							(0.02)	(0.02)	(0.01)
Public Investment Externality								0.066	0.009
								(0.05)	(0.04)
Lagged GDP									0.500***
									(0.04)
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2) test, p-value	.	0.217	0.260	0.268	0.726	0.466	0.340	0.339	0.260
Observations	470	470	470	470	470	470	410	410	410

Note: The method of estimation in column (1) is least squares; columns (2)-(9) SYS-GMM using instruments dating 2 years and further back (Blundell and Bond, 1998). Heteroscedasticity and autocorrelation robust standard errors are shown in parentheses. The dependent variable is log GDP; all explanatory variables are in logs. *Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 2. Estimates of Specific Government Investment Multipliers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	LS	GMM	GMM	GMM	GMM	GMM	GMM	GMM
	Livelihood	Industry	Agriculture	Land	Other	Central Gov.	Prefecture	City
Government Investment	0.039***	0.014***	0.043***	0.039***	0.012***	0.028***	0.022**	0.044***
	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2) test, p-value	0.262	0.239	0.399	0.326	0.402	0.360	0.220	0.280
Observations	410	410	410	410	410	410	410	410

Note: The method of estimation is SYS-GMM using instruments dating 2 years and further back (Blundell and Bond, 1998). Heteroscedasticity and autocorrelation robust standard errors are shown in parentheses. The dependent variable is log GDP; all explanatory variables are in logs. Additional control variables (not shown) are tax revenue, public debt, private investment, exports, and lagged GDP. *Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 3. The Local Government Expenditure Multiplier

	(1) LS	(2) GMM	(3) GMM	(4) GMM	(5) GMM	(6) GMM	(7) GMM	(8) GMM	(9) GMM
Government Expenditure	0.168**	0.218***	0.201***	0.221***	0.158**	0.145**	0.056	0.065	0.041*
	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)	(0.06)	(0.06)	(0.02)
Tax Revenue			-0.066	-0.080	-0.097**	-0.101**	-0.144***	-0.146***	-0.119***
			(0.05)	(0.05)	(0.05)	(0.04)	(0.03)	(0.03)	(0.02)
Public Debt				-0.047**	-0.042**	-0.048***	-0.035	-0.036*	-0.011
				(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Private Investment					0.148***	0.148***	0.126***	0.126***	0.066***
					(0.04)	(0.03)	(0.03)	(0.03)	(0.02)
Employment						0.239**	0.144*	0.144*	0.049
						(0.10)	(0.08)	(0.08)	(0.04)
Exports							0.058**	0.059**	0.034**
							(0.02)	(0.02)	(0.02)
Expenditure Externality								0.491***	0.094*
								(0.11)	(0.06)
Lagged GDP									0.560***
									(0.04)
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(2) test, p-value	.	0.041	0.039	0.316	0.138	0.102	0.446	0.444	0.352
Observations	470	470	470	470	470	470	410	410	410

Note: The method of estimation in column (1) is least squares; columns (2)-(9) SYS-GMM using instruments dating 2 years and further back (Blundell and Bond, 1998). Heteroscedasticity and autocorrelation robust standard errors are shown in parentheses. The dependent variable is GDP; all variables are in logs. *Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 4. Estimates of Specific Local Government Expenditure Multipliers

	(1) Government Personnel	(2) Social Assistance	(3) Transfers to Firms	(4) Construction
	GMM	GMM	GMM	GMM
Expenditure	-0.127**	-0.010	0.055***	0.036***
	(0.06)	(0.01)	(0.02)	(0.01)
Prefecture FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
AR(2) test, p-value	0.364	0.530	0.162	0.293
Observations	410	410	410	410

Note: The method of estimation is SYS-GMM using instruments dating 2 years and further back (Blundell and Bond, 1998). Heteroscedasticity and autocorrelation robust standard errors are shown in parentheses. The dependent variable is GDP; all variables are in logs. Additional control variables (not shown) are tax revenue, public debt, private investment, exports, and lagged GDP. *Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 5. The Effect of Government Investment (Expenditures) on Private Investment and Consumption

Panel A: Government Investment

	(1) Private Investment	(2) Private Consumption
	GMM	GMM
Government Investment	0.042	-0.078**
	(0.07)	(0.04)
Prefecture FE	Yes	Yes
Year FE	Yes	Yes
AR(2) test, p-value	0.309	0.175
Observations	410	410

Panel B: Government Expenditure

	(1) Private Investment	(2) Private Consumption
	GMM	GMM
Government	-0.436*	-0.159
Expenditure	(0.25)	(0.14)
Prefecture FE	Yes	Yes
Year FE	Yes	Yes
AR(2) test, p-value	0.185	0.802
Observations	410	410

Note: The method of estimation is SYS-GMM using instruments dating 2 years and further back (Blundell and Bond, 1998). Heteroscedasticity and autocorrelation robust standard errors are shown in parentheses. Additional control variables (not shown) are tax revenue, debt, exports, employment, and GDP as well as private investment where appropriate. The dependent variable in column (1) is private investment; column (2) private consumption. All variables are in logs. *Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 6. Estimates of the Output Elasticity of Capital

	Imposing Constant Returns to Scale		Flexible Functional Form	
	(1)	(2)	(3)	(4)
	LS	GMM	LS	GMM
Private Capital Elasticity	0.346***	0.283**	0.452**	0.580***
	(0.09)	(0.13)	(0.18)	(0.18)
Public Capital Elasticity	0.368***	0.323***	0.314***	0.461***
	(0.06)	(0.10)	(0.07)	(0.13)
Prefecture FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	368	368	368	368

Note: The method of estimation in columns (1) and (3) is least squares; columns (2) and (4) SYS-GMM using instruments dating 2 years and further back (Blundell and Bond, 1998). Heteroscedasticity and autocorrelation robust standard errors are shown in parentheses. The dependent variable is GDP. All variables are in logs. *Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Table 7. Declining Fiscal Multiplier

	1975-1989		1990-2000	
	(1)	(2)	(3)	(4)
	LS	GMM	LS	GMM
Government Expenditure	0.442***	0.444***	0.073***	0.072***
	(0.07)	(0.07)	(0.02)	(0.02)
Lagged GDP	0.250***	0.252***	0.693***	0.756***
	(0.01)	(0.02)	(0.04)	(0.04)
Prefecture FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	690	690	470	470

Note: The method of estimation in columns (1) and (3) is least squares; columns (2) and (4) SYS-GMM using instruments dating 2 years and further back (Blundell and Bond, 1998). Heteroscedasticity and autocorrelation robust standard errors are shown in parentheses. The dependent variable is GDP. All variables are in logs. *Significantly different from zero at the 90 percent confidence level, ** 95 percent confidence level, *** 99 percent confidence level.

Figure 1. Distribution of Government Investment Multipliers Across Prefectures

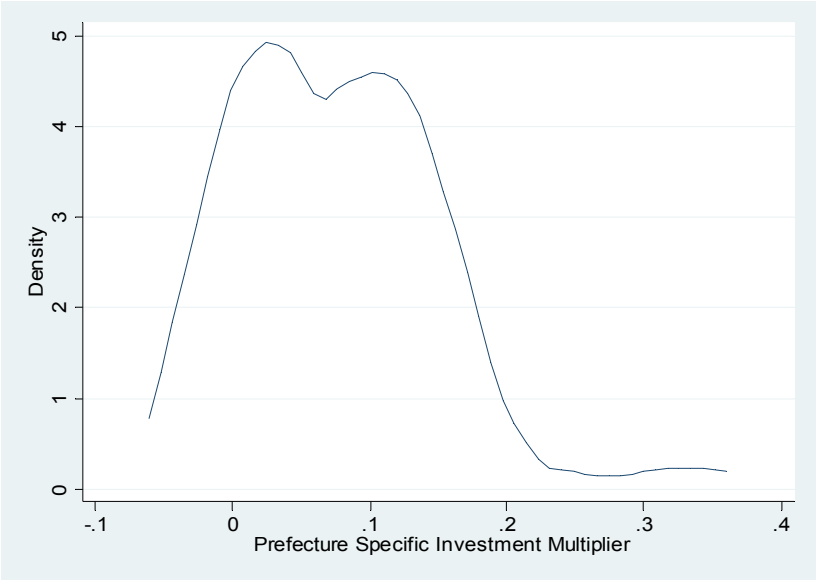


Figure 2. Panel VAR Impulse Responses for GDP and Government Investment

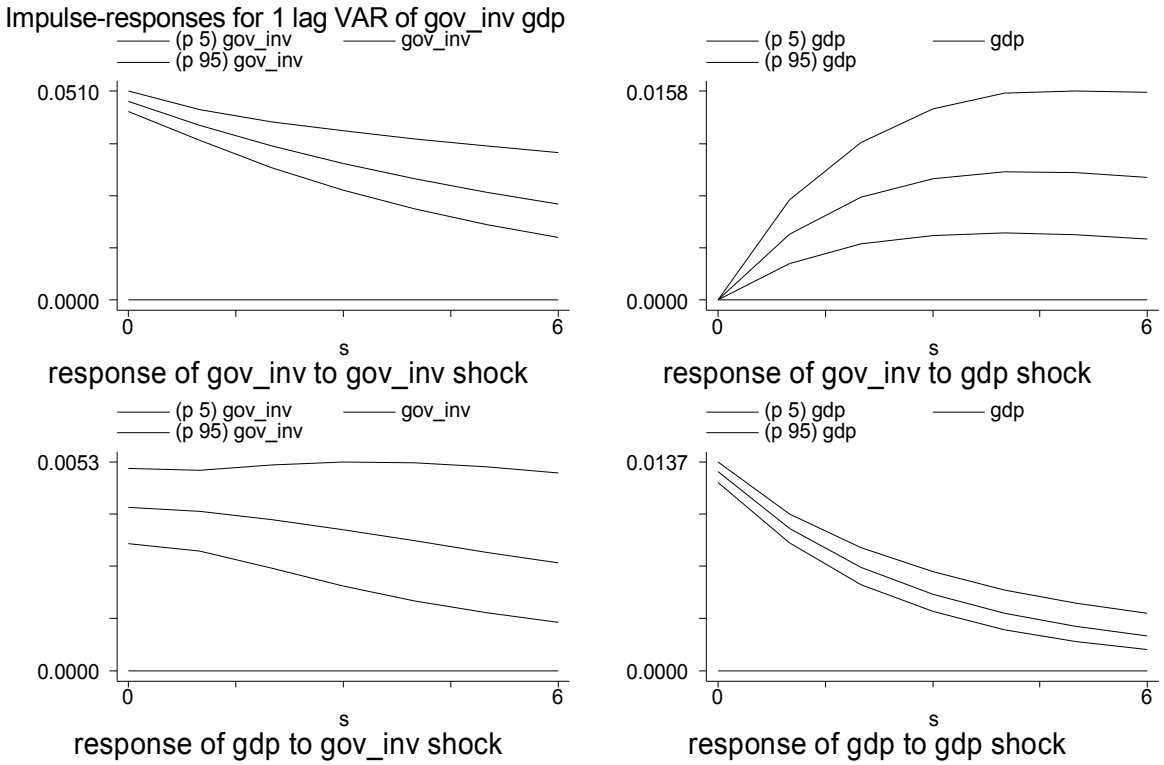
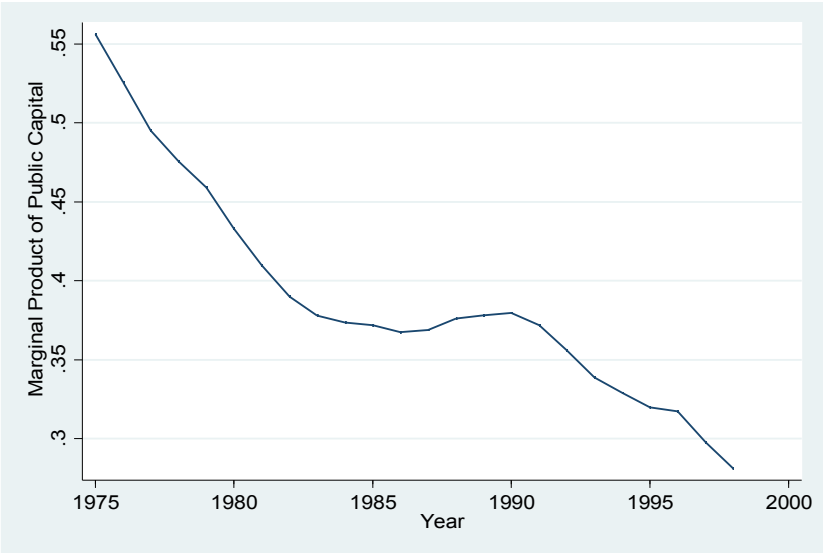


Figure 3. Declining Marginal Product of Capital



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).

Data Appendix

We obtain annual prefecture level data for 47 Japanese prefectures during the 1990-2000 period from the Japan Statistical Yearbook. The Japan Statistical 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 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 Japan Statistical Yearbook also provides detailed local government finance data on government expenditures and government tax revenues from the ordinary accounts of local governments. The 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. We obtain from the Japan Statistical Yearbook also prefecture-level GDP, export, employment, and investment data. Public capital stock data are from Doi (1998).

Data Appendix Table 1. Description of Specific Investment Measures Used

Variable	Description	Source
Livelihood Investment (44 % of total investment)	• city, town and village roads • streets • city planning • housing • environment sanitation • welfare (including works of hospitals) • educational facilities • water supplies	Japan Statistical Yearbook
Industry Investment (22 % of total investment)	• national highways and prefectural roads • harbors • airports • industrial water	Japan Statistical Yearbook
Agricultural Investment (12 % of total investment)	• agriculture, forestry, fishery	Japan Statistical Yearbook
Land Conservation Investment (10 % of total investment)	• forest and river conservation • seashore conservation	Japan Statistical Yearbook
Other Investment (12 % of total investment)	• unemployment measures • disaster restoration • government office repairs • railways • subways electricity • gas • residential land formation	Japan Statistical Yearbook