

# Public Investment and Stock Price Returns: The Case of Japan<sup>♦</sup>

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This research examines the effects of public investment on stock price returns using the Japan's cross-industry data. To do so, we calculate the impulse response function by local projection method. The empirical results show that public investment has a positive impact on stock price returns. We observe this mainly for manufacturing industries both in quarterly and annual data. However, the policy effects after the 1990s was not necessarily large enough to stimulate the economy. Our empirical evidence on the post high-growth era in Japan suggests that public investment has been partly useful to support the revitalization of stock market.

*JEL classification:* E44, G12, H54

*Keywords:* Public investment in Japan; Stock price targeting; Local projection method

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## 1. Introduction

In the aftermath of the global financial crisis (GFC), many developed countries implemented tremendous amount of public investment to pump up the economy. On the other hand, the Japanese government has also implemented public investments as a tool for supporting stock prices, as argued in Fukuda and Yamada (2011) even before the GFC. Following this, the Japanese case is worth investigating to examine the relationship between public infrastructure investment and stock prices.

Incidentally, both positive and negative can be considered as the effects of public infrastructure investment on stock prices. First, on the theory behind the positive effect, Belo and Yu (2013)'s theoretical model is assumed. Belo and Yu (2013) specify the public capital as an input in the firms' production technology within the framework of the neoclassical model of investment (q-theory), and thus it affect the productivity of the private inputs through the positive externality. Second, we also assume the negative effects as in the case of private firm's investment rate and future stock returns.<sup>1</sup> If public investment is confirmed to have a positive impact on stock prices, it may be useful to

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<sup>1</sup> For this point, please see Cochrane (1991) and Cooper et al. (2008), etc.

retrieve the market participants from the abyss of a deep depression. However, to our knowledge, little previous works have examined whether or not public investment increases stock prices in Japan.<sup>2</sup>

This research examines whether public investment has positive or negative impact on stock prices in Japan using the sectoral panel data. To perform empirical investigation, we estimate the impulse response function (IRFs) using local projection method (LLP) developed by Jordà (2005) and Teuling and Zubanov (2014). We use LLP because this method has several advantages in estimating IRFs. First, this approach is relatively robust to misspecifications of the data generating process. Second, we can economize on the number of estimated parameters compared to the panel vector autoregression model.<sup>3</sup> Further, we use return of investment on stock (hereafter, stock returns) to capture the effects on stock prices.<sup>4</sup> This is why the level stock prices may not become stationary even if we take more than first or second differences.

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<sup>2</sup> Fukuda (2002), Fukuda and Ji (2002), Miyazaki (2010), and Fukuda and Yamada (2011) examine the effect of fiscal policy on the stock market using event study. However, while these works examine the effect of specific policy events on stock prices, the effect of public investment itself is not examined. Although Hiraga et al. (2016) examine the Granger's causality from public capital to stock price returns and the calculation of its contribution within the shocks of stock price returns, they do not clarify whether its effects on stock price returns are positive or negative.

<sup>3</sup> For more details, please see Jordà (2005) and Sekine and Tsuruga (2014).

<sup>4</sup> This is calculated by the equation  $\left(\frac{\text{Income gain} + \text{Capital gain}}{\text{Stock Price}}\right)$ .

Our results are summarized as follows. First, public investment has positive and significant effects on stock returns using quarterly level data. This especially does so in a group of manufacturing industries. Second, we do not necessarily confirm a positive effect after the 1990s, when the government implemented a large amount of public investment as a part of economic stimulus packages. We conclude that while the public investment in Japan has positive and statistically significant effects on stock returns dependent on sectors, it was not always useful to invigorate the stock market. Our results imply that even if the Japanese government has planned public investment so as to boost stock prices so many times, it may not necessarily play a crucial role in the revitalization of a sluggish stock market.

This paper is organized as follows. Section 2 summarizes the public investment policy and stock price target policy in Japan. Section 3 presents an empirical framework. Section 4 reports the estimation results. Section 5 presents our conclusion.

## 2. Background: Public infrastructure investment and stock target policy in Japan

Figure 1 shows the movement of public infrastructure investment (public capital formation, per GDP) among some developed countries. Public infrastructure investment had been highest among these groups until the mid-2000s, which shows that the Japanese government implemented a large amount of public infrastructure investment.

A lot of public infrastructure was destroyed during World War II, which the government repaired in the decades after the end of the war. Moreover, since the lack of public infrastructure was a bottleneck for economic recovery, the government implemented large-scale infrastructure investment such as the construction of the Tokaido Shinkansen network and Keihin factory area. These public infrastructures, which were concentrated in three major metropolitan areas (Kanto, Chubu, and Kansai), supported the tremendous growth in the mid-1950s to the early 1970s in Japan.

On the other hand, public infrastructure investment has been frequently used as a tool of macroeconomic stabilization.<sup>5</sup> Above all, after the collapse of the asset price bubbles

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<sup>5</sup> For more details, please see Miyazaki (2010) and Asako (2012).

in the early 1990s, the government implemented fiscal stimulus packages almost every year, as shown in Table 1. Stimulus packages implemented in August 1992, April 1993, and September 1995 comprised more than half of public infrastructure investment.<sup>67</sup>

The Japanese government implemented these stimulus packages also as a tool for supporting stock prices in these periods. Actually, Fukuda and Yamada (2011) argue that stock prices were a target of Japanese macro stabilization policy during the 1990s. The government implemented stimulus packages that mostly consisted of public infrastructure investment to maintain stock prices in these periods. Following these, the Japanese case is worth investigating to examine the relationship between public infrastructure investment and stock prices.

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<sup>6</sup> Whereas the Public Finance Act in Japan prohibits the issue of deficit bonds in principle, the Act allows limited bond issuance in the General Account (the Japanese central government's budget) to raise funds to finance public investments, equity investments, and loans to public corporations. Reflecting this, the government has mainly used public infrastructure investment as an economic stimulus by issuing construction bonds.

<sup>7</sup> Incidentally, the Japanese government also implemented large economic stimulus packages after the economic slowdown accompanying the 2008 global financial crisis. However, the principal items in these packages were not public investment but subsidies or tax cuts such as lump sum transfers (teigaku-kyuhu kin), subsidies for consumer purchases of energy-conserving home appliances, and a program of tax breaks and subsidies for purchasing "eco-friendly" cars and financial support for small and medium-sized enterprises. For more details, see Iwaisako (2010) and Miyazaki (2016).

### 3. Empirical framework

First, in order to estimate IRFs, for each future period  $k$  the following equation has been estimated on annual and quarterly data:

$$R_{i,t+k} - R_{i,t} = \alpha_i^k + time^k + \sum_{j=1}^l \delta_j^k \Delta R_{i,t-j} + \beta_k GI_t + \varepsilon_{i,t}^k, \quad (1)$$

where  $R_{i,t}$  represents the stock returns for industry  $i$  in period  $t$  (quarterly).  $\alpha_i^k$  is an industry fixed effect in each forecasting horizon  $k$ ,  $time^k$  is a time trend,  $GI_t$  is the public investment shocks calculated by the Factor-Augmented VAR estimation by Hiraga et al. (2017) for quarterly data in the specification.<sup>8</sup>

The key parameters in Equation (1) are  $\beta_k$ , representing the response of  $k$ -period-ahead stock returns to a current public investment. In our estimation, we directly estimate IRFs of the stock returns to public and private investment and plot the estimated  $\beta_k$  for  $k=1, \dots, 12$ , with 95 % confidence bands for the estimated IRFs, which

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<sup>8</sup> In our specification, public investment or public investment shocks is plugged into the estimation equation as a “common shock” across the sectors as in the case of Belo and Yu (2013).

are computed using the standard deviations associated with the estimated coefficients  $\beta_k$ .

Note that all coefficients in Equation (1) are separately estimated for each horizon  $k$ .

In standard LLP estimation, Equation (1) is estimated using least squares dummy variable (LSDV) with White (1980)'s robust standard errors.<sup>9</sup>

## 4. Empirical Results

### 4.1. Dataset

The sample period is from 1983 Q1 to 2008 Q4 in quarterly data. Data on stock returns ( $R$ ) came from the data of stock price earnings ratio provided by Japan Securities Research Institute (JSRI). The number of industries is 28.

To address the public investment policy shock, we use the aforementioned public investment shocks calculated using the dataset by Hiraga et al. (2013). We estimated factors using Fujii et al.'s (2013) dataset, which contain 136 aggregate and sectoral

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<sup>9</sup> However, it is also apprehended that the lagged dependent variables in our panel estimation may lead to a severe bias due to small number of cross sections and time periods. To deal with this, we also estimate Equation (2) by system GMM, and acquire almost all the same results as LSDV estimation.

variables of Japanese industries,<sup>10</sup> in addition to public capital, TFP, and stock returns.<sup>11</sup>

### 4.3. Estimation results

First, we estimate the IRFs based on the basic specification of Equation (1). The result is shown in Figure 2. As shown in figure, while the policy effect is positive and statistically significant until three periods ahead, it becomes insignificant in the fourth periods after the implementation. IRF is positive after the 5th periods, and significant except the ninth and twelfth periods, respectively.

Second, not only do we conduct cross-industrial comparison, but we weigh the effects among three decades. Here we divide 28 industries into some groups: (i) a group of mining and manufacturing industries (16 industries), (ii) a group of non-manufacturing industries (10 industries), and (iii) construction industry. While (i) and (ii) are the panel data estimation by limiting the industry into these groups, the estimation for construction industry is a time-series estimation. The results are shown in Figures 3a to

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<sup>10</sup> See Table 1 of Fujii et al. (2013) for a detailed list of variables.

<sup>11</sup> For more details, please see the revised version of Hiraga et al. (2017) downloadable from the website below: <https://sites.google.com/site/tomomisite/research/dp>.

4c. As shown in Figure 3a, the results of manufacturing industry are basically the same as the one shown in Figure 2. Although we confirm a positive response for non-manufacturing and construction industries, the IRFs are not as persistent as the one of manufacturing industry.

Finally, we show the results that compare the policy effects for three decades: the 1980s, 1990s, and the 2000s. As in the case of the estimation using the annual data, we assume the effects in the 1980s as a base. Then, we make dummy variables specifying the 1990s and the 2000s, and multiply these by  $GI_t$ . Whereas we basically confirm a positive and significant effects in the 1980s and 1990s, we cannot confirm a positive and persistent effects in the 2000s.

## 5. Conclusion

This research examines whether or not public investment has increases stock prices in Japan using sectoral panel data. Through the calculation of IRFs using LLP, we confirm the positive and significant effects of public investment on stock market mainly

for the manufacturing industry. However, the policy effects were not necessarily positive throughout the sample periods. This implies that although public investment contributed to the revitalization of stock market, it did not necessarily play a key role in boosting the stock price returns. Some economists or practitioners advocate public investment is a “savior” for stock market participants. However, our empirical results cast a doubt for such opinion, judging it as a kind of “quack economics.”

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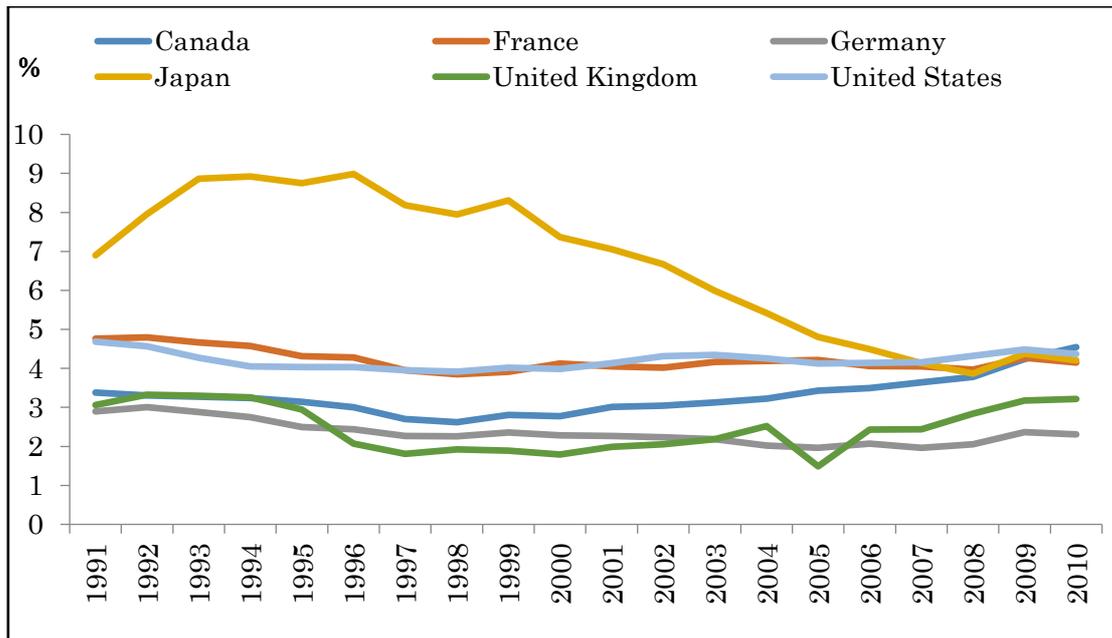
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Table 1. Fiscal Stimulus Packages in the 1990s (JPY trillion)

	1992 August	1993 April    September	1994 February	1995 April    September	1998 April    November	1999 November	2000 October
Tax cut		0.2	5.9		4.6    6		
Cash transfers to households					0.7		
Public works (Public investment)	<b>6.3</b>	<b>7.2    2</b>	<b>3.7</b>	<b>0    7.7</b>	<b>3.1    3.6</b>	<b>2.9</b>	<b>2.6</b>
Public works involving central government	4.5	5.6    1.5	3.4	6.7	1.6    3.6	2.9	2.6
Public works by local governments	1.8	1.6    5	0.3	1	1.5		
Other government investment				5.4    1.4	4.6    3.6	4	2.6
Other government measures	4.5	5.8    4	5.7	1.5    5.2	4.4    9.1	11.3	5.8
Total size of economic stimulus packages	<b>10.8</b>	<b>13.2    6</b>	<b>15.3</b>	<b>6.9    14.3</b>	<b>16.7    23</b>	<b>18.2</b>	<b>11</b>

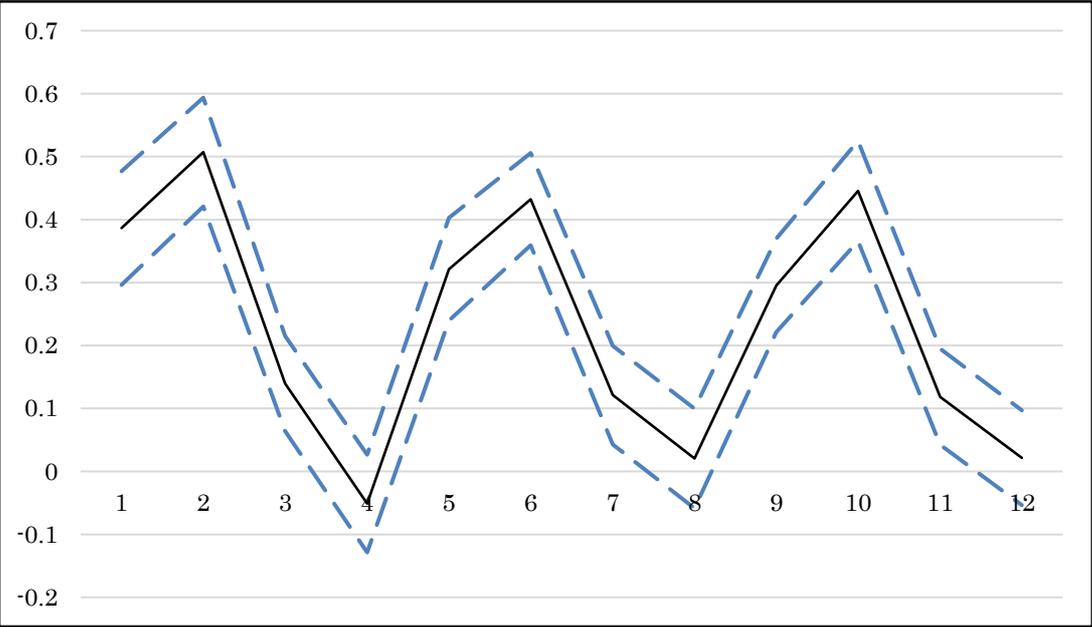
*Note:* This table follows Brückner and Tuladhar (2014). Other government investment includes investment in fields such as science and technology, education and social welfare, alternative energy and the environment, and natural disaster relief. All government investment in economic stimulus packages in April 1995 was for natural disaster relief because this package was planned as a countermeasure for the Great Hanshin-Awaji earthquake.

Figure 1. Government gross capital formation per GDP among some developed countries



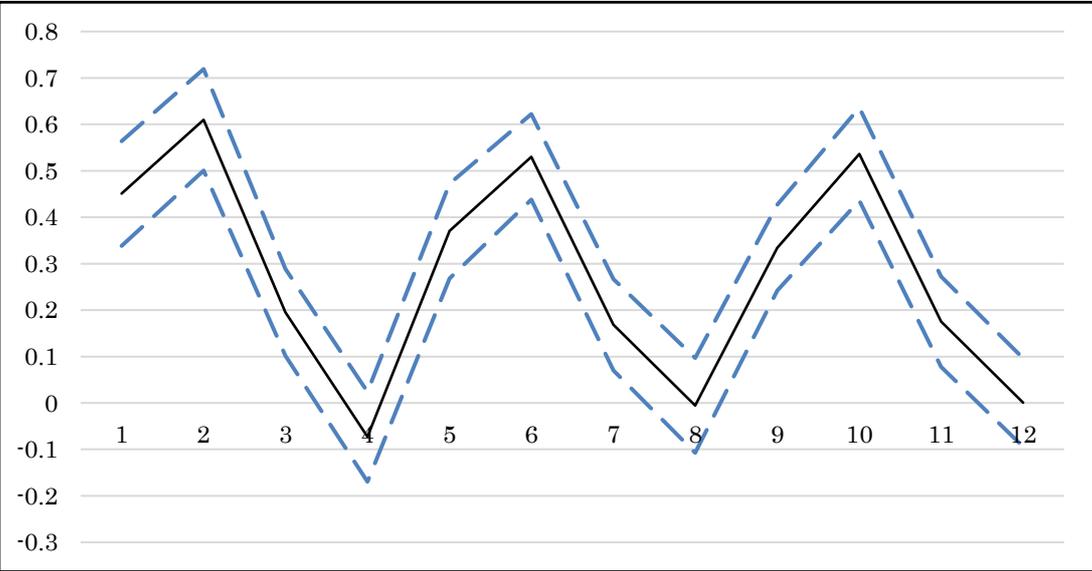
Source: OECD Economic Outlook

Figure 2: IRF of stock returns with respect to public investment (LSDV, quarterly)



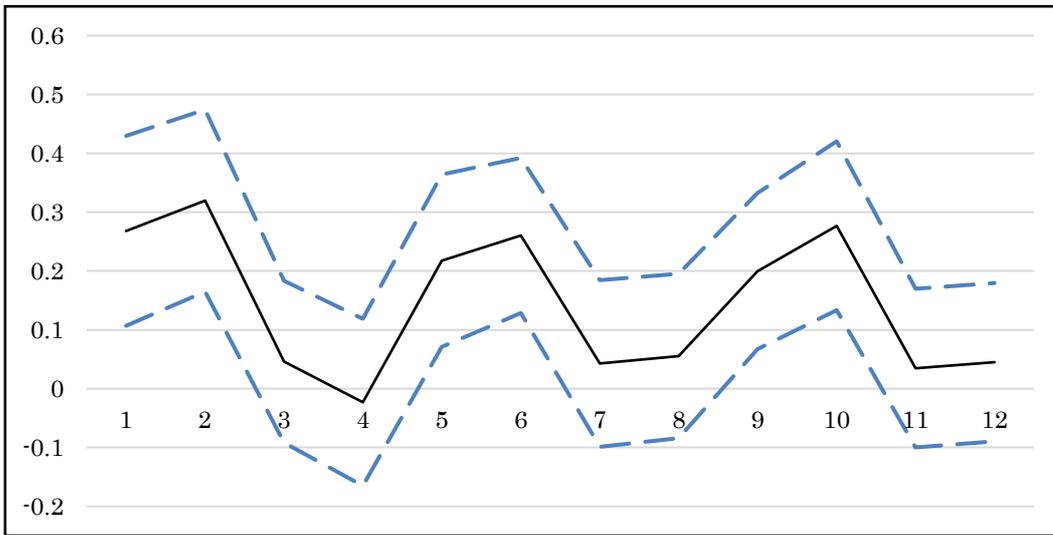
Note: The solid line indicates the estimated response, and the dotted lines represent the 95% confidence intervals.

Figure 3a: IRF of stock returns with respect to public investment (LSDV, quarterly, a group of the manufacturing and mining)



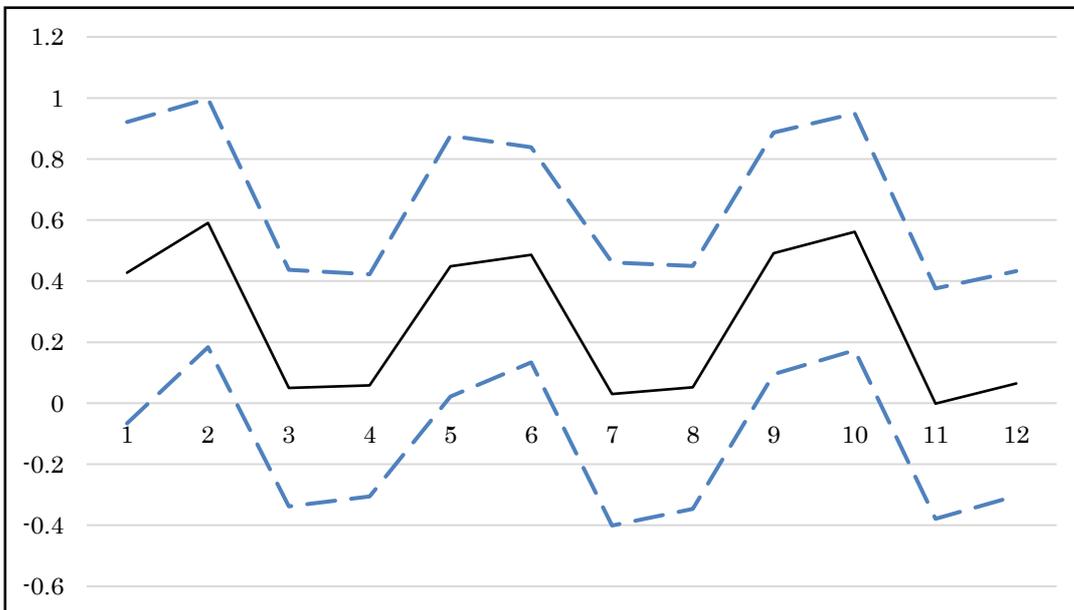
Note: The solid line indicates the estimated response, and the dotted lines represent the 95% confidence intervals.

Figure 3b: IRF of stock returns with respect to public investment (LSDV, quarterly, a group of non-manufacturing)



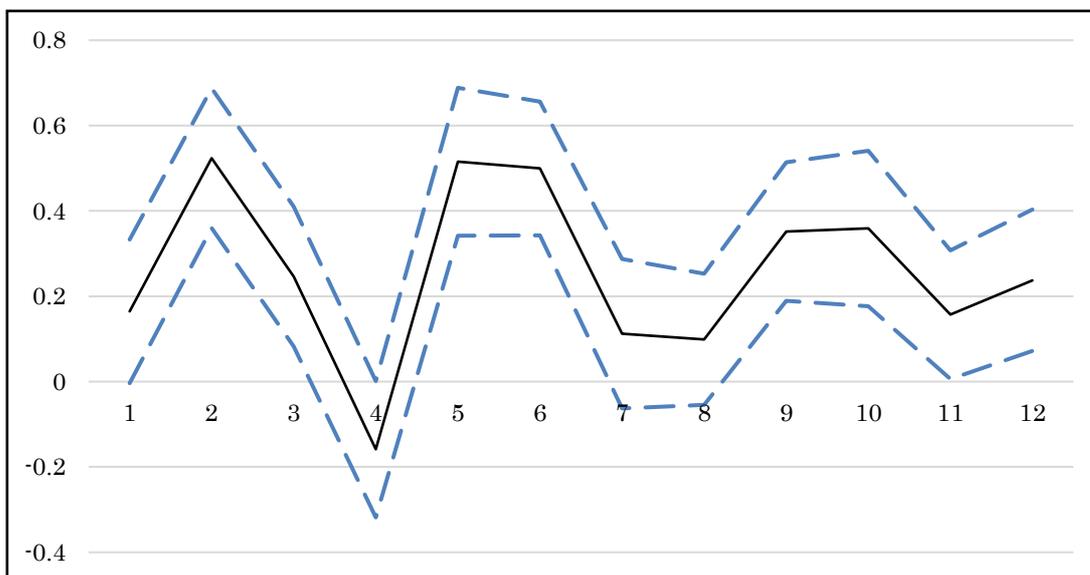
Note: The solid line indicates the estimated response, and the dotted lines represent the 95% confidence intervals.

Figure 3c: IRF of stock returns with respect to public investment (LSDV, quarterly, construction)



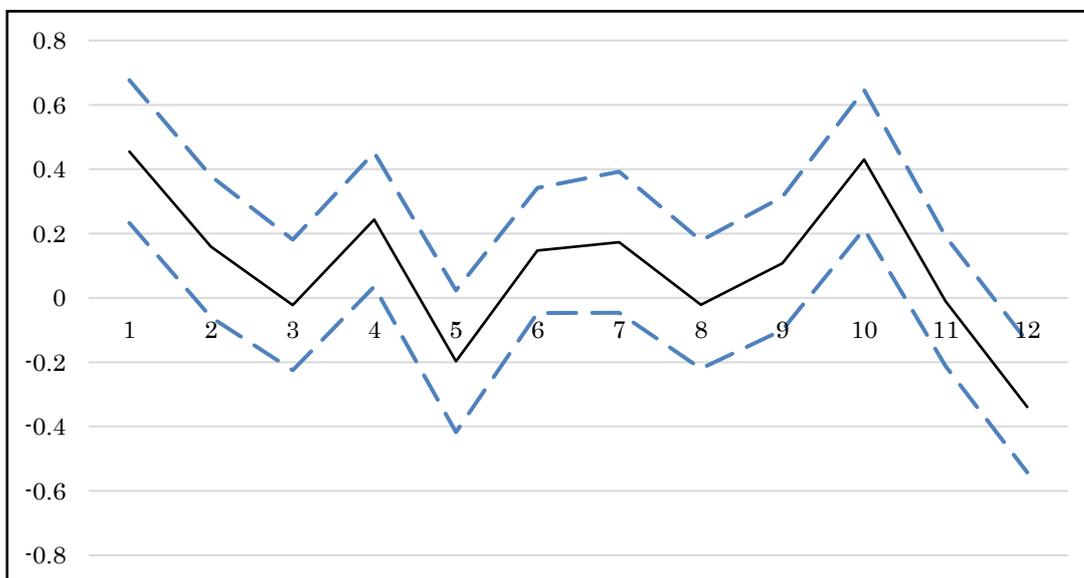
Note: The solid line indicates the estimated response, and the dotted lines represent the 95% confidence intervals.

Figure 4a: IRF of stock returns with respect to public investment (LSDV, quarterly, the 1980s)



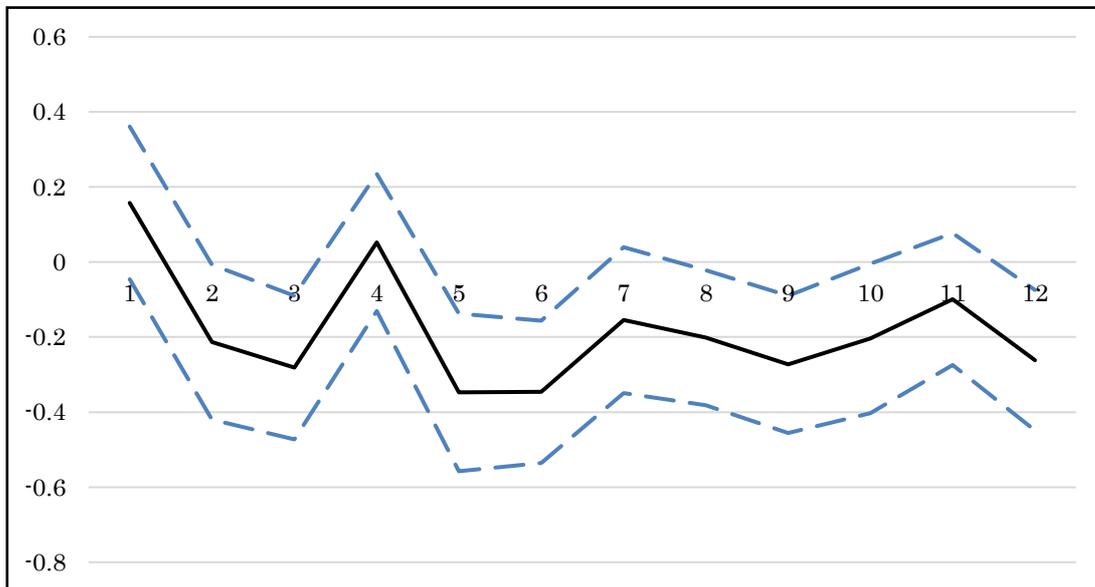
Note: The solid line indicates the estimated response, and the dotted lines represent the 95% confidence intervals.

Figure 4b: IRF of stock returns with respect to public investment (LSDV, quarterly, the 1990s)



Note: The solid line indicates the estimated response, and the dotted lines represent the 95% confidence intervals.

Figure 4c: IRF of stock returns with respect to public investment (LSDV, quarterly, after the 2000s)



Note: The solid line indicates the estimated response, and the dotted lines represent the 95% confidence intervals.