Political Economy of Public Capital Formation in Japan[*1]

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Abstract

This paper investigates public investment policy (mainly from the 1980s onwards) with a political–economic approach. The points of this paper are as follows. First, at the macro level, it is possible that the short–term fluctuation of public investment has been controlled by the government party's political incentive to win an election rather than in order to dampen economic fluctuations. Second, as for regional allocation, up to 1993 when the Liberal Democratic Party of Japan (LDP) stepped down from government, the LDP had had a great influence on public investment allocation; however, following such a government alternation the influence of local special interest groups may have become stronger. Focusing on the local side, empirical analysis of the public investment function considering political–economic factors clarifies that local public investment policy has been deeply affected by the construction industry as a local interest group (which is heavily dependent on public investment in general), and that levels of public investment have not been determined in the way the median voter theorem implies.

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I. Introduction

It has been pointed out in political science or public choice literature that public capital formation (public investment) or public expenditure can be influenced by politics. For example, some political scientists[1] point out that members of the LDP called "*zoku-giin*" (which means special interest politician in Japanese) have a great influence on government policy through the process of budget formation and use public works as a pork barrel. Also, Nakano (1986) states that local special interest groups lobby local governments directly or local offices of the LDP to exercise influences on the budget formation of local governments. In the field of economics, since the 1990s research on the productivity of public capital has been developed and many of papers on this issue conclude that the allocation of public capital between regions or project purposes is not efficient[2]. This is probably evidence that public capital is allocated not on the basis of its productivity or benefit, but by political incentives as pointed out by Ihori (2001). Also, the inefficiency of some large-scale public projects is discussed by the mass media or journalists[3].

However, political scientists tend to emphasize the political aspects of public investment (or public expenditure) too much, but hardly analyze it from the viewpoint of economic theory. On the other hand, economists have not conducted theoretical and empirical studies on public investment sufficiently while considering its political aspects.

Therefore, this paper investigates public investment policy (mainly since the 1980s onwards) with a political-economic approach by using data on administrative investment and expenditure for ordinary construction works in local government finance. Specifically, we clarify which political agents such as representatives of the Liberal Democratic Party (hereafter, the LDP), local politicians and special interest groups have influenced public investment, and how their political power has been changing over time. This is done by new empirical analyses from three aspects: (i) the macro level, (ii) regional allocation, and (iii) policymaking of local governments.

In particular, many preceding studies use data up to the mid 1990s at most, since it takes two or three years for statistics on administrative investment to be available to the public. In this paper, we use a newer sample (up to FY 2003) than preceding research and are thus able to identify significant changes in the political environment that occurred in Japan in the 1990s,

[1] See Inoguchi and Iwai (1987) and Hori (1996).
[2] As for regional allocation, see Yamano and Ohkawara (2000), Mitsui et al. (1995), Yoshino and Nakano (1996), Yoshino and Nakajima (1999), Homma and Tanaka (2004) and others, and as for allocation between project purposes, see Ida and Yoshida (1999) and Yoshino and Nakajima (1999). Tanaka (1999), Mitsui and Hayashi (2001) and Hayashi (2003) apply capitalization approach to evaluate allocation efficiency of public capital.
[3] For example, Nikkei Business (2002).

such as the collapse of "1955 System" in 1993 and the following political instability during the time of the coalition government. As such, this paper is also meaningful in this sense.

This paper is constructed as follows. Section Ⅱ investigates the possibilities that public investment policy is affected by political incentives, from trends of public investment at the macro level. In section Ⅲ, we review preceding papers on the regional allocation of public investment and conduct an empirical analysis to investigate the change of political power of government parties and special interest groups, compared with previous research. Considering the results from preceding sections, in section Ⅳ we derive a public investment function based on the political-economic approach and test this theoretical prediction empirically to check whether local public investment policy is affected by special interest groups or median voters. We also discuss these results normatively. Section Ⅴ concludes this paper.

II. Trends of public investment at the macro level and political factors

II.1. Trends of public investments at the macro level-from the Report on Administrative Investment

We will survey trends of public investment since the 1970s through data of the "Report on Administrative Investment" published by the Ministry of Internal Affairs and Communications (MIAC). Although the figures by prefecture and project purpose (livelihood investment, industry investment, agricultural, forestry and fishery investment, land conservation investment and others[4]) are available in this report, we use aggregate data in this section to check the changes and features of the total amount of investment and allocation by project purpose.

Figure 1 depicts the total amount of administrative investment and its ratio to GDP since FY1970 to FY2003. In the 1970s, administrative investment was carried out at a higher growth rate than GDP and expanded from 5.9 trillion yen (7.9%) in FY1970 to 27.9 trillion yen (11.3%) in FY1980, reflecting discretionary and expansionary fiscal policy after the end of postwar high economic growth. In the early 1980s, the growth rate of administrative investment had become slower, and was negative in FY1982 for the first time due to deterioration of the fiscal balance. However, from 1986 the amount of investment began to rise again and reached its peak of 51.1 trillion yen (10.6 %) in FY1993. The high level of investment during the 1990s after the collapse of the bubble economy is most likely due to the Japan-US conference on structural problems in 1990 where Japan promised the US that it would expand its domestic demand through public works in order to decrease trade surplus to the US, and to the "Public Investment Basic Plan" of the same year. However, since FY1995 the amount of investment has tended to decline taking serious fiscal deficit into consideration. In FY2003 this amount became almost the same as that

[4] See appendix (A) as for the breakdown of administrative investment.

of FY1988 (31.6 trillion yen) and its ratio to GDP fell to 6.3 percent, which was the lowest level since FY1970.

Figure1 Trends of Administrative Investment FY1970-2003

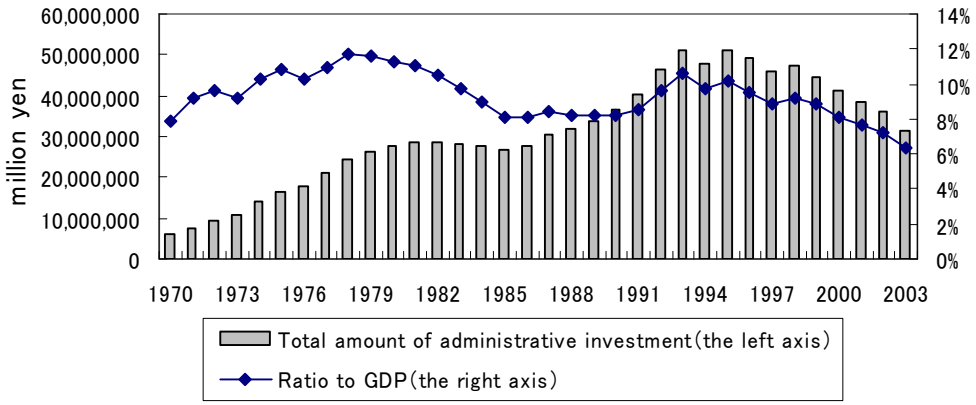
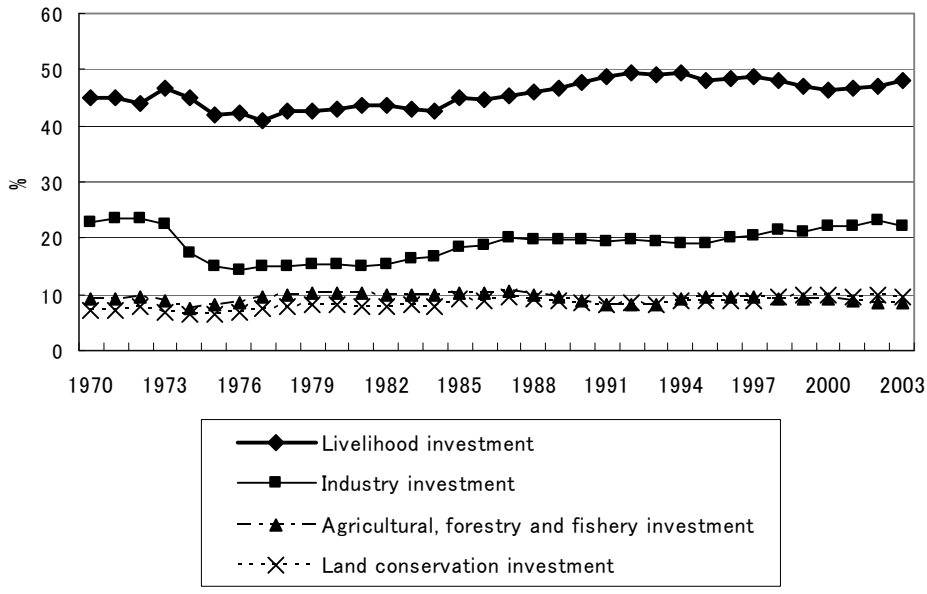


Figure2 Trends and Composition of Administrative Investment FY 1970-2003



Next, we will look at the trends of public investments by project purpose. Figure 2 shows the ratio of expenditures for each investment by purpose (livelihood investment, industry investment, agricultural, forestry and fishery investment and land conservation investment) to total public investment expenditure. This figure proves that the share of livelihood investment is the highest (around 40～50%), while industry investment is the second highest (around 20%) Shares of agricultural, forestry and fishery investment (hereinafter AFF investment) and land conservation investment are relatively low, and have been flat at around 10% since the 1970s. In particular, the share of agricultural, forestry and fishery investment is very stable, although that of the primary industry in our economy has been declining in this period. This fact perhaps implies that budget allocation between ministries has been inflexible. As Ihori (2001) points out, it is possible that the allocation between project purposes is inefficient if public works relating to the agricultural industry or disaster-control programs have been vested interests and if too much money has been spent on them.

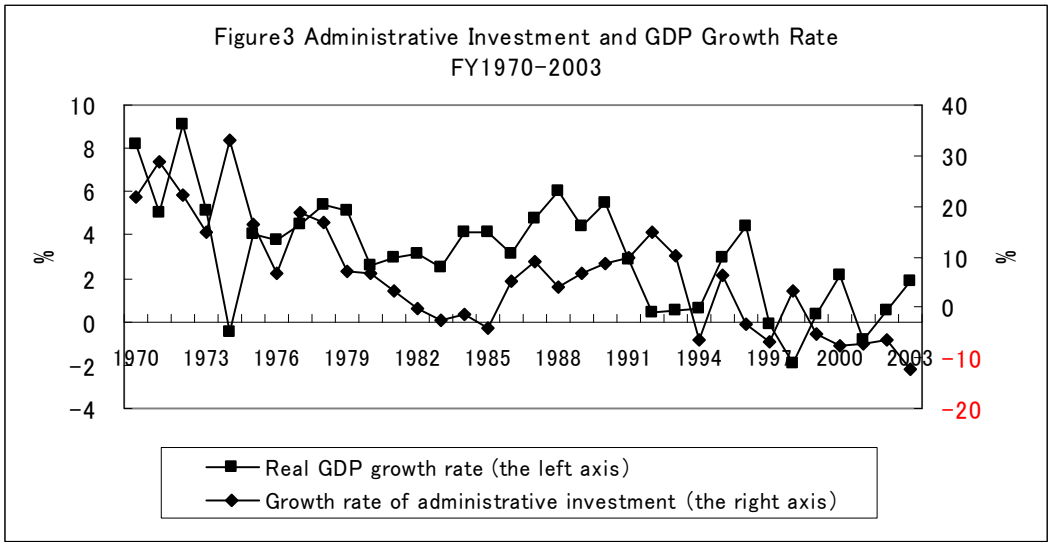
II.2 Patterns of fluctuations in public investment –the relationship with business cycles

In this section, we will confirm the relationship between business cycles and public investment since short-term fluctuations in public investment may reflect a counter-cyclical fiscal policy.

In general, two roles of public investment would be expected. One is a role as a formation of infrastructure that is beneficial to us ("Stock effect"), and the other is one of which public investment itself produces demand ("Flow effect"). As pointed out by Hayashi (2004), it is reasonable to think that the "Flow effect" is a by-product of public investment. However, people in Japan have a strong tendency to expect public works to stimulate the macro economy or bring employment to rural areas. As such, the Japanese government has carried out a considerable amount of public investment to meet these demands.

If government policy stance is consistent with the traditional Keynesian-type aggregate demand management policy, public expenditure (public investment) must be counter-cyclical; that is, a negative relationship between the growth rate of GDP and public investment will be observed.

In order to investigate this, Figure 3 shows the relationship between the growth rate of real GDP and public investment since FY1970. From this graph, it is not obvious that the movement of public investment is counter-cyclical. Also, the simple correlation coefficient of these variables is 0.74. So it cannot be said that counter-cyclical public investment is observed, although large-scale public investment was carried out in the 1990s under the pretext of stimulating the economy. Therefore, we endeavor to pay attention to the political incentives of government and clarify a part of the reasons why public investment fluctuates in the short term.



II.3 Patterns of fluctuations in public investment –a political economic explanation

The "Political Business Cycle" theory, which was presented by Nordhaus (1975), has implications for short-term public investment policy. The theory states that if the utility level of electorates depends on macroeconomic variables (such as the rate of unemployment and inflation) and electorates vote depending on their utility level, business cycles can arise by political reasons when the government can control economic policies (monetary and fiscal policy) according to a stable Phillips-curve. Therefore, it can be thought that the political business cycle theory in the Nordhaus sense applies if macroeconomic conditions improve by way of expansionary fiscal policy or monetary policy prior to an election[5]. It should be noted that there is the possibility in Japan that the government would have an incentive to hold an election when economic conditions are good ("opportunistic cabinet hypothesis"[6]), rather than manipulating economic policy before an election ("manipulative cabinet hypothesis"). This is because the Japanese cabinet has the right to dissolve the House of Representatives[7]. However, with regard to the House of Councilors, a political business cycle theory ("manipulative cabinet hypothesis") may be more applicable as the timing of its election is predetermined. Following the approach of Alesina, Cohen and Roubini (1992), Doi (1998) tests the manipulative

[5] In subsequent research of this literature, Rogoff and Siebert (1988) and Rogoff (1990) show theoretically that economic policy could be manipulated before an election based on a model where myopic electorates (in the sense that they are interested in present economic conditions only) are not assumed. These "rational" political business cycle models imply an expansionary policy before an election, but not business cycles as a result.

[6] This classification ("opportunistic" and "manipulative") is given by Ito and Park (1988).

[7] Inoguchi (1983) and Ito (1990) argue that the "opportunistic" hypothesis applies better than "manipulative" in Japan. However, some papers such as Cargill and Hutchison (1991) conclude that "opportunistic" does not apply strongly.

hypothesis using Japanese data and confirms that an expansionary fiscal policy was adopted in advance of an election of the House of Councilors. In estimation results using sub-sample data, no effects of the election are observed following the oil crisis. Therefore, the above-stated results are not necessarily robust. This may be due to the fact that Doi (1998) adopts real governmental expenditure (=governmental final consumption expenditures plus gross fixed capital formation) as a fiscal policy variable, which is not restricted to public investment[8].

So, following the approach adopted by Doi (1998), we will conduct an empirical analysis in order to clarify whether or not public investment policy is influenced by national elections. We will run distributed lag econometric models, which regress fiscal policy variables on their lag variables (including the growth rate of GDP) and election dummies (election year=1). If an election dummy is statistically and positively significant, it can be said that the political business cycle theory applies. In this paper, administrative investments by purpose (livelihood investment, industry investment, AFF investment and land conservation investment) and governmental final consumption expenditures are considered as fiscal variables. Therefore, this analysis is different from previous ones in the sense that we can investigate which variables the government would target and to what extent they could manipulate fiscal variables. An equation that should be estimated is as follows:

$$G_i(t) = \alpha_0 + \alpha_1 G_i(t-1) + \alpha_2 Y(t-1) + \beta_1 HCELED + \beta_2 HRELED \quad (1)$$

where Gi denotes the growth rate of six fiscal variables[9] (livelihood investment, industry investment, AFF investment, land conservation investment, the total of administrative investment expenditures and governmental final consumption expenditures), Y indicates the growth rate of real GDP, HCELED and HRELED indicates the House of Councilors and the House of Representatives election dummy, respectively. We use data from FY1975 to FY2003, and fix the order of lags of the estimation model to 1 depending on SBIC (Schwartz Bayesian Information Criterion). Estimation results are described in Table 1.

According to this, it is confirmed that the House of Councilors dummies are positively and statistically significant with respect to any administrative investment, but not with governmental final consumption expenditures. These results probably imply that "manipulative cabinet hypothesis" targeting the House of Councilors election applies to administrative investments but not to governmental final consumption expenditures[10]. However, the impact of

[8] Preceding papers, for example, Nishizawa and Kohno (1990) and Inoue (2002) analyze the relationship between national elections and public investment policy.

[9] In table 1, we represent them as "Livelihood", "Industry", "Agriculture", "Land", "Investment" and "Consumption" for short, respectively.

[10] Our sample contains some years when the House of Councilors election was held, and the necessity of economic stimulating policies was particularly high, such as in 1986 (recession after the Plaza Accord) and 1998 (financial crisis after the Asian currency crisis). However, primary results are unchanged even if we drop the data of these years in estimation.

Table1 Public Investment and National Elections Sample FY 1975-2003

	Dependent Variables											
	Livelihood		Industry		Agriculture		Land		Investment		Consumption	
Constant	-3.232	†	-1.947		0.443		0.306		-3.345	†	0.342	
	(-1.842)		(-0.814)		(0.195)		(0.120)		(-1.936)		(0.611)	
Gi (t-1)	0.593	**	0.388	†	0.871	**	0.680	**	0.679	**	0.470	**
	(5.049)		(1.907)		(6.144)		(4.510)		(6.253)		(11.389)	
Y(t-1)	1.275	*	1.155		-0.557		0.380		0.691		0.482	**
	(2.631)		(1.625)		(-0.845)		(0.553)		(1.502)		(3.785)	
HCELED	**4.485**	**†**	**7.338**	*****	**8.526**	******	**6.583**	*****	**7.697**	******	**0.904**	
	(2.053)		**(2.387)**		**(2.943)**		**(2.095)**		**(3.555)**		**(1.552)**	
HRELED	**-2.896**		**-3.416**		**-5.438**	*****	**-7.866**	*****	**-2.738**		**0.825**	
	(-1.422)		**(-1.217)**		**(-2.020)**		**(-2.620)**		**(-1.385)**		**(1.465)**	
$\overline{R^2}$	0.605		0.315		0.586		0.451		0.635		0.837	
SBIC	6.515		7.152		7.063		7.257		6.455		3.938	
DW	2.417		2.473		2.140		2.646		2.560		1.742	

Note: t-values are in parentheses.
**, *, † indicates statistically significant at 1,5, 10 percent level, respectively.

the House of Councilors election on administrative investments (that is, the value of each coefficient) is different between purposes. The highest is AFF investment (the value of coefficient is 8.53), and the second is industry investment (7.34). On the other hand, the value of the coefficient with livelihood investment is low (4.48). Considering their significance levels also, it is quite possible that administrative investments related to specific industries have been controlled more than livelihood investments before an election.

Contrary to the House of Councilors, the House of Representatives dummies are consistently insignificant or have opposite signs. So, we cannot observe political business cycles related to the House of Representatives elections.

In this section, we show results that the political business cycle theory applies also in the case of the House of Councilors elections of Japan, and that administrative investments related to the agricultural, forestry and fishery industry are particularly easy to be manipulated. Therefore, we can most likely conclude that the public investment policy of Japan can be influenced by national elections and that short-term fluctuations in public investment have been distorted (even if partially) by political incentives.

III. Regional allocation of public investment and political factors

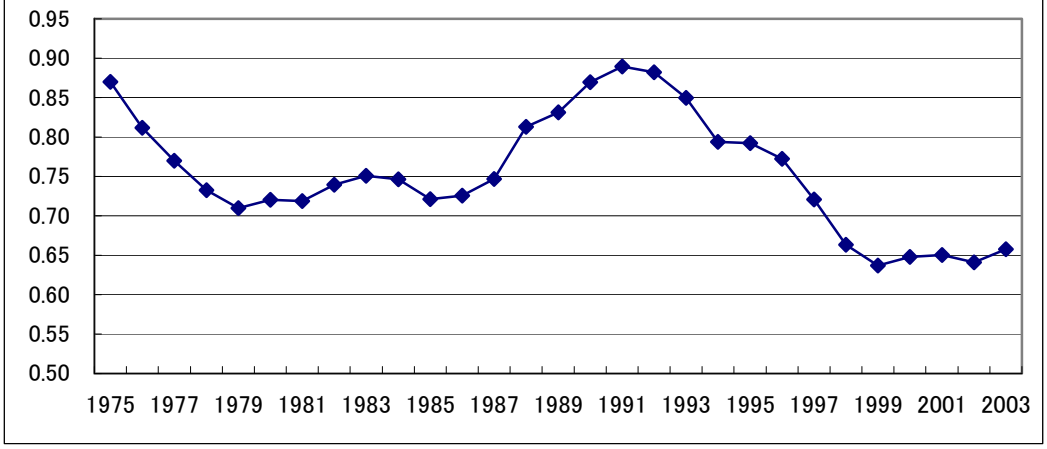
It can be pointed out that public investment had been allocated more to rural areas than to metropolitan areas as a feature of the regional allocation of public investment in Japan; this has been since the 1970s when the rapid economic growth period ended. With respect to this fact,

some argue that the difference between metropolitan and rural areas has been caused by some specific policy goals of the government, while others state that it is due to political-economic reasons including the election system[11]. Therefore, we will clarify the factors and trends of regional allocation of public investment by looking at the relevant data and trying to estimate an allocation equation based on the survey of preceding empirical studies.

III.1. Trends of regional allocation of public investment

First of all, dividing the areas into metropolitan and rural using the definition in the "Report on Administrative Investment"[12], we will check the trend of per capita administrative investment (Figure 4). This figure shows that the ratio of the rural area rose from FY1975 to FY1979, and after that the ratio was steady until FY1985, when the ratio of the metropolitan area started rising. However, the ratio of the rural area started rising again after the collapse of the bubble economy in FY1991, and the level became higher than in the first half of 1980s, which was almost flat after FY1999. Throughout this period, the ratio of the metropolitan area to the rural area remained consistently below 1; so, it can be said that public investment has been allocated more to the rural area in per capita terms.

Figure4 Regional Allocation of Administrative Investment
(per capita, Metropolitan Area over Rural Area)



[11] Okuno (1994) and Doi (1995) are given as an example of each. Regarding regional allocation of public investment, Okuno (1995) insists it can be roughly explained by the hypothesis that regional allocation of public investment changes according to each economic development stage. On the other hand, Doi (1995) points out that the difference between metropolitan and rural areas is possibly due to the over representation of rural areas in the Diet.

[12] The following 19 prefectures are included in the metropolitan area; Ibaragi, Tochigi, Gunma, Yamanashi, Nagano, Saitama, Chiba, Tokyo, Kanagawa, Gifu, Shizuoka, Aichi, Mie, Shiga, Kyoto, Nara, Osaka, Hyogo and Wakayama.

Next, Figures 5-1 to 5-4 summarize the trends of regional allocation of administrative investments by purpose (FY 1980 – FY 2003). To grasp the changes in more detailed regional allocation, we divide the region into six blocks (Hokkaido-Tohoku, Kanto, Tokai-Hokuriku, Kinki, Chugoku-Shikoku, and Kyushu-Okinawa).

First of all, the trend of livelihood investment (Figure 5-1) shows that the ratio of the Kanto region, which occupies the largest share, tends to decrease after the peak of 1990, while those of the other regions gradually rose except for the Kinki region. Meanwhile, the Kanto region had the largest share of population at about 30-35%, followed by the Kinki region (about 16%), the Hokkaido-Tohoku region (about 15%), the Tokai-Hokuriku region (about 14%), the Kyushu-Okinawa region (about 12%), and the Chugoku-Shikoku region (about 10%), which are stable in this order. Based on this fact, it can be said that the amount of livelihood investment is closely related to the share of population. Next, the trend of industry investment (Figure 5-2) shows that the order of the regional share has changed often, which influences the regional allocation of public investment in total. It is the same trend that the share of the Kanto region has been decreasing since around FY1990, while those of other regions increased. However, the different points are that the share of the Tokai-Hokuriku region, which expanded the scale of its economy during the 1990s, has rapidly increased, and that of the Hokkaido-Tohoku and the Chugoku-Shikoku region, whose populations are not large, have received a considerable amount of allocation.

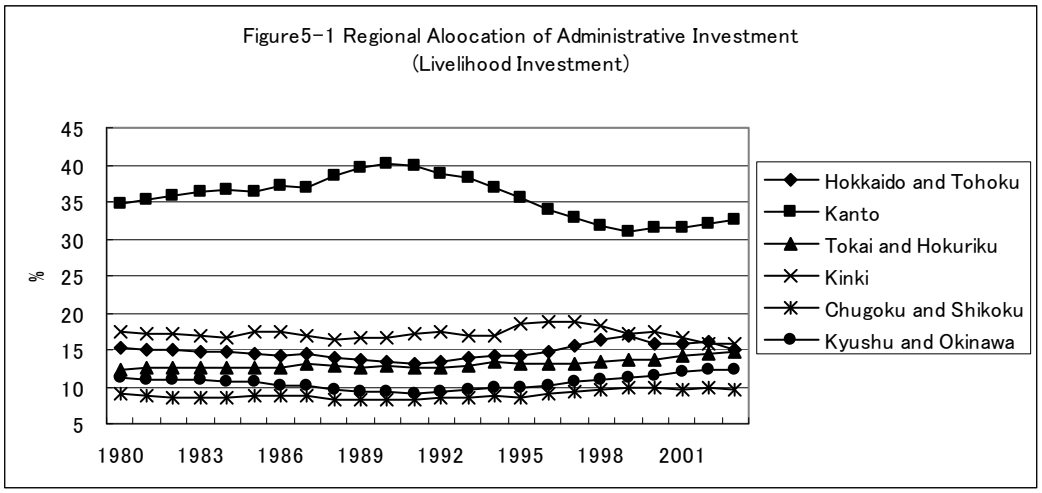


Figure5-2 Regional Allocation of Administrative Investment
(Industry Investment)

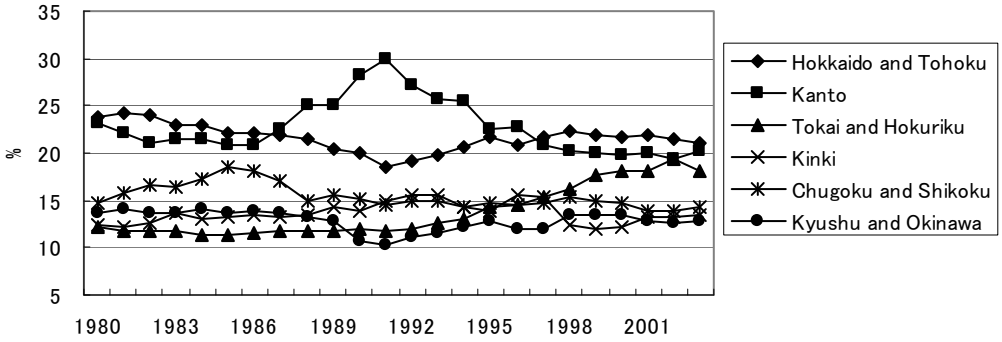


Figure5-3 Regional Allocation of Administrative Investment
(Agricultural, Forestry and Fishery Investment)

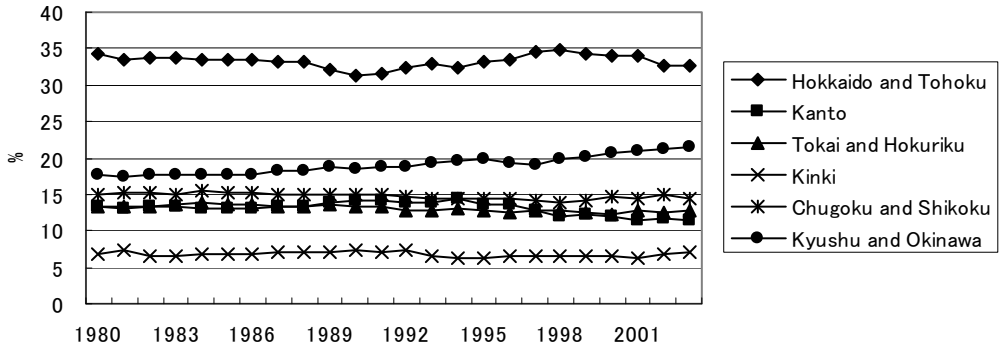
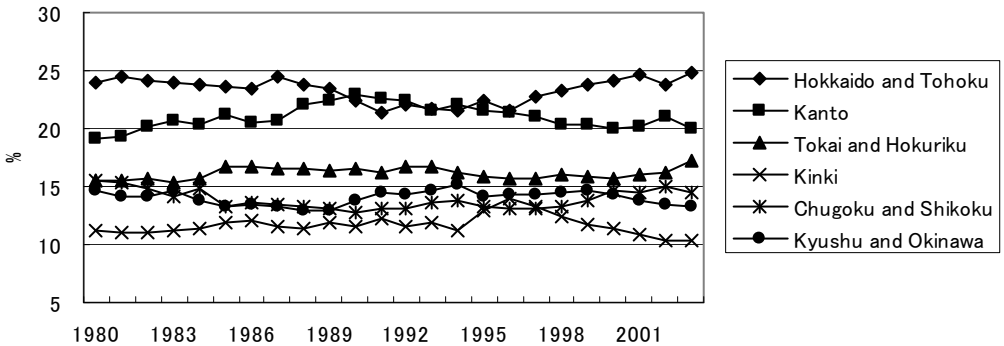


Figure5-4 Regional Allocation of Administrative Investment
(Land Conservation Investment)



Regarding the AFF investment (Figure 5–3), the trend of regional allocation is extremely stable in this period. From the fact that the share of the Kanto, Tokai–Hokuriku and Kinki regions, which are included in the metropolitan area, is low while that of the Hokkaido–Tohoku and the Kyushu–Okinawa regions is high, it can be said that the allocation is strongly correlated to area size rather than to population or income. Finally, the trend of land conservation investment (Figure 5–4) shows that the regional allocation is comparatively stable, though it is not any steadier than AFF investment. It can be confirmed that the order between the Kanto and the Hokkaido–Tohoku regions is changed, which can also be seen in industry investment, and the ratio of the Kinki region is higher around FY1996 than other years because of the Great Hanshin Earthquake. Moreover, as compared to the trend of the share of population, from the facts that the Hokkaido region has more investment than the Kanto region, and that the Kinki region has less allocation than the Tokai–Hokuriku region whose population is smaller than that of the Kinki region, it can be said that regional allocation is also influenced by area size.

Considering all the results shown in Figures 5–1 to 5–4, it is considered that there is a difference in regional allocation depending on the purpose of investment. Namely, there is a possibility that livelihood investment correlates to population, AFF investment mainly to area size, and industry investment and land conservation investment to both of them. Moreover, observing trends of regional allocation in this period, we can say that the change of industry investment is the largest and that of livelihood investment is fluctuating to a certain extent, while that of AFF investment and land conservation investment is relatively small.

It is worth pointing out that the trends of population and area size share is small and so they cannot explain everything about the regional allocation of public investment.

III.2. Empirical analyses on regional allocation of public investment (previous research)

After the 1980s, empirical analyses on the regional allocation of public investment in a broad sense have been done in the field of economics and politics. As seen in the foregoing paragraph, the actual way of allocation is not always explained only by regional characteristics, such as population or area size. Public investment is done not only for the original purpose of forming public capital, but also for various flow effects (employment and redistribution policy), and is also affected by political factors. That is the reason why many empirical analyses have been done in order to identify the true factors affecting the regional allocation of public investment.

Table 2 is a list of the previous research on the regional allocation of public investment. In the previous research, depending on its interest, there are differences in (A) type of statistics ("Report on Administrative Investment" or statistics on local government finance), (B) objects of analysis (the data and period of estimation), (C) explanatory variables (whether or not there is a political variable) and so on. This section takes up mainly the previous research using prefectural level data of the "Report on Administrative Investment", which will be used in the

empirical analysis (estimation of allocation equation) in section Ⅲ.4[13].

Empirical analyses on the regional allocation of public investment so far (estimation of allocation equation) basically estimate the following regression model, where IG is the amount of public investment[14].

IG=f (population, area size, income level, political variables) (2)

The biggest factor which influences the interpretation of results will be whether or not political variables are considered. As shown in Table 2, among the research considering political influences, the adopted political variables in each research are different. Yoshino and Yoshida (1988), Yoshino and Sakakibara (2002), and Tamada (2005) used the "weight of one vote (voting weight)" as a political variable, while Kikuchi (1989), Ishigami (1991), Hori (1996), and Tamada (2005) used "the number of seats" or "the seat share of LDP (or the Government party)". Additionally, there are some studies which use the relative vote rate or variables of local politics, such as Yamashita (2001).

Yoshino and Yoshida (1988) regressed administrative investments by purpose on income, area size, and the voting weight. They showed that there is a positive correlation between livelihood investment and income, and that the other investments are positively correlated with area size. Moreover, it is also shown that voting weight as a political variable has a negative effect on livelihood investment but a positive effect on the industry investment. Yoshino and Sakakibara (2002) used almost the same model as Yoshino and Yoshida (1988) to estimate using pooled data. They obtained the results that income and area are positively significant to all investments by purpose, and the voting weight is negatively significant to the livelihood investment and positively significant to the rest. From this result, they concluded that industry investment, AFF investment, and land conservation investment tend to be distributed in regards to political power; so, there is a high possibility that the rent is received by interest groups related to public works such as regional construction companies.

In addition, Ishigami (1991) attempted to clarify factors of the regional allocation of administrative investments by purpose through regression analysis, and showed that both the number of LDP seats and number of times elected of LDP Representatives are positively significant to all investments except for livelihood investment. Although this result is consistent with that of Yoshino and Sakakibara (2002), the independent variables in Ishigami (1991) are selected ad hoc and there is some doubt of misspecification in their regression models; as such, it cannot necessarily be said that the result is trustworthy econometrically.

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[13] In the empirical analysis of this paper, we mainly use data from the "Report on Administrative Investment" as we intend to clarify how the central government allocates public investment and whether the motives for regional allocation are different between purposes. Nagamine (2001) surveys the literature of empirical analysis, which considers political aspects of the allocation of ordinary construction expenses or grants.

[14] For a dependent variable, several ways of specifications can be considered. For example, Kikuchi (1988) used the per capita amount of investment, Yamashita (2001) used the percentage of GDP, and Tamada (2005) used the regional share of investment. It is necessary to note that the way of specification of a dependent variable affects selection of the set of independent variables and interpretation of estimation results.

Table2 A Survey of Previous Studies on Regional Allocation of Public Investment

	A. Definition of Public Investment	B. Data Sample	C. Political Variables
Yoshino and Yoshida(1988)	Administrative investment	Prefectural, Cross section Sample: 1966-1984, average of five years each	Voting weight
Kikuchi(1989)	Total amount of expenditure, ordinary construction expenses and national treasury disbursements	Prefectural, Cross section and Pooled data Sample:1965-1980	Seat share of government party, Relative vote rate
Marutani(1989)	Administrative investment	Prefectural, Cross section Sample: 1966-1984 (average of five years each) and 1971-1987	None
Ishigami(1991)	Administrative investment	Prefectural	Number of LDP seats, Number of times reelected (LDP Representatives)
Okuno(1994)	Administrative investment	Prefectural, 10 regional blocs and Pooled Data Sample: 1958-1986	None
Mitsui, Takezawa and Kawauchi(1995)	Public capital formation	Prefectural, Pooled data Sample: 1966-1984	None
Hori(1996)	Expenditure for public works	Prefectural Sample: Years of a national election from 1972 to 1990 (7times)	Number of LDP seats, and those sorted by number of times reelected
Yamashita(2001)	Ordinary construction expenses	Prefectural, Panel data Sample: 1976-1997	Seat share of LDP in prefectural assemblies, Gubernatorial election year dummy, Central government bureauctrats dummy
Yoshino and Sakakibara(2002)	Administrative investment	Prefectural, Pooled data	Voting weight
Tamada(2005)	Administrative investment, National treasury disbursements	Prefrectural, Cross section and Pooled data Sample: 1991-1998	Seat share of LDP, the President dummy, Posts in the LDP dummy, Voting weight

Moreover, as opposed to these studies which insist that political power has influenced the allocation of public investment, there are also studies such as Kikuchi (1989) which insist that there has been no pork barrel politics. They used the relative vote rate and the seat share of the government party as political variables and carried out regression analysis to explain local government expenditure, subsidy, and ordinary construction expenditure. However, those political variables are not statistically significant.

Among recent studies, Yamashita (2001) and Tamada (2005) used the data of the latter half of 1990s. Yamashita (2001) attempted to check some hypotheses empirically that related to the decision making of public investment, assuming that public investment of local governments was controlled by the central government. Also, they clarified by panel analysis that the political motives of the LDP influenced (the ratio of) ordinary construction expenditure (to prefectural total expenditure). However, when the sample period was divided into 1976–1993 and 1994–1997, the variable concerning the LDP was not significant in the latter half; instead, the Gubernatorial election year dummy was partially significant. He interpreted this result in the following way: political power of the central government has been declining after a single-party government ruled by the LDP collapsed, while that of prefectural governors has become stronger[15].

In a more recent study, Tamada (2005) examined the relation between the LDP and public investment allocation by using detailed political variables and instrumental variables. As a result, Tamada (2005) showed that variables concerning the political power of the LDP (mainly its seat share) were not significant and concluded that the LDP did not have a political influence on public investment allocation. However, because there is a strong correlation between population, financial capability index, and per capita taxable income, it is highly possible that there is the multicollinearity problem.

On the other hand, studies such as Marutani (1989), Okuno (1994), Mitsui, Takezawa and Kawauchi (1995) do not use political variables. Among these studies, Mitsui, Takezawa and Kawauchi (1995) estimated production function and public investment function simultaneously to deal with the simultaneity problem, to which we must pay attention to econometrically when measuring the productivity effect of public capital. Income, population, and other dummy variables are introduced as independent variables in this public investment function, where the coefficients of them are positive. It is preferable to use instrumental variable methods also when the public investment function is estimated as a single equation, considering the endogeneity of independent variables in the allocation equation of public investment. There are a few studies that have used this method, such as Yoshino and Yoshida (1988), and Tamada (2005), however. Therefore, it seems that more refined empirical analyses are required in the future, in that allocation equations should be estimated by a valid method with more appropriate instruments.

III.3. Empirical analyses on regional allocation of public investment (problems)

As mentioned above, empirical analyses have been conducted so far that have considered various political factors. However, there are many problems with them.

First of all, there is a problem of which political variables should be used in these analyses. In previous studies, the "weight of one vote" (voting weight) has been often used as a variable

[15] Horiuchi and Saito (2003) pointed out the possibility that the political influence of the LDP on fiscal transfers to municipalities had declined in the latter half of 1990s.

representing political power, but considering the fact that decisions in the Diet are made by the majority, it cannot be necessarily said that a heavy voting weight implies strong political power, as Ihori and Doi (1998) pointed out. Moreover, we might encounter the problems of multicollinearity or spurious correlation since the voting weight often correlates to population, financial capability index, and other political variables.

The second point is the simultaneity problem. Though the regional income level or per capita income level is used in many allocation equations, it is natural that the problem of simultaneity arises because the level of public investment also influences the level of income. Therefore, we need to estimate an allocation equation simultaneously with a production function, or at least to do so by the instrumental variable method.

Finally, there is the problem of multicollinearity. Although variables such as population, area size and income level are often included to control the scale or the demand for public investment of each region, the estimation result tends to be unstable since the correlation between population and income (level) is high. Moreover, it is also common that the job offers-to-seekers ratio or per capita income is used as an independent variable, considering the possibility that the central government allocates public investments as an employment policy or interregional redistribution. However, these variables tend to be correlated with each other and so it is also possible that they have correlation with political variables (voting weight or number of LDP seats) as pointed out by Nagamine (2001). Therefore, it is necessary to pay attention when interpreting the results.

Taking these points into account, an allocation equation of public investment will be estimated in the next section.

III.4. Estimation of an allocation equation of public investment

As shown in Figure 4 in section Ⅲ.1, as for the regional allocation of public investment in Japan since the rapid economic growth period, we can see not only the regional area has been treated well at all times, but also the ratio of the metropolitan area to the rural area in per capita terms fluctuates greatly. However, there are only a few studies on this change of regional allocation since the 1990s. Therefore, in this section we will clarify factors for the recent change in public investment allocation by doing empirical analysis, following the approach of previous studies that estimated allocation equations of public investment and considered the effects of political factors. We will estimate the following allocation equation (3).

$IP_i = f$ (income, population, area size, construction industry share, AFF industry share, job offers-to-seekers ratio, number of LDP seats) (3)

Here IPi stands for administrative investments by purpose[16]. As a political power affecting public investment allocation, we consider the construction industry share (value added share of construction industry) and the number of LDP seats (the number of LDP Representatives per capita). The number of LDP seats is also used in previous research, but some papers such as Yamashita (2001) have pointed out that the political power of the LDP might have declined after 1993 when the times of the coalition government began. So, in the empirical study of this paper we will consider the effect of changes in political environment on public investment allocation by clarifying how the political power of the LDP has changed after the government alternation in 1993. Also, we use the number of LDP Representatives as variables that indicate the political power of the LDP. This is because the number of LDP Representatives can include the effect of the voting weight, and it is difficult to interpret the meaning of variables used in the previous studies, such as the seat share or the vote rate of the LDP.

The other variable that is regarded as a political variable is construction industry share. As pointed out so far, the construction industry, which can make a profit as a receiver of public works, has a strong relationship with politicians. Therefore, it seems plausible to consider that the construction industry is a powerful interest group involved with the public works of local governments. While we will discuss theoretically in section Ⅳ that it is possible for the construction industry as a local interest group to affect the fiscal management of local governments by its political power, here we will consider construction industry share as a variable representing their political power for the present. We use the value added share of the construction industry as a proxy variable that represents the political power of the interest group. This is because data on the number of employed persons in each industry is not available every year on a prefectural level, although it might be appropriate to use the ratio of workers employed in the construction industry from the viewpoint of lobbying power[17].

Additionally, referring to Yoshino and Sakakibara (2002) and so on, we use income (logarithms value), population (logarithms value), area size (logarithm value), and AFF industry share[18] (which is defined as the value added share of the agricultural, forestry and fishery industry) as control variables.

Moreover, the job offers-to-seekers ratio is added as an independent variable to consider the possibility that public investment might be used as an employment policy as some previous papers have pointed out[19]. As mentioned above, since there are simultaneity problems in some variables, which are income, construction and AFF share, and job offers-to-seekers ratio, we use the instrumental variable method in the estimation[20].

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[16] We take logs of all administrative investments.
[17] The coefficient of correlation between the value added share and the ratio of workers employed in the construction industry is around 0.64 (in years when both statistics are available).
[18] This might reflect the political power of the agricultural, forestry and fishery industry as a local interest group, as for the AFF investment.
[19] Definitions and sources of the data are given in appendix (B).
[20] We use the first order and second order lags of income, construction industry share, AFF industry share,

Table 3 shows the estimation result of allocation equations concerning administration investments by purpose (livelihood, industry, AFF and land conservation). The sample period is from FY1980 to FY2003, but we also show the result of estimation in which sample period is divided into FY1980–1993 and FY 1994–2003 in order to see the effect of government alternation.

First of all, from the results on independent variables which control the scale of each region, we can confirm the following: livelihood investment has been influenced from income and population; industrial investment from income, population, and area size; AFF and land conservation investment from population (or income) and area size as for their allocation. This result almost corresponds to what was understood from the data in section Ⅲ.1, and it is consistent with results of earlier research as a whole.

Though coefficients of job offers–to–seekers ratio are negatively significant in many cases, they are positively significant to land conservation investment and are not significant to industry investment and AFF investment in some cases. Therefore we cannot necessarily conclude that public investment is allocated in consideration of the employment situation in each region.

Next, as for political variables, the number of LDP seats is positively significant in all cases except for livelihood investment, to which it is negatively significant or insignificant. It can be said that this result is consistent with the result of Yoshino and Sakakibara (2002), which concluded that political power has an influence on public investments except for livelihood investment, although the set of explanatory variables is somewhat different. However, we can confirm that coefficients of the number of LDP seats have greatly declined after 1993 when the government alternation occurred, even for industry investment, land conservation investment, and AFF investment, to which they are significant. Judging from the size of coefficients in the previous period (FY1980–1993), it can be considered that the political power of the LDP is strong for industry investment and AFF investment. According to estimated coefficients, it is confirmed that if the number of LDP Representatives per capita is 10% larger than that of the national average, both industry investment and AFF investment increase by about 2.2% on average.

On the other hand, as for construction industry share, we can confirm that it is positively and strongly significant to all investments by purpose. Moreover, we can confirm that the coefficients are higher after FY1993.

If we can regard the size of these coefficients as the strength of the political power of the construction industry, there is a possibility that the political power of the LDP has relatively decreased, while regional construction companies have strengthened their political power after 1993, when the times of the coalition government began. However, we have to acknowledge the possibility of reverse causality that public works might help the construction industry share to go up.

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and job offers-to-seekers ratio as instruments.

Table3 Estimation Results : Allocation Equations of Public Investment Estimation Method: IV

Dependent Variable:
Livelihood Investment

Independent Variables	Sample Period 1980-2003	1980-1993	1994-2003
Constant	1.841 **	-2.315 **	-0.849 **
	(-11.419)	(-27.184)	(-5.025)
Income	0.534 **	0.505 **	0.577 **
	(13.514)	(8.075)	(21.774)
Population	0.387 **	0.459 **	0.265 **
	(8.251)	(6.825)	(7.334)
Area Size	0.002	-0.011 **	0.020 *
	(0.317)	(-2.634)	(2.578)
Construction Industry Share	7.247 **	6.592 **	7.590 **
	(20.357)	(27.309)	(15.237)
AFF Industry Share	-4.562 **	-2.427 **	-7.674 **
	(-7.779)	(-10.785)	(-10.939)
Job Offers-to Seekers Ratio	-0.100 **	-0.042 **	-0.201 **
	(-4.637)	(-3.532)	(-4.199)
Number of LDP Seats	-0.063 **	-0.153 **	-0.020
	(-3.347)	(-15.353)	(-1.245)
Fixed Effect	Time Effect	Time Effect	Time Effect
Sample Size	1128	658	470
$\overline{R^2}$	0.974	0.979	0.969

Dependent Variable:
Industry Investment

Independent Variables	Sample Period 1980-2003	1980-1993	1994-2003
Constant	-0.969 **	-1.914 **	0.250
	(-4.093)	(-12.783)	(-1.009)
Income	0.413 **	0.428 **	0.288 **
	(11.543)	(7.227)	(8.588)
Population	0.233 **	0.291 **	0.332 **
	(5.089)	(3.991)	(7.409)
Area Size	0.183 **	0.164 **	0.169 **
	(21.807)	(16.972)	(11.049)
Construction Industry Share	6.180 **	5.545 **	7.180 **
	(15.488)	(7.979)	(12.982)
AFF Industry Share	-1.844 **	-2.166 **	-0.791
	(-5.081)	(-4.364)	(-0.987)
Job Offers-to Seekers Ratio	-0.214 **	-0.282 **	-0.010
	(-6.808)	(-7.626)	(-0.178)
Number of LDP Seats	0.109 **	0.223 **	0.036 *
	(4.504)	(7.595)	(2.562)
Fixed Effect	Time Effect	Time Effect	Time Effect
Sample Size	1128	658	470
$\overline{R^2}$	0.812	0.798	0.772

Dependent Variable:
Agricultural, Forestry and Fishery Investment

Independent Variables	Sample Period 1980-2003	1980-1993	1994-2003
Constant	1.486 **	0.300 *	2.657 **
	(5.907)	(1.971)	(10.835)
Income	-0.244 **	-0.197 **	-0.324 **
	(-5.837)	(-4.058)	(-4.283)
Population	0.308 **	0.334 **	0.343 **
	(10.039)	(6.214)	(6.000)
Area Size	0.623 **	0.613 **	0.610 **
	(42.295)	(32.963)	(33.206)
Construction Industry Share	5.377 **	5.141 **	5.299 **
	(16.510)	(8.574)	(13.469)
AFF Industry Share	0.710 †	-0.292	3.077 **
	(1.746)	(-0.527)	(6.960)
Job Offers-to Seekers Ratio	-0.054 *	-0.114 **	-0.040
	(-2.541)	(-4.476)	(-0.957)
Number of LDP Seats	0.068 *	0.223 **	-0.016
	(2.201)	(8.954)	(-0.791)
Fixed Effect	Time Effect	Time Effect	Time Effect
Sample Size	1128	658	470
$\overline{R^2}$	0.747	0.748	0.748

Dependent Variable:
Land Conservation Investment

Independent Variables	Sample Period 1980-2003	1980-1993	1994-2003
Constant	-0.484 **	-0.659 **	-0.337 *
	(-4.528)	(-9.870)	(-2.479)
Income	0.126 **	0.121 *	0.042
	(2.850)	(2.160)	(0.548)
Population	0.351 **	0.362 **	0.453 **
	(6.643)	(5.403)	(4.799)
Area Size	0.303 **	0.305 **	0.279 **
	(29.099)	(22.668)	(17.904)
Construction Industry Share	3.229 **	2.091 **	5.113 **
	(5.253)	(3.286)	(5.826)
AFF Industry Share	-0.123	0.199	-0.635
	(-0.297)	(0.476)	(-1.032)
Job Offers-to Seekers Ratio	0.103 **	0.092 **	0.215 **
	(4.475)	(4.564)	(3.178)
Number of LDP Seats	0.035 †	0.041 **	0.022
	(1.660)	(3.059)	(0.690)
Fixed Effect	Time Effect	Time Effect	Time Effect
Sample Size	1128	658	470
$\overline{R^2}$	0.759	0.743	0.701

Note: Heteroskedasiticity-robust t-values are in parentheses.
**, *, † indicates statistically significant at 1,5, 10 percent level, respectively.

Considering that the weight of the construction industry (share of employed persons or added value) is high in the rural area, it can be considered the fact that the political power of the construction industry has become stronger while that of the LDP has declined after government alternation is one of the reasons public investment allocation in the rural area increased again during the 1990s.

In the following section IV, based on the findings obtained above, we will investigate the decision mechanism of public investment in local governments by constructing a political–economic model and carrying out an empirical analysis.

IV. A political economic analysis on the public investment policy of local governments

In this section, considering the possibility that the influence of the local side (local politicians, local interest groups, etc.) on public investment policy has been stronger[21], we will focus on how local governments make their policy decisions. By constructing a political–economic model that considers the process of policy decision on the public investment of local governments and by doing an empirical analysis, we will examine whether the political power of the local side influences the level of public investment in prefectures and its implications for resource allocation.

IV.1. Local public investment function (the model)

As political agents involved in the public investment policy of local governments, we consider voters, an interest group depending on public investment (concretely, the construction industry), a local politician (prefectural governor), and assume a political environment such as that of the interest group ask the governor to increase public investment by cooperating his campaign in exchange.

The basic framework of this model follows Grossman and Helpman (1996), which clarifies characteristics of the policy achieved in political equilibrium when lobbying and electoral competition are considered, and Kondoh (2007), which analyzed the influence of an interest group that depends on the expenditures of local governments. It differs from Kondoh (2007) in that we consider the median voter's preference.

[21] Kato (2003) and Sunahara (2006) are given as examples of research, which pointed out that political factors of the local side (such as partisanship of the governor or assembly) affect the fiscal management of local governments.

IV.1.1. Political process and equilibrium policy

It is assumed that political games as follows are played according to Grossman and Helpman (1996).

① Two candidates for a governor(A,B) fight over an electoral campaign, promising a certain level of public investment.

② Two types of voter, an informed voter and an uninformed voter, are assumed. Here, informed voters vote based on utility, which they achieve from the public investment level that each candidate promises. On the other hand, uninformed voters do not have information on the public investment level that each candidate promises, and vote based on the relative size of campaign contributions thrown out in the electoral campaign.

③ Each candidate chooses the public investment level to maximize a vote rate.

④ An interest group can indirectly manipulate the voting behavior of informed voters through making a campaign contribution to the candidate in order to maximize the members' expected utility.

⑤ The public investment level promised by the candidate who won the election is executed (the commitment is binding).

Therefore, an interest group can achieve its desirable policy by offering a sufficient contribution to the candidates for a governor.

To consider the median voter's preference[22], a vote rate from informed voters is assumed to be maximized when the public investment level is chosen that maximizes the median voter's utility (bliss point), and it is assumed that the vote rate decreases monotonically as the public investment level is away from the bliss point.

We consider the policy decision mechanism mentioned above as a two-stage and non-cooperative game, such that

(1) an interest group announces a campaign election contribution schedule,

(2) each candidate decides the public investment level (K=A,B) which will be announced as a commitment respectively.

Then, the equilibrium policy is obtained as a Subgame Perfect Nash Equilibrium , and it is shown to satisfy the following property.

Proposition: When an interest group makes campaign contributions to each candidate, the equilibrium policy satisfies the following condition[23],

$$g^K = \arg\max_g \left[\varphi^K W_{SIG}(g) + \delta W^M(g)\right] \qquad \text{for K=A,B} \tag{4}$$

[22] Hereafter, we assume that the median voter is a person with a median income in each jurisdiction.

[23] This corresponds to Proposition 1 of Grossman and Helpman (1996). It differs in that our condition includes the median voter's preference, W^M. Derivation of this condition is given in appendix (C).

where W_{SIG} represents the total utility of an interest group, W^M represents the median voter's utility, and φ^K is assumed as a function that shows the probability that candidate K wins, which is increasing in relative advantageousness in the election of candidate K (represented by parameter b). δ shows the relative weight of informed voters.

IV.1.2. Derivation of the public investment function

The policy characterized by the above proposition becomes the public investment policy of local governments (=local public investment function) if the commitment is binding. In the following, the public investment function is derived by specifying the objective function of the median voter and the interest group.

A. Local government

It is assumed that local governments invest their funds in public works (public investment level = g), which are financed by proportional income tax from voters (tax rate= t_L), a matching grant from the central government (rate of subsidization= θ), and a lump-sum grant (local allocation tax) T. At this time, the budget constraint of each local government is as follows:

$$t_L \sum_i y^i + T = (1-\theta)g \tag{5}$$

where y^i is the income level of individual i.

B. Median voter

The median voter is assumed to obtain utility from private good consumption (c) and public investment level (g), and maximizes the following utility function,

$$u^M = c^M + v(g) \tag{6}$$

where we assume $v' > 0$, $v'' < 0$.

The median voter's budget constraint is as follows, if we denote the proportional income tax rate of the central government as t_C.

$$c^M = (1-t_L-t_C)y^M \tag{7}$$

Here, if we define the median voter's income share as $s^M \equiv \dfrac{y^M}{\sum_i y^i}$, and use this expression and the budget constraint of a local government (5), the median voter's burden of local tax can be written as follows:

$$t_L y^M = s^M(1-\theta)g - s^M T \tag{8}$$

Therefore, the median voter's budget constraint, which consolidates the budget constraint of a local government, becomes as follows.

$$c^M = (1-t_C)y^M - \left[s^M(1-\theta)g - s^M T\right] \tag{9}$$

The median voter's indirect utility function is obtained by inserting (9) into (6).

$$W^M = (1-t_C)y^M - \left[s^M(1-\theta)g - s^M T\right] + v(g) \tag{10}$$

C. Interest group

We assume that the income of an interest group is closely related to the public investment level (g), and its utility function is linear for g ,

$$u_{SIG} = \gamma_{SIG} \cdot g \tag{11}$$

where γ_{SIG} represents a degree to which the interest group (member) depends on public investment[24].

Then, the total utility of the interest group is written as follows:

$$W_{SIG} = n_{SIG} \cdot \gamma_{SIG} \cdot g \tag{12}$$

where n_{SIG} represents the number of members of the interest group.

D. Political equilibrium

The equilibrium policy can be solved as follows by substituting (10) and (12) into (4), from the proposition;

$$g^* = \arg\max_g \left[\varphi(n_{SIG} \cdot \gamma_{SIG} \cdot g) + \delta\left\{(1-t_C)y^M - \left[s^M(1-\theta)g - s^M T\right] + v(g)\right\}\right] \tag{13}$$

Then the equilibrium policy satisfies the following first order condition,

$$v'(g) = (1-\theta)s^M - \frac{\varphi}{\delta} \cdot n_{SIG} \cdot \gamma_{SIG}$$

$$= (1-\theta)\frac{1}{N} \cdot \frac{y^M}{\bar{y}} - \frac{\varphi}{\delta} \cdot n_{SIG} \cdot \gamma_{SIG} \tag{14}$$

where $\bar{y}$ shows average income of each jurisdiction, namely $\bar{y} = \sum_i y^i / N$.

In the equilibrium policy, it is shown that the preference of median voter's and the interest group is reflected in the first and second term of the right hand side of (14), respectively. From this condition, it is understood that the public investments level in political equilibrium increases as the income of the median voter is lower than that of the average income in the

[24] We assume the degree of dependence is unchanged even if the number of members changes, since it denotes responsiveness; that is, how closely income of the industry is correlated with the amount of public works.

jurisdiction, and as the interest group increases their members (as long as φ/δ is not 0) and as their degree of dependence on public investment rises. If the interest group does not exist ($n_{SIG}=0$) or only informed voters exist ($\delta=\infty$), the second term in the right hand side becomes 0, and a preferable policy for the median voter will be achieved. In addition, if median income equals average income ($y^M=\bar{y}$), it is understood that the first order condition becomes $Nv_g=1-\theta$, and that the level of public investment becomes optimal in the jurisdiction (satisfies Samuelson condition). In short, in the case of general income distribution, $y^M<\bar{y}$, the amount of public investment increases and the efficiency of resource allocation will be distorted, as the ratio of the median to average income is lower (that is, as income distribution is unequal), in addition to the influence of the interest group.

When we denote the equilibrium policy (local public investment function) by $g^*(N,n_{SIG},\gamma_{SIG},MED,\theta,\varphi,\delta)$ (where the ratio of the median to the average income is defined as relative median income; $MED=y^M/\bar{y}$), the direction of change of the equilibrium policy with respect to each parameter's change becomes as follows:

$$\frac{\partial g^*}{\partial N}>0,\ \frac{\partial g^*}{\partial n_{SIG}}>0,\ \frac{\partial g^*}{\partial \gamma_{SIG}}>0,\ \frac{\partial g^*}{\partial MED}<0,\ \frac{\partial g^*}{\partial \theta}>0,\ \frac{\partial g^*}{\partial \varphi}>0,\ \frac{\partial g^*}{\partial \delta}<0 \qquad (14)'$$

IV.2. Local public investment function (empirical analysis)

In this section, based on the results obtained by the model of the previous section (14), we will estimate the following equation (15) regarding the construction industry as an only interest group[25].

IG= f (ratio of persons employed in the construction industry,
degree of the construction industry's dependence on public investment,
relative median income, rate of subsidization, and reelection dummy) (15)

Using the notation of the theoretical model, the ratio of persons employed in the construction industry is n_{SIG}, degree of the construction industry's dependence on public investment (hereafter, the degree of dependence) is γ_{SIG}, relative median income is MED, rate of subsidization is θ, and reelection dummy is φ[26]. Sign conditions are as follows. The ratio of persons employed in the construction industry, degree of dependence, rate of subsidization, and reelection dummy are positive, while the median relative income is negative. We added the amount of standard financial need (per capita, national average, and logarithm values) in order

[25] Definitions and sources of the data are given in appendix (B).

[26] Strictly, it corresponds to parameter b (relative advantageousness of the candidate in the election), an argument of φ. We use the reelection dummy as a proxy variable of parameter b, since it is highly possible that the incumbents are well known and that they have advantages in the election.

to consider the macro effect of a fiscal transfer through local allocation tax, and per capita income[27] as a proxy variable to control the central government's motive for regional allocation (or political motivation of the ruling party) to the set of independent variables. As a dependent variable (IG), besides ordinary construction expenses (per capita, expenses by prefectures, and logarithm values), we will use ordinary construction expenses share (=ordinary construction expenses/total expenses) in order to control the difference in scales between local governments.

Similar to the estimation of the allocation equation of public investment in chapter III, we will use panel data of prefectural and cross sectional data that is pooled for multiple fiscal years. Since data on income distribution and the number of persons employed in the construction industry, which are necessary for constructing key independent variables, are only available in years when the "Employment Status Survey" by MIAC was conducted, we use the data of these discrete five years: FY1982, FY1987, FY1992, FY1997, and FY2002. As for government expenses, we use data on the settlement of accounts in the following year of each, considering the time lag of policy decision. Moreover, equations are estimated by the instrumental variable method that uses lag variables as instruments[28]; this is because there is the problem of simultaneity between the construction industry share or degree of dependence and ordinary construction expenses.

Ordinary construction expenditures of local governments are classified depending on how much local governments pay the costs of projects; one is subsidized projects that receive subsidies from the central government, and the other is each local government's own projects, which are carried out without receiving any subsidies from the central government. Since there is the possibility that this difference in the burden of the costs may influence estimation results, we estimate four equations that are different in terms of definition of the dependent variable; ordinary construction expenses (the total, local government's own projects, subsidized projects) and the share of ordinary construction expenses in total expenses. Table 4 shows the estimation results.

According to this, variables which represent the influence of the interest group (ratio of persons employed in the construction industry and degree of dependence) satisfy sign conditions and are considered to be strongly significant. The results do not depend on the definition of the dependent variable, while relative median income representing the influence of the median voter is positively significant, which is contrary to the sign condition. Thus, we can confirm that the public investment policy of local governments is strongly affected by the political power of the interest group, but it is not determined in the way the median voter theorem implies[29]. Moreover, we cannot necessarily say that the influence of the interest group

[27] If the central government allocates public investment based on motives for regional redistribution (as pointed out by Iwamoto et al. (1996)) or keeping in the power of government by the LDP, the coefficients of per capita income will take negative values.

[28] We use the first order and second order lags of ratio of persons employed in the construction industry, ratio of persons employed in the AFF (Agricultural, Forestry and Fishery) industry and degree of dependence.

[29] It is possible that this estimation result is biased, if the size of the interest group correlates strongly

is different depending on own projects or subsidized projects, because the coefficient of own projects is high for the ratio of persons employed in the construction industry, while that of subsidized projects is high for the degree of dependence.

Additionally, the reelection dummy used as a variable that represents the governor's attributes also satisfies the sign condition and significant; as such, it is implied that the reelected governors have a stronger influence on policy management as compared with newcomers (except for successors).

Table4 Estimation Results: Local Public Investment Function

Data Sample; Prefectural Panel Data
Sample Period: FY1983, 1988, 1993, 1998, 2003

Dependent Variable:
Ordinary Construction Expenses(per capita, share)

Independent Variables	Total	Own Project	Subsidized Project	Share
Constant	-7.850 **	-8.022 **	-9.344 **	-1.048 **
	(-13.461)	(-8.750)	(-12.847)	(-8.440)
Ratio of persons employed in the construction industry	9.622 **	13.837 **	9.342 **	1.121 **
	(3.639)	(7.636)	(3.208)	(4.653)
Degree of Dependence	2.363 **	1.574 **	2.641 **	0.175 **
	(9.631)	(6.261)	(11.014)	(10.980)
Relative Median Income	3.920 **	3.635 **	3.513 **	0.768 **
	(3.702)	(3.212)	(2.847)	(5.054)
Rate of Subsidization	0.929 *	-1.946 **	3.236 **	0.241 **
	(2.326)	(-5.410)	(9.623)	(5.922)
Incumbent Dummy	0.063 **	0.068 †	0.050 **	0.006 *
	(3.449)	(1.718)	(3.473)	(2.357)
Standard Financial Need	1.738 **	1.876 **	1.846 **	0.174 **
	(26.682)	(13.129)	(42.278)	(15.485)
Income Level	-0.656 **	-0.586 **	-0.554 **	-0.061 **
	(-5.944)	(-7.405)	(-5.145)	(-3.435)
Estimation Method	IV	IV	IV	IV
Regional Dummy	Yes	Yes	Yes	No
Sample Size	235	235	235	235
$\overline{R^2}$	0.986	0.938	0.974	0.908

Note: t-values are in parentheses.
**, *, † indicates statistically significant at 1,5, 10 percent level, respectively.
Tokyo and Hokkaido dummy are included.

with the income distribution of each region. However, the coefficient of correlation is low (about 0.2). Therefore, it is thought there do not exist any serious problems in estimation, although the interaction between the local interest group and income distribution is worth examining.

As for the rate of subsidization, it is negatively significant to own projects though the sign condition is positive. Here, because the rate of subsidization is defined as the ratio of national treasury disbursements to the total amount of ordinary construction expenses, this result implies that subsidized projects and own projects are used as substitutes for each other. Namely, it can be considered that when a project which is necessary for a local government can be subsidized, there is the possibility that the local government would decrease its own projects while increasing subsidized projects (vice versa).

Moreover, standard financial need is strongly and positively significant to per capita ordinary construction expenditures, which implies that there is a macro effect of local allocation tax on the amount (or scale) of spending. It is worth noting that the coefficient is positive even when the share of ordinary construction expenditure, which is independent of the budget scale, is taken as the dependent variable. This result shows that the amount of investment expenditure tends to increase more than that of obligatory expenditure in local government expenditures when fiscal transfer from the central government to local governments is larger. Also, there is the possibility that the result is affected by subsidization of local bonds, which was intended to induce public investment of own projects after the burst of the bubble economy[30][31].

From the results of empirical analysis on the local public investment function, we have proved that the construction industry as an interest group (whose income depends on public works) has influenced the public investment policy of local governments, while the median voter's preference has not. Moreover, as for the effects of grants, it is verified that both a lump sum and matching grant influence the level of public investments. Though it can be said that each local government takes reasonable action if a subsidy policy (the amount of grants and rate of subsidization) is exogenously (or institutionally) given for local governments, we should note that there is the possibility that welfare loss is generated as a whole country by distorting tax price for them.

Ⅴ. Conclusion

In this paper, we have analyzed how a government party or special interest groups would influence public investment policy in order to investigate the political-economic aspects of public capital formation in Japan. This analysis has been done from three points of view: short term fluctuations at the macro level, regional allocation of public investment, and the policy formation process of local governments.

First, at the macro level, it is possible that short-term fluctuations in public investment have

[30] Higo and Nakagawa (2001) discussed the subsidization of local bonds in detail. Doi and Bessho (2005) clarified by empirical analysis the possibility that the subsidization of local bonds induced local governments to expand public investment.

[31] The coefficients of per capita income are negative for local own projects, which is not considered to be controlled easily by the central government. This also may be due to the subsidization of local bonds.

been controlled by the government party's political incentive to win an election (that is, they use public investment as an expansionary policy tool for winning a national election) rather than in order to dampen economic fluctuations. Second, as for regional allocation, up to 1993 when it stepped down from government, the LDP had had a great influence on public investment allocation; however, following that government alternation, the influence of local special interest groups may have become stronger.

Also, focusing on the local side, empirical analysis of the public investment function considering political economic factors has clarified that local public investment policy has been strongly affected by the construction industry as a local interest group (which is heavily dependent on public investment), and that levels of public investment have not been determined in the way the median voter theorem implies. Moreover, it has been confirmed that fiscal transfers from the central government could affect the incentives of local governments.

From the analyses of this paper, we have proved that the public investment policy of Japan is influenced by political incentives both in the central and local governments, and that it has been often utilized for different purposes (political purposes or disguised income transfers to special interest groups) from primary ones.

As shown by the theoretical analysis of section Ⅳ, in many cases efficiency loss is greater when special interest groups have political power than when the median voter has decisive power. Given that, ongoing reform toward fiscal decentralization is desirable, in the sense that it aims to mitigate the inefficiency of intergovernmental transfers, but still insufficient. Reform of local politics is needed in order to eliminate policy determination tilted to a particular special interest group[32] as much as possible.

As pointed out in Sato (2004), although the progress of fiscal decentralization can make the government that makes decisions on local public policy closer to people living in the region, on the other hand, the government will possibly become closer also to special interest groups of the region. Therefore, to be concrete, it may be important to promote the disclosure of public information and the reform of local elections in order to form public capital efficiently.

Appendix

(A) Breakdown of administrative investment

Source: "Report on Administrative Investment" by the Ministry of Internal Affairs and Communications (MIAC).

Livelihood investment consists of:

[32] In this paper, we have regarded the construction industry as a special interest group as we focus on expenditures for public investment. However, it is natural that interest groups (or industries) would vary with expenditure purposes.

[1] City, town and village roads, [2] Streets, [3] City planning, [4] Housing, and [5] Welfare (including works of hospitals, nursing care services, national health insurance, health and medical services for the elderly, insurance for the elderly care and hospitals attached to public universities).

Industry investment consists of:

[1] National highways and prefectural roads, [2] Harbors (including simplified waterworks), [3] Airport, and [4] Industrial water.

Land conservation investment consists of:

[1] Forest and river conservation, and [2] Seashore conservation.

(B) Definitions and sources of the data

(1) Allocation equations of public investment

・'Income', 'Construction industry share', 'AFF (Agricultural, Forestry and Fishery) industry share'–

Source: "Prefectural Accounts" by MIAC.

Definition: 'Income' is Gross prefectural domestic product (prefectural GDP). We define 'Construction industry share', and 'AFF industry share' as the ratio of gross prefectural domestic product by economic activities (construction industry and agricultural, forestry and fishery industry) to prefectural GDP.

・'Population'–

Source: "Population in Japan derived from the Basic Resident Registers" by the MIAC.

・'Area size'–

Source: "The Whole Country Area Size Survey of Prefectures, Cities, Wards, Towns and Villages" by the Geographical Survey Institute, the Ministry of Land, Infrastructure and Transport (MLIT).

・'Job offers-to-seekers ratio'–

Source: "Statistics for Job Placement Operations" by the Ministry of Health, Labor and Welfare (MHLW).

・'Number of LDP (the Liberal Democratic Party of Japan) Seats'–

Source: "Survey on the House of Representatives Election and Results of a Review of the Supreme Court by the Citizens at the polls" by the MIAC.

We define 'Number of LDP Seats' as the ratio of the number of LDP members elected from electoral districts (the House of Representatives, per capita) to the overall national average.

(2) Local public investment function

・'Ratio of persons employed in the construction industry'–

Source: "Employment Status Survey" and "Census" by the MIAC.

We define 'Ratio of persons employed in the construction industry' as the ratio of the

number of persons employed in the construction industry to the total number of persons employed.

- 'A degree of the construction industry's dependence on public investment' (or 'Degree of dependence', for short)–

  Source: "Survey on Construction Works Statistics" by the MLIT.

  We define 'A degree of the construction industry's dependence on public investment' as the ratio of the amount of civil engineering works for public sectors to the total amount of civil engineering works.

- 'Relative median income'–

  Source: "Employment Status Survey" by the MIAC.

  We define 'Relative median income' as the ratio of the median income to the mean income. The 'median' and 'mean' incomes are calculated from tables on the income distribution of households reported in the "Basic Survey on Employment Structure".

- 'Rate of Subsidization'–

  Source: "Survey on Prefectural Government Financial Settlements" by the MIAC.

  We define 'Rate of Subsidization' as the ratio of the amount of national treasury disbursements appropriated for ordinary construction expenses to the total amount of ordinary construction expenses.

- 'Incumbent Dummy"–

  We define 'Incumbent Dummy' which takes a value of 1 if the governor in office was reelected or was a successor of the former governor, or otherwise it is 0.

  We identify whether or not the governor is a successor of the former one, depending on newspaper articles (the "Asahi Shinbun" and "Nikkei Shinbun").

- 'Standard financial need' –

  Source: "Annual Statistical Report on Local Government Finance" by the MIAC.

  We use the 'Standard financial need' variable, which is calculated as the per capita amount of standard financial need (the overall national average).

- 'Income level'–

  We define 'Income level' as the ratio of prefectural GDP (nominal, per capita) to GDP (nominal, per capita).

(C) Derivation of Propositions

Although we basically follow the model of Grossman and Helpman (1996), we specify the vote rate function as follows in order to incorporate preferences of the median voter into the model. Letting s denote the vote rate of candidate A (accordingly, the vote rate of candidate B is 1–s), we have

$$s = (1-\alpha)\left\{\frac{1}{2} + \upsilon\left(W^M(g^A) - W^M(g^B)\right)\right\} + \alpha\left\{\frac{1}{2} + h(C^A - C^B)\right\} \qquad \text{(A.1)}$$

where α is the fraction of uninformed voters, C^K is the campaign spending undertaken by candidate K(=A,B), υ is the degree to which informed voters respond to policy (we assume $\upsilon > 0$), and h is the degree to which uninformed voters respond to campaign spending (we assume $h > 0$), respectively. Therefore, the first term of the right hand side of (A.1) denotes the vote rate from informed voters and the second term denotes the vote rate from uninformed voters.

Each candidate has the option of declining the campaign contributions offered by interest groups, and could adopt the policy that maximizes the vote rate from informed voters. This vote rate, which we denote by s^*, can be written as follows:

$$s^* = (1-\alpha)\left\{\frac{1}{2} + \upsilon\left(W^M(g^*) - W^M(g^B)\right)\right\} + \alpha\left(\frac{1}{2} - hC^B\right) \tag{A.2}$$

The interest group must pay enough contributions to be certain of obtaining the vote rate of s^* at least. The minimum contribution to meet this requirement, which we denote by $\overline{C^A}$, is calculated as follows from (A.1) and (A.2).

$$\overline{C^A} = \frac{1-\alpha}{\alpha h} \cdot \upsilon \cdot \left\{W^M(g^*) - W^M(g^A)\right\} \tag{A.3}$$

By inserting (A.3) into (A.1), it is easy to confirm that the vote rate of candidate A is constant if the interest group offers the contribution of $\overline{C^A}$.

The interest group is then able to let the candidate implement the policy which maximizes the interest group's net benefit: $V = \varphi \cdot W_{SIG}(g^A) + (1-\varphi) \cdot W_{SIG}(g^B) - C^A - C^B$.

Consequently, candidate A should maximize $V = \varphi \cdot W_{SIG}(g^A) + \frac{1-\alpha}{\alpha h} \cdot \upsilon \cdot W^M(g^A)$. As we can calculate this in the same way also for candidate B, the first order condition (4) is obtained using the expression of $\delta \equiv \frac{1-\alpha}{\alpha h} \cdot \upsilon$.

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