The Interregional Distribution through fiscal policy and the Movement of Production Factors in Japan

Kazuyasu Kawasaki
Associate Professor, Tokai University School of Political Science and Economics
4-1-1 Kitakaneme Hiratsuka, Kanagawa, 259-1292, Japan

Abstract

A regional development policy in Japan has focused on equalizing interregional difference. For achieving a policy target, Japanese government has executed attracting policy industries to the region. The net movement of population is sometimes used as one of the outcome because labor force moves to an area being able to earn higher income. A wage level associates with productivity. Nowadays, the net interregional migration is decreasing in Japan.

I confirm whether the gap of interregional productivity exists or not. It is important topics for regional economist and urban planner whether it is adjusted with the gap of productivity through the movement of production factor or not. If the gap of interregional productivity does not exist, then the net movement of population decreases means the result to be adjusted with the movement of production factor (convergence). If the gap of interregional productivity exists, then the net movement of production factor decreases means to cause other factor.

In this paper, I estimate regional production function and confirm whether the gap exists by comparing numerical value with real value. As a result of analysis, I have cleared that the gap of interregional productivity exists. It is mean that the net movement of population decrease in Japan does not cause to converge. As a result of empirical analysis that investigated the cause, it was clarified that it gives a big effect of interregional distribution. This is one of the big political topics in Japan's post WW2 regime.

Keywords: convergence, productivity of production factor, public employment
JEL classification: E6, H3, H4

1. Introduction

In Japan, as symbolized by the Comprehensive National Development Plan with its slogan of "the balanced development of national land," regional promotion measures such as factory location and resort development have been promoted in an effort to correct interregional gaps. Also, past comprehensive national development plans clearly stated the investment scale of financial resources for infrastructure development in these regional promotion measures, and the measures bore a strong resemblance to public works projects. Moreover, in the background of these plans lay the income gap between urban and rural areas, which was one of the main reasons for urban concentration. By getting industries that generate relatively high incomes to locate in rural areas, these plans were designed to control the rural population outflow and stimulate regional economies.

However, if the market mechanism is working, whenever this kind of interregional income gap occurs, the movement of labor and capital stock should over the long term cause the gap to move in the direction of shrinking (converging) and eventually be corrected. It was understood that when an interregional gap in marginal productivity occurs, production factors move from regions where marginal productivity is lower to regions where it is higher, causing marginal productivity to converge and production in society as a whole to be made efficient.

If we focus on labor, when a gap occurs in real wages, which go hand in hand with labor productivity, labor moves from the place (industry or region) where wages are lower to one where they are higher, thereby bringing about an equalization. But in post-war Japan, it appears that in response to this interregional gap, efforts were made to correct the gap not through the market but by way of redistribution through fiscal policy.

In reality, if we look at the statistics, as the population movement shown in Figure 1 decreases (converges), the interregional income gap is shrinking, as seen in Figure 2. Researchers who have focused on this point include Barro and Sala-i-Martin (1992), Fukao and Yue (2000), and Shioji (2001). Barro and Sala-i-Martin (1992) assert that the income gap in Japan shrank through population movement, while Fukao and Yue (2000) and Shioji (2001) say that such a phenomenon was not observed. In particular, Shioji (2001) states that as a result of population movement, labor with high productivity (human capital) is concentrated in cities, and productive capacity has by no means been equalized. Also, in Kawasaki (2007), upon estimating and analyzing the dispersion of the derived marginal productivity, it was found that for private capital

stock, that dispersion showed a tendency to shrink over time, or more specifically to converge, while for labor, the dispersion showed a tendency to expand over time. In other words, the study demonstrated that the phenomenon in which population movement appears to converge is not due to a shrinking of the interregional gap in marginal productivity.

<Insert Fig. 1> <Insert Fig. 2>

From a macroeconomics viewpoint, it can be interpreted that in order to equalize the business cycle, in bad economic times expansive fiscal policies were taken and public investment serving that function was distributed to rural areas. As seen in Figure 3, historically the distribution of investment in rural areas was expanded, primarily in the recession periods after the oil shock and after the bubble economy collapsed. While we do not deny the fact that these policies propped up regional economies by creating demand in the recession periods, neither can we deny the possibility that by retaining low productivity sectors, the policies delayed structural reform that would have led to increased rural production capacity.

<Insert Fig. 3>

In this light, this paper aims to estimate the optimal distribution of labor and capital stock through the mobilization of production factors as well as to determine whether or not the stagnation in population movement in recent years is actually due to a shrinking of interregional gaps, and in doing so to reveal the role of the redistribution that was carried out through fiscal policy.

In Section 2 below, we estimate the regional production function, which is a measure of the influence that production factors, including social capital stock, had on macroeconomics. With this production function estimate, we derive the marginal productivity of the various production factors. In Section 3, we use the derived marginal productivity to explore the optimal distribution of production factors through a simulation. In Section 4, we examine what factors cause interregional productivity gaps to occur, and we conduct an empirical analysis in an effort to reveal their relationship with fiscal surplus. In Section 5, we close by organizing the results derived from this study and the issues that remain.

2. Derivation of marginal productivity

In this section, we explain about the estimation of regional production function, which forms the core of this study's analysis, and the method we use to derive the marginal productivity of the various production factors.

Since Aschauer (1989), a great deal of analysis has been done, including in Japan, of the productivity effect of social capital stock. Two methods have been employed for this research on the productivity effect of social capital stock: a method using macro data to measure the effect that social capital stock has on a single country's production, and a method that separates social capital stock by categories or by regions and analyzes it. This study has as its central theme the issue of the interregional distribution of resources, so it conducts an analysis by region.

(1) Formulation

Since Aschauer (1989), many experimental studies have been conducted to measure the productivity effect of social capital stock. With regard to issues such as the specification of a function model and the resilience of social capital stock, a comprehensive survey was done by Homma and Tanaka (2004), and with regard to function models, there have been many measurements done using the Cobb-Douglas model and the Translog model. Also, Hayashi (2003) writes that social capital stock does not contribute directly to production but instead has an indirect influence by improving productivity through private capital stock. In this study, we hypothesize an environmental creation model of production function and formulate it as follows.

$$y_{it} = A_i K_{it}^{1-\alpha} L_{it}^{\alpha} G_{it}^{\beta} \tag{1}$$

In this equation, y represents gross production in a prefecture, A represents technological parameters, K represents private capital stock, G represents social capital stock, and L represents the number of employed workers. Meanwhile, i represents the regional index and t the time index. Here, if we take the natural logarithm of both sides of formula (1), we can transform it as follows.

$$\ln Y_{it} = a + (1-\alpha)\ln K_{it} + \alpha \ln L_{it} + \beta \ln G_{it} \tag{2}$$

After developing and organizing this, we estimated the regional production function used in this paper, using the following estimation model. As Hayashi (2003) and others have noted repeatedly, there is a problem with synchronism, in that capital stock is represented by end-of-term data and cannot be attributed to production activities at

that point in time. Therefore, in this study, for capital stock data, we employed a one-term lag and did an empirical analysis using the following formula.

$$\ln(y_{it} / K_{it-1}) = a + \alpha \ln(L_{it} / K_{it-1}) + \beta \ln(G_{it-1}) \tag{3}$$

When we use formula (1) and show the marginal productivity of private capital stock, of social capital stock, and of labor as MPK, MPG, and MPL, respectively, the relationship is as follows.

$$\partial y / \partial K \equiv MPK = (1-\alpha)\, y/K \tag{4}$$

$$\partial y / \partial L \equiv MPL = \alpha\, y/L \tag{5}$$

$$\partial y / \partial G \equiv MPG = \beta (y/G) \tag{6}$$

(2) Data

In this study, in order to conduct an analysis using long-term data, maintaining statistical consistency is difficult due to things like the revisions of standards. We thus converted the data used in the following way.

① Gross expenditure by prefectural residents (y_{it})

For the nominal gross expenditure by prefectural residents, we used data from the "Annual Report on Prefectural Accounts" (Japanese Cabinet Office). But those statistics from 2000 onward conform to the System of National Accounts 1993 (93SNA), which means they are not always fully consistent with statistics prior to that, which conform to the System of National Accounts 1968 (68SNA). Also, the data for before 1974 was acquired from "Long-term Retroactive Estimates, Annual Report on Prefectural Accounts (S30-S49)" (Economic Planning Agency of Japan (now the Japanese Cabinet Office)). This nominal data for before 1974 also conforms to 68SNA. With respect to the inconsistencies, in this study, we integrated the data by estimating separately the relational expressions for replacing the 68SNA with the 93SNA. Specifically, the 93SNA data is estimated retroactively to 1990[1], including at the prefectural accounts level, and we used the data from the period where 93SNA and 68SNA overlapped (1990-99) and conducted a regression analysis without constant terms, then used those parameters to replace the 68SNA data with 93SNA data.

Next, we converted this nominal data to real values. In this study, we used the GDP deflator in the "Annual Report on National Accounts" (Cabinet Office) to do the conversions. The reason we chose the national accounts instead of the prefectural

[1] Note that expenditure items in the macro statistics for System of National Accounts (SNA) can be taken back to as early as 1980.

accounts here was because there are some missing values[2] for some prefectures in the prefectural accounts, which would cause problems in the analysis. And also for the deflator, there is the problem of 93SNA and 68SNA, and differences exist in the base year as well. Statistics up until 1999 used 1990 as the base year with a value of 100, but statistics from 2000 onward were changed to make 1995 the base year. Therefore, in this study, just as with prefectural expenditures, we estimated a simple linear regression formula with no constant terms for the data from the overlapping period and then used those parameters and made that the conversion formula.

② Number of employed workers (L_{it})

For the number of employed workers[3], we used the figures listed in the "Annual Report on Prefectural Accounts" (Japanese Cabinet Office) for data from 1975 onward. And for data prior to 1974, we used estimated data from Takero Doi.[4]

③ Real private capital stock (K_{it})

The real private capital stock is macro data covering all industries. The most recent data that was available was data estimated by the Central Research Institute of Electric Power Industry (CRIEPI). Data since 1975 is recorded in this. CRIEPI's private capital stock data is converted to real values with a base year of 1995. In addition, Doi's (2002) private capital stock data for 1955-1998 is estimated and then converted to real data with a base year of 1990. We opted to use these two sets of data to create a data set for estimation purposes.

Just as in the case of the gross prefectural expenditures, we used the periods when data overlapped (in this case, 1975-1998), estimated a conversion equation, substituted the past data, and integrated it with the data covering up to 1974.

④ Real social capital stock (G_{it})

For real social capital stock data as well, we used social capital stock data by CRIEPI as the base and integrated it with the data from Doi (2002) using the same method as with private capital stock. For both the CRIEPI data and the Doi (2002) data, we made estimations using the 1970 National Wealth Survey as a benchmark, and we took measures designed to accommodate the statistical inconsistencies that came with the privatization of NTT and JR after 1985, incorporating that into social capital stock.

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[2] Specifically, there are values missing in the 1970s in the data for Fukushima, Saitama, Toyama, Okayama, and Okinawa prefectures, so the data cannot be converted to real data.

[3] The number of employed workers is not affected by the SNA standard revisions.

[4] These are publicly available on Professor Doi's website (http://www.econ.keio.ac.jp/staff/tdoi/).

(3) Estimation of regional production function

As is noted in Yoshino and Nakano (1996) and others, we took into account the possibility that the effects of social capital stock would spill over and thus divided the country into seven blocs[5] before conducting the analysis. There are some variables for which data cannot be collected for Okinawa prior to its reversion to Japanese administration, so the prefecture was excluded from the analysis.

The level variables for these blocs are simple sums of the values for each prefecture. As for the estimation period for the production functions, to account for issues like data integration, we used data from 1975 onward for our estimation. Also, the Hausman test found the Random Effect model to be supported, so we used those parameters to derive the marginal productivity in formulas (4) through (6). The results of the estimation made with formula (3) with the Random Effect model are as follows. The parentheses under each coefficient show the t-value.

$$\ln(y_{it} / K_{it-1}) = -2.308 + 0.739 \ln(L_{it} / K_{it-1}) + 0.197 \ln G_{it-1}$$

(-4.51) (24.48) (6.12)

$$\text{adj}\, R^2 = 0.919,\ F = 7633.42,\ \text{Hausman Test} = 1.09$$

(4) Derivation of marginal productivity for the various production factors

Using the parameters estimated by this Random Effect model, we followed formulas (4) through (6) and calculated the marginal productivity. According to the optimal theory for social capital stock posited by Arrow and Kurz (1970), resource distribution that equalizes the marginal productivity of social capital stock and that of private capital stock is considered preferable from the viewpoint of efficiency. Using this theory,

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[5] (Hokkaido, Tohoku bloc) Hokkaido, Aomori prefecture, Iwate prefecture, Miyagi prefecture, Akita prefecture, Yamagata prefecture, Fukushima prefecture; (Kanto bloc) Ibaraki prefecture, Tochigi prefecture, Gunma prefecture, Saitama prefecture, Chiba prefecture, Tokyo-to, Kanagawa prefecture; (Hokuriku, Koshinetsu bloc) Niigata prefecture, Toyama prefecture, Ishikawa prefecture, Fukui prefecture, Yamanashi prefecture, Nagano prefecture; (Tokai bloc) Gifu prefecture, Shizuoka prefecture, Aichi prefecture, Mie prefecture; (Kinki bloc) Shiga prefecture, Kyoto-fu, Osaka-fu, Hyogo prefecture, Nara prefecture, Wakayama prefecture; (Chugoku, Shikoku bloc) Tottori prefecture, Shimane prefecture, Okayama prefecture, Hiroshima prefecture, Yamaguchi prefecture, Tokushima prefecture, Kagawa prefecture, Ehime prefecture, Kochi prefecture; (Kyushu bloc) Fukuoka prefecture, Saga prefecture, Nagasaki prefecture, Kumamoto prefecture, Oita prefecture, Miyazaki prefecture, and Kagoshima prefecture.

many previous studies compared the marginal productivity of social capital stock and private capital stock and evaluated such things as the regional distribution of public investment. In accordance with this, Figure 4 shows the marginal productivity of social capital stock and private capital stock in each of the regional blocs.

<Insert Fig. 4>

We can see that in periods of advanced economic growth, between social capital stock and private capital stock, there was an oversupply of social capital stock and an undersupply of private capital stock. This suggests that Japan at that time lagged behind in the accumulation of private capital stock. After the oil crisis, due to the concentrated distribution of public investment in rural areas, the marginal productivity of social capital stock gradually surpassed the marginal productivity of private capital stock, primarily in urban areas, and the undersupply of social capital stock in urban areas became clear after the beginning of the 1990s.

This trend is consistent for the most part with previous studies, and the data and parameters used are considered to be appropriate.

3. Interregional distribution of production factors

In this section, we present ideas regarding the optimal distribution of production factors for conducting a simulation using the marginal productivity derived in the previous section, and we derive the gap between the optimal distribution and the actual distribution.

(1) Ideas regarding the optimal distribution of production factors

According to a neoclassical interpretation, if production factors are movable, when a gap occurs among regions, the gap will converge or move in a shrinking direction through the movement of production factors.

This way of thinking is described using Figure 5, which is a simple model featuring one production factor and two regions. It explains how interregional gaps shrink (converge) through the movement of production factors.

<Insert Fig. 5>

First, we consider the economies of two regions, a and b, and only one production

factor[6], that of labor. And the production function is presumed to have diminishing returns to scale. With this presumption, we can draw a descending curve for the marginal productivity (MP) of both the a and b regions. Now, if we assume the total population is constant and is distributed among only these two regions, we can draw a diagram such as that in Figure 5. Specifically, the total population is shown as OaOb, with Oa the starting point for region a and Ob the starting point for region b, and the marginal productivity for both regions diminishes.

Let's consider the distribution shown[7] by M as the initial state. In M, there is a gap in the marginal productivity of labor between the two regions. Specifically, marginal productivity in region a is higher than that in region b. In this case, by moving one unit of labor from region b, where productivity is lower, to region a, where productivity is higher, we can expand production in society as a whole. This is because the increase in production volume due to one unit of labor moving to region a, where marginal productivity is higher, exceeds the amount by which production volume decreases as a result of the one-unit reduction in labor in region b, where marginal productivity is lower. In this way, as production factors move as far as N, where marginal productivity equalizes (converges), production in society as a whole expands.[8]

The same concept used in the two-region model can be applied to n-region models, and the distribution where the marginal productivity for all regions becomes equal can be called "optimal distribution." Also, let's call the gap between the optimal distribution of the various production factors and their actual distribution the "productivity gap." Specifically, if we make L^*_{it} the optimal number of employed workers in region i in term t, the labor productivity gap (L_gap_{it}) and the labor productivity gap ratio (L_gR_{it}) are as follows.

$$L_gap_{it} = L^*_{it} - L_{it} \tag{7}$$

$$L_gR_{it} = (L^*_{it} - L_{it}) / L_{it} \tag{8}$$

In the same way, we show the private capital stock productivity gap (K_gap_{it}) and the private capital stock productivity gap ratio (K_gR_{it}) as the difference or rate of divergence between the optimal distribution and the actual value for each.

(2) Marginal production by region

Based on this concept, let's take a brief look at the movement over time of the

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6 This presumption is synonymous with presuming that other production factors such as land do not move.

7 Here, region a's population is OaM, and region b's population is MOb.

8 At this point, under this paper's presumption, production volume is at a maximum.

production factors by region as estimated in the previous section and the dispersion among regions.

① Marginal production of labor by region

Figure 6 is a graph showing the marginal productivity of labor by region and a calculation of its dispersion. During the period analyzed, the marginal productivity of labor showed an ever-increasing trend, and we can see that during periods of advanced economic growth and during the bubble economy the interregional dispersion of marginal productivity was large. We infer that the interregional productivity gap during this period expanded.

<Insert Fig. 6>

② Marginal production of private capital stock by region

Figure 7 shows the marginal productivity of private capital stock by region and a measurement of its dispersion. The marginal productivity of private capital stock shows a downward trend during the period analyzed, and we can see that its interregional dispersion was also shrinking. As for private capital stock, we infer that as the private sector shifted its investments from regions where marginal productivity was lower to regions where it was higher, the marginal productivity gap shrunk (converged).

<Insert Fig. 7>

③ Marginal production of social capital stock by region

Figure 8 shows the marginal productivity of social capital stock by region and a measurement of its dispersion. During the period analyzed, the marginal productivity of social capital stock showed a downward trend, but it fluctuated widely during periods of advanced economic growth and during the bubble economy, and we can see that it made a somewhat cyclical movement.

<Insert Fig. 8>

Based on the above facts, in terms of labor we can see that while the interregional dispersion of marginal productivity moved in an expanding direction, the dispersion of private capital stock moved in a shrinking direction. With regard to private capital stock, this suggests that a movement of capital stock occurred through the shifting of

investments to regions with higher productivity, whereas with regard to the production factor of labor, such a movement did not occur. This indicates that the shrinking of the post-war interregional income gap was not based on adjustments made through the movement of labor.

(3) Deriving the optimal distribution of the various production factors

Now let's use the marginal productivity derived earlier to consider the optimal distribution of production factors. Since this paper is also mindful of time series analysis, it is necessary to use some care in considering the time periods studied. As seen in formula (3), in this paper's estimation, for capital stock we use data from the end of the previous term – in other words, with a one-term lag.

In this paper's model, social capital stock is considered an exogenous variable, and the model determines the distribution of private capital stock for the previous term and determines the distribution of labor for the present term. Social capital stock distribution is determined not by market mechanisms but rather politically, so it is probably more natural to treat it as exogenous.

① Optimal distribution of private capital stock

The optimal distribution of private capital stock is, based on the ideas presented in (1), a distribution in which the marginal productivity of private capital stock is equalized.

Now, in order to determine the optimal allocation of private capital stock, we presume that the parameters, the total private capital stock for each term (the total amount of private capital stock in the country as a whole), and the number of employed workers in each region at the beginning of each term remain unchanged. Also, the distribution of private capital stock at the end of the present term is presumed to be determined given the number of employed workers at the beginning of the present term and the distribution of social capital stock in the present term. Based on these presumptions and formulas (1) and (4), MPK_{it-1} is as follows.

$$\begin{aligned} MKP_{it-1} &= (1-\alpha)\, AK_{it-1}^{1-\alpha} L_{it-1}^{\alpha} G_{it-1}^{\beta} / K_{it-1} \\ &= (1-\alpha) A \left(L_{it-1} / K_{it-1}\right)^{\alpha} G_{it-1}^{\beta} \end{aligned} \tag{9}$$

The total private capital stock of term t is $\overline{K_t}$.

$$\overline{K_t} = \sum_i K_{it} \tag{10}$$

Here, under the constraints of formula (10), by seeking K_{it}, which is

$$MPK_1 = MPK_2 = \cdots\cdots = MPK_i \tag{11}$$

the optimal distribution of private capital stock is determined.

② Optimal distribution of the number of employed workers

In order to determine the optimal distribution of a proportionate number of employed workers, we presume that the parameters, the capital stock for the previous term, and the total number of employed workers in the present term remain unchanged. Based on this presumption and formulas (1) and (5), MPL_{it} is as follows.

$$\begin{aligned} MPL_{it} &= \alpha\, AK_{it-1}^{1-\alpha} L_{it}^{\alpha} G_{it-1}^{\beta} / L_{it} \\ &= \alpha A \left(K_{it-1} / L_{it} \right)^{1-\alpha} G_{it-1}^{\beta} \end{aligned} \tag{12}$$

With $\overline{L_t}$ as the total number of employed workers,

$$\overline{L_t} = \sum_i L_{it} \tag{13}$$

Here, under the constraints of formula (15), the optimal distribution is L_{it}, which is

$$MPL_1 = MPL_2 = \cdots\cdots = MPL_i \tag{14}$$

(4) Simulation

The optimal distribution of the various production factors is as described in (3) above, but capital stock becomes a predetermined variable due to the fact that there is a lag involved. Consequently, its initial value, given the regional allocation in term t-1 of the number of employed workers and social capital stock, determines the distribution of private capital stock. Given the distribution of private capital stock thus derived, this is the structure of a model that determines the distribution of employed workers in term t. In our simulation, for all the given values, we use actual values.

Also, to keep results from varying according to when the simulation begins, once we determine the private capital stock for term t-1 and the number of employed workers for term t, we do not use those figures in the next term's simulation but instead use actual values.

Based on this premise, we solve a nonlinear simultaneous equation that fulfills formulas (10), (11), (13), and (14) for each term. To get the solution, we use actual values for the initial values, move production factors (10 people, 1 million yen at a time) from places where marginal productivity was lower to places where it was higher, and perform computer simulations until the marginal productivity gap between regions reaches zero to four decimal places. The solution for this nonlinear simultaneous equation -- specifically, the gap ratio between the optimal distribution of production factors and the actual value -- is calculated and presented in Figures 9 and 10. The

definition of "gap ratio" is as follows.

$$= \frac{^{*}}{} \tag{15}$$

$$= \frac{^{*}}{} \tag{16}$$

Note that K* and L* represent the optimal distribution of private capital stock and the optimal distribution of the number of employed workers, respectively.

<Insert Fig. 9> <Insert Fig. 10>

From these results, it is clear that the convergence in the population movement in recent years is not the product of equalization in the marginal productivity of labor. If the marginal productivity of labor had equalized, this interregional gap in marginal productivity would not have occurred. In the Kanto area in particular, especially the capital city and its suburbs, labor productivity stands out, and this indicates that it has sufficient economic potential to absorb population from other regions. Meanwhile, while it is difficult to say for certain, the gap in the marginal productivity of private capital stock seems to be smaller than that of the movement in labor, and it would appear to be moving in the direction of convergence.

4. Fiscal surplus and marginal productivity equalization

Mochida (2004) says, "When a local government is present, production factors move in such a way that the sum of marginal product and fiscal surplus become equal for each region. Regions with a larger fiscal surplus attract excess amounts of resources" (p. 220). If we define fiscal surplus as the balance of the benefit received from the government and the burden, the gap in the fiscal surplus would serve as an incentive for production factors to move to places where the household budgets and company burdens are smaller and benefits are greater. Consequently, there is a possibility that the gap in the fiscal surplus would cancel out the gap in marginal productivity. In this section, we examine how much influence this government redistribution has on the movement of production factors.

(1) Deriving the fiscal surplus

In Buchanan (1952), fiscal surplus was defined as the difference between the benefit

from government spending and the tax burden. In this paper, we use this definition as a base to derive the fiscal surplus in various regions of Japan.

First, let's look at "the benefit from government spending" (benefit). Here, we shall consider the government outlay to a region to be the benefit from government spending. What we need to be cautious about when getting government outlay from financial data is spending related to fiscal transfers that the national or prefectural governments make to municipalities. Specifically, it is necessary to replace them with figures based on a net budget. In this case, we must closely scrutinize financial statistics and such. On the one hand, because SNA based statistics are secondary statistics of tax allocations to local governments basis where fiscal transfers have been performed, they are simple and easy to use. However, in this case, we must keep in mind that issues such as not including land costs will remain. In this paper, we decided to use SNA based statistics as a primary approximation to the research topic. Specifically, the sum of the "final consumption expenditure by the government" and the "public sector fixed capital stock formation" in the "Annual Report on Prefectural Accounts" is defined as the benefit from government spending. As for the discontinuity in statistics posed by revisions in standards, this was resolved by taking the same steps that were taken in section 2 with gross prefectural expenditures.

Next, let's discuss the "tax burden" (burden). Just as with government spending, it would be good to have SNA based statistics, but unfortunately, statistics on a prefectural accounts basis do not exist. Therefore, it is necessary to calculate them from financial statistics and such. We also looked into ways of handling usage fees, processing fees, and the like, and although it is not necessarily true in all cases, most of them are likely being paid by local residents and local corporations. Consequently, with regard to prefectures and municipalities, in this paper we used “internal revenue sources" from the financial statements of the prefectures and municipalities. Also, for national tax, we used the "amount of national tax determined for collection" from "National Tax Agency Annual Statistics Reports." This national tax amount was aggregated for each prefecture with internal revenue sources for the prefecture and for the municipalities therein.

The balance of benefit and burden defined in this way is defined in this paper as fiscal surplus. Figure 11 is an overview of fiscal surplus by regional blocs.

<Insert Fig. 11>

The Kanto and Tokai blocs have had excess burden consistently since 1985, the year

when statistics became available. As for the Kinki bloc, while it had excess burden for the most part, in 2002 it showed excess benefit. Meanwhile, other areas maintained conditions of excess benefit throughout this period. It goes without saying that what is regulating this inequality between benefit and burden is fiscal control by the nation toward the rural areas. These inequalities in fiscal surplus are occurring because interregional redistribution took place through means such as tax allocations to local governments and national treasury disbursements.

Figure 12 presents an aggregation of this data for the whole country. We can see from this that while there is excess benefit from 1998 onward, this can be interpreted to be a result of intertemporal redistribution carried out through such measures as the issuance of government bonds.

<Insert Fig. 12>

(2) The influence of fiscal redistribution on the movement of production factors

Next we examine what influence this fiscal surplus has on the movement of production factors. We examine whether a gap in fiscal surpluses like Mochida (2004) points out acts in the direction of canceling out the gap in the marginal productivity of production factors. Here, taking data constraints and such into account, we test our hypothesis about the relationship of the gap ratio with the optimal values of the number of employed workers and private capital stock, as estimated in section 3, and the fiscal surplus. If the gap in fiscal surplus acts in the direction of canceling out the gap in the marginal productivity of production factors, it is anticipated that a significant negative coefficient would be obtained between the gap ratio and the fiscal surplus.

We carried out OLS estimation using the marginal productivity of labor and private capital stock as the dependent, or response, variable and fiscal surplus as the independent, or explanatory, variable. Due to the data constraints, we used panel data for the period between 1985 and 2002. The results of the estimate are as follows. The figures in parentheses below the coefficients are the t-values, and FS represents the fiscal surplus.

$$\mathrm{Lgap} = -0.185 - (3.84\mathrm{e} - 08) * \mathrm{FS}$$
$$(-8.13) \qquad (-10.8)$$
$$\mathrm{R} = 0.5145, \qquad \mathrm{Root\,MSE} = 0.2411, \qquad \mathrm{F}(1,110) = 116.59$$
$$\mathrm{Kgap} = -0.077 - (5.96\mathrm{e} - 10) * \mathrm{FS}$$
$$(-6.07) \quad (-0.30)$$

$$R = 0.0008, \quad \text{Root MSE} = 0.1334, \quad F(1,110) = 0.09$$

While a significant negative coefficient was obtained between the fiscal surplus and the gap ratio in the number of employed workers, a significant coefficient was not obtained between the fiscal surplus and the gap ratio in private capital stock. These results suggest that, as Mochida (2004) points out, in addition to the marginal productivity of production factors, the fiscal surplus has a large impact on population movement. Specifically, it acts in such a way that the interregional gap in marginal productivity is canceled out by the fiscal surplus. In this sense, it is worth nothing that while redistribution through fiscal policy does indeed have such effects as driving up income levels in rural areas and controlling population movement from rural to urban areas, since it does not increase regional productivity, it impedes regional economic independence. In short, the outflow of production factors through market mechanisms would have had the effect of increasing productivity, but redistribution through fiscal policy actually ended up canceling out that effect.

Meanwhile, a significant relationship between private capital stock and fiscal surplus could not be found. In terms of private capital stock, this thus suggests that it is moving in a way that causes marginal productivity to equalize. Also, as Kawasaki (2007) shows, because there is little dispersion in the marginal productivity of private capital stock among regions, we can see that the movement of capital stock is strongly influenced by marginal productivity.

5. Conclusion

In closing, let's review the results obtained in this paper and set forth some topics for future study.

This study attempted to analyze the interregional distribution of production factors, with a focus on marginal productivity. Also, the fact that it used relatively long-term data is one of its distinguishing features. In terms of specific means, it took a supply-side approach, estimating regional production factors and deriving the marginal productivity of each production factor. With panel data from seven blocs to account for spillover, we were able to obtain estimate results for this regional production function that are consistent with earlier studies. Using the parameters obtained here, we derived the long-term marginal productivity of each production factor by bloc and carried out a simulation to derive the optimal distribution of production factors, then estimated the gap between those figures and the actual values. We conducted an

empirical analysis on the relationship between this gap and the fiscal surplus, and we analyzed the relationship between the movement of production factors and redistribution through fiscal policy. As a result of this series of analyses, the following results were obtained.

In terms of the marginal productivity of labor, there is a large gap among regions. Meanwhile, the gap in the marginal productivity of private capital stock is relatively smaller than that in the marginal productivity of labor. From this, it is at least clear that the fact that population movement and the interregional income gap are shrinking is not because production factors moved among regions and caused the income gap to shrink. In terms of labor in urban areas, while an influx of labor is needed in the Kanto area, which centers on Tokyo, the need arises to drain labor away from the Tokai and Kinki areas. This tells how high productivity is in Tokyo.

It is necessary to consider the reasons why, despite the fact that this interregional gap in productivity exists, movement in labor has shrunk. With that in mind, we analyzed the control effect on movement through fiscal policy redistribution from urban to rural areas. This is the theory of fiscal surplus that has been studied since Buchanan (1952). Focusing the distribution of public investment and such in rural areas causes the fiscal surplus in rural areas to become large, which is known to attract an excessive amount of resources. Alesina et al. (1999) call the employment that occurs due to distributing public investment and such in rural areas "Public Employment," and they point out its harmful effects. Specifically, we can consider that interregional population movement diminished because redistribution through fiscal policy caused incomes to rise without an increase in productivity.

The results of an empirical analysis based on this hypothesis suggest that for labor, the existence of a fiscal surplus cancels out the gap in marginal productivity and controls population movement. In other words, while it is recognized that fiscal redistribution through means such as tax allocations to local governments and national treasury disbursements has played the role of controlling population movement from rural to urban areas, it actually sacrificed the increasing of regional productivity in exchange. In the end, this can be considered to have impeded these rural areas' independence. Looking at things from this perspective, in order to rectify the overconcentration in Tokyo and foster regional independent revival, what is needed is not the creation of employment by way of fiscal redistribution, but rather measures that boost rural areas' productivity. This will not only cause the gap between urban and rural areas to shrink, but will also lead to maximized production on the macro level and contribute to economic growth.

Meanwhile, a significant relationship between private capital stock and fiscal surplus could not be found. In terms of private capital stock, this thus suggests that it is moving in a way that causes marginal productivity to equalize.

Finally, the elaboration of fiscal surplus can be pointed to as a challenge for the future. In particular, we believe it is necessary to organize how we think about intertemporal transfers performed by issuing national and local government bonds.

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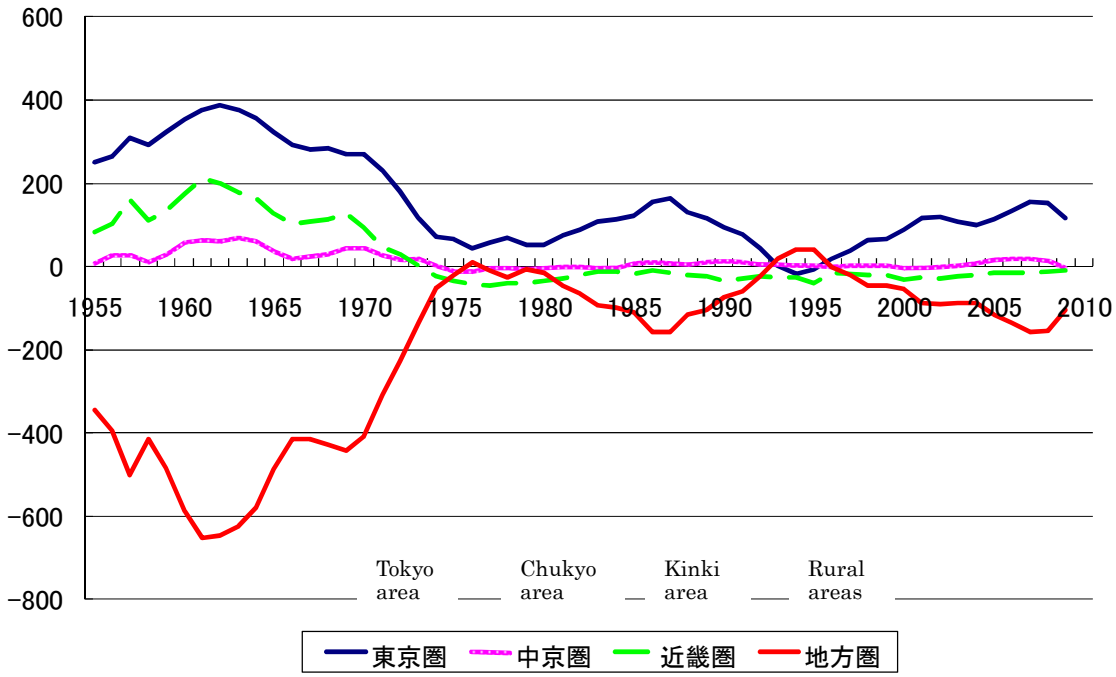
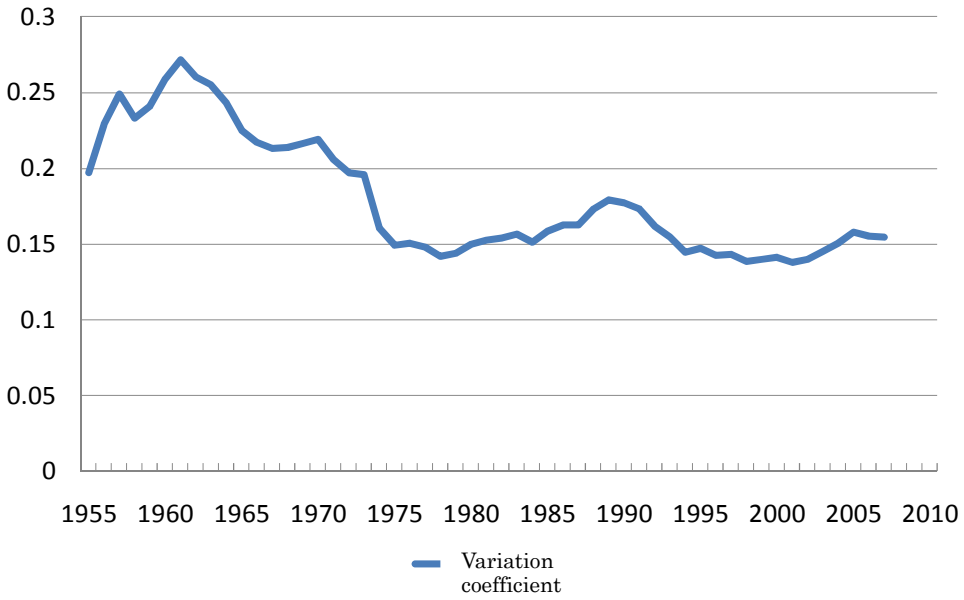
Fig. 1 Excess Move-ins in Urban Areas (Unit: 1,000 people)



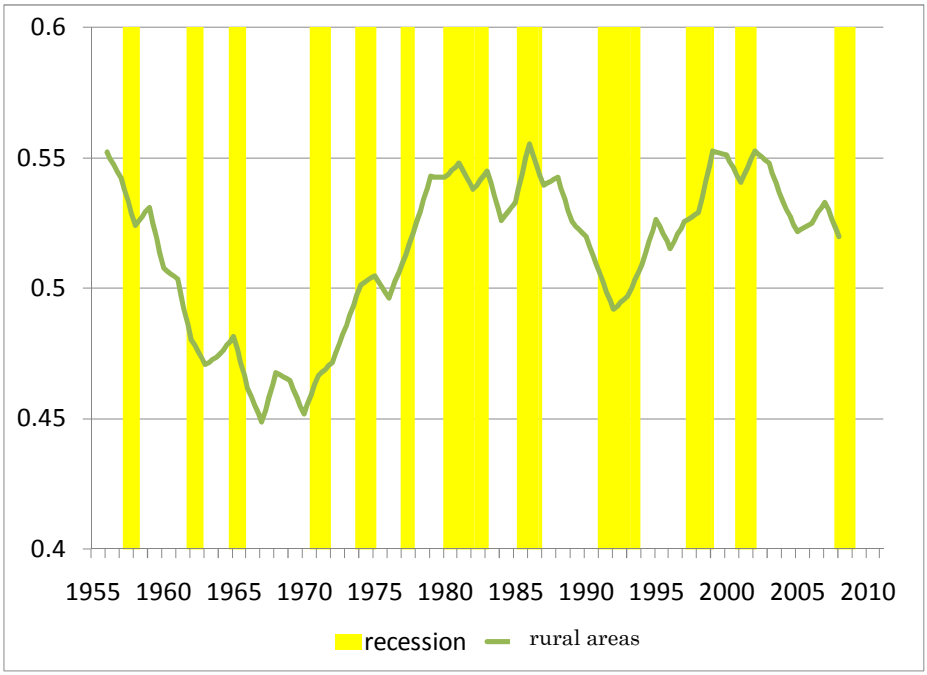
Source: Basic Resident Register Migration Report (Ministry of Internal Affairs and Communications)

Fig. 2 Variation Coefficient for Income per Prefectural Resident



Source: "Annual Report on Prefectural Accounts" (Japanese Cabinet Office)

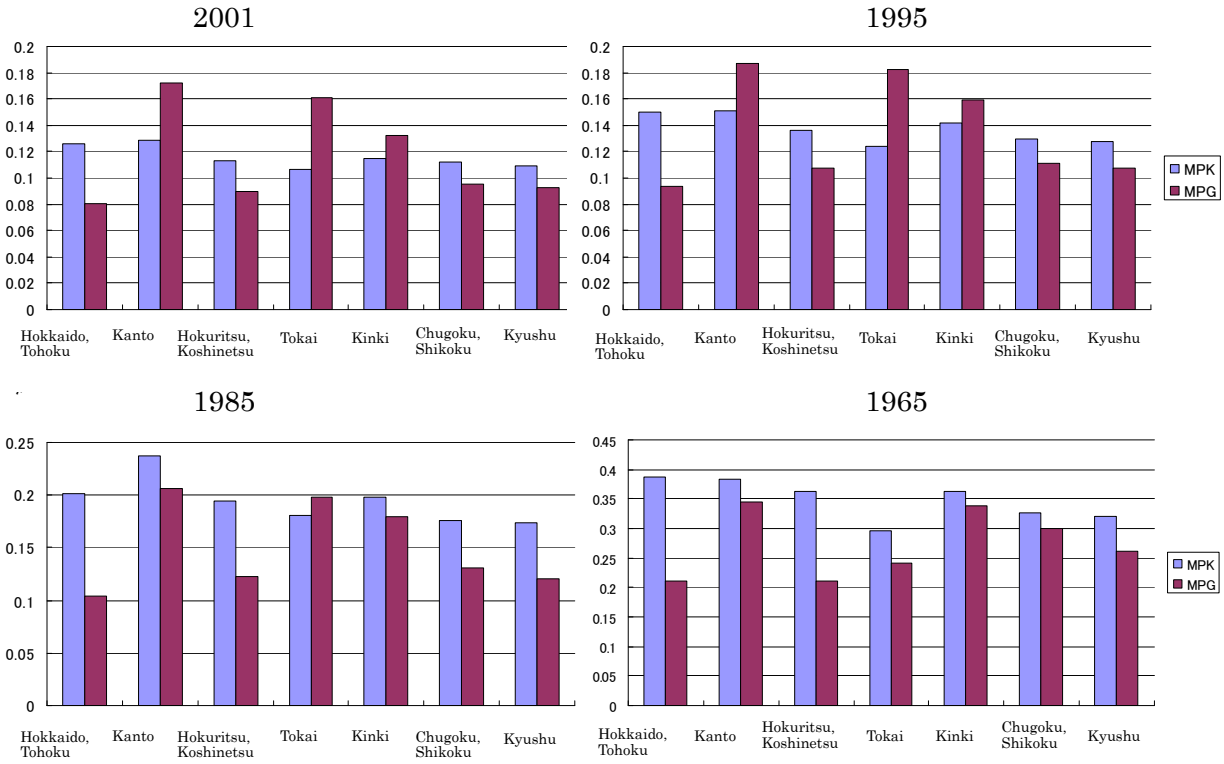
Fig. 3 Rate of Public Investment Distribution to Rural Areas



Source: Compiled by the author from "Annual Report on Prefectural Accounts" (Japanese Cabinet Office) and "Business Cycle Dating" (Japanese Cabinet Office)

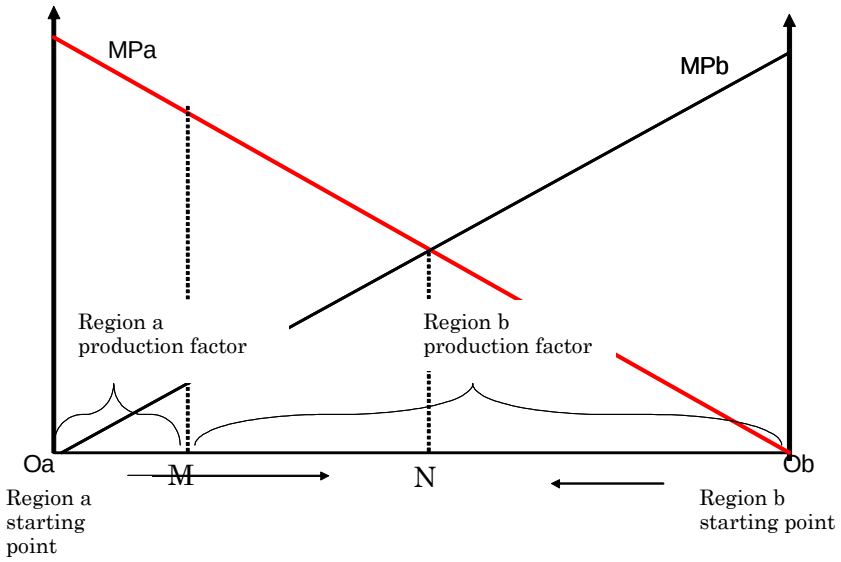
Note: Business Cycle Dating includes provisional figures for cycle 14

Fig. 4 Marginal Production of Private Capital Stock and Social Capital Stock by Region



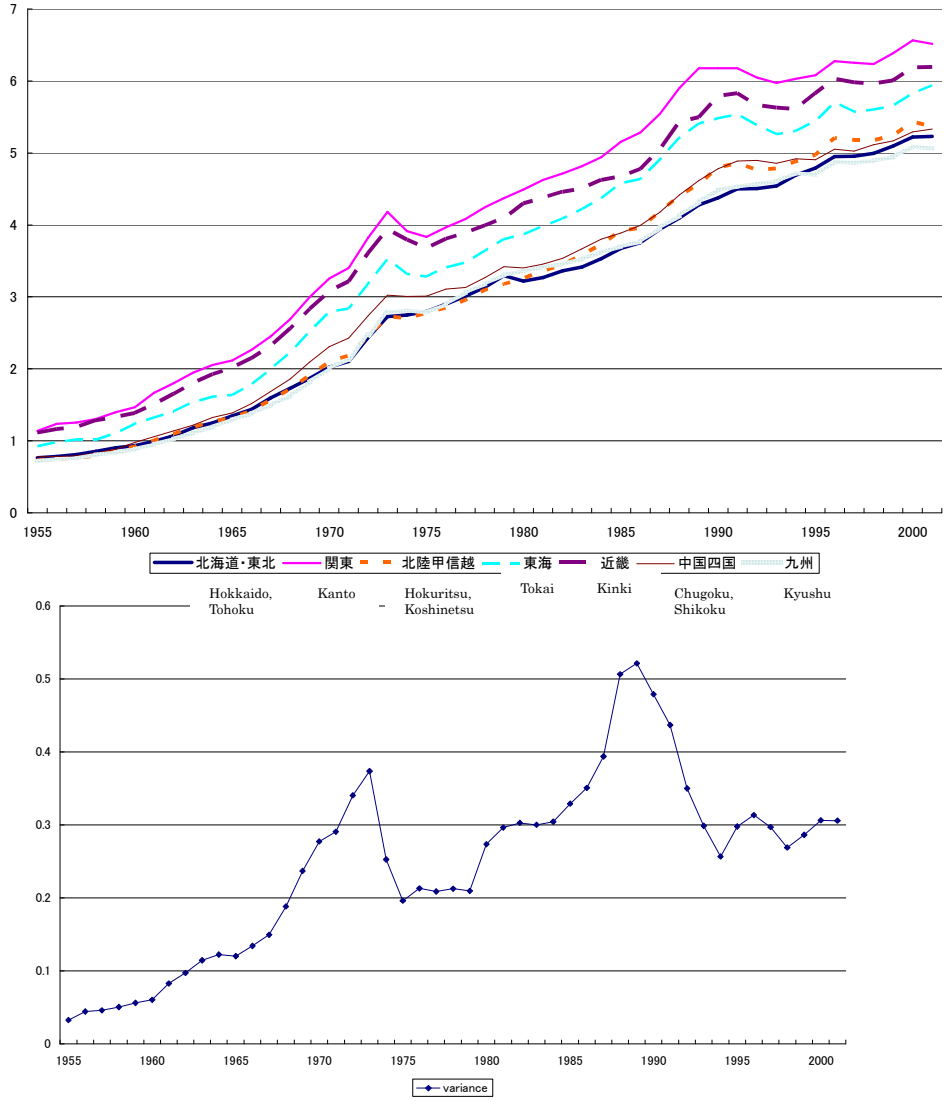
Materials: Author's estimates

Fig. 5 Production Factor Movement



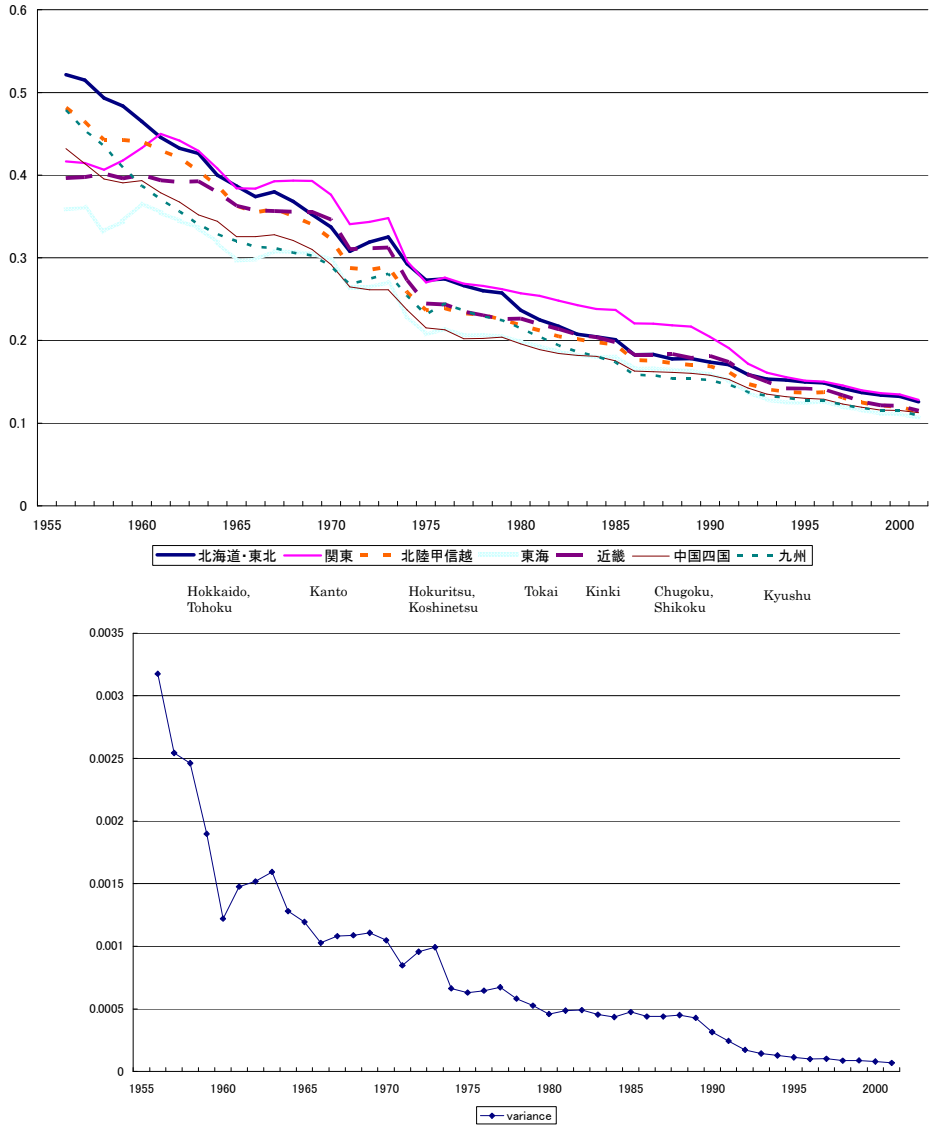
Materials: Compiled by author

Fig. 6 Marginal Production of Labor (upper graph) and its Dispersion (lower graph)



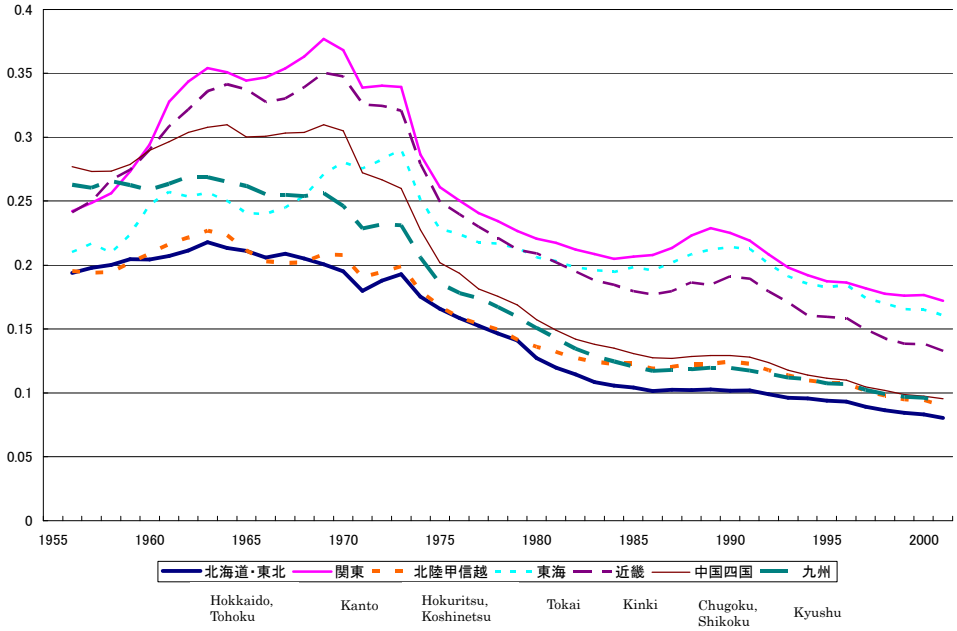
Source: Author's estimates

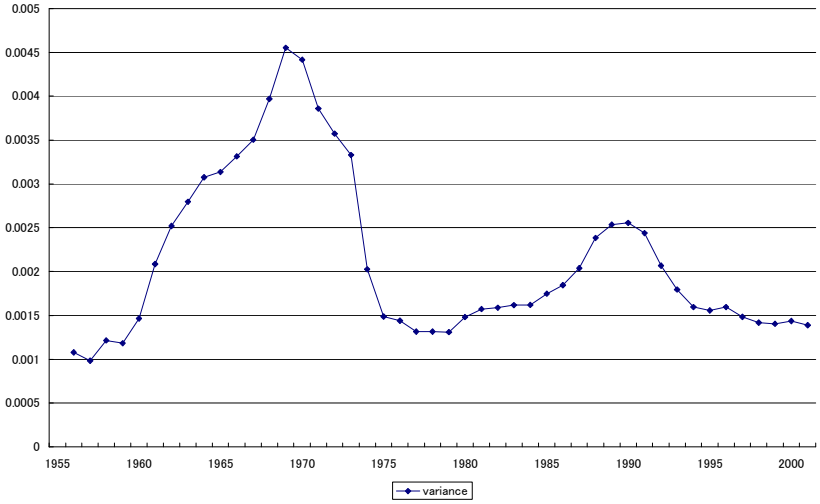
Fig. 7 Marginal Production of Private Capital Stock (upper graph) and its Dispersion (lower graph)



Source: Author's estimates

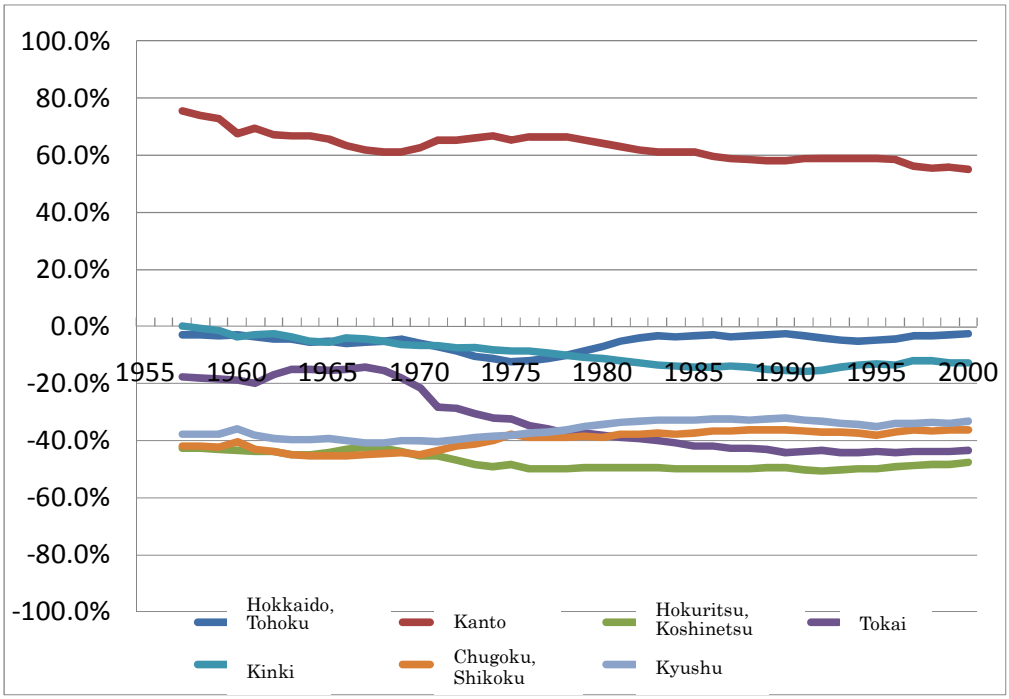
Fig. 8 Marginal Production of Social Capital Stock (upper graph) and its Dispersion (lower graph)





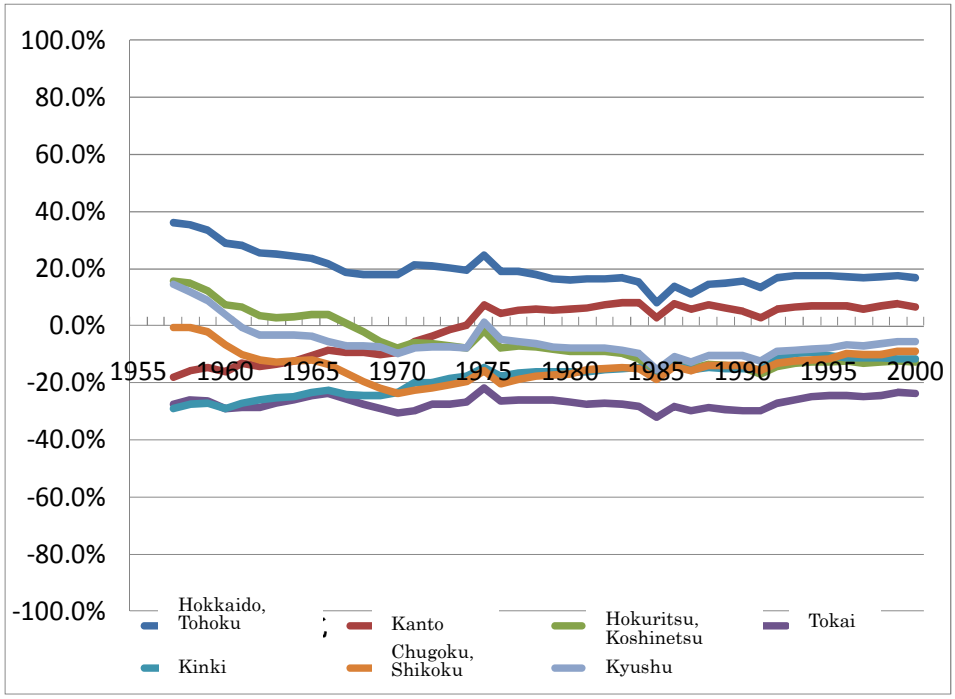
Source: Author's estimates

Fig. 9 Gap Ratio for Number of Employed Workers



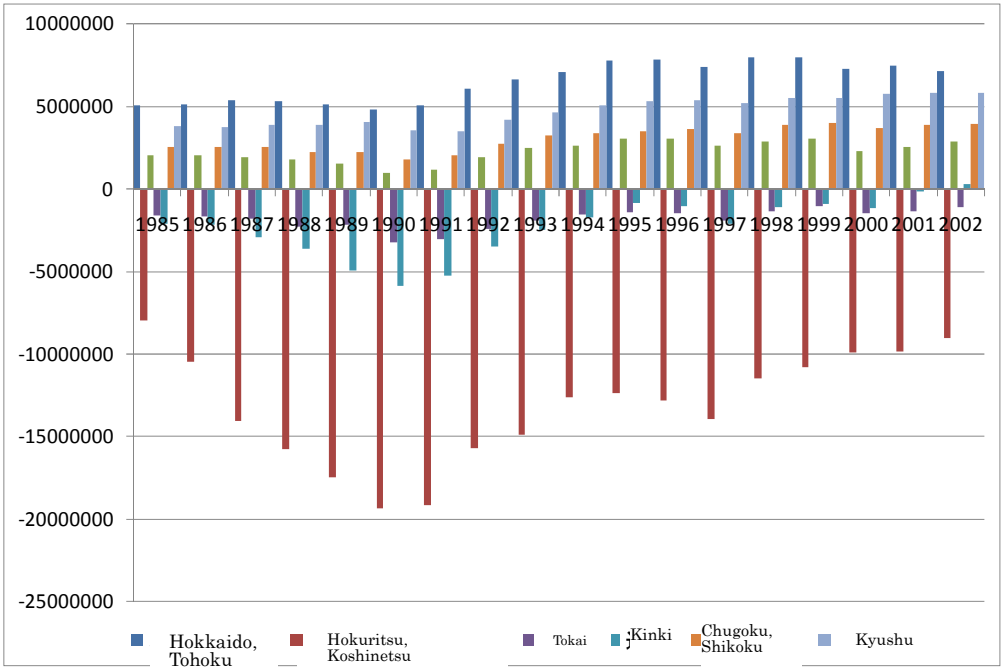
Source: Compiled from author's estimates

Fig. 10 Gap Ratio for Private Capital Stock



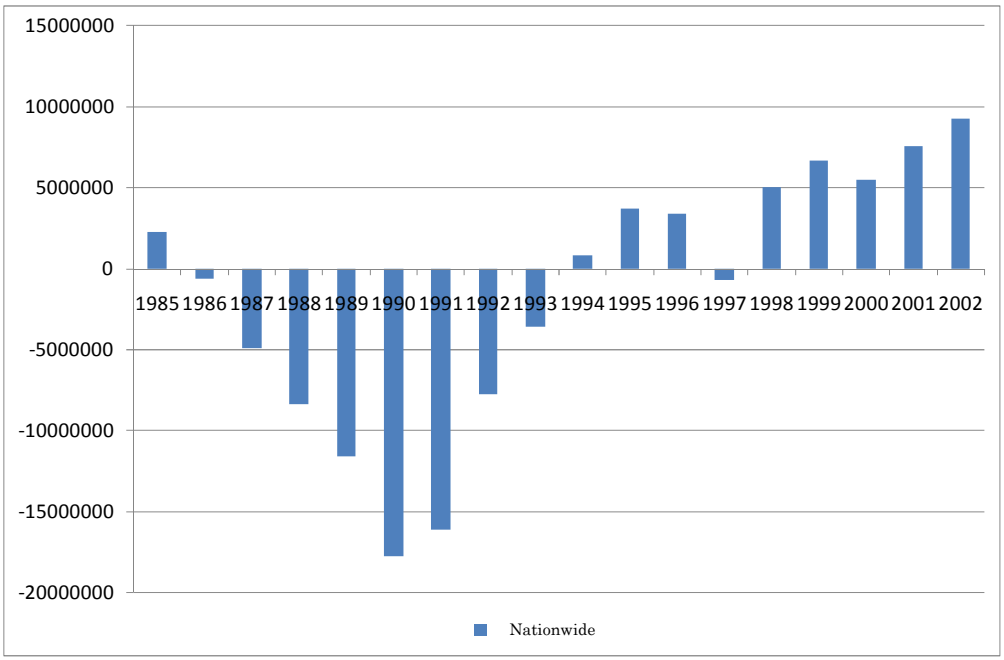
Source: Compiled from author's estimates

Fig. 11 Fiscal Surplus by Regional Bloc (Unit: 1 million yen)



Source: Compiled by author from "Annual Report on Prefectural Accounts" (Japanese Cabinet Office), "National Tax Agency Annual Statistics Reports (National Tax Agency), and financial statements for prefectures and municipalities (Ministry of Internal Affairs and Communications)

Fig. 12 Fiscal Surplus (Unit: 1 million yen)



Source: Same as Fig. 7