# Why Do We Observe a Regional Balassa-Samuelson Effect?[1]

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## Abstract

Drawing a scatter diagram between differences in service prices and productivity among Japanese regions reveals a positive correlation. Additionally, all students of international economics know of the famous Balassa-Samuelson Effect, which explains why poorer countries tend to have cheaper service prices than richer countries. The apparent resemblance of the two phenomena could justify naming the domestic phenomenon the regional Balassa-Samuelson effect. Are the economic mechanisms that achieve these phenomena the same in the domestic and international contexts? The international version of the Balassa-Samuelson effect explains the phenomenon by relying on the presumption that labor productivity of rich countries is much higher than that of poor countries in the tradable manufacturing sector, but not in the non-tradable service sector. Although this presumption seems to be realistic in the international context, it does not hold in the domestic context. When we compare domestic labor productivity between rich urban areas and the other areas, while the manufacturing sectors exhibit little difference in productivity, the service sectors exhibit a pronounced productivity gap. Therefore, we consider two alternative hypotheses that may explain the regional Balassa-Samuelson effect: high land use costs or high labor costs in urban areas. To conduct this research, we constructed consistent prefectural-level input-output tables, and estimated land use costs for each industry in each prefecture. We apply the Leontief price model and calculate regional price differences caused by differences in both land use cost and labor cost and we estimate a regression equation with regional service price index as dependent variable and calculated price differences caused by land use cost and by labor cost as explanatory variables. Using the estimated regression equation, we decompose the sum of squares for the dependent variable into that related to land use cost and that related to labor cost, to find that the former account for only 20 percent and the latter account for 80 percent. Thus, the impact on prices of high urban labor cost is more important in accounting for the regional Balassa-Samuelson effect.

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## 1. Introduction

What are the implications of having leading industries in a region on income distribution? This question is closely related to clarifying the economic mechanisms which cause the regional Balassa-Samuelson effect. In this paper, we first confirm that a phenomenon similar to the Balassa-Samuelson effect in international context is observed among domestic regions in Japan. And then we point out that original explanation of the Balassa-Samuelson effect, which depends on the labor productivity gap between manufacturing and non-manufacturing sectors, does not hold across regions in Japan. As the alternative economic mechanisms behind the regional Balassa-Samuelson effect possibly emerge two hypotheses. One is the price-boosting effect of the cost of land, whose supply cannot be increased even if production activities are concentrated within particular region. The other comes from the cost of labor, whose supply cannot be easily increased due to the imperfect mobility of labor among regions. Although these two possibilities are similar economic phenomena, they have very different implications to the income distribution consequences.

In this research, we determine which of the two hypotheses is more valid in this phenomenon, using a price model of the input-output analysis. To that end, what is first essential is consistent input-output tables for the 47 prefectures. In addition, we need to estimate the land service inputs by prefecture and by industry, since they are included in the operating surplus of factor income and not measured independently. Using these data, we can run the price model of the input-output analysis for the 47 prefectures, and from the results, we calculate contributions to regional price differences for five sectors in the service industries, which are already estimated by Tokui and Mizuta (2019).

Of the two hypotheses that explain the regional Balassa-Samuelson effect, Karadi and Koren (2008) presented a theoretical model focusing on the land input costs. The other hypothesis was presented by Moretti (2012), who pointed out that wages in a wide range of sectors are higher in regions where leading industries are located than in other regions, although he did not explicitly mention the Balassa-Samuelson effect. However, no empirical study has analyzed which of these possibilities is more important using actual factor price data and the input-output structure of regional industries, and this is the contribution of this research.

Section 2 first reviews the facts observed around the regional Balassa-Samuelson effect with data, and explains in more detail the two alternative hypotheses, followed by the explanation of the methodology used in this research. Section 3 describes in detail the data prepared for this research including, among others, the method of estimating the land service inputs by prefecture and by industry. Section 4 reports the results of the output price-boosting effect of the costs of both land and labor, calculated by applying the price model of the input-output analysis. Section 5 explains the method of regressing the price-boosting effect of these two factor prices on the regional price differences by sector and then decomposing them, and reports the results. The last section summarizes the results obtained in this research and presents their implications.

## 2. Confirmation of the Issue and the Methods of Analysis

Tokui and Mizuta (2019) applied the method of estimating absolute purchasing power parity to estimate the service price differences across prefectures in Japan and examined the extent to which the analysis of the regional labor productivity gap is affected by this. We also confirmed that there is a positive correlation between the obtained regional price differences and the regional labor productivity gap. Figure 1 shows a scatter diagram of the correlation between the two for the 2009 data.

(Figure 1)

The fact that service prices are higher in regions with higher labor productivity (i.e., regions with higher per capita income) is a phenomenon similar to the Balassa-Samuelson effect, which is well known in international economics.[2] Therefore, we call this phenomenon the regional Balassa-Samuelson effect. What kind of economic mechanisms are at work behind the observed regional Balassa-Samuelson effect? Is it similar to the relationship between developed and developing countries as pointed out in international economics?

The Balassa-Samuelson effect in international economics focuses on the fact that the productivity gap between developed and developing countries differs in the tradable manufacturing sector and the non-tradable service sector. That is, in the tradable manufacturing sector, labor productivity of developed countries is significantly higher than that of developing countries, whereas in the non-tradable service sector, the labor productivity gap between developed and developing countries is not so large. As a result, labor costs of developed countries are relatively higher than those of developing countries, pulled up by the tradable manufacturing sector, whose labor productivity is higher in developed countries and where international price arbitrage of output is at work. On the other hand, in the non-

[2] For the Balassa-Samuelson effect, see Balassa (1964) and Samuelson (1964).

tradable service sector, as international price arbitrage of output does not work and labor productivity of developed countries is not so higher than that of developing countries, their output prices are pushed up by their own high labor costs resulting in relatively higher service prices, so the explanation goes.

Can this international economics theory be applied to among domestic regions in Japan? Figure 2 shows a regional comparison of labor productivity for the manufacturing and non-manufacturing sectors, classifying the prefectures of Japan into the Tokyo, Nagoya, Osaka metropolitan areas, and other areas using the R-JIP database 2017.[3] Labor productivity is measured by adjusting the real value added in the R-JIP data for regional price differences of Tokui and Mizuta (2019), and then divided by man-hour, and the vertical axis of the bar chart shows it as a percentage relative to the national logarithmic average value. As shown in the figure, in the manufacturing sector, labor productivity in the metropolitan areas is rather slightly below that of other areas. In contrast, in the non-manufacturing sector, labor productivity in the metropolitan areas is significantly higher than that of other areas, which is the exact opposite of the above explanation of the international Balassa-Samuelson effect.

(Figure 2)

Then, what kind of economic mechanisms lead to the phenomenon that we call the regional Balassa-Samuelson effect? Karadi and Koren (2008) explain the Balassa-Samuelson effect, focusing on the differences in land prices between urban and other areas. They explain that the service sectors are concentrated in densely populated urban areas due to the needs to be located close to customers, which raises land prices in urban areas. On the other hand, the manufacturing sectors do not need to be located close to customers, so they can be located in non-urban areas where land prices are low. This explanation is not only an alternative explanation of the international Balassa-Samuelson effect in developed countries with developed service sectors as higher land prices are reflected in the output of the service sectors, but also a promising hypothesis for the regional Balassa-Samuelson effect.

While land is clearly a factor of production that cannot be moved across regions, it is not so easy to move labors across regions as well. Moretti (2012), in analyzing regions with high concentration of high-tech industries such as Silicon

[3] The Tokyo area includes Saitama, Chiba, Tokyo, and Kanagawa; the Nagoya area includes Aichi, Gifu, and Mie; and the Osaka area includes Kyoto, Osaka, Hyogo, and Nara.

Valley, observed that in these regions, not only professional workers employed in the high-tech industries, but also non-professional workers employed in the customer-adjacent service sectors also enjoy higher wages than those in similar service sectors in other regions. Given divided labor markets across regions, the concentration of high-tech industries and their workers in a region may raise wages of workers of customer-adjacent service sectors, which are non-tradable goods across regions, and this may be reflected in the price. This will be the other hypothesis to account for the regional Balassa-Samuelson effect.

In fact, the content of the service sectors is not identical in urban and rural areas. Figure 3 compares the share of the output value of the information and communication service sectors, which have attracted attention in recent years due to technological innovations, to the broadly-defined service sectors across prefectures. In urban areas such as Tokyo, Osaka, and Aichi, the share is higher than the national average, and high-productivity fields within the service sectors are concentrated in these areas. This trend is particularly noticeable in Tokyo.[4]

(Figure 3)

The purpose of this paper is to examine the validity of these two hypotheses. We first calculate the extent to which the costs of regional land inputs and labor inputs are reflected in prices, using the price model of the input-output analysis for each prefecture. Assuming that consistent regional input-output tables are obtained for each prefecture, the import and inward transport coefficient ($m_{ri}$) for an industry (i) in a region (r) is defined as follows:

$$m_{ri} = \frac{iimport \wedge inward\ transport_{ri}}{production_{ri} - export \wedge outward\ transport_{ri} + import \wedge inward\ transport_{ri}}$$

Letting $M_r$ denotes the diagonal matrix with its diagonal elements are $m_{ri}$, and $\mathrm{A_r}$ the input coefficient matrix, and I the unit matrix, the IO price model is the

[4] There are numerous hypotheses and empirical researches on why urban wages are higher (urban wage premium). Based on Yankow (2006), the main hypotheses include (1) the cost of living in cities is higher, (2) cities attract highly skilled workers, (3) the productivity of companies located in cities is higher, (4) cities can easily accumulate human resources through learning, and (5) the accumulation of economic activities in cities makes the matching of workers and companies more efficient. Among these, the hypothesis which is close to the perspective of this paper is (3).

following equation (1), which determines the regional price vector $P_r$ from the value-added vector per unit of output $v_r$. Here, the superscript T represents the transpose of the matrix, and the superscript -1 represents the inverse matrix.

(1) $$P_r = \left[ \left[ I - \left( I - M_r \right) A_r \right]^T \right]^{-1} v_r$$

By estimating the land inputs and labor inputs by industry for each region, we can calculate the magnitude of the impact on prices using equation (1), respectively. As we have already estimated prefectural service price differences in Tokui and Mizuta (2019), in this research a regression equation is estimated with regional price differences as dependent variable and the impacts on price by land and labor input costs as explanatory variables respectively. The regression equation is then used to evaluate the relative importance of the two hypotheses in explaining the regional Balassa-Samuelson effect.

**3. How to Prepare Data**

The 2005 multi-regional input-output tables by prefecture used here are intermediate products of a work by Arai (2019) whose ultimate aim is to construct inter-prefectural input-output table. In Japan the IO tables by prefecture are prepared and published by each prefecture, but in order to use them as multi-regional tables, it is necessary to unify the estimation concepts as well as sector classifications. The IO tables by prefecture used here are 25-sector tables consisting of 23 sectors in the R-JIP database plus two sectors (office supplies and unclassified). As this is less than the greatest common divisor of 76 sectors of the sector classification of the input-output tables published by each prefecture, it is possible to create 25-sector tables by integrating some sectors. On the other hand, unification of the concepts has following issues: whether or not to set up an in-house transportation sector, whether or not to set up a social capital sector, treatment of intermediate products, and treatment of headquarters sector; see Arai (2019) for details. However, with regard to the treatment of the headquarters sector, unlike the final products by Arai (2019), separation of headquarters services is not taken into account.[5]

Of the two production-factor inputs we focus on here, labor costs are already

[5] For this reason, for the input-output table published by the Tokyo Metropolitan Government, the value-added equivalent of the headquarters service is deducted from the output value.

listed in the IO tables by prefecture, so we use them as they are. However, when calculating labor costs per unit of output, the denominator, output value, is divided by the regional price differences to obtain a price difference-adjusted value. The same is applied when calculating the land service inputs per unit of output.

The value added attributable to land service inputs is included in the operating surplus of the value added of the IO tables and is not listed separately, so it must be estimated independently. The 2005 value of land service inputs should also be estimated in line with the input-output tables by prefecture. The estimation procedure is first to estimate the amount of land stock by prefecture and by industry, and then convert them into the user cost concept to obtain the land service inputs.

The estimation of the value of land stock is based on the "Summary Record of Regional Real Estate" of the Ministry of Internal Affairs and Communications.[6] This data is prepared by prefecture and by the purpose of land use. We use its appraisal value of land by purpose of each prefecture, but as it is set at 70% of the prevailing price, the amount is adjusted by dividing it by 0.7 to approximate the prevailing price. For each prefecture, the appraisal land value for the commercial district and the industrial district are first obtained for individuals and corporations combined. For the correspondence between the district of land and industrial sectors, we assume that the industrial districts correspond to 16 sectors from mining, manufacturing, construction and electricity/gas/water supply, while commercial districts correspond to 5 sectors of wholesale/retail, finance/insurance, real estate, transportation/communication, and services (private and non-profit). For the method of dividing the purpose-specific amounts to each industrial sector, we first assume the 13 manufacturing sectors as one sector, and obtain the split coefficient based on the capital stock by prefecture and by industry in the R-JIP database which is modified using the "land versus fixed assets other than land" ratio (nationwide) calculated by industry from the "Financial Statements Statistics of Corporations by Industry". Next, to divide the manufacturing sector into 13 sectors, we use the land value by prefecture and by industry from the “Census of Manufacture” as the division ratio.

Figure 4 shows a bar chart of land stock by industry estimated in this way at selected three locations: Hokkaido, Tokyo, and Aichi, where Hokkaido is Farming region, Tokyo is a metropolitan area, and in Aichi manufacturing industries are concentrated. A large amount of land stock is put in the non-manufacturing sectors such as construction, wholesale/retail, finance/insurance, real estate, transportation/communications, and services (private and non-profit), and this trend

[6] This data covers those equal to or above the statutory tax exemption point.

is particularly noticeable in Tokyo. This tendency is consistent with the argument by Karadi and Koren (2008) that land input is higher in the service sectors which are accumulated at locations close to customers. Figure 5, on the other hand, compares the land stock of the service sectors (private and non-profit) which have large value-added weight among the 47 prefectures. The three major metropolitan areas and Fukuoka, especially Tokyo, have the largest land stock inputs.

(Figure 4)
(Figure 5)

From the value of land stock by prefecture and by industry obtained as above, a coefficient for determining the amount of land service inputs of the user cost concept is given by the following equation:

$$(2)\quad \frac{\textit{interest rate} - \textit{land price increase rate} + \textit{effective tax rate of property tax}}{(1 - \textit{effective tax rate of corporate tax}, \textit{etc}.)}$$

The effective tax rate on land property in the numerator of this equation is obtained from the following formula:
Effective tax rate of property tax = standard taxable amount / appraisal value× statutory standard tax rate

Although data on the standard taxable amount by prefecture and by land use can be obtained from the "Summary Record of Regional Real Estate" of the Ministry of Internal Affairs and Communications, we set the ratio of the standard taxable amount to the appraisal value at 0.6, referencing the national average value for corporations.[7] The effective tax rate was calculated assuming the statutory standard tax rate of 1.4%, the appraised price is of 70% of the prevailing land price, and the standard taxable amount of 60% of the determined price. The interest rate is set at the long-term prime rate (annual average). The denominator, the effective tax rate of corporate tax, etc. is set at 30%, which is the basic corporate tax rate as of 2005, derived from the "Ministry of Finance Statistics Monthly (Special Feature on Taxation)."

(Figure 6)

[7] The national average for 2005, calculated from the " Summary Record of Fixed Asset Prices, etc." by the Ministry of Internal Affairs and Communications, was 0.608 for commercial districts and 0.673 for industrial districts.

The problem in the calculation of equation (2) above is the land price increase rate in the numerator. Figure 6 shows changes in the land price increase rate in the three major metropolitan areas and other areas by commercial and industrial district, using data from the "Publication of Value of Standard Sites by Prefectural Government" by the Ministry of Land, Infrastructure, Transport and Tourism. After a sharp decline of land prices following the collapse of the bubble economy in the early 1990s, the land price decrease rate in the three major metropolitan areas gradually slowed down, and as of 2005, the subject year of this research, the decline in commercial land prices had almost ceased. On the other hand, decline in land prices in rural areas gradually progressed even after the collapse of the bubble economy, and the rate of decline was the highest in 2005. Due to these large changes in the land price increase rate, and the timing gap between the urban and rural areas, we decided to use the average rate of increase in land prices over the 15 years from 1991 to 2005, rather than the rate of increase in a single year. This resulted in relatively higher land use costs in urban areas.[8] The land price increase rates are calculated for each of the commercial and industrial uses for each prefecture.[9]

(Table 1)

Table 1 summarizes the converting coefficients from land stock to land services by region and by industrial and commercial use of land. The right-hand side of the table shows the average land price increase rate over the 15 years from 1991 to 2005 which was used to calculate the converting coefficients, and the average land price increase rate was negative in all regions. This raises the user cost of land holding higher and makes the converting coefficients larger. In particular, the Tokyo and Osaka areas experienced the most severe land price declines, making the conversion factors of these two areas larger than those of other areas. Other areas include 36 prefectures, but even among them, the differences in the average land price increase rates are large, and there is a considerable gap between the maximum and minimum converting coefficients. In addition, the land price decrease rate for commercial land use is larger than those for industrial use in all areas, a factor that contributes to the

[8] Of the two hypotheses on the economic mechanisms behind the regional Balassa-Samuelson effect, the calculations favor the land services hypothesis. Nonetheless, the results of the analysis shown below favor the labor costs hypothesis.
[9] For Fukui and Okinawa prefectures, semi-industrial land data was used as some of the data of industrial land for this period was missing.

higher user costs of commercial land use compared to industrial use.

The converting coefficients explained above are multiplied by the previously estimated land stock by prefecture and by industry to obtain land service inputs by prefecture and by industry. Figure 7 shows the land service inputs of the service sectors (private and non-profit) as a bar chart for each prefecture. As explained earlier, the converting coefficients from land stock to land services is higher in urban areas where the land stock of this sector is larger, so the general shape of the graph is identical to that of Figure 5, and the land service inputs are also larger in urban areas.

(Figure 7)

**4. Calculating the Impact of Factor Costs on Regional Price**

The next step is to apply the price model in equation (1) to calculate how the land and labor input costs per unit of output are reflected in the regional price, using the data explained in the previous section. As a preparation for that, we first calculate the input coefficients and the import and inward transport coefficients from the IO tables for each prefecture, and then calculate the inverse matrix $\left[\left[I-\left(I-M_r\right)A_r\right]^T\right]^{-1}$.

Then, for the output value by prefecture and by industry, which is used as the denominator when calculating the factor input cost per unit of output, we use the output value from the IO tables for each prefecture that we have already prepared, but we remove the effect of regional price differences from the output value using the prefectural price differences by service sector. The results are shown in Figure 8 for the service sectors (private and non-profit). The shape of the bar chart in this figure differs significantly from those in Figures 5 and 7 seen earlier. In urban areas, the land stock and land service inputs of the service sectors (private and non-profit) are certainly large, but at the same time, the output value of the service sectors is also large, so the land service input per unit of output is not necessarily larger than in other areas.

(Figure 8)

Applying the price model in equation (1) to the land service input per unit of output, we calculated the impact on prices by industry within each region. Figure 9 shows the results for the service sectors (private and non-profit) across prefectures. Comparing Figure 9 with Figure 8, we see that impact on prices shown in Figure 9 tends to be higher in Tokyo and other urban areas. This occurs by the import and inward transport coefficients, which is used to adjust the input coefficients in the price model (1), resulting in larger impact in urban areas where the service sectors (private and non-profit) are more self-contained within the region.[10]

(Figure 9

Similar calculations are made for the impact on prices of labor input costs within each region. Labor input costs by prefecture and by industry are taken from the IO tables for each prefecture. For the output value, which is used as the denominator when calculating the labor input cost per unit of output, we also use the value from which the effect of regional price differences is removed using the prefectural price differences by service sector. Figure 10 shows the labor input cost per unit of output for the service sectors (private and non-profit) for each prefecture. We then applied the price model of equation (1) and calculated its impact on prices by industry within each region. Figure 11 shows the results for the service sectors (private and non-profit) for each prefecture. Figures 10 and 11 show a similarity to that seen in Figures 8 and 9.

(Figure 10)
(Figure 11

**5. Which is More Important, Land Cost or Labor Cost?**

We now see if there is any correlation between the impact on prices from land and labor inputs within each region obtained in the previous section and the regional price differences directly measured from the service sector item-specific data using the absolute purchasing power parity method. While the impact on prices from land and labor inputs within each region captures price-boosting effect measured by common regional unit, regional price differences by sector, which are measured using the absolute purchasing power parity method, measure relative prices across regions. Therefore, the measurement concepts are different and they cannot be directly added or subtracted.

[10] When we define the price impact ratio of factor prices within each region by dividing the calculated price impact from factor inputs by the factor input values, the simple average of the price impact ratio of land services of all prefectures in Japan, for example, is 1.38 times, whereas it is 2.27 times in Tokyo, 1.69 times in Osaka, and 1.49 times in Aichi. So, the number tends to be high in metropolitan areas.

For this reason, we first obtain a regression equation with regional price differences by sector as the dependent variable and the impact on prices from land and labor input costs within each region as the explanatory variables, and then use this equation to decompose the two explanatory variables. Note that, as data for the five industries are pooled and used to estimate the regression equation, industry dummies are added to the explanatory variables to control the fixed effects of the industry-specific factors. The estimated equation is as follows. Although this estimation is done on very small sample (235 data), the adjusted R2 is 0.89 indicating that this estimation explains about 90% of the changes in price differences by industry. Both the land cost effect and labor cost effect are positive as expected and statistically significant.

Regional Price Differences by Industry =
0.765 + 1.721*Land Cost Effect + 0.400*Labor Cost Effect + Industrial Dummies
(6.27) (3.73)
Adjusted $R^2$ = 0.89

Using the fact that the vector of the residuals of the regression equation is orthogonal to each vector of the explanatory variables, the sum of squares of the dependent variables can be decomposed as follows where $y_i$ is the vector of the dependent variable, $x_{ik}$ is the vector of the explanatory variables, $b_k$ is the coefficient of each estimated explanatory variable, and $u_i$ is the vector of residual terms.

(3) $$\sum y_i^2 = \sum y_i \left( b_0 + b_1 x_{i1} + b_2 x_{i2} + \cdots + b_k x_{ik} + u_i \right)$$
$$\text{¿} \sum y_i \left( b_0 + b_1 x_{i1} + b_2 x_{i2} + \cdots + b_k x_{ik} \right) + \sum u_i^2$$
$$\text{¿} b_0 \sum y_i + b_1 \sum y_i x_{i1} + b_2 \sum y_i x_{i2} + \cdots + \sum y_i x_{ik} + \sum u_i^2$$

Assuming that the first explanatory variable in this regression equation is the impact on prices from land input within each region and the second explanatory variable is the impact on prices from labor input within each region, the second and the third terms (the sum of the impact on prices from land and labor inputs within each region multiplied by the dependent variable, respectively) are extracted from the decomposition of the right-hand side of equation (3) to compare their relative magnitude. The land effect is 6.368 (the second term) while the labor effect is 25.843 (the third term), which results show that about 20% of the regional price differences can be explained by the impact on prices of land, while the remaining 80% is explained by the impact on prices of labor.

## 6. Conclusion

In this research, we prepared consistent IO tables for each prefecture, measured land service input cost and labor input cost per unit of output by prefecture and by industry, and applied the price model of the IO analysis to each prefecture to calculate the impact on prices of the input costs of the two production factors within each region. Using the results and separately estimated regional price differences by sector, we decomposed whether the price-boosting effect from the land input cost or the labor input cost is more important for the observed regional price differences. The results show that about 80% of the observed regional price differences can be explained by the price-boosting effect from the labor input cost.

This result suggests that, of the two hypotheses on the regional Balassa-Samuelson effect presented in Section 2, the importance of the impact of wages in the regional labor market pointed out by Moretti (2012) is more important. This gives interesting implications on the location of leading industries in a region from income distribution perspective. If the regional Balassa-Samuelson effect was solely attributable to the rise in land prices caused by the concentration of the service sectors, it might be difficult to say that the benefits would be evenly distributed to a wide range of local residents. However, on the contrary, it has led to higher wages for a wide range of workers in the region, further increasing the significance of having leading industries located in a region.

## References

Arai, S（2019）, Japanese Inter-prefectural Input-Output Table: Construction Method and Main Results for 2005, RIETI Discussion Paper Series, 20-J-009 (in Japanese).

Tokui, J. and T. Mizuta (2019), Japan's Prefectural-level KLEMS: Productivity Comparison and Service Price Differences, International Productivity Monitor, Spring, pp. 143-160.

Balassa, B. (1964), "The Purchasing Power Parity Doctrine: A Reappraisal," Journal of Political Economy, Vol. 72, pp. 584-96.

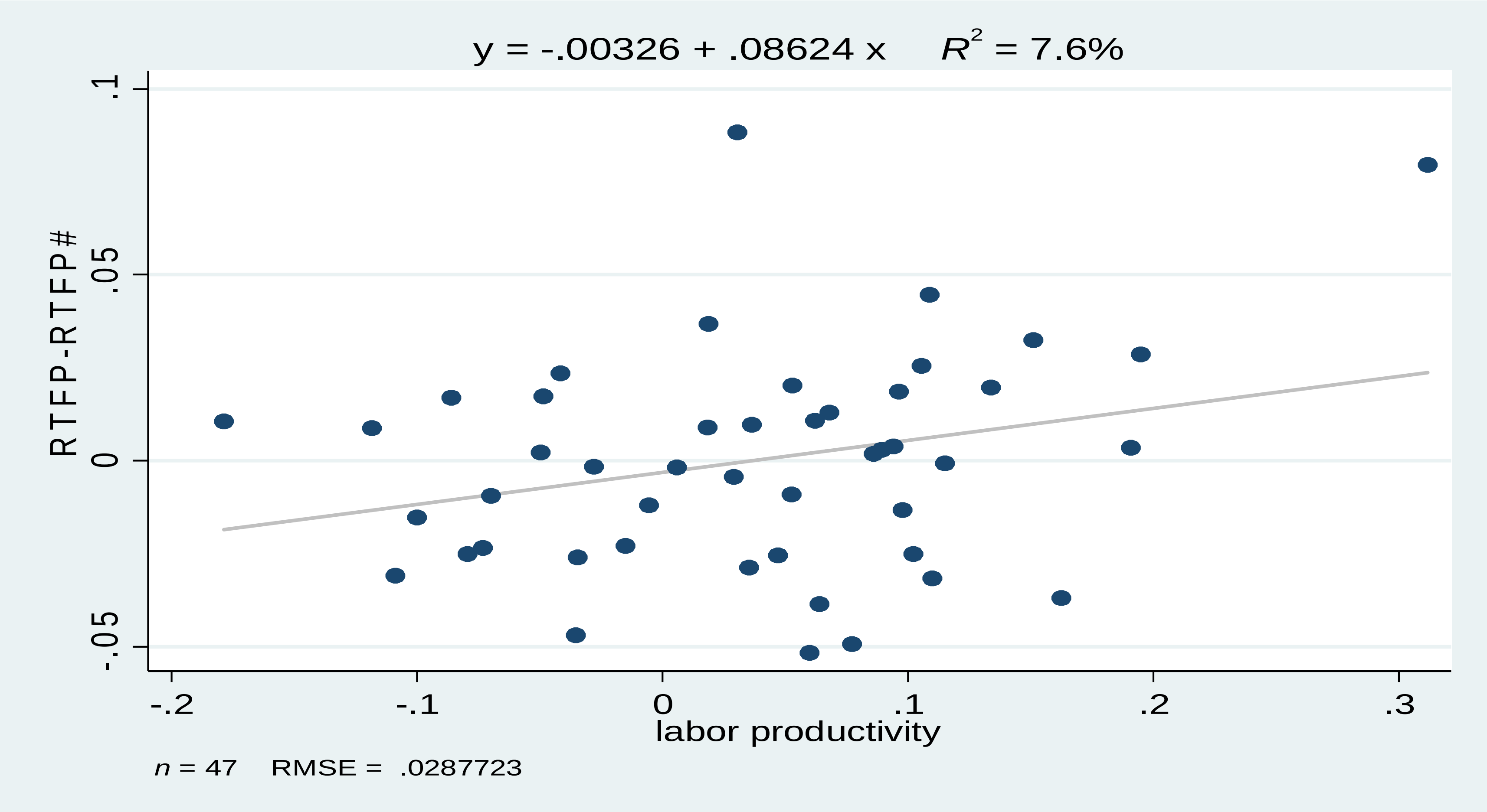
Karadi, P, and M. Koren (2008), A Spatial Explanation of the Balassa-Samuelson Effect, preliminary.

Moretti, Enrico (2012), The New Geography of Jobs, Houghton Mifflin Harcourt.

Samuelson, P. (1964), "Theoretical Notes on Trade Problems," Review of Economics and Statistics, Vol. 23, pp. 1-60.

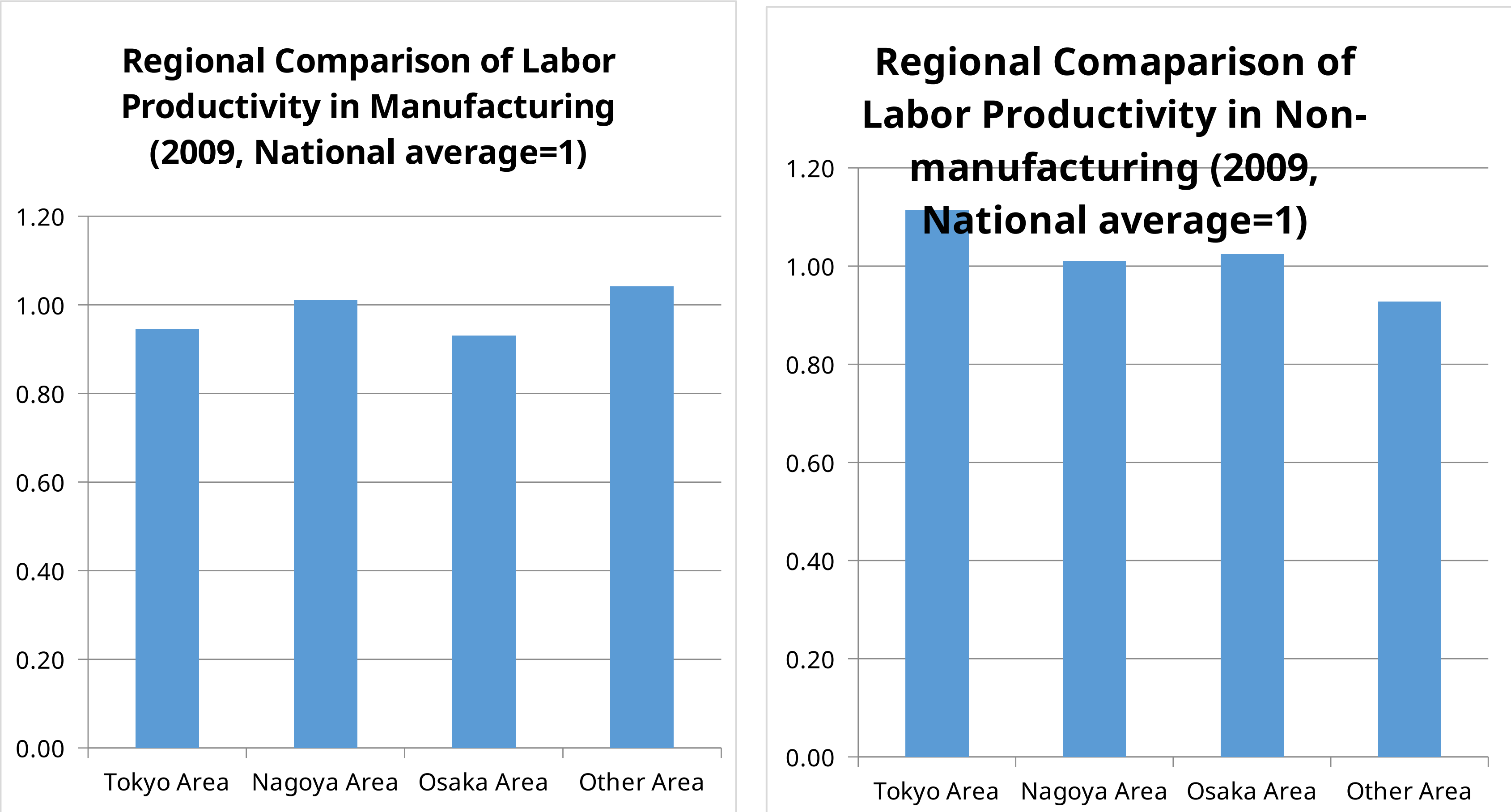
Yankow, J. J. (2006), "Why Do Cities Pay More? An Empirical Examination of Some Competing Theories of the Urban Wage Premium," Journal of Urban Economics 60, pp. 139-161.

Fig. 1 Correlation between Regional Price Difference and Labor Productivity



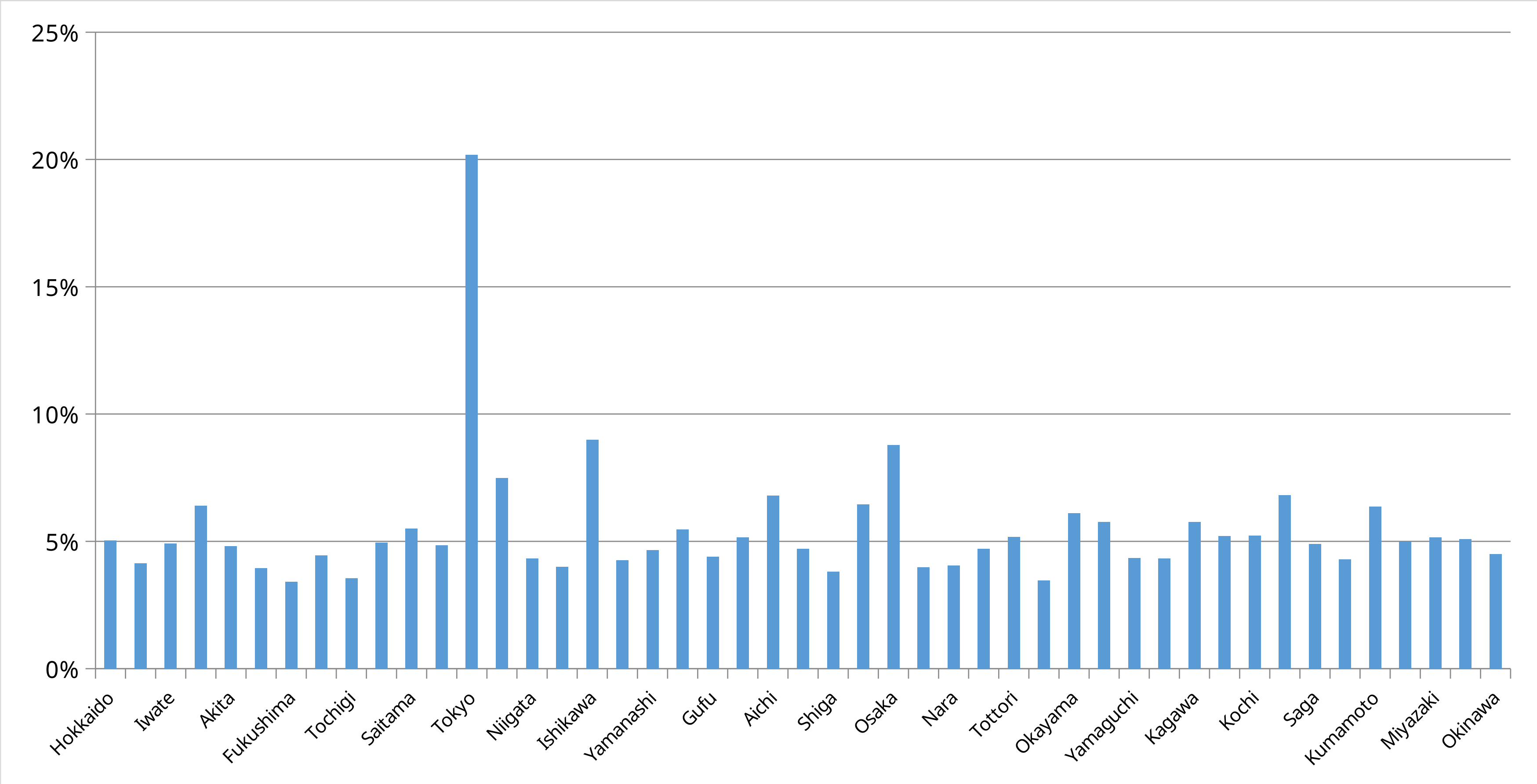

From chart 4 of Tokui and Mizuta (2019).

Fig. 2  Does Higher Labor Productivity in Metropolitan Area occur in Manufacturing?




Data source is R-JIP Database 2017. Tokyo Area includes Tokyo, Saitama, Chiba, and Kanagaw includes Aichi, Gifu and Mie. Osaka Area includes Osaka, Kyoto, Hyogo a manufacturing are indicated as Non-manufacturing.

Fig. 3 Prefectural Comparison of Output Share of Information and Communication, and Advertising in the broad Service Industries




Data source is Inter-prefectural IO table by Arai (2019). In the broad service industries we include Construction, Electricity, Gas and Water Supply, Waste-disposal, Real Estate, and Transportation industries.

Fig. 4 Land Stock by Industries in Hokkaido, Tokyo and Aichi, 2005

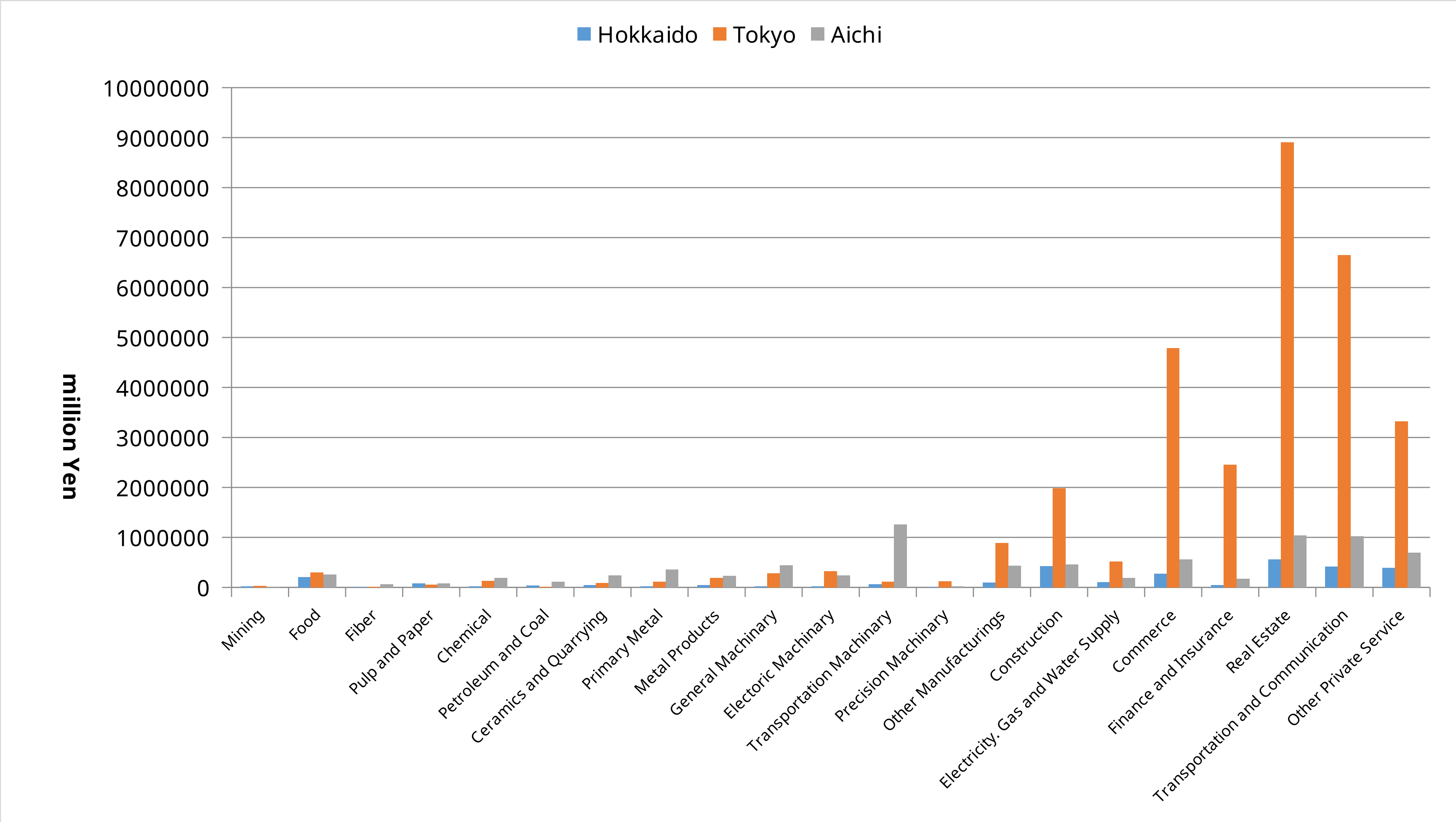


Fig. 5 Prefectural Comparison of Land Stock in Other Private Service Industries, 2005

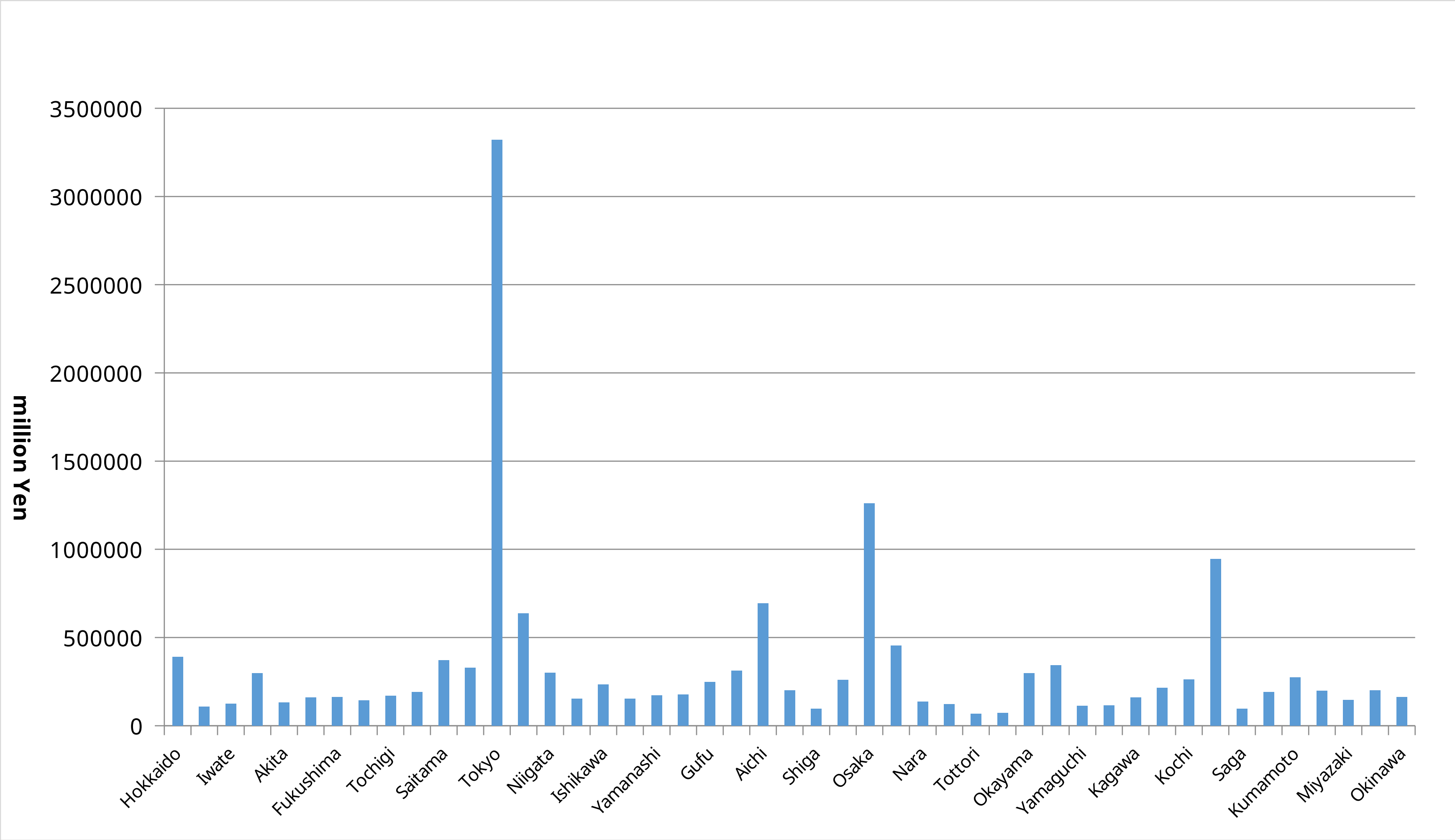
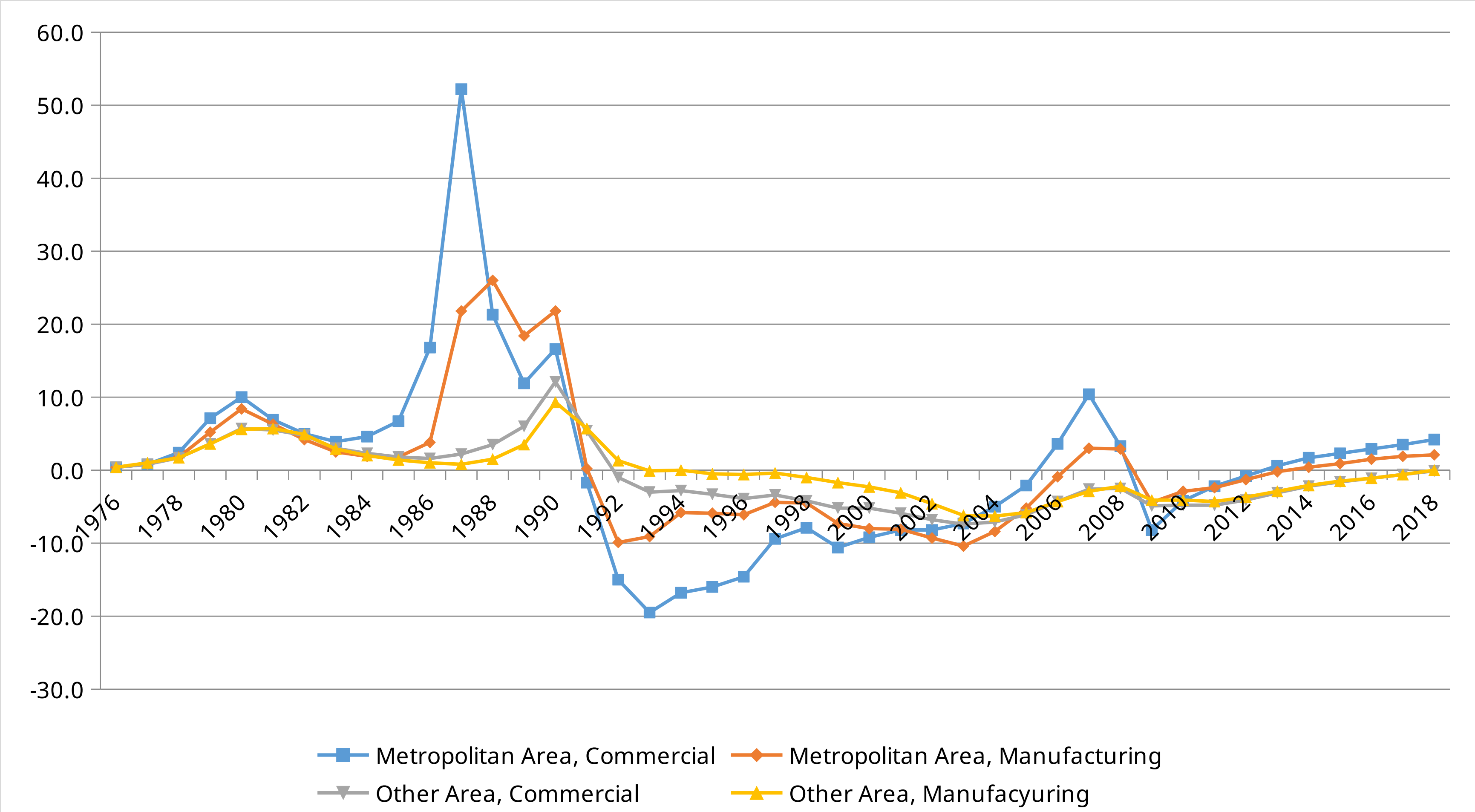


Fig. 6 Rate of Change in Land Prices by Area and Purposes, 1976-2018




Data source is the Prefectural Survey of Land Price by the Ministry of Land, Infrastructure and Tra
Tourism.

Table 1 Summary of Converting Coefficients from Land Stock to Land Service Input

| | | Converting Coefficient | | | (in reference) Average Rate of Change in Land Price (%) ：1991-2005 | | |
|---|---|---|---|---|---|---|---|
| | | average | maximum | minimum | average | maximum | minimum |
| Tokyo Area | Manufacturing | 0.136 | 0.160 | 0.119 | -7.3 | -6.1 | -9.0 |
| | Commercial | 0.171 | 0.204 | 0.153 | -9.8 | -8.5 | -12.1 |
| Nagoya Area | Manufacturing | 0.063 | 0.071 | 0.057 | -2.2 | -1.8 | -2.8 |
| | Commercial | 0.108 | 0.137 | 0.092 | -5.3 | -4.2 | -7.4 |
| Osaka Area | Manufacturing | 0.132 | 0.163 | 0.079 | -7.0 | -3.4 | -9.2 |
| | Commercial | 0.166 | 0.220 | 0.126 | -9.4 | -6.6 | -13.2 |
| Other Areas | Manufacturing | 0.055 | 0.098 | 0.032 | -1.6 | -0.1 | -4.6 |
| | Commercial | 0.086 | 0.133 | 0.037 | -3.8 | -0.4 | -7.1 |

Fig. 7  Prefectural Comparison of Land Service Input in Other Private Service Industries, 2005

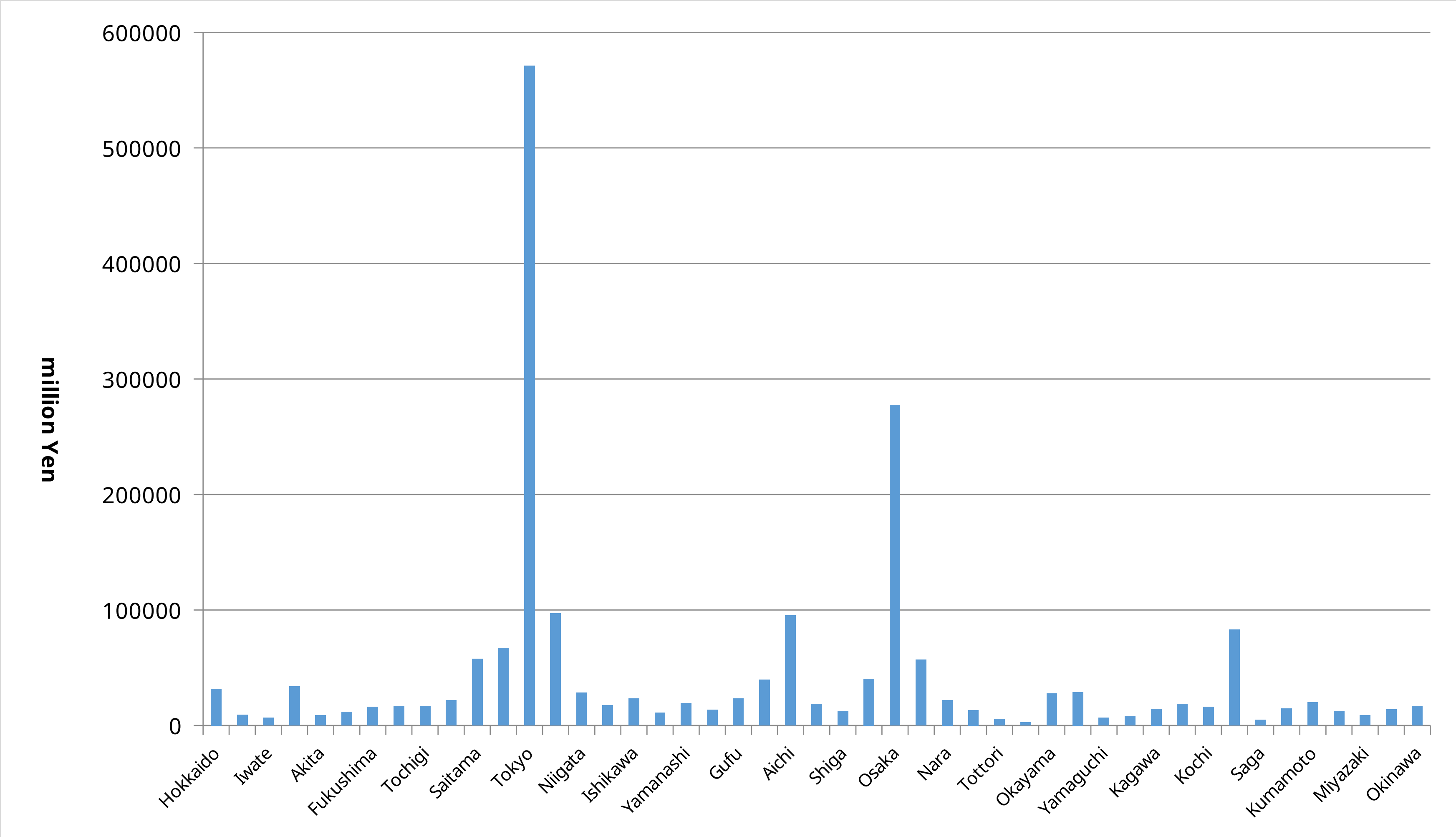


Fig. 8  Prefectural Comparison of Land Service Input per Output in Other Private Service Industries, 2005

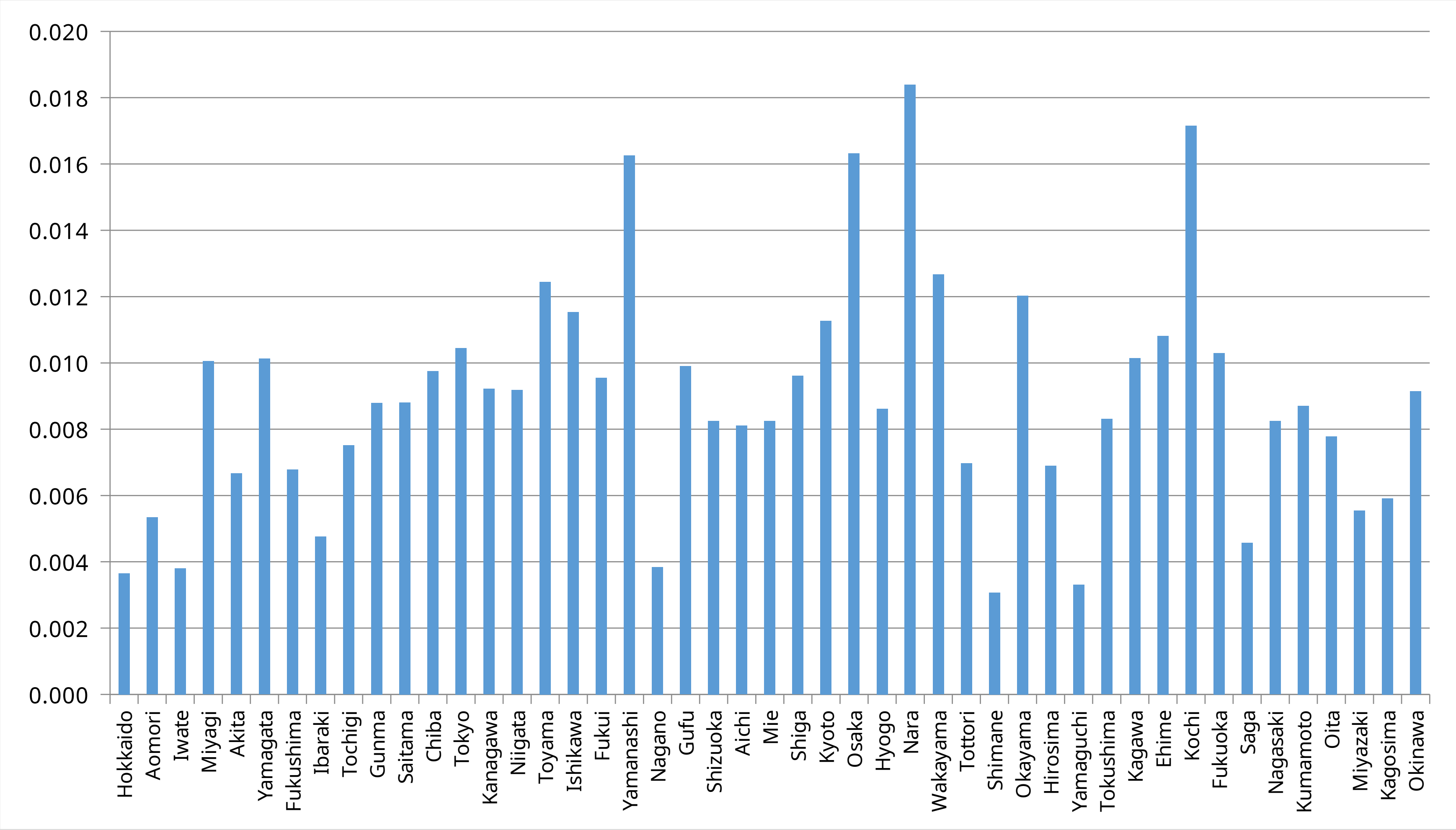


Fig. 9 Contribution to Regional Price Differences from Land Service Input per Output in the Other Private Service Industries, 2005

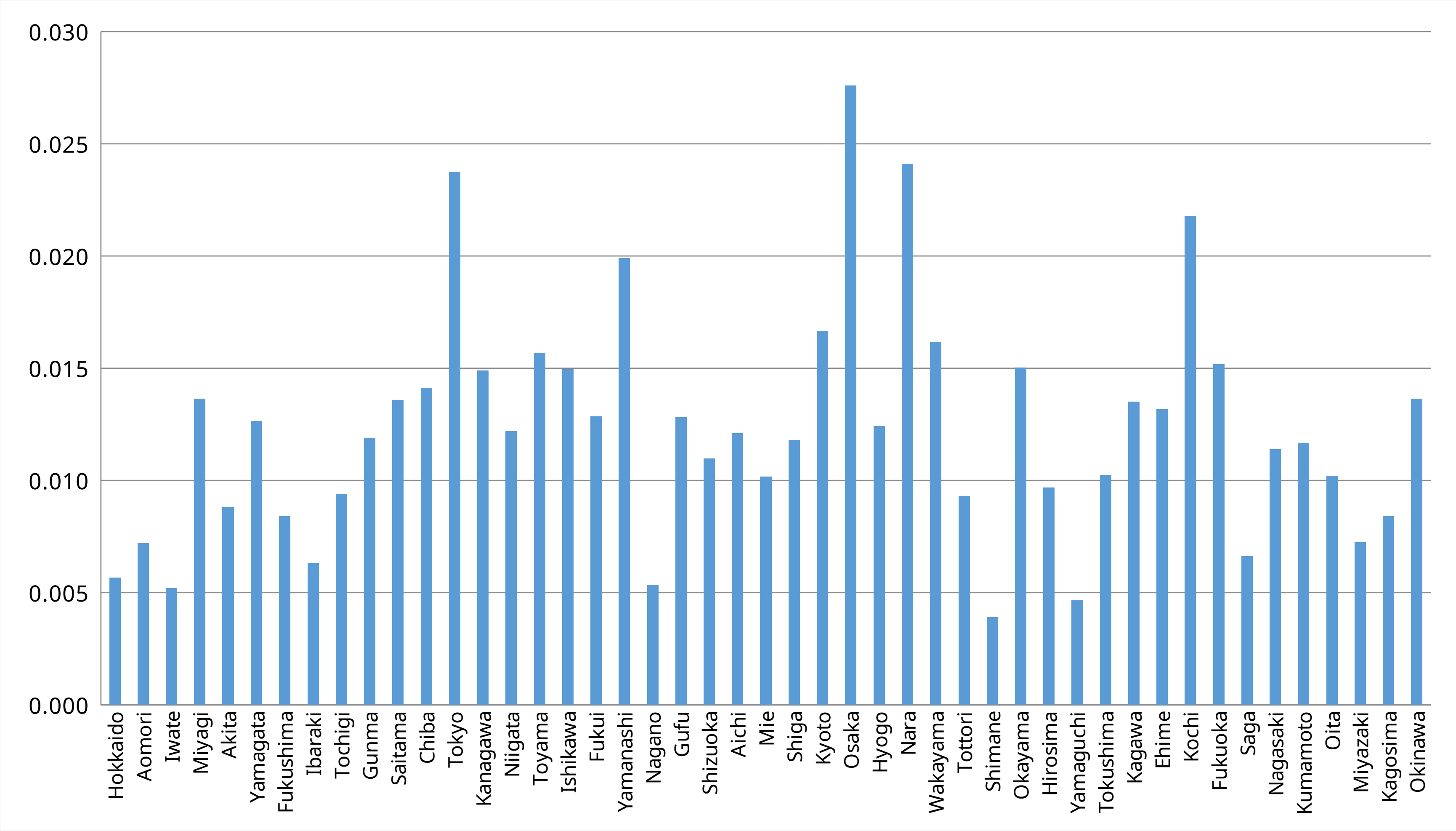


Fig. 10 Prefectural Comparison of Labor Input per Output in Other Private Service Industries, 2005

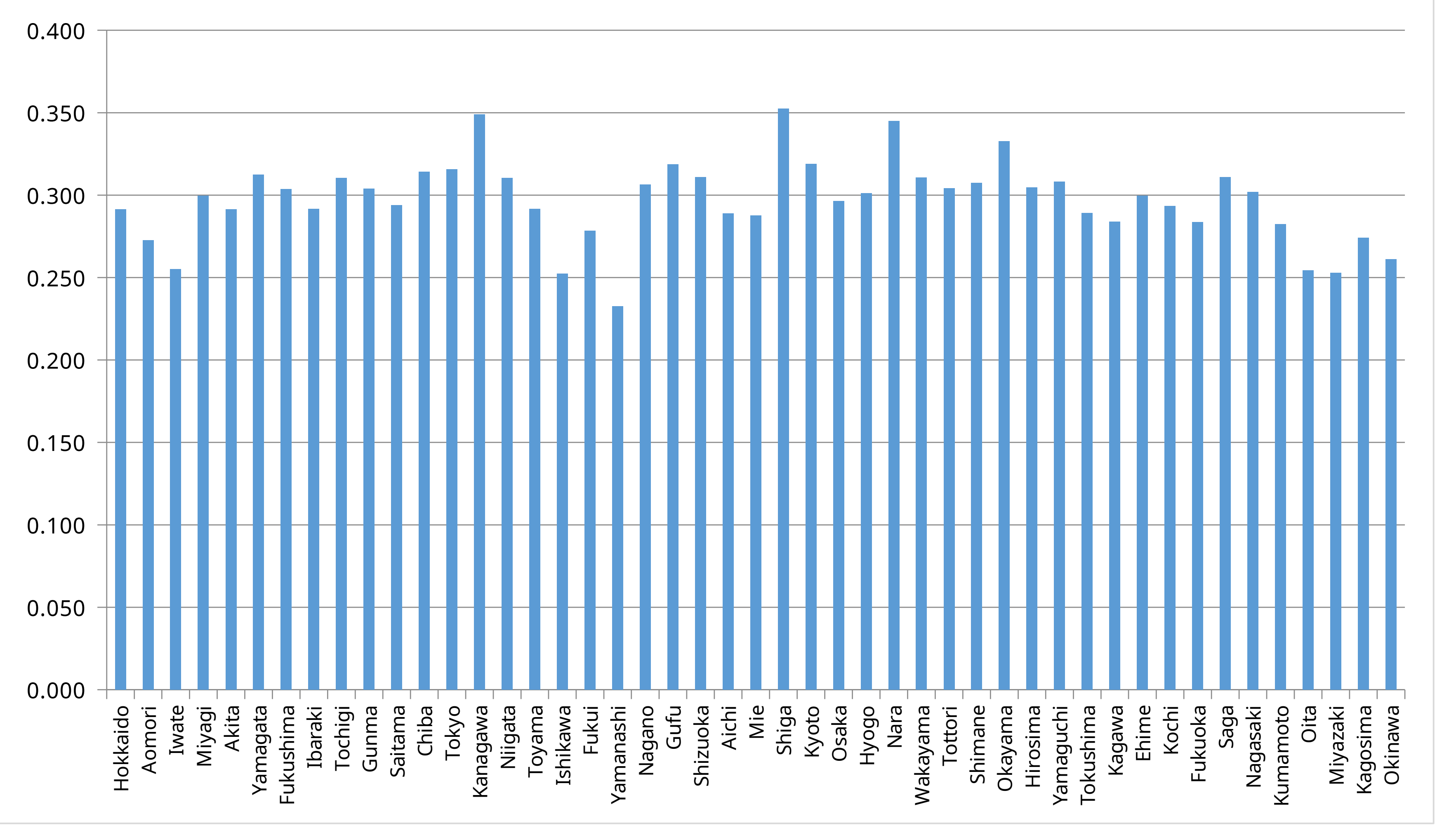


Fig. 11 Contribution to Regional Price Differences from Labor Input per Output in the Other P
Industries, 2005