Occasional Paper No.59

The Measurement of Labour Exchange Rate through Intermediate Trade in Japan, the U.S., and China

April 2016

Hosei University

Japan Statistics Research Institute

The Measurement of Labour Exchange Rate through Intermediate Trade in Japan, the U.S., and China

HASHIMOTO Takahiko
Ritsumeikan University
e-mail: tht27008@fc.ritsumei.ac.jp

Summary

This paper measures the total labour required per monetary unit of tradable commodity output between countries from 1995 to 2007. The total labour required per monetary unit of tradable commodity output between countries is also called the exchange rate of labour. In this paper, we verify the bilateral exchange rates of labour (using Japan, the U.S., and China), that is, the relationship between the real exchange rate and the total labour required per tradable commodity output unit between these countries.

JEL codes: C67, F20
Keywords: Total Labour Required, Exchange Rate, Exchange Rate of Labour

Introduction

This paper is an empirical study of the exchange rate of labour, which is represented by the total labour required per unit output of tradable commodity between two countries. Total labour required is amount of labour input directly and indirectly into the production of one unit of net product.

The ground-breaking empirical studies on the exchange rate of labour were conducted by Yamada (1991), and Izumi & Nakajima (1995). Yamada (1991) tested the Japan-U.S. exchange rate of labour for tradable commodities as of 1985 and found that, for each unit of U.S. labour, Japan used 1.631 hours of labour. However, this study was limited in that it only measured the exchange rate of labour as of 1985. In contrast, in their study of the exchange rate of labour from 1960 through 1985, Izumi & Nakajima (1995) showed that economic development was shrinking the disparities in the unequal exchange of labour. However, Izumi & Nakajima (1995) did not attempt to analyse the causes of the unequal exchange of labour. The reasons for changes in the unequal exchange of labour are (1) disparities between countries in the productivity of tradable commodities, (2) exchange-rate issues (fluctuations in the real exchange rate), and (3) differences in the composition of exports. This paper therefore analyses the factors in this exchange rate of labour.

2. Model

2-1 Total labour required model

The method for measuring the total labour required used in this paper is that used by Okishio (1958), Wolff (1979), Yamada (1991), Okishio & Nakatani (1993), and Nakajima (2008). Here what we can actually measure is total labour required per unit price. Unit price is taken as one million dollars. The formula for total labour required per unit price is defined as follows.

$$t = tA + t_m\mu + \tau \qquad (1)$$

$$t_m = tE \qquad (2)$$

On the right-hand side of equation (1), the first item denotes the indirect labour included in capital consumption and intermediate goods. The second item denotes the labour value of imports as expressed by t_m. The third item 3 denotes the direct labour. In equation (2), t_m denotes total labour required domestically times its share of total tradable commodities.

Symbols

$t = [t_i]$: the amount of labour required directly and indirectly to produce one unit of the *i*th commodity, say, one million dollars of the *i*th commodity (row vector); $A = [a_{ji}]$: the amount of the *i*th commodity in monetary terms directly necessary to produce one unit of the *i*th commodity (matrix); $\mu = [\mu_i]$: the sum of imports necessary to produce the *i*th commodity for a million dollars (row vector); $\tau = [\tau_i]$: the amount of labor directly necessary to produce a million dollars of the *i*th commodity (row vector); $E = [e_i]$: the composition of exports of the *i*th commodity per one million dollars of exports (column vector); t_m: the amount of labour directly and indirectly necessary within the country to obtain imported goods for a million dollars (scalar); I : the identity matrix (matrix).

Applying equation (2) to equation (1) yields the following:

$$t = tA + tE\mu + \tau \qquad (3)$$

so that solving for the total labor required results in:

$$t = \tau[I - A - E\mu]^{-1} \qquad (4)$$

Here, the monetary unit is $1 million. The World Input-Output Database[1] used here contains the local currency values of 40 countries converted to U.S. dollars according to nominal exchange rates. This database covers 35 industries in 40 countries, thereby measuring the total labour required for 1,400 industries. Besides these 40 countries, the table also shows the intermediate coefficient for the Rest of World.

Yamada (1991) and Izumi & Nakajima (1995) covered single countries' endogenous data only. However, the advantage of this paper is that it captures endogenous data on 40 countries' intermediate goods input relationships and labour inputs.

The nominal exchange rate of labour in equation (5) has the total labour required to export goods from Japan to the U.S. as its numerator, and the total labour required to export goods from the U.S. to Japan as its denominator[2].

$$\rho^{v}_{JPN\_USA} = \frac{\sum_{j} t_j^{JPN} e_j^{JPN\_USA}}{\sum_{j} t_j^{USA} e_j^{USA\_JPN}} \qquad (5)$$

Here, USA denotes the U.S., JPN denotes Japan, CHN denotes China. And $e_j^{USA\_JPN}$ define the component ratio of export of the *j*th commodity from the U. S. to Japan. Equation (5') is the exchange rate of labour, whereby the denominator is total labour required to export goods from China to Japan, while the numerator is the total labour required for tradable commodity moving from Japan to China.

$$\rho^{v}_{JPN\_CHN} = \frac{\sum_{j} t_j^{JPN} e_j^{JPN\_CHN}}{\sum_{j} t_j^{CHN} e_j^{CHN\_JPN}} \qquad (5')$$

If the nominal exchange rate of labour equals 1, then an equivalent exchange exists, meaning that the same amount of labour is used when exchanging the same value of tradable commodities. If it does not equal 1, it is called an unequal exchange of labour.

$$\rho^{v}_{JPN\_CHN} > 1$$

For example, if nominal exchange rate of labor is greater than 1, it means that when exchanging the same amount of a tradable commodity, China used a greater amount of labor than did Japan. This

[1] See the appendix for the World Input-Output Database.

[2] The appendix contains a detailed description of the calculation method.

situation is disadvantageous to China and advantageous to Japan.

Symbols

$p = [p_i]$: dollar-denominated unit price of the *i*th commodity (row vector); w_i : dollar-denominated nominal wage rate for the *i*th commodity; $x = [x_i]$: dollar-denominated amount of *i*th part gross output (column vector); $y = [y_i]$: dollar-denominated amount of *i*th net output (column vector). EXR^{JPN} : nominal exchange rate of yen into dollars. PPP_j^{JPN} : commodity purchasing power parity from yen into dollars.

2-2 Exchange rate of labour factor analysis

For the purpose of capturing only the rate of decrease in the amount of labour used directly and indirectly to produce one unit of a certain net product, we define Real Total Labour Required $t_j^{R,JPN}$ as a fixed value with 1997 as the base year. The rate of decline in the Real Total Labour Required is called technical change in terms of productivity criteria. Substituting the Real Total Labour Required for total labour required in equation (5) yields what is called the Real Exchange rate of Labour (equation (6)).

$$\rho_{JPN\_USA}^{v,REAL} = \frac{\sum_j t_j^{R,JPN} \overline{e}_j^{JPN\_USA}}{\sum_j t_j^{R,USA} \overline{e}_j^{USA\_JPN}} \qquad (6)$$

The equation for converting using purchasing power parity by industry[3] is described in the footnote[4].

[3] The EUKLEMS database uses the same industrial classifications as WIOD for purchasing power parity by industry (URL: http://www.euklems.net). However, we could not prepare industry-specific purchasing power parities for China.

[4] Using the dollar as the criterion for purchasing power parity by industry, the exchange rate of labor measured in terms of U.S. price levels can be determined using the following formula.

$$\rho_{PPP}^{v} = \frac{\frac{PPP_j^{JPN}}{EXR^{JPN}} \sum_j t_j^{JPN} \overline{e}_j^{JPN\_USA}}{\sum_j t_j^{USA} \overline{e}_j^{USA\_JPN}}$$

The table shows the Japan-U.S. values for Real Total Labor Required.

On the other hand, the real exchange rate for U.S. tradable commodities via-a-vis Japan can be defined as follows[5].

$$\rho^{p}_{JPN\_USA} = \frac{\sum_{j} p_j^{JPN} \overline{e}_j^{JPN\_USA}}{\sum_{j} p_j^{USA} \overline{e}_j^{USA\_JPN}} \qquad (7)$$

The real exchange rate in equation (7) is the same as the tradable commodity exchange rate viewed from the standpoint of price. Also, the economic meaning of equation (7) is the volume of tradable commodities from Japan to the U.S. required to obtain one unit of tradable commodities from the U.S., in other words, the exchange rate between Japanese and U.S. trade commodity volumes. In this paper, we measure the real exchange rate index, taking 1995 as 1.0.

The relationship between the nominal exchange rate of labor (equation (5)), the real exchange rate of labor (equation (6)), and the real exchange rate (equation (7)) can be defined as follows.

$$\Delta \ln \rho^{v}_{JPN\_USA} \approx \Delta \ln \rho^{v,REAL}_{JPN\_USA} - \Delta \ln \frac{1}{\rho^{p}_{JPN\_USA}} + \varepsilon \qquad (8)$$

Here, $\ln$ is the natural logarithm, and Δ denotes the difference between different points in time. The first item in equation (8) is the contribution of real exchange rate of labour to nominal exchange rate of labour, in other words, the technical change in productivity criteria between two countries. On the other hand, the second item in equation (8) is the contribution of the real exchange rate to the change in the nominal exchange rate of labour. ε is the contribution of exports to the change in the nominal exchange rate of labour.

Also, when the real exchange rate and the real exchange rate of labour are in the following relationship,

$$\Delta \ln \rho^{p}_{JPN\_USA} > \Delta \ln \rho^{v}_{JPN\_USA} \qquad (9)$$

this indicates that the real exchange rate has changed to Japan's advantage in terms of the exchange rate of labour (and vice versa). Also, in a relationship such as that of equation (9), the nominal exchange rate of labour will increase and the unequal exchange of labour will progress.

3. Measuring results

In this section, we verify the exchange rate of labour between Japan and China and between Japan and the U.S. from 1995 through 2007. Here, the exchange rate of labour was measured using the World Input-Output Table and the World Input-Output Database for endogenous sectors in 40

[5] Here $\overline{e}_j^{JPN\_USA}$ and $\overline{e}_j^{USA\_JPN}$ indicate the share of exports in the base (criterion) year.

countries and the rest of the world. The unit used in the tables and figures to represent total labour required per unit of output is million hours per million dollars of net production value.

First, the exchange rate of labour between Japan and the U.S. is the ratio of the total labour required for a tradable commodity in Japan in the numerator to the total labour required for a tradable commodity in the U.S. in the denominator. Measurements of this ratio are shown in Figure 1 and Table 1 (lines 5-8). The nominal exchange rate of labour in Figure 1 and Table 1, line 5, is the same for each total labour required of nominal million dollars' worth. We see that the nominal exchange rate of labour is 0.652 (1995). This number means that in 1995 it took Japan 0.652 hours to produce the same amount of tradable commodity for the U.S. that took the U.S. one hour to produce for Japan. Comparing the nominal exchange rate of labour of 1.708 for 1985 in Izumi & Nakajima (1995) with this measurement of 0.652 for 1995 shows that the nominal exchange rate of labour declined significantly between 1985 and 1995[6]. This nominal exchange rate of labour then rose from 0.652 in 1995 to 1.106 in 2007. Such a movement in the nominal exchange rate of labour can be viewed as close to an equivalent exchange. The degree of change in nominal exchange rate of labour can be seen by looking at the index for the nominal exchange rate of labour, which sets 1995 (the base year) as 1.0 (Figure 1 and Table 1, line 7). The index for the nominal exchange rate of labour between Japan and the U.S. rose significantly from 1.0 in 1995 to 1.695 in 2007.

Next, the exchange rate of labour between Japan and China is shown in Figure 2 and Table 2 (lines 5-8). In this ratio, the numerator is the total labour required per tradable commodity in Japan, and the denominator is the total labour required per tradable commodity in China. The Japan-China nominal exchange rate of labour was 0.026 in 1995 and 0.060 in 2007. This indicates a very favourable exchange situation for Japan during this period. In addition, the index for the nominal exchange rate of labour rose from 1.0 in 1995 to 2.314 in 2007 (Table 2, line 7).

We will examine the cause of this change in the nominal exchange rate of labour using equation (8). Notable first of all is the contribution of the first item in equation (8) to the technical changes in U.S. and Japanese tradable commodities. Taking the index for the real exchange rate of labour, in which the Real Total Labour Required for tradable commodities in the U.S. is the denominator and the Real Total Labour Required for tradable commodities in Japan is the numerator, we can compare the pace of improvement in efficiency of tradable commodities between the two countries. This metric is shown in Figure 1 and Table 1, line 8. The index of Japan-U.S. real exchange rate of labour remained almost unchanged, at 1.0 in 1995 and 0.966 in 2007. This is because the Real Total Labour Required per tradable commodity in these two countries decreased at almost the same rate.

The Real Total Labour Required per tradable commodity in Japan (million hours per million dollars) dropped from 0.054 in 1995 to 0.035 in 2007 (Table 1, line 3), while the Real Total Labour

[6] However, Izumi & Nakajima uses the National Input-Output Table for measurement purposes. This paper uses the World Input-Output Table, where treats indirect labor of imported goods differently.

Required per tradable commodity in the U.S. dropped from 0.048 in 1995 to 0.032 in 2007 (Table 1. line 4).

Then, we examine the real exchange rate, with Japan's tradable commodity price index as the numerator and the U.S. tradable commodity price index as the denominator. Taking 1995 as 1.0, we obtain the real exchange rate index (Japan-U.S.) index using equation (5). An index of 1 means that the exchange rate is the same as it was in the base year. When the real exchange rate index is less than 1, it means that Japan requires more physical units per U.S. tradable commodity unit than it did in 1995. If this change is to be realized only through the nominal exchange rate, the yen will weaken vis-a-vis the dollar. The real exchange rate index for Japan and the U.S. is given in Figure 1 (Table 3, line 3). For Japan and China, it is given in Figure 2 (Table 3, line 6).

The real exchange rate index for Japan and the U. S. declined significantly, from 1.0 in 1995 to 0.617 in 2007. At the same time, the real exchange rate index that takes Japan's tradable commodity price index as the numerator and China's tradable commodity price index as the denominator declined significantly, from 1.0 in 1995 to 0.560 in 2007. In both cases, this was because Japan's tradable commodity price index declined significantly in relation to the price indices of the other two countries (the U.S. and China).

Therefore, the fluctuations in the real exchange rate of labour index and the real exchange rate index are seen to have the relationship of $\Delta \ln \rho^{p} < \Delta \ln \rho^{v,REAL} \approx 0$. In the case of Japan and the U.S., the increase in the nominal exchange rate of labour index is clearly due to the change in the real exchange rate index, not to the change in the real exchange rate of labour index. A change in the real exchange rate alone moves the nominal exchange rate of labour closer to 1.0.

Next, the nominal exchange rate of labour, in which Japan's total labour required per tradable commodity is the numerator and China's total labour required per tradable commodity is the denominator, is shown in Table 2, line 5. The differential between both countries in the nominal exchange rate of labour per tradable commodity rose from 0.026 in 1995 to 0.060 in 2007, as shown in Table 2, line 5. Compared with this, the real exchange rate of labour is shown in Figure 2 and Table 2, line 8. This real exchange rate of labour rose from 1.0 in 1995 to 1.392 in 2007. The cause of this increase is that the total labour required per tradable commodity dropped more rapidly in China than in Japan.

The Japan-China real exchange rate of labour index and real exchange rate index are shown in Figure 2. The real exchange rate of labour is seen to have risen gradually, while the real exchange rate dropped sharply. In the Japan-China case, the real exchange rate of labour and the real exchange rate are clearly moving independently of each other. This outcome suggests that the gradual adjustments made through China's fixed exchange-rate system may not have been sufficient so far.

4. Conclusion

This paper used the World Input-Output Database to verify measurements of the nominal exchange rate of labour between Japan and the U.S. and between Japan and China from 1995 to 2007.

First, we saw that the Japan-U.S. nominal exchange rate of labour, which compares the total labour required for tradable commodities in Japan vs. the U.S., rose from 0.652 in 1995 to 1.106 in 2007. Our tentative conclusion is that the Japan-U.S. nominal exchange rate of labour seems to be approaching the level of equivalent exchange. This confirms that, of the two change factors, the change in nominal exchange rate of labour from 1995 to 2007 can be explained by real exchange rate fluctuations alone. The trend in the other change factor--the Real Total Labour Required in each of the two countries--was similarly downward, but the real exchange rate of labour was almost unchanged. The outcome of this factor analysis is this paper's singular achievement in building upon previous research.

In contrast, the Japan-China nominal exchange rate of labour showed that as of 1995 exchanging the same $1 value of tradable commodity cost China 1 unit of labour but it cost Japan only 0.026 units, which is a very unequal exchange of labour. Subsequently, the Japan-China exchange rate of labour skyrocketed, to 0.06 in 2007. This rise in nominal exchange rate of labour is a result of a negligible decline in Japan's Real Total Labour Required and a sharp decline in China's Real Total Labour Required. On the other hand, the real exchange rate, in which Japan is the numerator and China is the denominator, was on a downward trend. From this, we confirmed that the Japan-China real exchange rate of labour and real exchange rate move independently of each other.

Appendix: Data Source

We get some data to calculate some indexes (Total labor required, etc.) by the Website (http://www.wiod.org/new_site/home.htm). This data for the components of the world input-output accounting framework (40 countries, 1995-2009) were assembled from some parts. The basic data can be divided into four components: (1) inter-industry matrix, (2) labor coefficient, (3) price deflator, (4) nominal exchange rate.

(1) Inter-Industry Matrix

The World Input-Output tables (WIOTs) are industry-by-industry type (see Timmer (eds.) (2012a)). Inter-Industry Matrix is a part of the WIOD, This World Input-Output table is at current prices and at previous year prices (35 industries by 35 industries). The import coefficients (μ) and the export coefficients (E) was calculated using the final demand section and inter-industry matrix in WIOD.

(2) Labor Coefficient

The labor coefficient was calculated by the total hours worked by persons engaged and gross output. These data are part of the WIOD Socio-economic Accounts (see Timmer (eds.) (2012a), p. 56, table 7.1).

(3) Price Deflator

The Price deflator is in the WIOD Socio-economic Accounts (see Timmer (eds.) (2012a), p. 56, table 7.1). This price deflator is about gross output, intermediate inputs, gross value added and gross fixed capital formations. The base year of this price deflator is in 1995 year.

(4) Nominal Exchange Rate

The data source of exchange rate is the International Monetary Funds (IMF).

Reference

Izumi, H., Kinoshita, S., Fujie, M., Ohnishi, H. & Fujii T. (eds.) (1995), *Modern Economic Statistics*, Koyo-Shobo (in Japanese).

Izumi, H. & Nakajima, A. (1995), "Measurement of Unequal Exchange," in Izumi, H. et al.

Okishio, N. (1958), "An Empirical Approach to the Labor Theory of Value," *Syogaku-Ronsyu*, Vol. 27, No.3 (in Japanese).

Nakashima, A. (2008), "Total Labour Requirements and Value Added Productivity of Labour in the Process of Economic Development," *Economic Systems Research*, Vol. 20, No. 3.

Okishio, N. & Nakatani, T. (1993), "A Measurement of the Rate of Surplus Value," in Okishio, N., *Essays on Political Economy*, New York, Peter Lang.

Shaikh, A. & Antonopoulos, Rania (2012), "Explaining Long Term Exchange Rate Behavior in the United States and Japan," in Moudud, J. K. and Bina, C. and Mason, P. L. (eds.) *Alternative Theories of Competition*, Routledge.

Timmer, M. (eds.) (2012a), *The World Input-Output Database (WIOD): Contents, Sources and Methods*, WIOD.

Timmer, M. (eds.) (2012b), *WIOD Socio-Economic Accounts (SEA): Sources and Methods*, WIOD.

Wolff, E. N. (1979), "The Rate of Surplus Value, the Organic Composition, and the General Rate of Profit in the U.S. Economy, 1947-67," *The American Economic Review*, Vol. 69, No. 3.

Yamada, H. (1991), "A Comparative Analysis of the Labor Productivity by Industry in the US and Japan," *Ritsumeikan Economic Review*, Vol. 40, No.1 (in Japanese).

Table 1. Japan-U.S. Exchange Rate of Labor (million hours/ million dollars)

	Components / Years	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	Nominal TLR to export goods from Japan to the U.S.	0.031	0.033	0.037	0.038	0.035	0.034	0.039	0.039	0.037	0.034	0.034	0.036	0.034
2	Nominal TLR to export goods from the U.S. to Japan	0.047	0.043	0.043	0.043	0.043	0.042	0.041	0.039	0.037	0.037	0.036	0.034	0.031
3	Real TLR to export goods from Japan to the U.S.	0.054	0.050	0.048	0.047	0.045	0.043	0.044	0.043	0.042	0.040	0.038	0.037	0.035
4	Real TLR to export goods from the U.S. to Japan	0.048	0.045	0.043	0.044	0.042	0.040	0.038	0.036	0.035	0.037	0.036	0.035	0.032
5	Nominal Exchange Rate of Labour 1÷2	0.652	0.769	0.854	0.901	0.814	0.796	0.947	1.009	0.989	0.926	0.948	1.040	1.106
6	Real Exchange Rate of Labour 3÷4	1.125	1.112	1.100	1.079	1.087	1.065	1.162	1.204	1.210	1.095	1.058	1.077	1.086
7	Index of Nominal Labor Exchange Ratio (1995=1.0)	1.000	1.180	1.309	1.381	1.248	1.220	1.452	1.547	1.517	1.420	1.453	1.595	1.695
8	Index of Real Labor Exchange Ratio (1995=1.0)	1.000	0.989	0.978	0.959	0.967	0.947	1.033	1.071	1.075	0.973	0.941	0.958	0.966

* TLR means Total Labour Required

Table 2. Japan-China. Exchange Rate of Labour (million hours/ million dollars)

	Components / Years	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	Nominal TLR to export goods from Japan to China	0.033	0.035	0.039	0.040	0.037	0.035	0.041	0.043	0.039	0.036	0.035	0.037	0.036
2	Nominal TLR to export goods from China to Japan	1.261	1.169	1.084	1.036	0.934	0.858	0.843	0.813	0.797	0.780	0.738	0.670	0.608
3	Real TLR to export goods from Japan to China	0.062	0.058	0.054	0.054	0.053	0.050	0.052	0.051	0.048	0.047	0.044	0.043	0.041
4	Real TLR to export goods from China to Japan	1.217	1.129	1.048	0.999	0.898	0.821	0.804	0.772	0.755	0.738	0.700	0.636	0.576
5	Nominal Exchange Rate of Labour 1÷2	0.026	0.030	0.036	0.039	0.040	0.041	0.049	0.052	0.049	0.046	0.048	0.056	0.060
6	Real Exchange Rate of Labour 3÷4	0.051	0.051	0.052	0.054	0.059	0.060	0.064	0.066	0.064	0.063	0.063	0.068	0.071
7	Index of Nominal Labor Exchange Ratio (1995=1.0)	1.000	1.166	1.397	1.511	1.533	1.578	1.902	2.033	1.893	1.775	1.862	2.155	2.314
8	Index of Real Labor Exchange Ratio (1995=1.0)	1.000	1.005	1.009	1.053	1.154	1.181	1.256	1.292	1.257	1.239	1.231	1.332	1.392

Table 3. Japan-U.S. and Japan-China Real Exchange Rate Index

	Components / Years	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	Price Index to export goods from Japan to the U.S.	100.0	84.9	75.9	70.1	77.3	79.2	69.4	66.0	69.1	72.9	71.8	69.6	69.5
2	Price Index to export goods from the U.S. to Japan	100.0	100.2	99.8	99.9	99.2	99.0	98.5	97.8	100.4	102.6	105.9	107.7	112.6
3	Real Exchange Rate Index 1÷2	1.000	1.181	1.315	1.426	1.282	1.249	1.418	1.481	1.452	1.407	1.475	1.547	1.621
4	Price Index to export goods from Japan to China	100.1	84.5	75.4	69.0	75.4	76.9	66.4	61.8	62.9	64.5	62.0	59.1	58.3
5	Price Index to export goods from China to Japan	100.0	102.5	101.9	98.6	95.6	95.7	95.2	93.2	93.8	98.2	99.2	100.7	104.1
6	Real Exchange Rate Index 4÷5	0.999	1.214	1.351	1.429	1.269	1.244	1.434	1.508	1.492	1.521	1.600	1.704	1.785

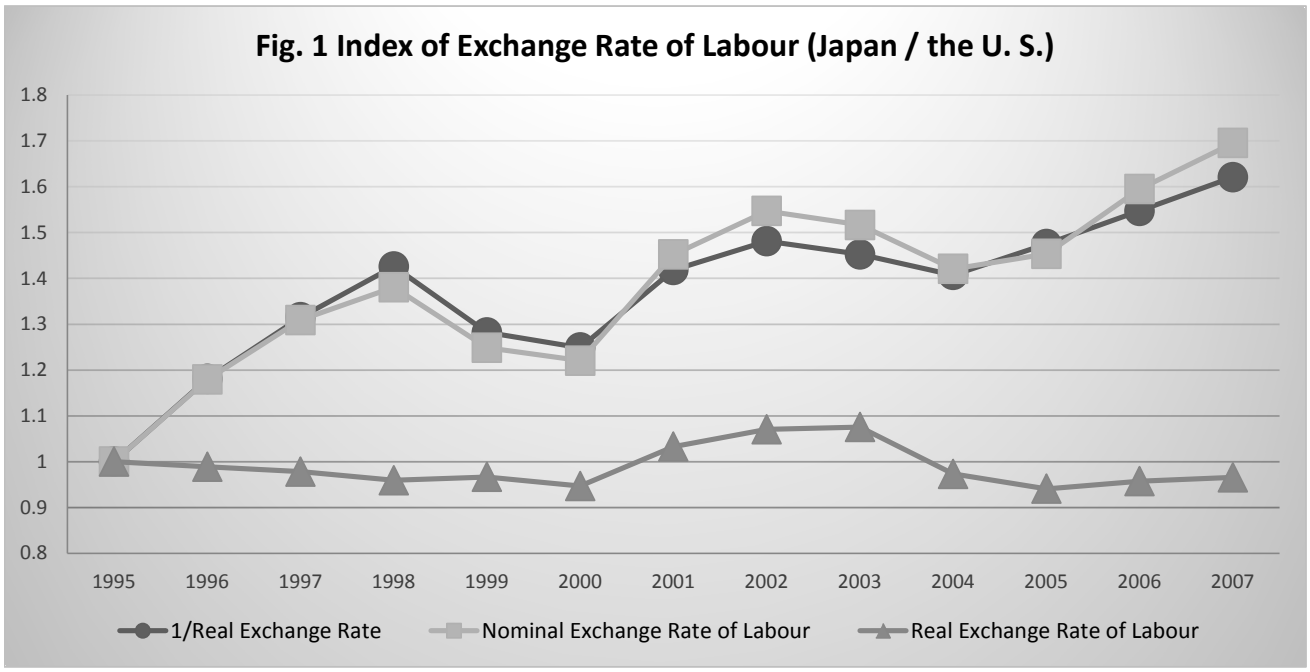
Fig. 1 Index of Exchange Rate of Labour (Japan / the U. S.)
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
1/Real Exchange Rate
Nominal Exchange Rate of Labour
Real Exchange Rate of Labour

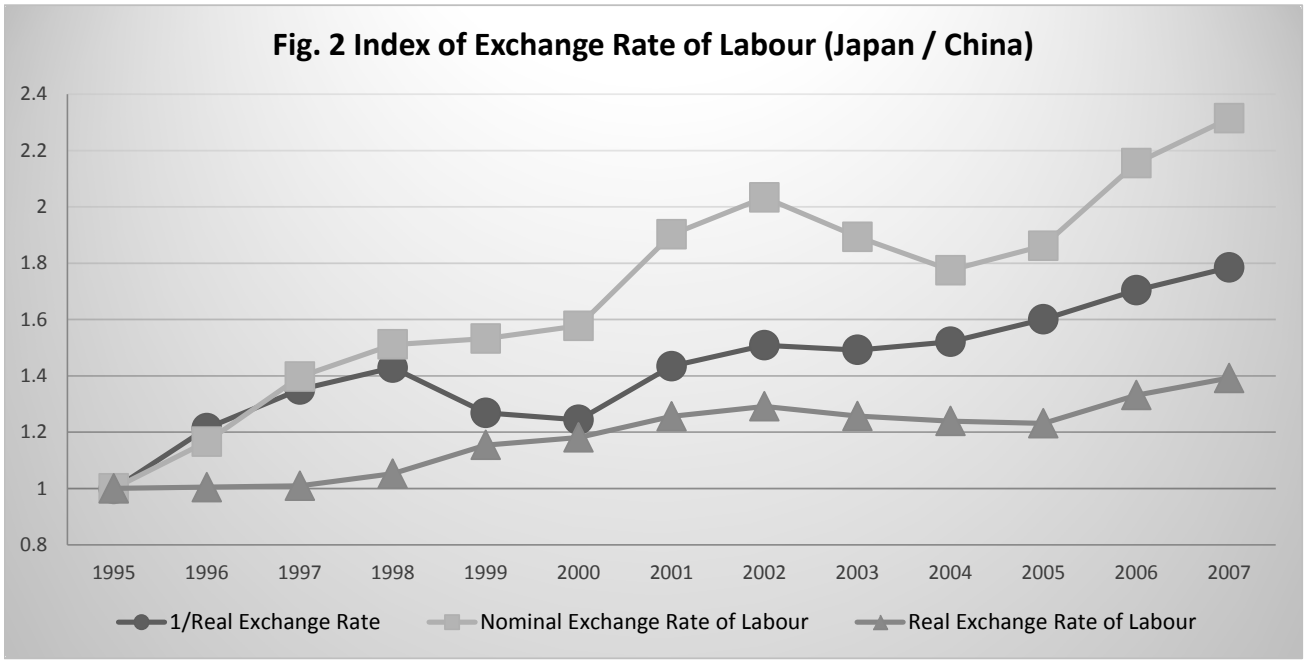
Fig. 2 Index of Exchange Rate of Labour (Japan / China)
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
1/Real Exchange Rate
Nominal Exchange Rate of Labour
Real Exchange Rate of Labour

日本統計研究所

オケージョナル・ペーパー（既刊一覧）

号	タ イ ト ル	刊行年月
34	タウンページ情報を用いた事業所の自然・社会動態の把握	2012.07
35	疑似景況パネルによる予想パフォーマンスの計測	2012.11
36	場所特性変数の付加による個体レコードの拡張について	2012.12
37	フランスの新人口センサスにおける詳細な統計結果の推計方法	2013.03
38	昭和 15 年農林統計改正と調査票情報について	2013.04
39	1855 年ザクセン王国営業調査について	2013.07
40	Estimation of the Start-up, Closure and Relocation Rates of Local Units	2013.09
41	村是調査における調査様式の展開	2014.01
42	明治 31 年内閣訓令第 1 号乙号と調査票情報	2014.05
43	データ統合の視点から見た調査票情報の意味について	2014.08
44	Google earth を利用したドット標本調査法による土地利用面積調査について	2014.10
45	場所的特性変数としての事業所の立地集積度に関する一考察	2014.12
46	QGIS と公表データによる鉄道沿線分析	2015.03
47	事業所・人口メッシュデータによる新線開業に伴う沿線駅周辺における事業所と人口の動向に関する一考察	2015.03
48	国勢調査町丁字データによる鉄道沿線駅のクラスタリング	2015.04
49	鉄道新線開業の沿線人口への影響について	2015.05
50	経済センサスと国勢調査の統合データから見た地域の労働供給力と労働需要力について―八王子市を事例とした町丁字別労働需給能力の計測―	2015.05
51	「事業所統計調査試験調査報告（昭和 22 年 5 月於千葉県木更津市）」について	2015.09
52	90 年代以降の人口の都心回帰に関する一考察－人口移動 OD データによる地域特性分析－	2015.09
53	首都圏人口の都心回帰に見られる地域的特徴について	2015.09
54	人口の都心回帰期における都区内人口移動の特徴について	2015.09
55	東京都区部への国内人口移動に見られる地域的特徴	2015.11
56	首都圏への国内移動に見られる移動元と移動先との地域的関係について－平成 22 年国勢調査の東京 20km 圏への移動データを用いて－	2015.12
57	東京 50 キロ圏から都区部への移動者の移動先選択に見られる規則性について	2016.01
58	小地域データから見た東京23区への移動者による移動先選択について(1)－東京都の市郡部から都区部への移動－	2016.04

オケージョナル･ペーパー　No.59

2016 年 4 月 1 日

発行所　法政大学日本統計研究所

〒194-0298　東京都町田市相原 4342

Tel　042-783-2325、2326

Fax　042-783-2332

jsri@adm.hosei.ac.jp

発行人　森　博美