Estimating Imputed Rent for Owner-occupied Dwellings in the
Japanese System of National Accounts

by

Haruhito Arai

May 2005

Economic and Social Research Institute
Cabinet Office
Tokyo, Japan

Estimating Imputed Rent for Owner-occupied Dwellings in the

Japanese System of National Accounts[*]

Haruhito Arai[†]

May 2005

Abstract

This paper analyses possible causes of large discrepancies among official data for imputed rent for owner-occupied dwellings in Japan, those including National Accounts, Regional Accounts, Input-Output Table, and National Survey of Family Income and Expenditure.

By reviewing the methodologies used by each statistical agency in the light of academic researches on imputed rent and rent functions, this paper finds that imputed rent for owner-occupied dwellings is likely to be <u>overestimated</u> when average unit rent which reflects high unit rent for small dwellings in downtown is used to calculate imputed rent for large owner-occupied dwellings mainly located in the suburbs, and conversely, that imputed rent for owner-occupied dwellings is likely to be <u>underestimated</u> if rent function is used to calculate imputed rent for owner-occupied dwellings, and if the function faultily captures an apparent negative correlation between unit rent and floor space when location differences are not fully controlled for.

This paper, using over 200 thousand realty rental advertisements in Metropolitan Tokyo, downloaded via Internet, then, examines the effectiveness of various estimation techniques used to control for location differences in estimating rent equations. Major findings include; i) stratification by area may not improve the performance of the set of area-wise rent functions; ii) use of area dummies in pooled estimate may not improve much the performance of the estimated rent function, either; and iii) alternative specifications can significantly improve the performance of rent functions, regardless of whether samples are stratified by area or not.

To conclude, this paper proposes that i) National Accounts estimates of imputed rent for owner-occupied dwellings be calculated based on regional estimates, ii) in both National and Regional Accounts, imputed rent be calculated for each category of building structures, iii) National Survey of Family Income and Expenditure utilize detailed information on housing location already available in Housing and Land Survey, or employ alternative specifications of rent function. Large discrepancies among official data for imputed rent for owner-occupied dwellings in Japan are expected to narrow significantly if these proposals are adopted by statistical agencies. The final goal is that one single estimate of imputed rent for owner-occupied dwellings which utilize best available information provide the common benchmark for all other statistics.

Table of Contents

1. Introduction

According to the 2003 Housing and Land Survey (preliminary estimates), the total number of owner-occupied dwellings amounted to 28.66 million housing units (the ratio of owner-occupied dwellings was 61.2 percent), while imputed rent for owner-occupied dwellings in the National Accounts reached approximately 52 trillion yen in Fiscal Year 2003, accounting for nearly 20 percent of the household final consumption expenditure and approximately 10 percent of nominal GDP, on a scale that exceeds public capital formation.

However, with respect to imputed rent for owner-occupied dwellings, since there is no actual data on rent, figures must rely on estimates. Given this characteristic, although estimates are basically calculated in accordance with the SNA Manual of the United Nations et al., an absolute method, comprehending up to its detail, has not been established.

Imputed rent for owner-occupied dwellings is also estimated in instances other than National Accounts, the most important ones being Regional Accounts (Cabinet Office), Input-Output Tables (Ministry of Internal Affairs and Communications) and the National Survey of Family Income and Expenditure (Ministry of Internal Affairs and Communications). Among these, the estimates of the National Survey of Family Income and Expenditure have a significant role since they are used for calculating weights in the Consumer Price Index (Ministry of Internal Affairs and Communications).

However, large discrepancies in the range of several trillion to several 10 trillion yens are observed when comparing the figures for imputed rent for owner-occupied dwellings in these statistics. Most likely, the agencies in charge of each statistic apply the methodology that best meets the purpose of their respective operations. Nevertheless, from the standpoint of users of statistics, it is not desirable that several largely differing figures are released as official data by the same government under the same concept.

From this viewpoint, this paper compares and reviews official statistics on imputed rent for owner-occupied dwellings, as well as estimates in previous studies, in order to clarify the mechanism through which different methodologies result in different estimates, and makes suggestions to improve estimation methodologies of each statistic.

2. The Structure of This Paper

This paper first compares data and methodologies for imputed rent of owner-occupied dwellings in National Accounts, Regional Accounts, Input-Output

Tables, and the National Survey of Family Income and Expenditure. Next, by organizing information available from previous studies on imputed rent for owner-occupied dwellings and rent functions, this paper clarifies why the difference in methodology greatly affects the results. Then, by independently calculating the rent function using rental-housing advertisements in the Tokyo Metropolitan Area, the effectiveness of each technique used to control for location differences is examined, and measures to improve estimation methodologies in National Accounts, Regional Accounts and such, are proposed. To conclude, this paper addresses remaining issues to further improve the estimations.

3. Comparison of Official Data on Imputed Rent for Owner-occupied Dwellings

To begin with, we will compare the data and estimation methodology of imputed rent for owner-occupied dwellings in National Accounts, Regional Accounts, Input-Output Tables, and the National Survey of Family Income and Expenditure. (Hereafter, for the purpose of comparison, data shall be as of 2000 or closest year.)

First, in National Accounts, *imputed rent for owner-occupied dwellings*, which is listed as a household final consumption item in the expenditure series, amounts to 49.9 trillion yen in 2000.

The estimation methodology, simply put, is *total rent = total floor space (m^2) X unit rent(yen/m^2).* Here, after benchmarking *total floor space* and *unit rent* to figures from the Housing and Land Survey (Ministry of Internal Affairs and Communications), annual and quarterly estimates are obtained by interpolation and/or extrapolation using Statistics of Building Construction Starts and Survey of Building Destruction for *total floor space,* and the Consumer Price Index for *unit rent.*[*]

Next, in Regional Accounts, although imputed rent for owner-occupied dwellings is not listed in the expenditure series, the item *imputed service of owner-occupied dwellings* is listed under *entrepreneurial income (after receivable and payable of distributed income of corporations)* in the Prefectural Income Table, which amounts to 21.1 trillion yen (all prefectures) in FY2000.

Here, the *entrepreneurial income* of owner-occupied dwellings refers to income from real estate activities, under a fiction that the proprietor of the owner-occupied dwelling is engaged in real estate leasing activity. Thus, entrepreneurial income is obtained by deducting expenses, such as intermediate input (repairs, etc), consumption of fixed capital, net indirect tax (property tax, etc), interest payments on

---

[*] 93SNA Estimation Method Manual (Tentative Version), November 15, 2000 (in Japanese).

mortgage, and payment of ground rent, from imputed rent for owner-occupied dwelling.[*] (Among deductible items, consumption of fixed capital, calculated by declining-balance method, and interest payments on mortgage are relatively large in Japan.)

The corresponding figure in National Accounts is *imputed service of owner-occupied dwellings* listed as an item of *entrepreneurial income (after receivable and payable of distributed income of corporations)* in the table for Distribution of National Income and National Disposable Income. This amounts to 24.2 trillion yen in FY2000.

Thus, between the figures for *entrepreneurial income (after receivable and payable of distributed income of corporations)* of *imputed service of owner-occupied dwellings* listed respectively under National Accounts and Regional Accounts, there is a discrepancy of 3.1 trillion yen.

Although Regional Accounts are compiled in conformity with National Accounts, estimates are made by prefectural governments, and imputed rent for owner-occupied dwellings is calculated , using the same formula as in National Accounts : *total rent = total floor space (m^2) X unit rent (yen/m^2)*, but by prefecture.

Thirdly, in the Input-Output Tables, *house rent (imputed house rent)* amounts to 44.0 trillion yen in the 2000 Tables. Although imputed rent in Input-Output Tables includes rent balanced with issued houses, and is not completely comparable to that of National Accounts, there is a difference of 6 trillion yen when it is compared to 49.9 trillion yen in the National Accounts.

In Input-Output Tables, the housing stock is first classified into owned houses and rented houses. Then they are classified by type of dwellings (detached houses/tenement houses/apartments/others), of which apartments are further classified by construction material (wooden buildings/non-wooden buildings). For each category, imputed rent is calculated by multiplying the number of owned houses by monthly rent of privately-owned rented houses with adjustments for floor space and age of building[†].

Fourthly, there is the National Survey of Family Income and Expenditure. According to the 1999 Survey, imputed rent for owner-occupied dwellings per household is 79,193 yen (Table 1). When this is multiplied by the total number of owner-occupied dwelling (26.268 million units) derived from the 1998 Housing and

---

[*] Yoichi Nakamura, *[Introduction to SNA statistics],* 1999 (in Japanese); and *Annual Report on* National *Accounts* "Definition of Terms".
[†] *2000 Input-Output Tables for Japan - Explanatory Report-* (in Japanese)

Land Survey, and 1 year = 12 months, the total amount of annual imputed rent is estimated at 25.2 trillion yen. (It is somewhat less when the existence of unoccupied dwelling is accounted for.) When this is compared to 49.9 trillion yen (2000) in the National Accounts, there is indeed, a difference of 24.7 trillion yen.

Table 1. Imputed Rent for Owner-occupied Dwellings in the National Survey of Family Income and Expenditure

	Average	Owned houses	Privately-owned rented houses and rooms	Of which: with exclusive use of facilities
No. of tabulated households	59,168	44,560	7,145	6,904
Distribution of households (based on adjusting sampling ratio)	1,111,681	738,308	213,855	204,662
Total floor space (m^2)	104.4	132.6	47.9	48.0
Housing (yen)	23,432	13,138	57,592	58,285
House and land rents	14,986	1,036	56,601	57,310
Repairs and maintenance	8,446	12,102	991	975
Materials for repairs and maintenance	1,334	1,865	229	235
Service charges for repairs and maintenance	7,112	10,237	762	740
[Imputed rent for owned houses]	52,595	79,193	-	-

(Source) *1999 National Survey of Family Income and Expenditure*, Statistical Tables on Family Income and Expenditure, Table 42 "Monthly Receipts and Disbursements per Household by Type of Tenure of Dwelling (All households, workers' households)".

In the 1999 National Survey of Family Income and Expenditure, to estimate imputed rent for owner-occupied dwellings, Japan is divided into the following four regional blocks: (1) Tokyo prefecture, (2) the 3 Kanto area prefectures of Saitama, Chiba and Kanagawa, (3) the 3 Kansai area prefectures of Kyoto, Osaka and Hyogo, and (4) other prefectures. Then, using micro data for privately-owned rented houses (with exclusive use of facilities) derived from the Housing and Land Survey conducted in October 1998, for each regional block a regression equation was estimated using the least-square method, with explanatory variables being dummy variables which represent district groups within each regional block, structure of dwellings (construction material), availability of baths, availability of flush toilets, year of construction, and total floor space[*].

---

[*] *1999 National Survey of Family Income and Expenditure* "Definition of Terms VIII. Imputed Rent for Owned Houses".

$$\ln\ y\,(i)\ =\ a\,_i + \sum_j\ b\,_{ij}\,x\,_j\ +\ c\,_i\ln\ S$$

i :   Regional block
y :   Rent
x_j: Dummy variables representing district groups within each regional block and housing characteristics (structure of dwellings, etc)
S :   Total floor space (m^2)
a_i, b_{ij}, c_j :   Coefficients

Unit rent (yen/m^2) for owned houses and privately-owned rented houses and rooms (with exclusive use of facilities), calculated from monthly rent and total floor space shown in Table 1, are 597 yen/ m^2 and 1,194 yen/ m^2, respectively, with the former amounting to only nearly half of the latter. In the National Survey of Family Income and Expenditure, since the country is divided into four blocks to estimate a rent function that reflects regionality, this has the effect of relatively pushing up unit rent of rented houses and rooms, given the large weight of *(1) Tokyo,* with its proportionally high ratio of households of this type and expensive rent. On the other hand, with regard to unit rent of owner-occupied dwellings, the effect to push down unit rent for such households can be observed since *(4) other regions* – with a high proportion of such households and inexpensive rent – weighs heavily.

4. Previous Studies on Imputed Rent

One reason why imputed rent for owner-occupied dwellings is estimated in the National Accounts based on the manual of the United Nations et al. is to enable international comparisons between countries with differing ratios of owner-occupied dwellings. Even in one country, if the ratio of owner-occupied dwellings changes over time, adjustment for changes in the ratio may be required when making comparisons between different points of time.

Furthermore, in Japan, the recognition that the possession or non-possession of housing assets creates disparity in income and assets between households in the period of the asset price bubble has led several researchers to make their own estimates of imputed rent for owner-occupied dwellings.

Among these, Tachibanaki & Yagi (1994) have calculated imputed rent – something more accurately called *imputed land rent*, since it does not include housing – from assessed land value, assuming that land value equals to capitalized value of rent, using data from Nikkei NEEDS-RADAR Financial Behavior Survey 1990 for the Tokyo Metropolitan Area (Table 2). For the purpose of comparison, they aggregated official data in the 1989 National Survey of Family Income and Expenditure for owner-occupiers in the Tokyo Metropolitan Area, and found that official data falls substantially below their own

estimates. Accordingly, Tachibanaki & Yagi claim that imputed rent in the National Survey of Family Income and Expenditure is "likely to be underestimated" and say, "It is hard to believe that housing equivalent to an owner-occupied dwelling for a representative household can be rented in the Tokyo Metropolitan Area at 80,000 yen a month – as the National Survey of Family Income and Expenditure indicates, and rather the imputed rent estimated in our paper better reflects market realities." (*80,000 yen a month* is meant to be a monthly-rate of the annual imputed rent shown in Table 2, which Tachibanaki & Yagi calculated using the data in the National Survey of Family Income and Expenditure for owner-occupiers in the Tokyo Metropolitan Area.)

Table 2. Median Imputed Rent for Owner-occupiers in the Tokyo Metropolitan Area

Age Group	Imputed Rent in 1989 National Survey of Family Income and Expenditure	Imputed Rent in NEEDS-RADER	PER in NEEDS-RADER
-24	939.6	-	-
25-29	969.0	1,630.5	36.8
30-34	1,017.6	1,358.7	36.8
35-39	1,000.8	1,331.9	37.9
40-44	981.6	1,352.0	37.8
45-49	982.2	1,563.5	36.8
50-54	985.2	1,665.8	36.8
55-59	1,032.0	1,630.5	36.8
60-64	1,036.2	2,174.0	36.8
65-69	1,005.6	2,065.3	36.8

Note   1. Imputed rent is in 1,000 yen/year.
          2. PER is price earnings ratio. Here, *price* is assessed value of assets and *earnings* are income from imputed rent.
Source: Tachibanaki, Toshiaki & Yagi, Tadashi. (1994). [The Current situation and recent trends in the distribution of income: Imputed rent and capital gain on stocks]. In Tsuneo Ishikawa (Ed.). *[The distribution of wealth and income in Japan]* (Chapter 1). Tokyo: Tokyo Daigaku Shuppan-kai (in Japanese).

Next, Takayama & Arita (1995) have estimated the unit rent function using the data from the 1988 Japan Housing Survey, to get imputed rent for 1989 by age group of household heads (Table 3). After comparing these to estimates by the Management and Coordination Agency (National Survey of Family Income and Expenditure), Takayama & Arita pointed that figures of the Agency for annual imputed rent for owner-occupied dwellings in 1989 – on a nationwide-basis and for ordinary households, the average was ¥761 thousand and the median was ¥688 thousand – represent only 55-60 percent of their estimates.

Table 3. Annual Imputed Rent for Owner-occupied Dwellings by Age Group of
Household Heads (in thousand yen)

Age group	Average	Median	Age group	Average	Median
-24	1,154	1,048	50-	1,346	1,095
25-	1,484	1,369	55-	1,412	1,101
30-	1,545	1,339	60-	1,364	1,095
35-	1,430	1,243	65-	1,374	1,049
40-	1,413	1,192	70-	1,337	978
45-	1,385	1,152	75+	1,313	1,032

(Source) Noriyuki Takayama & Fumiko Arita. [Intergenerational distribution of disposable income]. *Keizai Kenkyu [Research in Economics of the Institute of Economic Research, Hitotsubashi University], 46* (1), 1995 (in Japanese).

Here, Takayama & Arita, as Tachibanaki & Yagi, have adopted an estimation methodology that fundamentally differs from the one used in the National Survey of Family Income and Expenditure, for example, by interpreting rent as asset earnings and adopting assessed land value and housing value (after depreciation) as explanatory variables.

While these studies suggest that imputed rent for owner-occupied dwellings in the National Survey of Family Income and Expenditure is underestimated in comparison to their respective estimations, they do not necessarily clarify why considerable discrepancies appear in the estimated results.

5. Previous Studies on Rent Functions

Then, amidst the debate over whether to introduce the fixed-term housing lease rights system in March 2000, attempts were made to quantitatively analyze the effect of the Land and Housing Lease Law using econometric methods, and new findings were obtained with regard to the form of the rent function.

In this debate, the argument was that if the Land and Housing Lease Law has the effect to restrict the supply of quality rental housing, the rent of such housing will be relatively expensive and unit rent per floor space will rise as the size of the house increases. However, actual data often show a tendency for unit rent per area to fall as size increases. Accordingly, in order to verify whether unit rent has either a negative or positive slope with regard to size of rental housing, the rent function which controls for characteristics of dwelling had to be estimated.

Hatta & Akai (1995), picked up data for the Hokusetsu area – for which commuting time to urban centers can be easily measured – from the information for the whole Kansai Area listed in the *[Weekly Housing Information]* (published by Recruit Co., in Japanese) No. 21 (June 1, 1994 edition), and using this data, they showed that with regard to dwellings of

50 m^2 or more, unit rent rises as floor space increases when controlling for commuting time and building age (regression equation 1, below). Further, in Hatta & Akai (1996), they showed that, by accounting for, in addition to commuting time and building age, fixed costs for the construction of dwellings, for all samples including those under 50m^2, unit rent rises as floor space increases (regression equations 2 and 3).

Table 4. Estimated Unit Rent Function by Hatta and Akai

Unit Rent=2332.623 + 2.0058 (Floor Space)
    (21.377)   (2.01)
    -19.0296 (Commuting Time) - 14.4318 (Building Age) + u   (1)
    (-6.131)   (-4.907)
$R^2 = 0.2722$ $\hat{R}^2 = 0.2609$

Unit Rent=158.4207 + 4.9062 (Floor Space) + 32680.78 (1 / Floor Space)
    (11.409)[***] (4.273)[***]   (11.609)[***]
    -14.5824 (Commuting Time) - 20.7048 (Building Age) + u   (2)
    (-5.197)[***]   (-7.556)[***]
$R^2 = 0.5509$, adjusted $R^2 = 0.5446$, $F_{(4,285)}=88.00$, Prob>F=0.00

Unit Rent=1359.149 + 3.5331 (Floor Space) +31713.32 (1 / Floor Space)
    (10.633)[***] (3.169)[***]   (11.225)[***]
    -2.03 x 10^{-28} exp (Commuting Time) -45.1715 (Building Age)
    (-2.891)[***]   (-8.312)[***]
    +0.7777 (Building Age)^2 + u   (3)
    (5.037)[***]
$R^2 =0.5488$, adjusted $R^2 =0.5409$, $F_{(5,286)}=69.58$, Prob>F=0.00

(Source) Nobuo Akai. *[Research Library, Chapter 8. An analysis of housing market regulations: Doesn't the Land and Housing Lease Law restrict the supply of rental housing?]*. Available: http://www.geocities.co.jp/SilkRoad/3841/chap8.PDF (in Japanese).

According to the argument by Hatta & Akai, unit rent is high in convenient locations, and since a large number of small-sized rental housing are located in such areas, an observed relationship is that unit rent becomes higher for smaller-sized dwelling, and lower for larger-sized dwelling, resulting in the negative slope of unit rent in relation to the size of dwelling. Another factor for the negative slope of unit rent in relation to size is that there are fixed costs for facilities such as toilets and baths that housing constructions require regardless of size. However, if unit rent has a positive slope in relation to size after controlling for these characteristics of dwelling, it would testify the supply restricting effect

of quality rental housing by the Land and Housing Lease Law.

More recently, Otake & Yamaga (2001) have examined the impact of the system of fixed-term housing lease rights on rental housing in Tokyo Prefecture, using micro data from Recruit Co. in the six months immediately after the system was introduced. Table 5 summarizes their results, in which the rent function of a pooled data of conventional and fixed-term rental contracts were estimated by the method of Weighted-Least-Squares. (Note: The results of five month-dummies and the cross-terms of these with fixed-term rental contract dummy are omitted in the table to save space.)

Table 5. Weighted-Least-Square Estimates of Rent Function by Otake & Yamaga
(Dependent Variable: Logarithmic Rent)

Independent variable (Logarithmic)	i all sample	ii less than 51m^2	iii 51 m^2 or more
Constant	9.667***(0.0067)	10.066***(0.0077)	7.994***(0.0193)
Bus	-0.159***(0.0017)	-0.143***(0.0020)	-0.15*** (0.002)
On foot	-0.054***(0.0009)	-0.044***(0.0009)	-0.071***(0.0016)
Time distance	-0.253*** (0.0015)	-0.175***(0.0015)	-0.337***(0.0025)
Floor space	0.849***(0.0012)	0.646***(0.0017)	1.326***(0.0038)
Building age	-0.064***(0.0006)	-0.061***(0.0006)	-0.077***(0.0011)
Constant dummy	0.572***(0.0798)	0.356 (0.2208)	2.004***(0.0772)
D·bus	0.012 (0.0126)	-0.082* (0.0482)	0.007 (0.0095)
D·on foot	-0.022** (0.0088)	-0.024 (0.0231)	-0.004 (0.0068)
D·time distance	-0.131***(0.0148)	-0.001 (0.0439)	-0.062***(0.0112)
D·floor space	-0.030* (0.0162)	-0.052 (0.0421)	-0.440***(0.0162)
D·building age	-0.030***(0.0061)	-0.019 (0.0182)	-0.019***(0.0046)
AdjR^2	0.800	0.665	0.754
Sample size	143210	88560	54650
F-value	27302.7	8356.5	7977.8

(Note) Sampling period is March-August 2000. D is dummy variable for fixed-term rental contracts. Reference month is March. Notations ***, **, * indicate that the estimates are statistically significant at 1 percent, 5 percent, 10 percent levels, respectively. Figures in parentheses represent standard deviation.

(Source) Fumio Otake & Hisaki Yamaga. [The impact of the System of Fixed-term Housing Lease Rights on rent]. *Nihon Keizai Kenkyu [JCER Economic Journal], 42,* March 2001 (in Japanese).

Of interest in relation to this paper are the coefficients of floor space shadowed in gray. The coefficient of floor space for conventional rental contracts is 0.849 (<1) for all samples (Column i), 0.646 (<1) for dwelling under 51 m^2 (Column ii), and 1.326 (>1) for dwelling of 51 m^2 or more (Column iii). Thus, the study shows that, although the slope of the curve of unit rent is negative overall, the slope is negative for dwelling less than 51 m^2,

but positive for dwelling of 51 m^2 or more.

With regard to fixed-term rental contracts, which is the principal concern of Otake & Yamaga, results show that although the coefficients of fixed-term rental contract dummy and its cross-terms are not statistically significant and no significant difference can be observed between conventional and fixed-term rental contracts for dwelling under 51 m^2, for dwelling of 51 m^2 or more, the elasticity of floor space is lower in fixed-term rental contracts by 44 percent (-0.44), significant at a 1 percent level – in other words, floor space elasticity of fixed-term rental contracts is close to 1. (Although not presented in this paper, Otake & Yamaga have conducted detailed analysis –other than the one shown in this paper – including the quantile regression estimate.)

6. Area-wise Grouping and Locational Characteristics

In this paper, taking the study by Hatta & Akai for the Hokusetsu Area in Osaka, and the study by Otake & Yamaga for Tokyo Prefecture as references, approximately 200 thousand sets of data on rental housing[*] in the Tokyo Metropolitan Area were downloaded from Recruit Co.'s web site, in order to examine methods to control for locational characteristics.

In this set of data, locational characteristics are already controlled for in an extremely insufficient way in the sense that the area is limited to the Tokyo Metropolitan Area. In the following, by estimating the rent function after grouping the area into *Tokyo 23-wards* and *other parts of Tokyo Metropolitan Area*, this paper examines whether area-wise stratification will lead to better estimates of the rent function.

Figure 6 shows average unit rent of approximately 200 thousand rental housing grouped by area-occupied in 10 m^2 units. The graph illustrates unit rent functions that are either "U-shaped" with the slope turning to be positive at area-occupied of around 50-60 m^2 (total Metropolitan Area and Tokyo 23-wards) or "L-shaped" (other parts of Metropolitan Area).

---

[*] **http://www.isize.jutakujoho.jp/shuto/fr/**

Figure 6. Unit Rent by Size of Rental Housing

———— Tokyo 23 wards
– – – ·· Other parts of Metropolitan Area
······· Total Metropolitan Area

(yen/㎡)

| | under 20㎡ | under 30㎡ | under 40㎡ | under 50㎡ | under 60㎡ | under 70㎡ | under 80㎡ | under 90㎡ | under 100㎡ | 100㎡ and over |
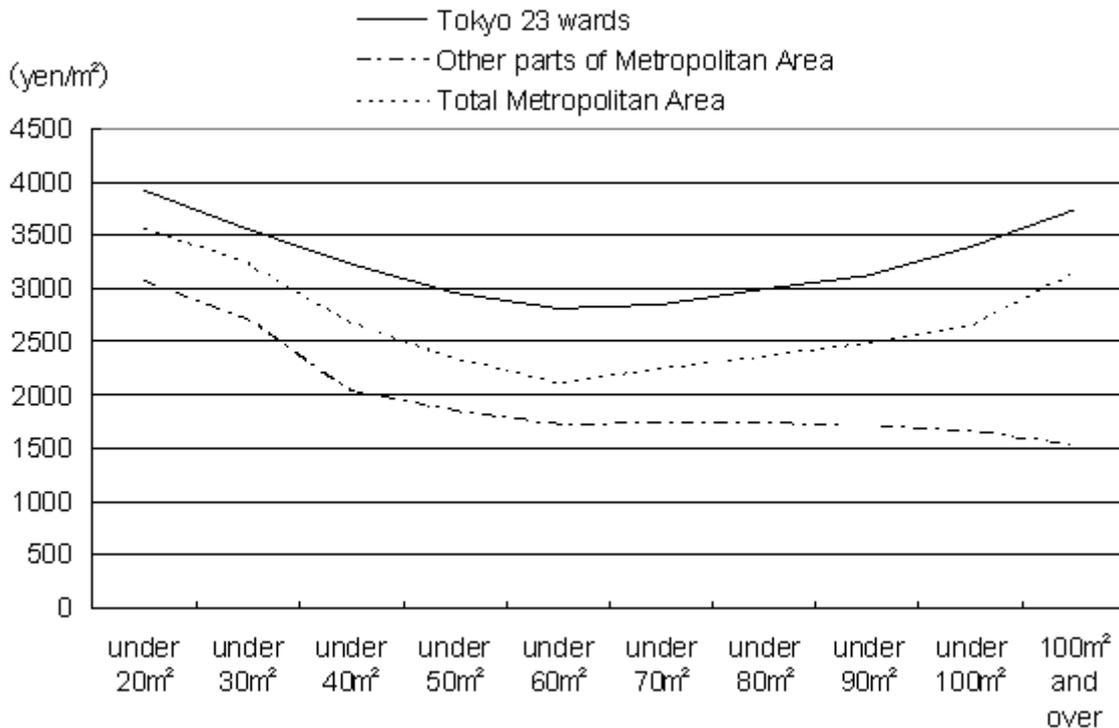
Note 1) Data as of October 17, 2004.
　　2) Unit rent=(rent+management expenses)/area-occupied
　　3) Data for the following(1)~(5)(27 samples) were judged to be abnormal values
　　　　(data entry error) and were excluded from the sample:
　　　(1)Data without mention of area occupied (1 case)
　　　(2)Data with area occupied of 1 m^2 or less (13 cases)
　　　(3)Data with area occupied of 1000 m^2 or more (6 cases)
　　　(4)Data with unit rent of 100 yen/m^2 or less (6 cases)
　　　(5)Data with unit rent of 10,000 yen/m^2 or more (20 cases)

　　　Shown next, are the results of double-logarithmic rent function estimated by the least-squares method using this set of sample of approximately 200 thousand (Figure 7). (Software "E-Views" is used).

　　　In Figure 7, the straight line drawn in the log-log scale scatter diagram is the estimated rent function. The slope is smaller than 1 (0.7 for Total Metropolitan Area) and the graph clearly shows how the rent for relatively large-sized rental housing is underestimated.

Figure 7. Area-occupied (Horizontal Axis) and Rent (Vertical Axis)

(Logarithmic Scale)

Total Metropolitan Area	Tokyo 23-wards	Other parts of Metropolitan Area
(N=196,590)	(N=102,136)	(N=94,454)

Ln (rent) = 9.158507 + 0.638078 Ln (floor)	Ln (rent) = 8.780275 + 0.801983 Ln (floor)	Ln (rent) = 9.336957 + 0.530797 Ln (floor)
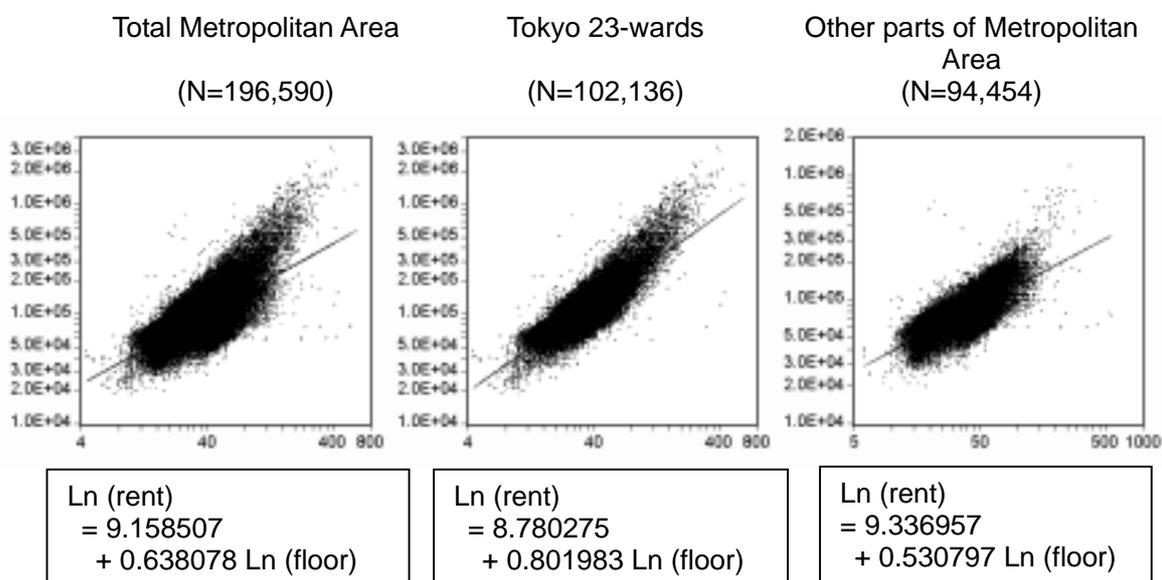
(Area-wise Grouping)

Next, in Figure 7, when the Metropolitan Area is sub-grouped into Tokyo 23-wards and other parts, the estimates show that while the slope of the rent function for Tokyo 23-wards is 0.8, slightly closer to 1, the underestimation of rent for relatively large-sized rental housing is not resolved. Moreover, the slope of the rent function for *other parts of the Metropolitan Area* is 0.5 – lower than the total Metropolitan Area –, which means that the rent of relatively large-sized rental housing is underestimated even more.

This indicates that even excluding Tokyo 23-wards – where there is a concentration of small-sized rental housing – unit rent function has a negative slope in relation to size, since small-sized rental housing are concentrated in locations such as prefectural capitals of neighboring prefectures. As shown in Figure 6, the fact that the negative slope is steeper for small-sized property in *other parts of the Metropolitan Area* than Tokyo 23-wards suggests that area-wise stratification to control for locational characteristics may even worsen estimation results.
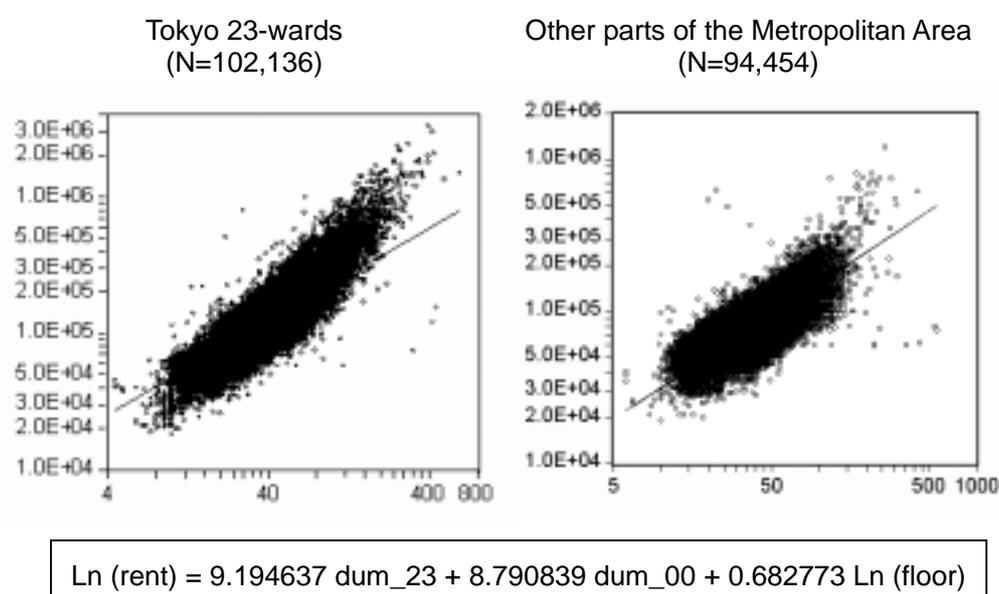
(Regional Dummy)

In the National Survey of Family Income and Expenditure, the country is divided into four blocks, and additional dummy variables that represent district groups within each regional block is applied to minutely account for regional differences. (Applying a dummy variable representing district group within each regional block in double-logarithmic form

rent functions assumes that there are fixed-multiplying factor differences in rent levels between districts.)

Figure 8 shows the rent function estimates with the data for Tokyo 23-wards and *other parts of the Metropolitan Area* are pooled and dummy variables are applied. The slope of the rent function shown by the straight line in the graph is 0.7 for both Tokyo 23-wards and *other parts of the Metropolitan Area*. Compared to Figure 7, whereas underestimation of rent for relatively large-sized rental housing in *other parts of the Metropolitan Area* has improved, underestimation of rent for large-sized rental housing is greater for Tokyo 23-wards.

Figure 8. Rent Function Estimates Using Regional Dummies

Tokyo 23-wards
(N=102,136)

Other parts of the Metropolitan Area
(N=94,454)

Ln (rent) = 9.194637 dum_23 + 8.790839 dum_00 + 0.682773 Ln (floor)

Looking again at Figure 6, the multiplying factor for rent existing between Tokyo 23-wards and *other parts of the Metropolitan Area* is not constant in relation to size; it increases as size increases. Therefore, it becomes clear that when regional dummies are applied, while underestimation of rent for relatively large-sized rental housing in certain areas improves, for other areas, the underestimation of rent for such housing may grows worse.

(The Difference in the Distribution of Rental Housing and Owner-occupied Dwelling)

Now, we consider what happens if rent functions as estimated above are applied to calculate imputed rent for owner-occupied dwellings.

Figure 9 compares the distribution by size of rented houses or rooms and

owner-occupied dwelling using the 1998 Housing and Land Survey. It shows that rented houses and rooms are mainly composed of small-sized housing that hardly exist in owner-occupied dwellings. (Although the flat scatter diagrams in Figure 7 and 8 do not show this degree of difference in distribution for rented dwellings, small-sized properties are extremely densely plotted, and distribution differences similar to that of Figure 9 can be depicted if 3-D scatter diagrams are used.)

Therefore, if the unit rent function that results in a negative slope in relation to size under the influence of small-sized housing is applied to large-sized owner-occupied dwelling, there is a risk of drastically underestimating imputed rent for owner-occupied dwelling.

This also means that even if the performance of the rent function is improved by accounting for locational characteristics through area-wise sub-grouping or regional dummies, if the rent of relatively large-sized rental housing is underestimated, it may not be appropriate for use on estimating imputed rent for owner-occupied dwellings.

Figure 9. Distribution of Owner-occupied Dwelling and Privateky-owned Rental Housing by Size
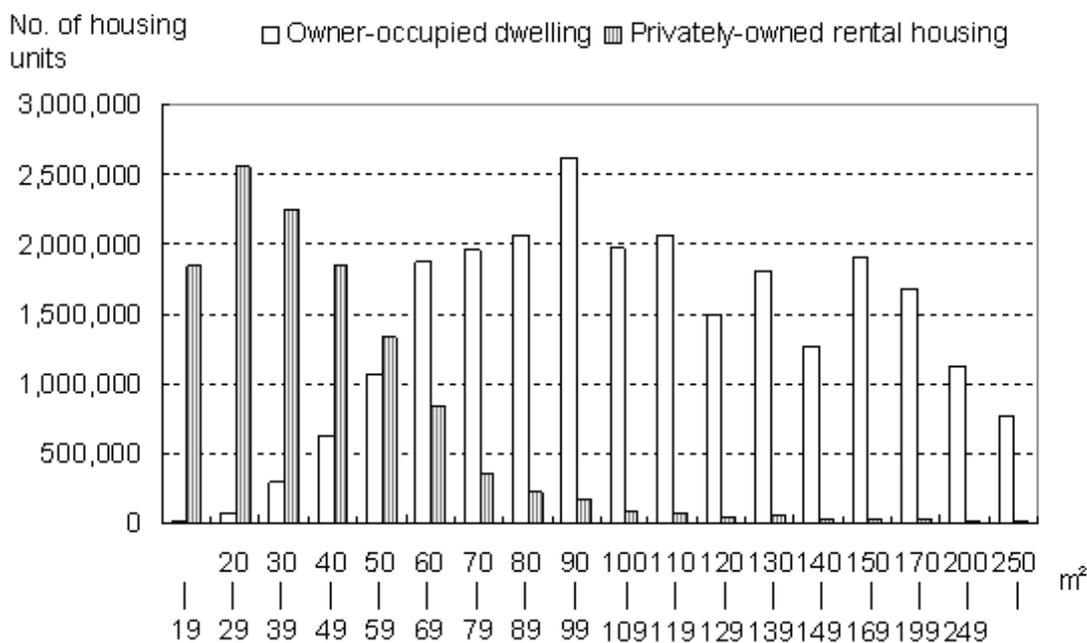
(Source) Compiled by the author, based on Table No. 12 of the *1998 Housing and Land Survey (National Version)*.
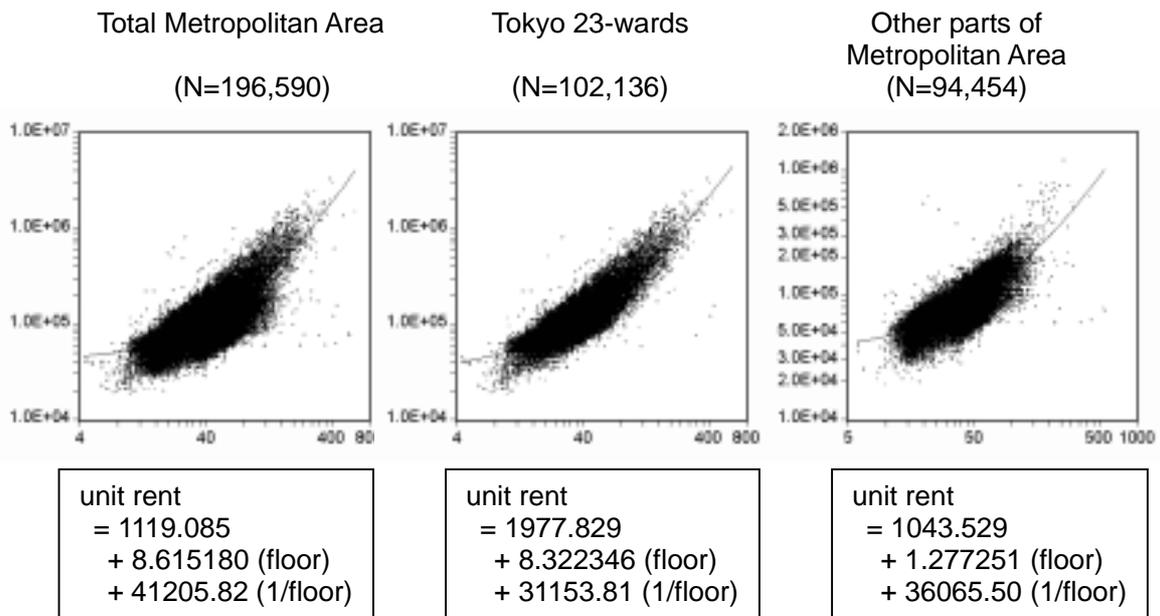
(Alternative Function Forms)

Next, this paper will estimate the unit rent function of Hatta & Akai, which, by taking

into account fixed costs on housing constructions, they used to demonstrate that unit rent rises as floor space increases in all samples including those under 50m^2. This rent function takes unit rent as the dependent variable and floor space and the reciprocal of floor space as explanatory variables.

As Figure 10 shows, the estimates of the total Metropolitan Area, Tokyo 23-wards and other parts of the Metropolitan Area all improved significantly. The underestimation of rent for relatively large-sized rental housing was almost resolved as well. The unit rent function overestimates actual rent for rental housing of extremely small size, but this can be understood as the result of extremely small-sized rental housing not being equipped with exclusively-used facilities, such as baths.

Figure 10. Area-occupied (Horizontal Axis) and Rent (Vertical Axis)
(Logarithmic Scale)

Total Metropolitan Area (N=196,590)	Tokyo 23-wards (N=102,136)	Other parts of Metropolitan Area (N=94,454)

unit rent = 1119.085 + 8.615180 (floor) + 41205.82 (1/floor)	unit rent = 1977.829 + 8.322346 (floor) + 31153.81 (1/floor)	unit rent = 1043.529 + 1.277251 (floor) + 36065.50 (1/floor)

In this estimate, since characteristics of dwelling are not strictly controlled for, it cannot be said that the addition of the reciprocal of floor space as an explanatory variable necessarily accounts for the existence of fixed costs in housing constructions. Rather, it can be said that the functional form fits well to approximate U- or L-shaped unit rent distribution even without strictly controlling for locational characteristics. Therefore, in this rent function, as the estimate for *other parts of Metropolitan Area* shows, even if the influence of small-sized rental housing remains in the stratified area, the underestimation of rent for relatively large-sized rental housing can be avoided.

The studies by Tachibanaki & Yagi and Takayama & Arita, discussed earlier in

this paper, take rent as asset earnings, and use the assessed asset value to estimate imputed rent. Assuming that locational conditions such as convenience and the surrounding environment are comprehensively reflected in the asset value of the housing unit in question, one can interpret that, in these studies, the locational conditions of dwelling, which is highly individual and difficult to measure objectively, is finely controlled for with the asset value playing the key role; and that this makes the difference from figures of the National Survey of Family Income and Expenditure. It should, however, be noted that, land prices in Japan became increasingly inconsistent to theoretic values in the process of the land price bubble, with huge disparities among region. Therefore, whether locational conditions are adequately reflected in the asset value of the housing in question is yet a matter for further discussion.

7. Implications for the Estimation Methodology of Official Statistics

As with the current practice in compiling the National Accounts, using the national average rent for estimating imputed rent for owner-occupied dwellings without taking into consideration regional differences is cause for overestimating imputed rent for owner-occupied dwellings, because comparatively expensive unit rent for small-sized rental housing in the downtown area of major cities are applied to owner-occupied dwellings in local areas.

In Regional Accounts, this drawback is largely avoided by calculating imputed rent by prefecture, and as a result, imputed rent for owner-occupied dwellings (direct comparisons can be made with *entrepreneurial income of owner-occupied dwellings*) is smaller than that of the National Accounts.

However, as the analysis in this paper indicates, since small-sized rental housing are unevenly distributed within the prefecture in highly convenient locations such as the prefectural capital, there still remains the risk of overestimation.

In the case of Input-Output Tables, as described earlier in this paper, dwelling is classified by type of dwelling (detached houses/tenement houses/apartments/others) and apartments are further classified by construction material (wooden buildings/non-wooden buildings). Here, distinction by type of dwelling – into detached houses, which are the majority of owner-occupied dwellings, and apartments, which are the majority of small-sized rental housing – appears to have the effect of preventing overestimation of imputed rent for owner-occupied dwellings. However, estimations in Input-Output Tables are made for the nation as a whole, and do not take into account regional differences. Even taking the same type of dwelling, it is easily the case that rental housing are mainly located in urban parts whereas owner-occupied dwellings in regions, suggesting the risk of

17

overestimation of imputed rent for owner-occupied dwellings in regions. As differences arise between National Accounts and Regional Accounts, prefectural Input-Output Tables are deemed to lack consistency with nation-wide Input-Output Tables if regionality is not taken into account in the latter.

With regard to the National Survey of Family Income and Expenditure, estimations are made to reflect regional differences by dividing the country into four blocks, for instance. Nonetheless, as this paper showed, locational characteristics cannot be fully controlled for neither by area-wise sub-grouping or by the use of regional dummies. This would result in the rent function estimates in which rent becomes comparatively less expensive as size increases, and hence, imputed rent for owner-occupied dwellings is likely to be underestimated.

8. Verification of Time Series

Up to this point, this paper examined the cause for discrepancies in imputed rent for owner-occupied dwellings in different statistics for the recent period. Next, each statistic will be compared retroactively to verify whether similar discrepancies had existed in the past.

First, when comparing *entrepreneurial income of owner-occupied dwellings* in National Accounts and Regional Accounts after 1992, the year when Regional Accounts were established in all prefectures, each year, the data in National Accounts are 10-15 percent higher than that of Regional Accounts (Table 11).

Table 11. Comparison of National Accounts and Regional Accounts
(Entrepreneurial Income of Owner-occupied dwelling, in trillion yens)

Fiscal Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
National Accounts	14.4	17.1	18.5	19.8	20.9	21.6	22.2	23.3	24.2	26.0
Regional Accounts	12.4	14.9	16.3	17.2	18.0	18.7	19.4	20.7	21.5	22.4
Difference	2.0	2.2	2.2	2.6	2.9	2.9	2.8	2.6	2.7	3.6
(%)	(16.1)	(14.8)	(13.5)	(15.1)	(16.1)	(15.5)	(14.4)	(12.6)	(12.6)	(16.1)

(Source) Compiled by the author, based on *Annual Report on National Accounts of 2004* and *Annual Report on Regional Accounts of 2004.*

Next, when gross rent (GDP of rental housing industry), for which time-series data for comparisons are available, in the SNA Input-Output Tables and Input-Output Tables of the Ministry of Internal Affairs and Communications are compared, the difference between the two series was small in the past, but a substantial difference appears in 2000 (Table 12).

Table 12. Comparison of National Accounts and Input-Output Tables (in trillion yens)

| Year	1975	1980	1985	1990	1995	2000
Gross rent						
SNA Input-Output Tables	10.9	19.8	27.9	40.2	54.1	61.2
Input-Output Tables	11.3	20.7	27.3	38.8	52.9	56.2
Difference	-0.4	-0.9	0.6	1.4	1.2	5.0
Imputed rent for owner-occupied dwellings						
National Accounts	8.7	15.9	22.7	32.4	43.8	49.9
Input-Output Tables	-	-	-	-	-	44.0
Difference	-	-	-	-	-	5.9

(Sources)
1. SNA Input-Output Tables: For 1975, Department of National Income, Economic and Social Research Institute, *[SNA Input-Output Tables (1985 basis)]*. Cabinet Office, Government of Japan, July 1992 (in Japanese). For 1980-1990, same author, *[1990 basis SNA Input-Output Tables (Nominal version)]*. March1996 (in Japanese). For 1995-2000, same author, *[SNA Input-Output Tables (1995 basis)],* March 2004 (in Japanese).
2. National Accounts: For 1975-1960, Economic and Social Research Institute (Ed.). *[Annual Report on National Accounts of 2000 (CD-ROM included*)]. Cabinet Office, Government of Japan, March 2000 (in Japanese). For 1990-2000, *[FY2003 GDP Figures (Gross Domestic Expenditure Series, etc) Time Series Table]*. Available: http://www.esri.cao.go.jp/jp/sna/qe043-2/gdemenuja.html (in Japanese).

One of the reasons for this is that the estimation method of Input-Output Tables of the Ministry of Internal Affairs and Communications was changed in the 2000 Table. Gross rent in the 1990-1995-2000 Linked Input-Output Tables compiled by using the same estimation method as the 2000 Table is some 3 trillion yen smaller in 1990 than the figure in the 2000 Table shown in Table 12, and some 1 trillion yen smaller in 1995, likewise. This confirms that differences in estimation method in the SNA Input-Output Tables and the 2000 Input-Output Tables of the Ministry of Internal Affairs and Communications had caused difference in figures, not only for 2000, but for 1990 and 1995, if the estimation method in the 2000 Input-Output Tables had been applied in the previous Input-Output Tables.

More importantly, for 2000, imputed rent for owner-occupied dwellings in National Accounts as shown in Table 12 are extrapolated with the 1998 Housing and Land Survey as the benchmark, the method used in extrapolation may contain a factor that causes overestimation. In order to examine this, we compare domestic product of the rental housing industry in the SNA Input-Output Tables before and after the base-year revisions and the Input-Output Tables of the Ministry of Internal Affairs and Communications since 1985 (Figure 13).

Figure 13. Domestic Product of Rental Housing Industry in the SNA
and Input-Output Tables
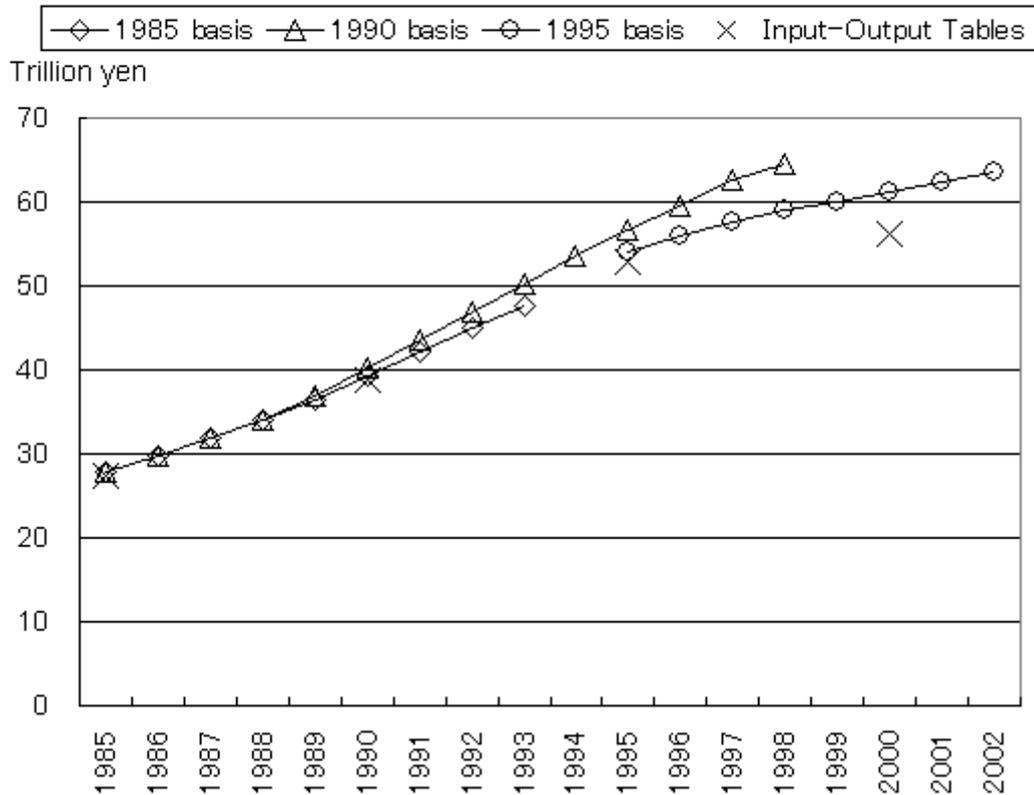
The SNA Input-Output Tables on 1985 basis (◊) <u>understated</u> domestic product of the rental housing industry for 1990-1993, with the upward revision amounting to almost 3 trillion yen for 1993. The SNA Input-Output Tables on 1990 basis (△), then, <u>overstated</u> domestic product of the rental housing industry for 1995-1998, with the downward revision amounting to more than 5 trillion yen for 1998. Although not shown in Figure 13, estimations by the author based on preliminary estimates of the 2003 Housing and Land Survey, show that, while total rent increased some 5 percent during the five years of 1998-2003, gross rent in the SNA Input-Output Tables on 1995 basis increased 7.5 percent during the four years of 1998-2002, suggesting that the SNA Input-Output Tables on 1995 basis (○) may overstate domestic production of the rental housing industry by some trillion yen.

Thus, although a systematic bias either of overestimation or underestimation is not detected with regard to the extrapolation method, sufficient attention should be paid to the fact that, even if the bench-year values are accurately defined by using the basic statistics such as the Housing and Land Survey, estimation error arising from extrapolation may

finally winds up to some trillions of yen.

Finally, a time-series comparison is made between National Accounts and the National Survey of Family Income and Expenditure.

Since the results of the National Survey of Family Income and Expenditure are given per household and per month, the annual total value of imputed rent is calculated by multiplying imputed rent for owner-occupied dwellings in Table 14-1 by the number of households living in owner-occupied dwellings, based on the Housing and Land Survey implemented in the previous year, and by 1 year = 12 months; the result is compared with imputed rent for owner-occupied dwellings in National Accounts (Tables 14-2).

Table 14-1. Imputed Rent for Owner-occupied Dwellings in the National Survey of Family Income and Expenditure (Ordinary Two-or-more-person households)

	1979	1984	1989	1994	1999
Owner-occupied dwellings					
Floor space (m^2)	-	-	131.6	135.3	138.2 (132.6)
Imputed rent for owner-occupied dwelling (yen)	29,160	38,420	63,798	87,858	80,774 (79,193)
Unit rent (yen/m^2)	-	-	484.8	649.4	584.5 (597.2)
Privately-owned rental housing (with exclusive use of facilities)					
Floor space (m^2)	-	-	56.6	58.9	59.6 (48.0)
Rent for housing and land (yen)	23,718	34,019	41,842	58,871	64,670 (57,310)
Unit rent (yen/m^2)	-	-	739.3	999.5	1,085.1 (1,194.0)

(Note) Numbers in parentheses for 1999 represent *total household*, not *ordinary two-or-more-person households*.

As Table 14-2 shows, the substantial difference in the figures of the two statistics has existed from before. And, while the gap in value widens with time, deviation rate, exceeding 100 percent until 1984, declined after entering the Heisei Era in 1989.

In the past National Survey of Family Income and Expenditure, although the basic form of the Hedonic equation to calculate imputed rent for owner-occupied dwellings is the same as today's, some modifications were made in the 1989 Survey.

First, regarding regional blocks, the nation is divided into three regional blocks in the Surveys in 1979 and 1984 - (1) the Keihin (Tokyo-Yokohama) Major Metropolitan Area, (2) the three Major Metropolitan Areas other than Keihin, and (3) municipalities other than the

four Major Metropolitan Areas -, whereas in the 1989 Survey onward, a change has been made to 4 regional blocks, which are (1) Tokyo, (2) the 3 Kanto area prefectures of Saitama, Chiba and Kanagawa, (3) the 3 Kansai area prefectures of Kyoto, Osaka and Hyogo, and (4) other prefectures.

Second, in the 1989 Survey, the number of dummy variables of structure of dwellings (construction material) was reduced from 4 to 1. Instead, in addition to the conventional dummy variable of *availability of baths*, the dummy *availability of flush toilets* was added. Also, the number of dummy variables concerning building age was increased from 3 to 4.

In the Survey Report of and after 1994, dummy variables are unnumbered, and detailed information on stratification is not available.

As indicated in Table 14-2, imputed rent for owner-occupied dwellings in the National Survey of Family Income and Expenditure jumped between 1984 and 1989, and the deviation rate to figures from the National Accounts was reduced. This might reflect the above-mentioned modification in the estimation method of the National Survey of Family Income and Expenditure in 1989.

Table 14-2. Imputed Rent for Owner-occupied Dwellings
(Comparison of National Accounts and National Survey of Family Income and Expenditure)

	1979	1984	1989	1994	1999
National Accounts(trillion yen)	15.9	22.7	32.4	43.8	49.9
National Survey of Family Income and Expenditure(trillion yen)					
	6.8	10.0	17.6	25.7	25.2
Difference					
(trillion yen)	9.1	12.7	14.8	18.1	24.7
(%)	(133.8)	(127.0)	(84.1)	(70.4)	(98.0)
(Reference) Owner-occupiers (previous year, number of housing units in ten thousand)					
	1,943	2,165	2,295	2,438	2,647

(Sources)
1. *Annual Report on National Accounts of 2004*
2. *National Survey of Family Income and Expenditure* of each year
    1979 …   Vol.1, Family Income and Expenditure (Ordinary two-or-more-person households) Part 1. Results on Japan, Table 20.
    1984 …   Vol. 1, Family Income and Expenditure (Ordinary two-or-more-person households) Part 1. Results on Japan, Table 28.
    1989 …   Vol. 1, Family Income and Expenditure (Ordinary two-or-more-person households) Part 1. Results on Japan, Table 22.
    1994 …   Vol. 1, Family Income and Expenditure, Table 22.
    1999 …   I Results on Family Income and Expenditure, Tables 22 and 42.
              http://www.stat.go.jp/data/zensho/1999/submenu1.htm (menu in Japanese only, tables in Japanese and English)
3. *1998 Housing and Land Survey, Annual Revision (Results on Japan)*
     Statistical Tables, Appendix Table 6,
     http://www.stat.go.jp/english/data/jyutaku/index.htm.

9. Proposals for Improvements in Estimation Methodologies in Official Statistics

With regard to National Accounts, first, among other reasons, in order to ensure consistency with Regional Accounts, it is necessary to conduct estimations not uniformly nationwide, but by prefecture. Further, it is worth considering estimating both National Accounts and Regional Accounts by distinguishing housing by its structure (wooden buildings/non-wooden buildings). By doing so, the problem of assessing imputed rent for wooden owner-occupied dwellings in areas other than the prefectural capital within the same prefecture by applying expensive rent of small-sized rental housing of non-wooden structure in prefectural capitals can be considerably resolved and deviation from the Input-Output Tables is expected to narrow.

It may be tempting to stratify even further in order to completely ensure consistency of all three, i.e., National Accounts, Regional Accounts and Input-Output Tables by, for example, estimating all three by prefecture, type of dwelling, structure of dwelling, and age of building. However, going this far may cause problems, in turn.

According to the 1998 Housing and Land Survey (Results on Japan), detached houses of fire-proof wooden structure are common in owner-occupied dwellings, accounting for 41 percent of total owner-occupied dwellings, but the share of such dwellings in privately-owned rental housing (with exclusive use of facilities) reaches only 6 percent. This contrast may become even more extreme when the comparison is made for certain prefectures. Furthermore, if the stratification is made by year of construction, differences in *quality* between owner-occupied dwellings and rental housing need to be adjusted to avoid a risk of underestimating imputed rent for owner-occupied dwellings (to be discussed in more detail in the next section).

As to the National Survey of Family Income and Expenditure, hedonic estimation should be improved using more detailed data on locational characteristics, such as *commuting time of main income earner of household* and *distance to nearest railroad station or bus stop* surveyed in the Housing and Land Survey. In doing so, in addition to the equation currently applied, alternative function forms, as done in this paper, may need to be tested to count for the fixed-cost of housing construction, instead of introducing old-fashioned baths and flush toilet dummy variables.

If these proposals are adopted, differences in the data for imputed rent for owner-occupied dwellings that exist between official statistics can, hopefully, be expected to narrow drastically than now.

Furthermore, in the future, presuming that improvements will be made in the hedonic estimation of the National Survey of Family Income and Expenditure by utilizing micro data from the Housing and Land Survey, it is desirable that other

statistics adopt this as the common benchmark.

10. *Quality* of Dwelling

In calculations of imputed rent for owner-occupied dwellings, the *quality* of dwelling, which cannot be explicitly defined through characteristics such as type of dwelling, structure of dwelling and age of building, is not taken into account.

Quality does not refer only to the *quality* of the housing unit as a building, since it is a concept that integrates external facilities (garden, parking space) and external environment (convenience, surrounding environment) and so forth. However, even if it were confined to the *quality* of the housing unit as a building, this would be composed of a wide range of factors such as foundation, construction material, plumbing, facing, and interior decoration.

When estimating imputed rent for owner-occupied dwellings, it is presumed that *quality* does not vary between owner-occupied dwelling and rental housing of the same character. However, as shown in Table 15 below, the Housing and Land Survey indicates that, older the building, larger is the percentage of "major repairs needed" or "dilapidated beyond repair" in rented houses than owner-occupied dwellings. Furthermore, when focusing on the components of privately-owned rental housing in terms of structure of construction, the tendency for such dilapidation is notable in wooden than in non-wooden rental housing.

Table 15. The Percentage of Dilapidated Dwellings (%)

	Ave.	Prior to 1945	1945-1960	1961-1970	1971-1980	1981-1990	1991-1995	1996-Sept. 1998
Owner-owned dwellings	4.5	16.4	13.9	8.1	4.1	1.5	0.5	0.3
Rented houses	8.1	30.4	29.6	17.6	10.8	3.6	0.6	0.3
Owned by local government	9.2	39.1	29.4	17.7	8.5	3.0	0.1	0.1
Owned by public corporation	4.2	–	16.9	5.7	3.1	1.0	0.2	0.0
Owned privately								
Wooden, facilities used exclusively	14.7	30.3	31.2	24.4	16.4	6.8	1.3	1.2
Wooden, facilities shared	33.4	49.2	46.4	29.8	26.0	22.2	16.7	0.0
Non-wooden	3.1	21.1	25.7	13.3	8.4	2.4	0.4	0.1
Issued houses	4.9	18.2	16.2	11.2	6.2	2.0	0.4	0.4

(Note) Values are the percentage of the sum of dwellings classified under "major repairs needed" and "dilapidated beyond repair" of the total.
(Source) Compiled by the author, based on Table 20 of the *Results of the 1998 Housing and Land Survey (Results on Japan).*

In the debate over whether to introduce the system of fixed-term housing lease rights, it was argued that the Land and Housing Lease Law discourages the supply of quality rental housing, pushing up rent for new contracts of relatively large-sized rental housing.

The Law, at the same time, has the effect of restraining continued rent of existing contracts. It can be deemed that as long as continued rent is kept low by institutional factors, there is little incentive for the landlord to sufficiently attend to maintenance and repairs and as a result, dilapidation of rental housing advances more than it would.

Recently, Iwata & Yamaga (2004) conducted a theoretic study on (1) what kind of influence the difference in form of ownership of dwelling, e.g. owner-occupied dwelling, leased land, or leased house, has on preserving the quality of the building, and (2) what kind of influence the restraintism on continued land rent (or housing rent) of the Land and Housing Lease Law has on preserving the quality of the building. At the same time, they conducted an empirical analysis using micro data from the 1998 and 2003 *Housing Demand Survey* and verified that (1) the maintenance of quality (degree of dilapidation) of leased land and leased housing is worse than that of owner-occupied dwelling, and (2) focusing on the existence of the Land and Housing Lease Law, the quality of leased houses deteriorates further.

It can be said that regarding the estimation of imputed rent for owner-occupied dwelling, when housing is stratified by characteristic, it is necessary to take *quality* into account, which is not fully captured in conventional characteristic.

11. Conclusion

This paper began with the simple question of why figures under the same concept differ substantially in the official statistics of National Accounts, Regional Accounts, Input-Output Tables, and the National Survey of Family Income and Expenditure. The cause was investigated and a set of measures for improvement was proposed. However, including the issue of *quality*, which was treated at the end, the issue of imputed rent is profound.

The essence of the problem lies in how to measure the market value of *housing service,* which is produced by the asset of housing and consumed by residents.

The attempt to measure the *user cost of capital* regarding housing is theoretically, deeply interesting. Because there are problems in applying it per se to actual statistics, including the treatment of negative user cost in periods of an asset price bubble, imputed rent for owner-occupied dwelling is currently estimated based on actual rent of rented houses not only in Japan, but in the US and Germany as well. However, even so, there is need to constantly pay attention to developments in academic circles and of other countries.

Along with this, with regard to data, if continued rent is constrained in Japan under the Land and Housing Lease Law, estimating imputed rent of owner-occupied dwelling

using continued rent may not be appropriate; in future, it would be necessary to consider this problem while keeping in perspective the use of data on rental housing with fixed-term contracts or for lease limited to corporations.

As stated at the beginning, the estimation of imputed rent for owner-occupied dwelling is a *best estimate* without actual data and so, in a sense, it is natural that results differ when estimation methods differ. However, GDP may be revised to the scale of several trillion yen by changes in the estimation method. While it can pose policy or political implications, there seems to be little consensus even in academic circles. On such an issue, this paper is hopeful that by offering information in an organized manner, a thorough discussion will be held among specialists of economics and statistics and such, to promote the consensus-building of the estimation method of imputed rent for owner-occupied dwelling.

Finally, in National Accounts, not only should imputed rent for owner-occupied dwelling be estimated for base years, there is need to calculate annual and quarterly, current-price and chain-weighted numbers by extrapolation. If the statistic used for the base-year estimation and for out-year extrapolation lack consistency, data for recent periods may always contain errors even if the base year numbers are accurately estimated. Particularly from the standpoint of a profession in charge of the estimation, this point calls for full attention.

Supplementary Notes and Tables

1) The Treatment of Imputed Rent for Owner-occupied Dwellings in the 93SNA Manual

---

Chapter VI The Production Account

    <Services of owner-occupied dwellings>

6.89 Heads of household who own the dwellings which the households occupy are formally treated as owners of unincorporated enterprises that produce housing services consumed by those same households. As well-organized markets for rented housing exist in most countries, the output of own-account housing services can be valued using the prices of the same kinds of services sold on the market in line with the general valuation rules adopted for goods or services produced on own account. In other words, the output of the housing services produced by owner-occupiers is valued at the estimated rental that a tenant would pay for the same accommodation, taking into account factors such as location, neighbourhood amenities, etc. as well as the size and quality of the dwellings itself. The same figure is recorded under household final consumption expenditures.

Chapter IX The Use of Income Account

Services of owner-occupied dwellings

9.58 Persons who own the dwellings in which they live are treated as owning unincorporated enterprises that produce housing services that are consumed by the household to which the owner belongs. The housing services produced are deemed to be equal in value to the rentals that would be paid on the market for accommodations of the same size, quality and type. The imputed values of the housing services are recorded as final consumption expenditures of the owners.

(Source) *[The System of National Accounts 1993 Revised] (Commission of the European Communities, International Monetary Fund, Organization for Economic Co-operation and Development, United Nations, and World Bank)*.

2) The Treatment of Imputed Rent for Owner-occupied Dwellings in the CPI Manual

In the CPI (consumer price index) Manual of the ILO (International Labor Organization), the treatment of owner-occupied dwellings in CPIs is stated as being "arguably the most difficult issue faced by CPI compilers" and multiple approaches focusing on *use*, *payments*, and *acquisitions* are presented. Of these, the approach recommended in the 93SNA is the one focusing on *use*.

One way to measure imputed rent in the *use* approach, is to calculate user cost of housing. However, according to the CPI Manual, "no national statistical office is currently

using the full user cost approach. This partly reflects the conceptual and methodological complexity of the measure, which may also make it difficult to obtain widespread public support for the approach."

Another way to measure imputed rent in the *use* approach is the rental equivalence method. Concerning this method, the CPI Manual points out that when the size of the rental market is small or if rental housing is different from owner-occupied dwellings in terms of quality, size and type, or when rents are subject to price control, direct imputation from actual rents is inappropriate. Thus, more detailed stratification (e.g. by type and size of dwelling, and by location) is required, and subsidized rent and controlled rent must be excluded from the calculations.

In addition, the CPI Manual indicates that owner-occupied dwellings provides significant additional utility for owner-occupiers from features such as security of tenure and the ability to modify the dwelling, implying a need to make additional adjustments to the initial imputations.

(Source) ILO, CPI Manual, Chapter 10, Some Special Cases.
http://www.ilo.org/public/english/bureau/stat/download/cpi/ch10.pdf

3) Imputed Rent of Major Countries (Ratio to household final consumption expenditures, Ratio to GDP, %)

	US (2002)	Japan (2003)	Germany (2002)	France (2003)	Italy (2003)	UK (2001)	Canada (2002)
To household final consumption expenditures	11.3	19.1	9.5	12.7	12.1	9.2	14.5
To GDP	8.0	10.6	5.4	7.0	7.3	5.9	8.0

(Sources) Compiled by the author, based on *National Accounts of OECD Countries, Detailed Tables*, Volume II, 1991-2002; and *[FY2003 GDP Figures (Gross Domestic Expenditure Series, etc)]*.

4) The Ratio of Imputed Rent for Owner-occupied Dwellings to Household Final Consumption Expenditures and to GDP in Japan, 1980-2003 (%)

	1980	1985	1990	1995	2000	2003
To household final consumption expenditure	12.2	13.1	14.0	16.1	17.8	19.1
To GDP	6.6	7.0	7.4	8.8	9.8	10.6

(Source) Compiled by the author, based on the Annul Report on National Accounts of 2003 and FY2003 GDP Figures (Gross Domestic Expenditure Series, etc).

5) International Comparison of the Ratio of Owner-occupied Dwellings (%)

	1970	1980	1990	2003
US	64.18	65.58	63.95	68.25
Germany	–	41.00	39.00	43.60
France	–	47.00	55.02	56.22
Italy	–	59.00	68.00	80.00
Spain	–	73.00	78.00	82.90
The Netherlands	–	42.00	45.00	53.00
Ireland	–	74.00	79.30	76.92
Japan	–	60.00	61.00	62.00
UK	50.00	55.00	66.00	70.00
Canada	60.00	62.00	63.00	65.20
Australia	–	71.00	72.00	70.00

(Source) IMF, *World Economic Outlook*, September 2004.
(Note)   Based on number of housing units. In Japan, since owner-occupied dwelling is larger than rental housing, the ratio of owner-occupied dwelling based on space area, reaching 79.7% in 2003 – according to preliminary estimates of the 1998 Housing and Land Survey – is substantially higher than when based on the number of housing units.

References

Akai, Nobuo. *[Research library, Chapter 8. An analysis of housing market regulations: Doesn't the Land and Housing Lease Law restrict the supply of rental housing?].* Available: http://www.geocities.co.jp/SilkRoad/3841/chap8.PDF (in Japanese).

Cabinet Office. (2000). *[93SNA Estimation method manual (Preliminary version)*]. Government of Japan, November 15.
Available: http://www5.cao.go.jp/2000/g/1115g-93sna/93suikei6.pdf (in Japanese).

Department of National Accounts, Economic and Social Research Institute (Ed.). *[Annual report on Regional Accounts of 2004].* Cabinet Office, Government of Japan (in Japanese).

Department of National Accounts, Economic and Social Research Institute (2004). *[SNA Input-Output Tables (1995 basis)].* Cabinet Office, Government of Japan, March (in Japanese).

Department of National Income, Economic Research Institute. (1995). *[The System of National Accounts 1993 revised (Commission of the European Communities, International Monetary Fund, Organization for Economic Co-operation and Development, United Nations, and World Bank).* Economic Planning Agency, Government of Japan, March (in Japanese).

Department of National Income, Economic and Social Research Institute. (1992). *[SNA Input-Output Tables (1985 basis)].* Cabinet Office, Government of Japan, July (in Japanese).

Department of National Income, Economic and Social Research Institute. (1996). *[1990 basis SNA Input-Output Tables (Nominal version)].* Cabinet Office, Government of Japan, March (in Japanese).

Economic and Social Research Institute (Ed.). *[Annual report on National Accounts of 2000 (CD-ROM included*)].* Cabinet Office, Government of Japan. (in Japanese).

Economic and Social Research Institute (Ed.). *Annual report on National Accounts of 2004.* Cabinet Office, Government of Japan.

Economic and Social Research Institute. *[FY2003 GDP figures (Gross Domestic Expenditure Series, etc) time series table].* Cabinet Office, Government of Japan. Available: http://www.esri.cao.go.jp/jp/sna/qe043-2/gdemenuja.html(in Japanese).

Hatta, Tatsuo & Akai, Nobuo. (1995). [Doesn't the Land and Housing Lease Law restrict the supply of rental housing?]. *Toshi Jyutaku-gaku [Urban Housing Sciences]*, *12*, 61-66 (in Japanese).

Hatta, Tatsuo & Akai, Nobuo. (1996). [Doesn't the Land and Housing Lease Law restrict the supply of rental housing? The case considering fixed costs]. *Jyutaku Mondai Kenkyu*

[Housing Review], *12*, (1): 2-8 (in Japanese).

ILO. (2004). Some special cases. In *Consumer price index manual: Theory and practice* (Chapter 10).

Available: http://www.ilo.org/public/english/bureau/stat/download/cpi/ch10.pdf

IMF. (2004). *World economic outlook*.

Iwata, Shinichiro & Yamaga, Hisaki. (2004). [The quality of housing and the form of ownership]. *Jyutaku Tochi Keizai [Quarterly Journal of Housing and Land Economics], 54*, Autumn (in Japanese).

Ministry of Internal Affairs and Communications. *1998 Housing and Land Survey.* Available: http://www.stat.go.jp/english/data/jyutaku/index.htm.

Ministry of Internal Affairs and Communications. *[1999 National Survey of Family Income and Expenditure]*.

Available: http://www.stat.go.jp/data/zensho/1999/submenu1.htm (in Japanese).

Other references are National Survey of Family Income and Expenditure of 1979, 1984, 1989 and 1994 (in Japanese).

Ministry of Internal Affairs and Communications. *2000 Input-Output Tables for Japan.* Other references are Input-Output Tables in 1975, 1980, 1985, 1990 and 1995 (in Japanese).

Ministry of Internal Affairs and Communications. *[2003 Housing and Land Survey: Preliminary results]*. Available: http://www.stat.go.jp/data/jyutaku/2003/3.htm (in Japanese).

Nakamura, Yoichi. (1999). *[Introduction to SNA statistics].* Tokyo: Nihon Keizaisha Shimbun (in Japanese).

OECD. (2004). *National Accounts of OECD Countries. Detailed Tables 1991-2002* (Volume II).

Otake, Fumio & Yamaga, Hisaki. (2001). [The impact of the System of Fixed-term Housing Lease Rights on rent]. *Nihon Keizai Kenkyu [JCER Economic Journal], 42,* March (in Japanese).

Tachibanaki, Toshiaki & Yagi, Tadashi. (1994). [The current situation and recent trends in the distribution of income: Imputed rent and capital gain on stocks]. In Tsuneo Ishikawa (Ed.). *[The distribution of wealth and income in Japan]* (Chapter 1). Tokyo: Tokyo Daigaku Shuppan-kai (in Japanese).

Takayama, Noriyuki & Arita, Fumiko. (1995). [Intergenerational distribution of disposable income]. *Keizai Kenkyu [Research in Economics], 46*, (1) (in Japanese).