CAPITAL FORMATION IN RESIDENTIAL REAL ESTATE IN JAPAN, 1887–1940

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I. *Introduction*

The aim of this paper is to analyze private residential construction as a part of a study of capital formation in Japan. A tentative estimate of such construction since 1930, has been made by the Economic Planning Board, but this estimate is problematical. In general, one of the weakest areas of Japanese statistics is the field of building construction, although, in varying degrees, a similar situation in some other countries. The construction sector is usually considered as indirect social investment and, having no direct relation to visible returns, as it differs from investment in producers' durable goods. Therefore, its role in economic growth is thought to be less important than that of the latter. Although individual landlords, from their view of profits, have regarded housing construction as capital investment, it is only recently that residential construction has been included as a component part of capital formation, the reason for inclusion having been clarified by the development of the conceptual framework of national income analysis.

One of the reasons for lack of emphasis on residential construction as a part of capital formation is the poor quality of Japanese housing. In addition, there are various statistical difficulties in estimating its value. First, residential construction has peculiar characteristics, depending upon location, so it is difficult to establish a common standard of measurement. Second, it is produced only on the order of occupants according to their particular preferences. Third, the construction industry has not sufficiently modernized its system of accounting. For example, there are many unincorporated contractors and carpenters. As a result of the above, the first comprehensive picture of this sector in Japan made available by the Ministry of Construction in a survey published in 1958.

II. *Availability of Data*

Public works in Japan has been mainly under the control of the government since the Meiji Restoration (1868), so estimates of this component of construction can be made as far back as the early Meiji period by examining government

expenditures.[1] However estimation of private construction activity, especially residential construction in the period before World War II, is very difficult because of the poor quality and dispersion of available materials. For the pre-war period, building statistics exist in two series. One is "Statistics on the Basis of Work-Put-In-Place" by the Ministry of Home Affairs (1927–1944); the other is "Building Statistics" by the Ministry of Commerce and Industry (1936–1943).

Ministry of Home Affairs series comprises data collected for areas covered by the Urban Districts Building Law and is in terms of amount of floor space, not value. This makes estimation of residential construction difficult, and indicates that the government was not interested in the annual flow of construction, but in the floor space occupied per person or the total physical amount of building. In other words, residential construction was not conceived on the basis of productivity of capital or investment value, but on the basis of welfare. Statistics for residential construction originated in the severe housing problem occasioned by World War I, when the movement of labor from rural to urban areas accompanying the remarkable development of commerce and industry occured.

In this way, the increment of residential construction has been estimated on the basis of the Urban Districts Building Law since 1927.[2] Next the method of measurement and some problems of residential construction in the context of capital formation in Japan will be presented.

III. *Some Problems in Measurement*

(1) Stock and flow

Because data for increments of construction is not available for years prior to enforcement of the Urban Districts Building Law, total constructive figures must be converted to obtain the flow of construction. The following formula is used.

$$N_t = S_t - S_{t-1} + D_t + D'_t + C_t \cdots\cdots (1)$$

N_t……Net residenital construction in year t
S_t ……Total residential construction in year t
D_t……Loss by fire and natural disaster in year t
D'_t……Removal in the year t
C_t ……Net increment through change in use

[1] K. Emi and H. Rosovsky, "Measurement of Government Construction in Japan" *Economic Review* (in Japanese), Hitotsubashi University Economic Research Institute, Vol. 9, No. 1, 1958.

[2] For years prior to the period covered by the Ministry of Home Affairs series, statistical, yearbooks of large cities include some building statistics, as shown on the following. These yearbooks show the total amount of construction in physical terms at the end of each year. In addition, they show kinds of construction, by materials, but not by use. Data for residential construction appears separately from 1918, in the case of Tokyo City.

Tokyo(Prefecture)	from 1886
Tokyo (City)	1887
Osaka	1906
Yokohama	1903
Kobe	1909
Nagoya	1910

(2) Gross and net

To measure gross capital formation in housing, it is necessary to include not only new construction and additions and alterations to existing housing, but also repairs on housing. The latter is fairly large in value,[3] but attention will be confined, at first, to the former.

The question is what function should be formulated theoretically for new and reinvestment in housing and how to measure them correctly. From a long run point of view, new investment in housing is a function of the increment of population or number of households, assuming the number of persons per dwelling to be in constant.[4] On the other hand, reinvestment in housing is considered a function of total housing.

Using G, N and R to represent gross, new and reinvestment in housing, respectively, the following equation can be formulated.

$$G=N+R$$
$$=\alpha(\Delta P)+\beta(S)\cdots\cdots\cdots\cdots\cdots\cdots(2)$$

If N_{iu} is defined as new investment in housing in urban areas during the year i,

$$N_{iu}=\alpha_i(\Delta P_{iu})$$

In actual estimation, data for the sample area are extended to the nation. Thus, if new investment in housing in the sample area is represented by N_{is} and unit value, or cost, of investment by m_i,

$$\alpha_i=m_i\cdot\frac{N_{is}}{\Delta P_{is}}$$

Then,

$$N_{iu}=m_i\cdot\frac{N_{is}}{\Delta P_{is}}\cdot\Delta P_{iu}\cdots\cdots\cdots\cdots\cdots\cdots(3)$$

This is considered as a definitional equation. Of course, the assumption that the following relationship exists is essential to this equation.

$$\frac{N_{is}}{\Delta P_{is}}=\frac{N_{iu}}{\Delta P_{iu}}$$

For the period before 1926, new investment in urban housing is estimated by expanding data from a sample of the five or six largest cities to the nation.

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[3] According to a study by the Institute of Building Research, Ministry of Construction, repairs are estimated 37–38% of the total of new construction and additions and alterations to existing housing in 1956. It seems that a carpenter in Japan builds two new houses a year, receiving additional earnings from repair work. However, this ratio fluctuates with the business cycle. Reference to this point will be made again later.

[4] It is better to use number of families than population. Here population is used under the assumption that the average number of persons per family in urban areas is fairly constant for long periods. In fact, it gradually decreased from the 1890's to period before World War I, then increased somewhat.

Average number of persons per family (in the six largest cities)

period	persons per family
1888–1900	4.58
1901–1910	4.32
1911–1920	4.37
1921–1930	4.51
1931–1940	4.77

Therefore, the ratio $\frac{N_i}{\Delta P_i}$ for these cities must be examined to determine whether it is representative.[5]

Next, reinvestment in housing is represented by $R_{iu}=\beta_i\ (S_i)$. Defining the annual replacement rate as r[6] and the value of reinvestment per *tsubo* as n, and assuming r to be nearly constant,

$$R_{iu}=r\cdot n_i(S_i)\cdots\cdots(4)$$

Combining formular (3) and (4) with (2),

$$G_{iu}=m_i\cdot\frac{N_{is}}{\Delta P_{is}}\cdot\Delta P_{iu}+r\cdot n_i\cdot S_i\cdots\cdots(5)$$

In conclusion,(1) and (5) are the fundamental formulae for estimating capital formation in housing for the period before 1927, when figures on "flow" are not available.

In making estimates by use of the above formlae, care must be exercised in expanding the sample to the nation as a whole. The urban area used as the sample continuously expands, so the difference between S_t and S_{t-1} in the sample city often increases sharply as the result of an extension of city limits. In such cases, the figures in the sample must be adjusted.

Other difficulties of housing construction statistics are present in the following.

(a) the distinction between residential and non-residential housing

(b) the relation between floor space and total floor space as physical unit of building construction

(c) the relation between the number of *mune* (ridge), number of houses and number of families or households

(d) the distinction between new construction, additions and alterations to existing housing, moving and repairs of varying degrees, corresponding to the concepts of gross and net investment

(e) differences in statistics as a result of collection of data at different stages of construction

Distinguishing residential from non-residential housing becomes a problem in the case of joint-use. Data gathered under the Urban Districts Building Law in the pre-war period include joint-use houses in residential housing. Tokyo City Statistics being to list joint-use house separately from 1936. Even in post-war statistics, the joint-use house was treated as residential housing till 1952.

In the inter-war period, the number of small shops or factories used also for residence increased rapidly, but most owners were not clearly conscious of the distinction between business and residence. Still, that part of joint-use housing used for business can be estimated for the earlier period by adjusting the ratio it

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[5] The distribution of $\frac{N_i}{P_i}$ using the population in stock term shows that the ratio for large cities is not necessarily higher, but that it differs according to stages of development in each city. In the bench mark year of 1935, the arithmatic average of $\frac{N_i}{P_i}$ for all cities is 0.122 *tsubo* (unit of floor space equal to 3.3058 square metres), while that for big cities is 0.120. Therefore, it is safe to use the data from large cities as the sample.

[6] According to the Institute of Building, r is estimated 2 % in the wooden building.

bears to total residence. This ratio is supposed to have a definite relationship to the growth of tertiary industry, but the correlation for this relationship is rough and weak, so the results obtained should be considered as merely suggestive.

Discrepancies among three kinds of statistics obtained at different stages of construction—building permits, housing starts, and housing completions—, present the problem of distinguishing their economic meaning. Urban Districts Building Law Statistics were obtained on housing completions basis while the Ministry of Commerce & Industry Statistics were complied on a housing starts basis. In the post-war period, also, the same system of statistics has been adopted. The former, as ex-post statistics, is suitable for tracing long term capital formation in residential housing. On the other hand, building permits or housing starts data is on an ex-ante basis and is therefore helpful in predicting business fluctuations in the short run. The former is broader in its coverage but is apt to accompany the understatement. The latter also is accompanied with undervaluation because of incomplete reporting.[7]

The above is limited to problems of estimating net investment in housing. The estimation of gross investment is more difficult and troublesome.

IV. *Measurements*

Various data on the national economy since 1930 have been compiled by the Economic Planning Board using modern statistical methods. As a result,

Table 1 *Example of Measurement* (1930–1932)

Year	*Tsubo* of new constr. in sample (in thous. *tsubo*)	Sample pop. (in thous.)	*Tsubo* per person in sample (A/B)	Total urban pop. (in thous.)	Urban Res. constr. (C)×(D)
	(A)	(B)	(C)	(D)	(E)
1930	1,535	13,790	0.111	18,343	1,926
31	1,636	14,090	0.116	19,081	2,079
32	1,796	14,400	0.125	19,803	2,317

Year	Index of constr. cost (1933=100)	Urban cost of const. per *tsubo* (F)×68.4 yen	Adjustment for joint-use housing (in thous. *tsubo*)	Value of urban res. constr. (G)×(H)
	(F)	(G)	(H)	(I)
1930	96.2	65.8	1,637	107,714
31	96.1	65.7	1,768	116,158
32	96.0	65.7	1,969	129,363

Notes on Table 1
(1) Columns (A) and (B) are data collected under the Urban Districts Building Law.
(2) Because the area included in Tokyo was increased by annexation of neighboring towns, column (D) is adjusted.

[7] According to an investigation by the Ministry of Construction, it is estimated that in terms of floor space, actual construction was about 1.6 times that reported during the period 1950–55. For the pre-war period, Drs. Kitazawa and Ito estimated that new and addition of building performed without was 10% of total floor space.

(3) The index of construction cost estimated by Dr. S. Tani is adopted here. He caluculated the index from 1900 to 1952. (Cf. *Study on Housing Management Expense by Shigeo Tani*, Report of the Building Research Institute, Dec., 1954)

(4) It is due to the comprehensive survey on total cost of construction in Japan 1933 which was investigated by Drs. Kitazawa and Ito. The unit cost of construction was estimated by weighting the average cost in large, middle size and small cities by the given total *tsubo*, using in 1933 as a bench mark year.

(5) That part of joint-use housing used for family dwelling purposes was estimated as being, 85 % of the figure for total residential housing. Of course, it is not constant over time, but must be adjusted for growth of tertiary industry, particularly the degree of subdivision of petty shops.

(6) Rural residential construction was estimated by means of the following formula

$$A_r=\frac{A_u\cdot\alpha\cdot P_r}{P_u} \quad \cdots\cdots(6)$$

P_u.....population in urban districts
P_r.....population in rural districts
A_u.....total *tsubo* for residential housing in urban districts
A_r.....total *tsubo* for residential housing in rural districts

α is the ratio of *tsubo* per person in rural districts to that in urban districts. It is estimated to be 0.42 for the entire period, excluding 1945—48, which were abnormal years in rural areas and is applied to pre-war period. To summarize, the total value of investment in residential housing can be calculated from

$$H=A_u\cdot\beta\cdot C_u+A_u\cdot\partial\cdot C_r$$

β and ∂ are, respectively, the ratio of dwellings to households in urban and rural areas; C_u and C_r are respectively, the unit cost of construction in two areas. The Economic Planning Board, by combining the various series of construction costs in the pre-war period estimates $C_r/C_u=0.75$. However, care must be used in applying this ratio to the post-war period, because wages and the market structure for building materials have greatly changed. According to my estimate, $C_r/C_u=0.57$.

private residential construction has also been estimated as one component of capital formation. The method used is the same as that of the following table.

Applying the various columns in Table I to equation (3), column (C) corresponds to $\frac{N_{is}}{P_{is}}$, colum (D) to P_{iu} and column (G) to m_i. The question is whether to use $\frac{N_{is}}{\Delta P_{is}}\cdot\Delta P_{iu}$ or $\frac{N_{is}}{P_{is}}\cdot P_{iu}$ in expanding the sample to obtain the total. The Economic Planining Board adopts the latter, which is based on the assumption that new investment in housing is a function of total population. Furthermore, it is assumed that the following relationship exists between new investment in housing (N), increment of population (ΔP), total population (P) and the total number of houses (D),

$$N=a(\Delta P)=b(P)=c(D)$$

Although the relationship itself must be proven, it is acceptable for the long run on the assumption of a constant rate of population increase and that of dwelling persons per house.

Using almost the same method, my estimation is compared with that of the Economic Planning Board in the following table (Table 2).

These two series are at different levels, but, with exceptions, movements are in the same direction.

The important question is how to extend the estimate for residential investment to the early Meiji era, when capitalism in Japan saw its beginning. Equations (1) and (2) should be used, but such an estimate is not attempted for gross investment. Data are availbale,

Period		Materials
I	1880–1886	Building land statistics by prefecture
II	1887–1908	Tokyo Prefecture statistics
III	1909–1926	Statistics of the six largest cities

However, these data are not consistent. In other words, the samples for II and III are different. In addition, I differ from the others in methods of measurement.

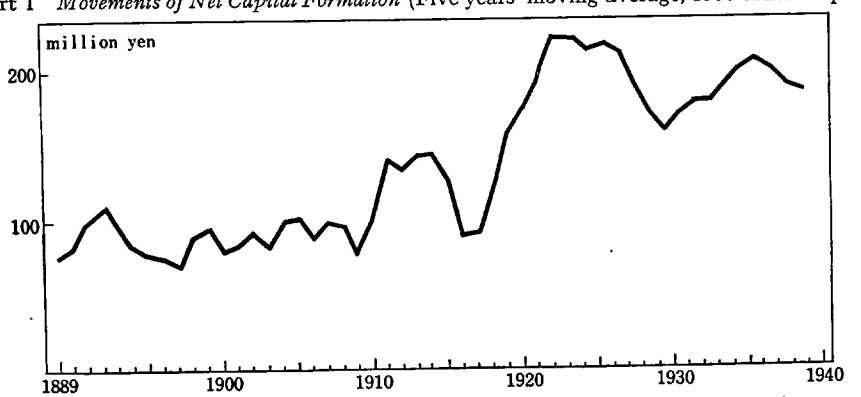
Table 2 *Measurements of Residential Construction*, 1930–40 (unit: million yen)

	E.P.B. (1)	Author (2)
1927		212
28		221
29		244
30	159	173
31	155	185
32	170	203
33	203	216
34	213	214
35	228	246
36	250	268
37	363	323
38	270	262
39	330	354
40	458	431

Source: (1) The E.P.B., *The Japanese Economy and National Income*, 1954

The difficulty in period II lies in the fact that two of the sample cities, Tokyo and Yokohama, suffered great damage in 1923 earthquake. Also, an adjustment must be made in applying $S_t—S_{t-1}$ in the sample to all urban areas. In period II, Tokyo Prefecture is treated by dividing it into urban and rural areas, the latter being further divided into rising and stationary section. The pattern of $\frac{N_i}{P_i}$ in each section is examined to determine what linking is possible or suitable between periods II and III. In period I, the investment in residential land ΔL in Tokyo Prefecture is used instead of ΔP. To use ΔL, the relationship between ΔL and ΔP should be examined in a period when both series are available. Finally, the nature of the data and method of measurement are inconsistent. Therefore, three series are overlapped for five year intervals then linked in the order III, II and I according to reliability. This method of linking contains some error, but the rough movement of building investment in the long run can be seen.

Chart 1 *Movements of Net Capital Formation* (Five years' moving average, 1933 constant prices)



First, the results will be treated from the standpoint of economic growth.

From the chart, it can be seen that residential construction in Japan, rose too higher levels during and after World War I. The upward surge appearing in the decade 1910–20 is caused by the movement of population from rural to urban areas occasioned by the War, as already indicated. The subsequent surge is mainly due to reconstruction after the 1923 earthquake. Computing the annual rate of growth of residential construction, it is 1.4% for the thirty years before the end of World War I, and 1.7% for the following twenty years ending in 1940. As the average rate of growth in population is 1.2% over the entire period, it can be said that growth in residential construction was almost cancelled by increase in population.

Table III shows the ratio of housing investment to national income in current prices for five year intervals.

Table 3 *Ratio of Residential Construction to National Income in Current Prices (five year average)*

Period	Residental construction (million yen)	Ratio
1889—1892	26	3.2%
1893—1897	26	2.1
1898—1902	35	1.7
1903—1907	46	1.8
1908—1912	55	1.6
1913—1917	72	1.6
1918—1922	247	2.2
1923—1927	306	2.4
1928—1932	205	1.4
1933—1937	253	1.3
1938—1940	349	1.2

In the above table, also, the entire period can be divided into two by World War I. The ratio in each shows a tendency to decrease at the rate of about one to three percent. This is somewhat lower than expected. According to accepted opinion, the annual rate of economic growth in Japan since the Meiji Restoration was maintained at the level of 3.5 to 4% as a result of high rates of savings and capital formation. The main component of capital formation is producers' durable goods, including productive construction activities, but not residential construction. In view of the low standard of Japanese housing in the past many years, it seems that the ratio of residential construction to total capital formation was too low. However, this released savings for investment in producers' durable goods and productive construction. In other words, a low level of investment in residential construction might be one of the factors contributing to the promotion of economic growth in Japan, though in a passive sense.

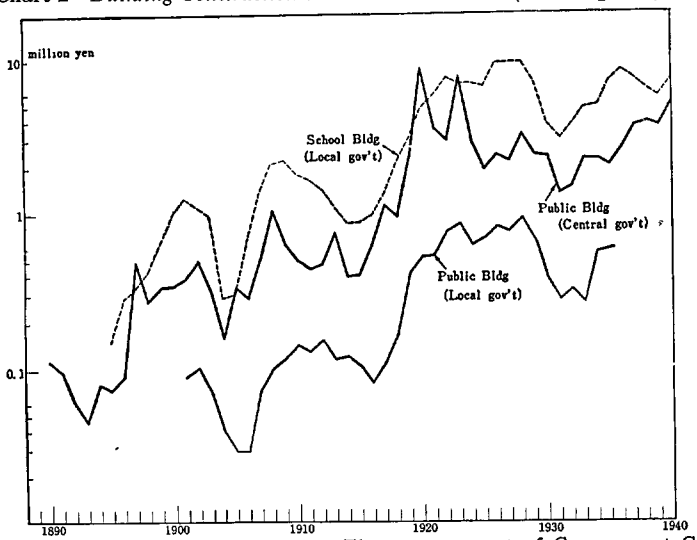
V. *Some Future Problems for Study*

(1) Building cycle

It is difficult to clearly indicate a building cycle in Japan by means of the foregoing methods. In general, however, a residential construction cycle of 6 to 10 years can be shown. As building cycles in Western Europe and the U.S.A.

are 17 or 18 years, the Japanese building cycle is only one-third to one-half as long. Also, the amplitude of cycle is no as great. This results from two

Chart 2 *Building Construction in Government Sector* (current prices)



Source: *Koichi Emi and Henry Rosovsky,* "The measurement of Government Construction in Japan, 1868-1940," *Economic Review* (in Japanese) Hitotsubashi University Economic Research Institute Vol. 9, No. 1, 1958.

general characteristics of housing investment in Japan. First, it is demand-determined as a result of the steady increase in population; and, second, Japanese investors in housing are small and weak.

Building cycles appear in the government sector are shown in Chart 2. Each series shows the same length of cycle of about 6 to 10 years, with coinciding peaks and troughs. Because most school construction is primary schools, movements of this series indicate an increase in the number of new pupils entering primary school. Thus, it is related to the demand for houses accompanying the increase in population. Peaks and troughs appearing in school building and private residential construction are compared in Table 4.

Table 4 *Troughs and Peaks in Building Cycles*

	Public School Construction	Private Residential Construction
T	1886	1888
P	1888	1892
T	1890	1895
P	1901	1900
T	1904	1902
P	1909	1906
T	1915	1910
P	—	1913
T	—	1917
P	1922	1920
T	1925	1927
P	1927	1932
T	1931	1936
P	1936	—

Time-lags occure in the cycles of the two series, and troughs and peaks are often reversed. That the school building cycle moves together with the cycles of other two series of government building indicates a compensating rela-

tionship between government and private investment. Although it is possible to show the existence of building cycles in Japan, further study of this problem is needed.

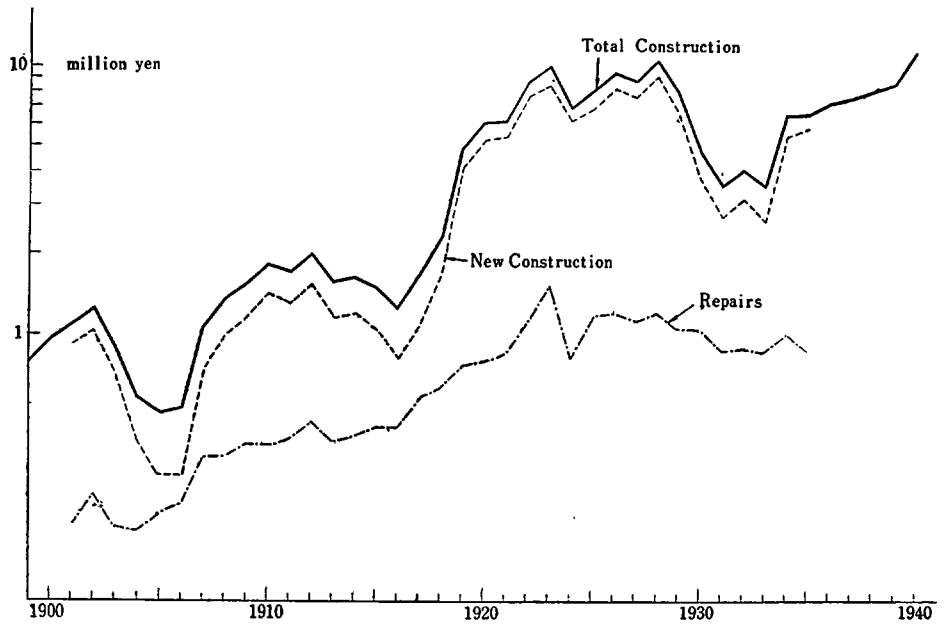
(2) New and repairs

Thus far, gross capital formation in residential construction, including repairs, has not been fully considered. This point will be briefly considered here. Table 5 shows the ratio of repairs to total investment. The percentage fluctuates for each five years' period except 1921–25, which includes the 1923 earthquake.[8] In general, new construction expands in boom period while repairs rise relatively in depression. This relationship is shown in Chart 3. If this is true, it can be said that fluctuations in repairs tend to offset cycles in new

Table 5 *Ratio of Repairs to Total Investment in Construction by the Central Government*

Period	Ratio of Repairs to total construction
1890—1895	28.34
1896—1900	17.62
1900—1905	23.66
1906—1910	16.11
1911—1915	19.64
1916—1920	9.12
1921—1925	9.37
1926—1930	15.76
1931—1935	18.99
1936—1940	15.55

Chart 3 *New Construction and Repairs by Prefectural Governments*



[8] It should be noted that the secular decline in the ratio of net to gross investment observed in the United States does not appear in this table (See Grebler, Blank and Winnick, *Capital Formation in Private Residential Real Eatate*, 1956, National Bureau of Economic Research, p. 10).

construction. This is particularly important in the analysis of the relationship between growth and net in capital formation.

(3) Housing investment and urban population

In saying that new investment in housing is a function of increase in population, it should be pointed out that this is due to mainly to the flow of population from rural to urban areas with increasing industrialization of the Japanese economy. Therefore, the function for housing investment is more closely related to the net increase in urban population than to increase in total population. Accordingly, the equation for estimating housing investment, should be modified.

(4) Residential housing investment and cost of housing in the Family Budget Survey

Although investment in housing is only a small proportion of national income, one to three per cent, the cost of housing in the Family Budget Survey is a rather large proportion of family expenditure. According to the Family Budget Survey for 1926–1927, the cost of housing for workers living in Tokyo amounted to 16% of total family expenditures. 88.6% of the sample families lived in rented houses, so rent comprised the greater part of housing cost. It might be concluded that high profits to landlords who must bear the cost of repairs and high depreciation costs resulting from the short life of wooden houses.

In conclusion, investment for residential construction in Japan was very conservative during the pre-war period. This corresponds to the low standard of living in Japan. Since the Meiji Restoration, net investment in housing has been low, its average annual growth rate being 1.5%. This figure would be slightly larger if investment in housing were measured in gross terms. However even in gross terms, repairs to existing housing have not fully counted in Japan.

In only two periods were houses which existed in the early Meiji era replaced on a large scale: one was the period following the 1923 earthquake, the other was the past World War II period. Excluding these two abnormal periods, it can be said that the direct cause of replacement of buildings was natural disasters occurring almost every year. In other words, new investment in construction is the result of the pressure from of increasing population; and reinvestment is mainly due to natural disasters. Here the one character of the Japanese economy appears. Further study is needed to clarify these problems.

In concluding this paper, I must heartily thank my friend, Henry Rosovsky, Assistant Professor at the University of California in Berkley, who worked with me when he was a visiting member of the staff of the Hotitsubashi University Economic Research Institute. Sections I, II, III and IV of this paper represent the results of works done jointly by Professor Rosovsky and the present author; the remaining part are what has been developed since then on that basis by the author and the responsibility rests entirely with him.