LONG-TERM MOVEMENT OF CAPITAL FORMATION

— The Japanese Case, 1868–1940 —

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The high rate of investment sustained by a high rate of saving has accelerated continuously the rapid growth in the Japanese economy since the Meiji period. This paper presents the estimation of annual capital formation by sector—public and private—and by type of investment. The estimates have revealed many facts regarding the relation between some specific aspects of economic growth and the rate of capital formation; the different roles of capital formation attained in different sectors; and the relation between precedence and lag observed among the different types of investment.

INTRODUCTION

The objective of this paper is to take a general view of the long-term development of capital formation in Japan in the last hundred years and to consider its connexions with the growth of the Japanese economy.

Capital formation includes on the one hand an accumulation of productive capital in the form of an increase in factories, mechanical equipment, raw materials, and partly finished goods on inventory, etc., for the purpose of raising direct productive potential. On the other hand, it includes elements which contribute indirectly to the raising of productive capacity, as, for example, house construction, road, harbour and riparian works, and railway construction. The former corresponds to equipment and inventory investment carried out mainly by private enterprise, while the latter corresponds to investments in construction. Practically all of the latter is dependent on the investment activities of the government, with the exception of the building, railway, and electricity projects carried out by the private sector with its own resources. The relationship between these two categories of capital formation is as follows: The original investment in social capital enlarges the productive base for industry and productive capital grows on the basis thus provided. Conversely, at times further investments in social capital are called for in order to break through the bottlenecks in economic growth caused mainly by the shortage of productive capital.

In the following we will consider the relationship between the government and private sectors in capital formation in Japan, looking at the subject in respect to the economic units concerned, as well as the long-term changes in construction and equipment investment in respect to the types of investment.[1]

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1 Most of the estimates quoted in this paper are given in *Capital Formation in Japan*, New York, The Free Press of Glencoe, 1961, by Henry Rosovsky, a former joint researcher with the author and at present a Professor of Harvard University. The author intends

I. OUTLINE OF CAPITAL FORMATION ESTIMATES

Capital formation can be divided according to the economic units concerned into government and private capital formation, and according to types of investment into construction, producer's durable equipment, and inventory. It is desirable to divide government investment into central and local, and investment by the private sector into investments made by enterprises and those by households (including private non-profitmaking institutions). Furthermore, enterprises should be divided according to type of industry. By classifying these relationships by economic units and types of investment in the form of a chart we can show the structure of capital formation as we have estimated it. Ideally, it would be best to estimate capital formation in accordance with Chart 1 which classifies capital formation by vertical and horizontal analytical approaches. Since, however, we cannot obtain statistical data which are consistent over the long period covering the pre-war and post-war years, it is necessary to devise methods of estimating which will fit to the available

Chart 1. TYPE OF CAPITAL FORMATION CLASSIFIED BY ECONOMIC UNIT

Economic Unit		Types of Investment		Construction		Equipment (c)	Inventory (d)
				Building (a)	Structures (b)		
Government	Central	Non-Military	General (1)	Expenditure Approach			Balance Sheet Approach
			Enterprises (2)				
		Military	(3)				
	Local	General	(4)				
		Enterprises	(5)				
Private	Non-Agricultural	Incorporated	(6)	Physical Stock Approach		Commodity Flow Approach	
		Non-Incorporated	(7)				
	Agriculture		(8)				
	Non-Profitmaking Bodies		(9)				
	Households		(10)				

Notes: 1. In the case of the non-incorporated enterprises (7) and agriculture (8), the business and household portions are combined, and thus when the household portion can be singled out, this has been included under households (10).
2. It is desirable to divide the non-agricultural category by industry.
3. The area of overlap of the commodity flow and expenditure approach in the chart indicates the part in regard to which both of the approaches are possible.

source material. Consequently, it is by combining the various methods of estimating represented in the chart that we arrived at our estimate of gross domestic capital formation.

First, capital formation by the government was arrived at by totalling expenditures for capital formation given in the *Kessansho* which record governmental revenues and expenditures by Ministry. We have called this 'the expenditures approach.' No such records exist for capital formation by private economic units, however, and thus we are obliged to estimate it by indirect methods. First, buildings occupy the greater part of construction in the private sector. By drawing up annual series of figures for the physical volume of buildings in existence as shown in the annual reports of local public organizations, then by converting these into terms of annual increase, and finally by multiplying them by value per unit area, we arrived at figures for the value of capital formation. Since these figures were arrived at from the stock of capital represented by the physical volume of buildings in existence we have called this 'the physical stock approach.' Next, we adopted the method of basing producer's durable equipment on the statistics of the factories producing machinery and other equipment and tracing the destinations to which these are sold, since there is no statistical material on expenditures by economic unit. This is called 'the commodity flow method.' First, we found the value of domestic production of machinery and other producers' durables, added to it the value of imports and subtracted the value of exports. The result we regarded as equipment investment carried out in Japan. Of course, the supply of these producers' durables includes not only equipment investment but also construction investment, and we must distinguish between the two on the basis of the type of materials used. As for the estimation of the last remaining item, inventory investment, this is the portion for which basic source material is insufficient and the estimation of which is the most difficult, particularly for the pre-war years. We have called this the 'balance-sheet approach' because we can elicit annual increases (or decreases) from the values of manufactured goods and raw materials on hand as shown in the balance-sheets of enterprises.

Since, as we see above, we employ a combination of several methods of estimation because of the restrictions imposed by the basic source material, it becomes necessary to check the results by other methods to confirm their reliability. Below we give a summary account of our methods of estimation and our estimates.

II. CAPITAL FORMATION BY THE GOVERNMENT

Our estimates of capital formation by the government amounts to abstracting items of capital expenditure from the expenditures given in the closing statement of the central government dating from the year 1868, the year of the Meiji Restoration, and in the records, incomplete though they are, of local governments dating from the year 1879. The following shows

the accounting mechanisms of the central and local governments in the period dating from 1890, the year in which Japan established the legal foundations of a modern state.

CENTRAL GOVERNMENT	General Account	Ordinary
		Extraordinary
	Special Account	Ordinary
		Extraordinary
LOCAL GOVERNMENT	Ordinary Account	Ordinary
		Extraordinary
	Works Account	Ordinary
		Extraordinary

Within the above we can further divide the Special Accounts of the central government into the Non-Enterprises Special Accounts used for the administration of buildings and funds owned by the government and the Public Enterprises Special Accounts which include the Bureau of Monopolies, the National Railways, the military arsenals, etc. Thus the General Account and the Non-Enterprises Special Accounts combined give us a figure for general government activity. The same holds for local government. A distinction is made between the ordinary and extraordinary categories shown under each of these accounts, the former representing regular expenditures from year to year centred on consumption expenditures in respect to salaries of government employees, office requisites, etc. The latter includes a large proportion of costly public works and building projects as well as disaster reconstruction expenses and military expenditures of an emergency nature. Consequently, the greater part of the items of capital expenditure by the government are included in expenditures made under the extraordinary accounts, and only expenditures for maintenance are included in the ordinary accounts. What we must note when estimating central and local government capital formation together is the necessity of singling out the construction subsidies granted to local governments by the central government, and, conversely, costs and part-shares of construction works paid in to the central government from local governments, and of removing any duplications among them.

1. Construction Investment by the Government

Government capital formation as arrived at by the above method is divided according to type of investment into construction investment and equipment investment. Within this, construction investment is divided into the following seven items:

1. Building*
2. Public Works; (1) Waterworks, (2) Harbour Works, (3) Riparian Works,* and (4) Roads and Bridges
3. Agriculture
4. Natural Disaster Reconstruction; (1) Building and (2) Others
5. Temples, Shrines, and Cultural Installations

6. Military; (1) Building* and (2) Others
7. Transportation.
* 1. The items marked with an asterisk are further divided into new constructions and repairs. The former of these categories includes additions and large-scale alterations. Simple maintenance is not included in capital formation.
  2. Agriculture includes costs of land reclamation, land improvement schemes, afforestation schemes, encouragement of the construction of fishing harbours, etc.
  3. Natural Disaster Reconstruction includes, as for example in the case of buildings, those newly built and those repaired following natural disaster.
  4. Military construction includes, besides barracks, military offices and school buildings, the construction of roads, harbours, and manoeuvring areas for exclusive use by the military. In the official formula for the calculation of national income only buildings used for permanent habitation are included in capital formation.
  5. The greater part of transportation construction represents railway construction.
  6. As regards capital formation by local governments, there is no doubt on such items as public works, electricity, gas, etc., the greater part of which are regarded as capital expenditure. But since the other capital expenditures are not clear in terms of the classification of uses in the published material we have estimated these from the statement of accounts of sample cities.

I_{ij} Expenditures in respect to items of capital expenditure j by sample bodies belonging to population size group i, ($i=1, 2, .. n$)

E_{is} Annual expenditures of sample bodies belonging to population size group i.

E_{it} Annual expenditures of all local bodies belonging to population size group i.

$$\sum_{i=1}^{n} I_j = I_{ij} \times \frac{E_{it}}{E_{is}}$$

Table 1. TREND OF CONSTRUCTION BY CENTRAL GOVERNMENT

(in thousand yen)

	Non-Military Construction	As % of Non-Military Construction						Military Construction	Total Government Construction
		Building	Public Works	Agriculture	Natural Disasters	Cultural	Transportation		
1870	3,460	24.3	29.2	...	...	1.4	45.1	...	3,460
1880	3,218	71.4	11.3	3.7	...	9.3	4.3	808 (20.1)	4,026
1890	4,620	31.4	39.1	2.0	15.2	5.8	6.5	1,984 (30.0)	6,604
1900	22,700	19.2	20.6	1.7	1.8	2.1	54.6	14,664 (39.2)	37,364
1910	53,945	11.7	18.7	2.6	4.1	0.2	62.7	8,073 (13.6)	62,018
1920	279,551	32.1	20.3	2.9	3.1	0.6	41.0	37,794 (11.9)	317,345
1930	206,118	12.8	21.2	11.8	19.3	0.2	34.7	10,345 (4.8)	216,463
1940	326,780	18.3	20.0	16.1	11.8	0.3	33.5	459,793 (58.5)	786,573

Note: Figures in parentheses are for military construction as % of total construction by central government.

Source: K. Emi & H. Rosovsky, "Seifu kensetsu-tōshi no sokutei" (Measurement of Government Construction, 1868–1940), *Keizai kenkyū*, Vol. IX, No. 1 (1958).

On the basis of the above classification we first show construction investment by the central government at ten-year intervals from 1870.

The long-term rise in government construction investment is apparent at first glance, but if we convert the nominal expenditures, including military expenditures, into real terms at 1934–36 prices, 1940 shows an increase of 24.5 times over 1870. If we make a simple straight-line link between these two points in time, the annual average growth rate in these 70 years works out at 6.7%. Naturally, this growth did not take place in a straight line, but, as can be seen from the table, there were marked jumps in the periods 1890–1900 and 1910–1920. The 1890's was the period in which Japan made herself into a modern state and set out towards the full establishment of a capitalist economy, the period which Professor W. W. Rostow describes as 'the stage of take-off.'[2] The 1910's, on the other hand, were the period in which the First World War provided the occasion for the expansion of the scale of Japan's economy, and in which her industrial structure developed rapidly in the direction of industrialization. Looking at the breakdown of construction investment in these leap periods, however, we find that transportation and military construction expanded in the 1890–1900 period, while in the 1910–1920 period a parallel expansion of building construction and public works took place in addition to these. However, military construction had little productive effect on the growth of the national economy, and strictly speaking, only buildings used for permanent habitation, which occupied no more than a small proportion of military construction, are to be included in capital formation. Consequently, in order to consider the trends in capital formation it is more appropriate to take the figures for non-military construction. If we convert the figures for non-military construction into real terms and work out the factor of increase of the figures for 1940 over those of 1870 we get an increase of 10.2 times, or an annual average growth rate of 3.6%. Consequently, we learn that a considerable difference arises in the results obtained, depending on whether we include military construction or not. This value, 3.6%, approximates the growth rate of the national economy in the period prior to the First World War, and it would seem to mean that construction investment more or less kept in step with the growth of the national economy.

Now in the period 1870–1890 it was public works which led the growth in non-military construction, while since 1900, transportation, centring on railways, has always occupied the largest share, accounting for between 30% and 60%. Next, after transportation, public works and building construction stand side by side with average figures of around 20%. In the case of Japan, natural disaster reconstruction is one of the important sources of demand for government construction, but because of its nature it exhibits a pattern of variation which is different from those of other types of construction. For the rest, it is to be noted that agricultural construction increased sharply in the 1930's. This shows that it had become necessary to make investments in

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[2]   W. W. Rostow, *The Stages of Economic Growth: A Non-Communist Manifesto*, Cambridge, Mass., Cambridge University Press, 1960, p. 38.

the interests of agriculture through government expenditure, since agriculture stagnated following the changes in the structure of industry after the First World War. In particular this is suggested by the fact that during the transition to the depression between 1920 and 1930, the figures for agricultural construction alone showed an increase while all the other items of expenditure, with the exception of natural disaster reconstruction, were exhibiting decreases in absolute terms.

A form of construction no less important than that carried out by the central government was construction by local governments. We give the results of our estimates in ten-year intervals.

Table 2. TREND OF CONSTRUCTION INVESTMENT BY LOCAL GOVERNMENT BODIES   (in thousand yen)

	As % of Total				Total	As % of Non-Military Construction by Central Government
	Building	Public Works	Agriculture	Public Utilities		
1880	17.6	82.4	...	...	6,584	2.04
1890	16.0	84.0	...	...	13,718	2.96
1900	30.4	65.5	3.9	0.1	43,672	1.92
1910	28.4	60.0	3.2	8.4	87,856	2.58
1920	28.1	59.5	3.5	8.9	253,528	0.90
1930	18.0	67.3	6.6	8.1	338,037	1.64
1940	25.2	70.3	...	4.5	476,236	1.45

Source : Emi & Rosovsky, " Seifu kensetsu-tōshi sokutei."

First, in comparing the total construction investment by local government bodies with non-military construction by the central government, we find that in the 1910's local construction exceeded central by a large margin, while even after 1920 construction investment by local governments was the greater. The explanation for this is that in the first half of the growth period of the Japanese economy, dating from the Meiji Restoration, the construction of public works tended to be entrusted to local governments because the central government was concentrating its efforts on the administrative functions of a modern state, on equipping its armed forces, and on the promotion of modern industries. It was unable to devote sufficient energy to the creation of social overhead capital, so the central government began supplying construction subsidies to local governments. The reason for the sudden rise in public works and agricultural construction by the central government after the First World War and on into the 1930's was that the government intended to remedy the prostrated condition of the agricultural villages and the effects of the business depression.

Looking at the annual average growth rate of construction by local governments in the period 1880–1940 for the purposes of comparing them with construction by the central government we find this to be 3.3%, which appears to be more or less the same as the growth rate for non-military construction

by the central government which we calculated for the same period, namely 3.4%. But as we have already pointed out, an analysis of construction by local governments shows that public works were overwhelmingly predominant, while in the majority of cases the next item was the construction of primary schools for compulsory education. The public utilities corresponding to transportation construction by the central government were electricity, gas, motor transport, etc., but the proportion they occupied within total construction by local governments was not to be compared with that of railway construction in the construction work undertaken by the central government. In sum, the nucleus of construction activity by the central government was located in military and railway construction, while that of local governments was in public works and the building of schools, and these forms of construction remained dominant.

2. Equipment Investment by the Government

Construction investment plays the main part in capital formation by the government. But in the first half of the Meiji period equipment investment was pressed forward through government activity, notably in transportation and telecommunications but also in iron and steel manufacture, military and naval arsenals, even after the government had sold off to private enterprises the textiles factories which it had set up and run for a time under its own direction. These facts show how great the government's contribution was in the field of equipment investment also.

Government equipment investment can be divided into the following categories:

      1. Furniture and Fixtures
      2. Machinery and Tools
      3. Transportation Equipment; (1) Vehicles and (2) Ships
      4. Military; (1) Furniture and Fixtures, (2) Machinery and Tools,
                 (3) Ordnance and (4) Ships.

Among these categories, items 1 to 3 are common to local governments, but military equipment is the concern of the central government alone. In itself military equipment does not constitute productive potential, and it is usually omitted in the calculation of capital formation within the framework of national income. Although this is so, the sums spent on these items of military equipment in the pre-war period were of such vast proportions as to dominate the expenditure pattern of Japanese government finance. As a consequence the demand effect they produced was closely related to the growth of Japan's heavy industries centred on iron and steel production and shipbuilding, and in consideration of this fact we give them below for purposes of reference. Table 3 shows at a glance how overwhelmingly large was the military portion within equipment investment in the broad sense of the term. In particular, the figures for 1940 reflect the influence of the Second World War. If, now, we consider equipment investment apart from the military portion we find the transportation equipment takes the place of the machinery

and tools of the initial period and progressively increases, and that within transportation equipment, excluding the shipping of the initial period, vehicles have increased at a rapid rate. Since telecommunications equipment bulks large within machinery and tools, it can be said that a characteristic of government equipment investment is that it is located mainly in transportation and telecommunications. Finding the real value of investment in transporation equipment and calculating the annual average growth rate for the half-century between 1890 and 1940 we get a figure of 12%, and perceive that it is markedly greater than that for construction investment.

Table 3. EQUIPMENT INVESTMENT BY THE CENTRAL GOVERNMENT

	As % of Total					Total Non-Military Equipment (A) (thousand yen)	Total Equipment Investment (B) (thousand yen)	(A)/(B) (%)
	Furniture and Fixtures	Machinery and Tools	Transportation Equipment					
				(Vehicles)	(Ships)			
1870	...	55.7	44.3	...	44.3	388	464	83.6
1880	33.8	41.4	24.8	11.6	13.2	526	1,520	34.6
1890	35.9	45.9	18.2	0.1	18.1	973	6,220	15.6
1900	9.2	70.1	20.7	16.9	4.8	11,364	54,106	21.0
1910	5.6	31.8	62.6	52.7	9.9	19,337	76,351	25.6
1920	3.6	34.9	61.5	51.9	9.6	126,640	489,908	25.8
1930	5.9	28.2	65.9	57.3	8.6	86,566	249,081	34.7
1940	8.1	10.4	81.5	71.7	9.8	237,043	3,158,037	7.5

Source: Henry Rosovsky, *Capital Formation in Japan, 1868–1940*, Glencoe, Ill., Free Press, 1961, Table VIII-1, pp. 198–203.

Looking next at equipment investment by local governments we find, as is shown in Table 4, that the greater part of it was in machinery and tools. This item represents the aggregate of supply equipment for gas, water, electricity, and other similar undertakings run by local governments and the machinery and tools used in public works by all such bodies. Although some degree of error due to indirect estimation is unavoidable, it is worthy of note that this item is of a size which makes it comparable with non-military equip-

Table 4. EQUIPMENT INVESTMENT BY THE LOCAL GOVERNMENT

(in thousand yen)

|	Furniture and Fixtures	Machinery and Tools	Transportation Equipment	Total
1880	128	2,477	...	2,605
1890	234	2,012	...	2,246
1900	736	8,216	...	8,952
1910	1,624	26,462	...	28,086
1920	5,775	59,163	9,648	74,586
1930	9,391	159,442	5,019	173,852
1940	24,622	224,900	11,334	260,856

Source: H. Rosovsky, *Capital Formation in Japan, 1868–1940*, Table VIII-3, pp. 207–208.

ment investment by the central government.[3]

3. Summary of Government Capital Formation

If we show the trend of five-year moving averages for investment by central and local governments in construction and equipment respectively we get Figures 1 and 2.

**Figure 1.   CONSTRUCTION INVESTMENT BY CENTRAL AND
   LOCAL GOVERNMENT, 1868–1940**
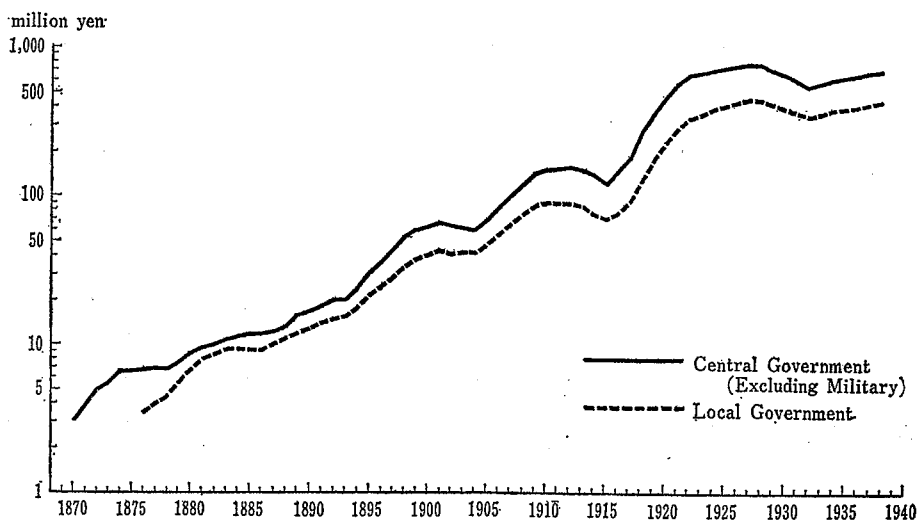
Note: The figures are in terms of five-year moving averages.

First, with regard to construction investment, the central and local governments fluctuate together, and from the 1890's cyclical fluctuations become apparent. We are probably right in understanding this in connexion with the construction cycle. The dips in the graphs coincide roughly with wartime years, and a rise in construction investment is apparent after every war. Next, with regard to fluctuations in equipment investment the movements in equipment investment by the central government follow a more rapid trend and exhibit stronger fluctuations than in the case of construction investment. The slump in the graph during the period of business depression in the 1930's, for example, is conspicuous. Thus we see that the general features of the equipment cycle are also to be found in the case of government equipment investment.   The fact that equipment investment by local governments is represented in the form of a straight line is due principally to the methods

[3]   We have abstracted the relevant items from the closing statements of the accounts
    of sample local governments at prefectural, city, town and village levels, and have
    expanded them to cover the whole country on the basis of the proportions of total
    annual expenditure they represent.

Figure 2. EQUIPMENT INVESTMENT BY CENTRAL AND
LOCAL GOVERNMENT, 1868–1940

hundred thousands yen
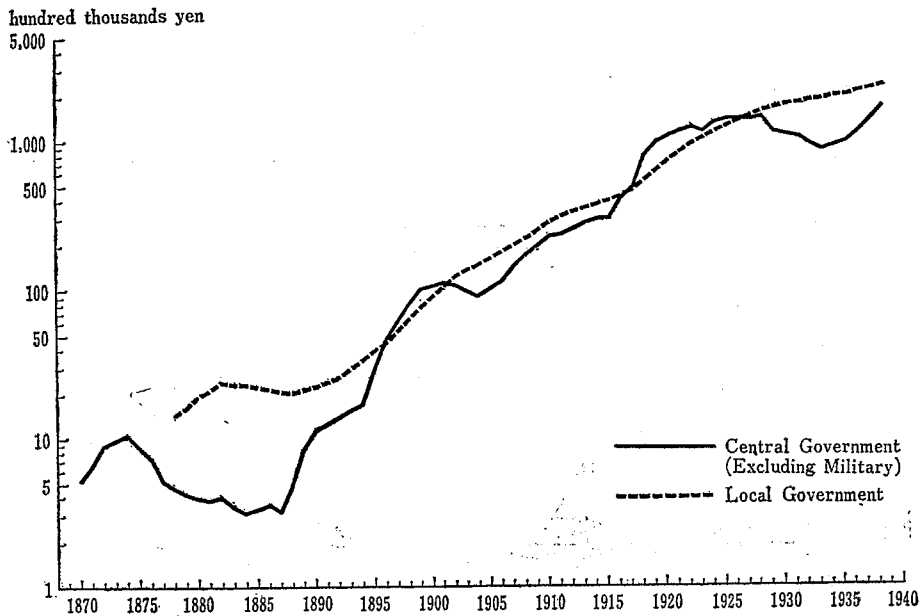
Note: The figures are in terms of five-year moving averages.

of estimation employed, but we will do well to point out that in reality its fluctuations were more moderate than those of equipment investment by the central government.

III. BUILDING INVESTMENT BY THE PRIVATE SECTOR

Like that of the government, capital formation by the private sector is divided into construction, equipment, and inventory, but since we cannot obtain sufficient basic source material for inventory investment we shall renounce any attempt to deal with this item and shall centre our analysis on construction and equipment. As has already been shown, construction (*kensetsu*) is divided into building (*kenchiku*) and structures other than building (*kōchiku*: e. g., bridges, dams, roads), the greater part of this last item being carried through by means of government public works. Consequently, construction by the private sector is centred on private railways and the supply of electricity and gas, and agricultural works carried out by private enterprises, to which we can add mining (and other works). On the other hand, building constructed by the private sector include private houses, the buildings belonging to private non-profit organizations, buildings used by non-incorporated businesses including agriculture, and the buildings belonging to incorporated

enterprises, including private railways and electricity and gas. Among these the buildings belonging to private non-profit organizations are mainly private schools. Again, in agriculture and other forms of non-incorporated businesses it is desirable to make a distinction between buildings used for residential purposes and buildings used for business purposes. Private construction is shown in the following Chart.

Chart 2.   TYPES OF PRIVATE CONSTRUCTION INVESTMENT CLASSIFIED
BY ECONOMIC UNIT

	Building		Structures
	Residential	Business	
Household	Private Housing (a)		
Private Non-Profit-making Institutions		Private Schools and Others	
Agriculture	Residential Buildings (a)	Agricultural Buildings	Agricultural Works
Non-Incorporated Business	Residential Buildings (a)	Shops (b)	
		Factories (c)	
Incorporated — Commerce		Commercial Buildings (b)	
Incorporated — Industry		Industrial Buildings (c)	
Incorporated — Private Railways and Others		Station Buildings and Others	Track, Bridges, Tunnels, etc.

Notes: 1. The total of the items marked 'a' is given as private housing, within which the portion left after the deduction of farmers' housing is called 'non-agricultural housing.'
2. The items marked 'b' under the heads of non-incorporated and incorporated business are considered to be 'commercial buildings,' and those marked 'c' are considered to be 'industrial buildings.'
3. There is a residential portion in the items marked 'b' and 'c' under incorporated businesses. But since it is not possible to abstract this these items have been regarded as referring wholly to buildings used for business purposes.

1.   The Building of Private Housing

Private housing is the most important component in capital formation by the private sector. But because of the insufficiency of basic source material it is extremely difficult to grasp it in terms of long-term statistical series. Practically no information is available regarding the building of private housing in rural areas, and even in urban areas we can only obtain figures for the physical volume of housing existing in a limited number of large-and middle-sized cities. Consequently, the series of figures for the existing physical volume of housing, expressed in terms of numbers of *mune* (the number of

buildings) or *tsubo*[4] (an area measurement) should be converted into terms of annual increase, and then they have to be converted again into money values. It is from 1927 that we have figures for the annual volume of housing covering the greater part of the urban built-up areas in the form of figures for the area of building sites, and it is from 1936 that we have figures for the value of residential building works in the principal cities throughout Japan. Consequently, the following procedure is necessary to estimate long-term series for housing since the Meiji period.

(1) We take as a sample a city or cities in respect to which figures for the volume of housing in existence are obtainable, find the area of housing per capita and expand it on the basis of population to correspond with the area of urban housing construction for the whole of Japan.

(2) We find annual increases from the series of figures for the volume of housing in existence, multiply them by unit values and convert them to a money base.

(3) From the differences between the urban and rural areas in respect to area of housing per capita and building costs per unit area we estimated the value of residential building in the rural areas, taking the urban areas as base.

These methods of estimation elaborated are as follows:

(1) The formula for the conversion from 'stock' to 'flow' estimation is:[5]

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

N_t is the volume of new building in year t, S_t the stock volume of building in year t, D_t the losses through natural disasters in year t, D_t' the portion demolished in year t, and C_t the net increase due to changes in mode of use in year t.

(2) Estimation of gross investment in housing.

Assuming the value of gross investment in housing in a given area to be G, the value newly invested to be N, the value reinvested to be R, the population to be P, and the stock of housing to be S, we get the equation:

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

Using equation (2) we expand from a sample city to all urban built-up areas, but for the purposes of estimation we devise the following equation:

$$G_{iu} = n_i \cdot \frac{N_{is}}{P_{is}} \cdot P_{iu} + v \cdot r_i \cdot S_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(3)$$

Suffix i represents year i, u universe, n value of new investment per unit area, v the reinvestment rate, and r the value of reinvestment per unit area.[6]

(3) The formula for the estimation of private residential building in the

4　*Tsubo* is a flat area measure corresponding to 3.95 square yards or 3.31 square meters. The number of *mune* may be assumed to correspond to the number of buildings. Cf. Rosovsky, *op. cit.*, p. 215.

5　Kōichi Emi " Capital Formation in Residential Real Estate in Japan, 1887–1940," in *The Annals of the Hitotsubashi Academy*, Vol. IX, No. 2 (April, 1957).

6　Theoretically, new investment in housing may be regarded as a function of population increase, but in making estimates more plausible figures are obtained if it is regarded as a function of aggregate population.

rural areas.

First, we have the equation for the area of private housing in the rural areas H_b.

$$H_b = \frac{H_a \cdot \gamma \cdot P_b}{P_a} \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots(4)$$

H_a represents area of housing in the urban areas, γ the area of building sites in rural areas as a proportion of that in urban areas, P_a urban area population, and P_b rural area population.

For the purposes of converting the equation (4) into money-values it will be sufficient to multiply H_b by the unit value ratio between rural and urban housing.[7] Official estimates for investment in private housing from 1930 have been published by the Economic Planning Agency, and the formulae for estimation in the period 1930–1944 appear to be the same as those employed by the present writer. We may note that for the period from 1887 for which the present writer has estimated the statistical sources which have been employed as samples are, basically, the statistical yearbooks of Tokyo City (Tokyo-shi) and Greater Tokyo (Tokyo-fu), and the series of figures which they contain constitute basic information regarding the volume of housing in existence and which covers the longest time-span available. Consequently, the results of the writer's estimations are also subject to the restrictions imposed by these basic statistical sources and methods of estimation.[8] Below we show the results of our estimation at five-year intervals.

Table 5. THE TREND OF INVESTMENT IN PRIVATE HOUSING

	Gross Investment Area (1,000 tsubo)		Gross Value of Investment (million yen)			Total Real Value Gross Investment (1934–36 prices) (million yen)
	Urban	Rural	Urban	Rural	Total	
1890	328	1,695	5.4	12.7	18.1	74.6
1895	677	859	15.3	8.8	24.1	72.4
1900	892	640	28.6	9.3	37.9	80.3
1905	529	1,055	10.9	15.4	32.3	68.5
1910	782	1,113	27.8	18.0	45.8	87.4
1915	1,494	1,374	55.4	23.2	78.6	143.8
1920	548	3,057	63.2	160.8	224.0	131.6
1925	2,228	401	204.3	16.8	221.1	163.5
1930	1,270	1,453	81.2	42.4	123.6	131.0
1935	2,284	1,188	156.4	37.2	193.6	191.6
1940	1,845	547	274.2	37.1	311.3	142.0

Note: 1 *tsubo*=3.952 sq. yds.

Source: Kōichi Emi, *Shihon keisei* (Capital Formation), Tokyo, Tōyōkeizai shimpō-sha, in print.

[7] In cases where house building includes premises jointly used for business purposes will further be necessary to multiply by the exclusive residential use ratio.

[8] For details of the process of estimating, see Kōichi Emi, *Shihon keisei.*

Viewed either in terms of investment area or of value invested the rural areas, in contrast to the rising trend of the urban areas, show a gradual rise and then a levelling off, if we omit the 1920's from consideration. We may regard this as due to the urbanization which accompanied the industrialization of Japan which increased the influx of population into the cities and brought about a continuous increase in the demand for housing. In particular, a great jump is apparent in the 1920's, following the First World War. If, in order to view the long-term trend, we calculate the annual average growth rate for the period 1890–1940 from the series of figures for the real value of gross investment in an urban and rural areas combined, the growth rate for gross investment in housing in a broad sense of the term, including housing also used as shop premises, works out at 1.5%, and at 1.1% if housing jointly used as shop premises is omitted. Taking into consideration the fact that the annual average rate of population increase from the Meiji period up to the Second World War works out at 1.2%, we have grounds for thinking that investment in housing barely kept up with population increase and that consequently the level of housing per capita was more or less constant. In order to go into this point further, let us take a look at the trend of the proportion of GNP occupied by gross investment in housing.

Table 6. GROSS INVESTMENT IN PRIVATE HOUSING AS PROPORTION OF GNP, 1888–1940. (Five-year Averages.) (in million yen)

	Including Premises Used as Shops (A)	Excluding Premises Used as Shops (B)	GNP	$\frac{(A)}{GNP}$ (%)	$\frac{(B)}{GNP}$ (%)
1888–92	17.8	17.1	848.6	2.09	2.01
1893–97	29.3	27.1	1,277.8	2.29	2.12
1898–1902	47.4	42.7	2,112.8	2.24	2.02
1903–07	36.6	33.1	2,506.8	1.46	1.32
1908–12	59.2	52.2	3,660.4	1.61	1.42
1913–17	98.4	83.4	5,006.8	1.96	1.66
1918–22	257.5	216.2	12,519.2	2.05	1.72
1923–27	279.1	219.1	14,369.8	1.94	1.52
1928–32	191.4	148.6	13,812.8	1.38	1.07
1933–37	264.4	198.3	17,593.2	1.50	1.12
1938–40	336.0	247.5	33,090.6	1.01	0.74

Source: K. Emi, *Shihon keisei.*

A glance at Table 6 shows that, although there have been some rises and falls in investment in private housing, both the (A) and (B) series have followed a progressively declining trend in relation to GNP. This constitutes one of the characteristics of capital formation in Japan. In America, for example, capital formation in housing accounted for 6.2% in 1891, 3.9% in 1910, 3.0% in 1930, and 2.6% in 1940.[9] Consequently, in America, too, housing investment

[9]   Grebler, Blank and Winnick, *Capital Formation in Residential Real Estate*, NBER, 1956, Appendix, pp. 429–430.

has shown a declining trend but in the case of Japan the percentages them-
selves are markedly small. We can show this relationship even more clearly
if we compare housing investment not with GNP but with capital formation.
The fact that, in general, the growth rate of the Japanese economy since the
Meiji period was able to maintain a level of 3.5%–4.0% was due to a contin-
uously high rate of capital formation, and the focus of capital formation was
in investment in producers' durable equipment related to direct producing
potential. Nevertheless, the fact that the proportion invested in private
housing was low in relation to the countries of Europe and America may be
supposed to have been due to the fact that the standard level of housing
among the Japanese had been at a low level over a long period. But this
was the reason for the high rate of private saving being liberated from invest-
ment in housing and for the resources of the nation being concentrated in
producers' durable equipment. Consequently, such a low level of investment
in housing may be said to have served to hasten the economic growth of
pre-war Japan in a passive sense. If we calculate the proportion of GNP
occupied by housing investment for the period after the Second World War
we get the results shown in Table 7.

Table 7. GROSS INVESTMENT IN HOUSING AS A PROPORTION OF GNP,
1951–1965 (Five-year Averages at Current Prices)   (in billion yen)

	Private Housing (A)	State Housing (B)	Total Housing Investment (C)=(A)+(B)	GNP (D)	$\frac{(A)}{(D)}$ (%)	$\frac{(C)}{(D)}$ (%)
1951–1955	203.5	24.5	228.0	7,127.4	2.9	3.2
1956–1960	441.2	49.9	491.1	12,408.2	3.6	4.0
1961–1965	1,248.3	112.6	1,360.9	24,995.1	5.0	5.4

Source: Economic Planning Agency, *Kokumin shotoku tōkei nempō* (Annual Report on
National Income Statistics), 1967, Table 3, pp. 46–47.

The table shows that the proportion of GNP occupied by investment in
housing after the Second World War has been markedly high, in contrast
with the pre-war years. The housing investment of the first half of the 1950's
may be supposed to have been due to the demand for reconstruction deriving
from war-damages, but the fact that housing investment as a proportion of
GNP continued to rise after this period may be regarded as a reflection of
the gradual rise in the level of housing. We may regard housing investment,
which had operated towards saving resources for the growth of manufacturing
industry in pre-war Japan, as having become the principal component in the
demand for construction in the post-war period, and as having grown in the
wake of the general growth of the economy.

2. Commercial Building

By commercial building we mean the building of banks, business premises,
and shops, but in a broad sense the term includes cinemas, theatres and
other places of amusement. As in the case of housing, we have no systematic

statistical source-material relating to pre-war buildings of this kind on a national scale up until 1926. Consequently, we employed indirect methods in estimating for the period 1886–1926. First, we divided the country into urban and rural areas and used the statistics published by Tokyo City for our estimates of commercial building in the urban areas. Then we found proportion of the floor space of commercial buildings to that of total buildings during the period for which both statistics are available, and multiplied this proportion by the floor space of all buildings existing prior to this period. In this method, the amount of commercial buildings is regarded as the function of the total of all buildings. Next we found area of commercial buildings per capita in Tokyo City and expanded it on a population basis to cover the total urban area. For commercial buildings in the rural areas we used the proportion between the figures for floor space of commercial buildings per capita in the urban and rural areas under Greater Tokyo, and expanded them to cover the entire country. Furthermore, we subtracted the portion of the dual-purpose housing which is used both as housing and shops, from housing investment and added it to commercial building. Again, in converting to money values we applied the post-war unit value proportion between urban and rural areas. Calculating the annual average growth rate of real value invested in the period 1900–1940 on the basis of the results obtained from our estimates we arrived at a figure of approximately 6.0%. This represents a high rate of growth which contrasts with that of housing investment. This shows that as a percentage of investment in housing, investment in commercial building increased from approximately 20% in 1900 to 50–60% in 1930–1940. Moreover, even if we consider it natural that commercial building should have been undertaken mainly in the urban areas, the decrease in the proportion represented by urban commercial building over the period 1890–1920 may be said to have been due to the progressive urbanization of

Table 8. GROSS VALUE INVESTED IN COMMERCIAL BUILDING

	Gross Value Invested (A) (million yen)	Urban Investment as % of Gross Value Invested (B) (%)	Real Gross Value Invested (C) (million yen)	$\dfrac{(C)}{\text{Real Value of Gross Investment in Housing}}$ (%)
1890	1.1	97.8	4.5	5.88
1895	3.5	94.1	10.4	13.36
1900	8.9	93.0	18.8	19.50
1905	5.5	76.9	11.7	15.51
1910	11.4	80.6	21.7	21.89
1915	26.4	80.9	48.2	26.30
1920	104.9	35.5	61.7	40.36
1925	96.9	93.4	131.2	45.99
1930	103.5	87.0	97.6	61.30
1935	129.0	89.5	130.5	50.63
1940	90.8	91.0	199.3	46.95

Source: K. Emi, *Shihon keisei.*

the rural areas on the periphery of the cities as against institutional reform
of the boundaries between urban and rural areas.

3. Industrial Buildings

By industrial buildings we mean principally factories and warehouses.
All warehouses are treated as industrial buildings for reasons of convenience.
The basic source-material for these is the figures on the number of buildings
and area owned by factories and warehouses. These are obtainable in frag-
mentary fashion from the statistical publications of Tokyo City and other
large- and middle-sized cities. From these figures we found ground area per
building and the weighted averages of these. Next we obtained the number
of factories in Japan from the *Kōjō tōkeihyō* (Factory Statistics), converted
this into number of buildings. We then multiplied the average area per
building by the total number of factory buildings in Japan. The conversion
to monetary values was carried out exactly the same as for residential and
commercial buildings. From Table 9 we see that industrial construction
fluctuates more than commercial construction, and consequently differences
appear when we calculate growth rates, depending on point in time selected.
However, it is clear that industrial building increased markedly with the
increased industrialization after the First World War. The annual average
growth rate for 1925–1940 works out at 13.7%. Furthermore, we must note
that in contrast to investment in the commercial sector, investment in the
industrial sector was mainly in the mechanical equipment installed in the
buildings rather than in the buildings themselves.

|	Table 9. INDUSTRIAL BUILDINGS		(in million yen)
	Gross Value Invested (A)	Real Value of Gross Investment (B)	(B) / Commercial Building (%)
1895	3.2	9.6	0.92
1900	4.2	8.8	0.46
1905	8.4	17.9	1.52
1910	20.6	39.2	1.80
1915	7.5	13.7	0.28
1920	105.1	61.7	1.00
1925	29.9	22.1	0.16
1930	58.3	61.7	0.63
1935	164.4	162.6	1.24
1940	339.4	154.7	0.77

Source: K. Emi, *Shihon keisei*.

4. Fluctuations in Building Investment

In order to get a total view of the completed long-term series of figures
for residential, commercial, and industrial buildings arrived at above, let us
find five-year averages for each series and plot them in the form of a graph.
From Figure 3 we see that the growth of housing investment has been ex-

tremely slow, while in contrast, there has been a rapid increase in investment in commercial and industrial buildings. This fact also appears in Table 10 in the decline in housing investment's share of total building investment. It is not necessarily appropriate to consider the fluctuations in building investment shown in the figure in relation to business fluctuations, but the fact

Figure 3. GROSS VALUE INVESTED IN BUILDING (in 1934–36 prices)
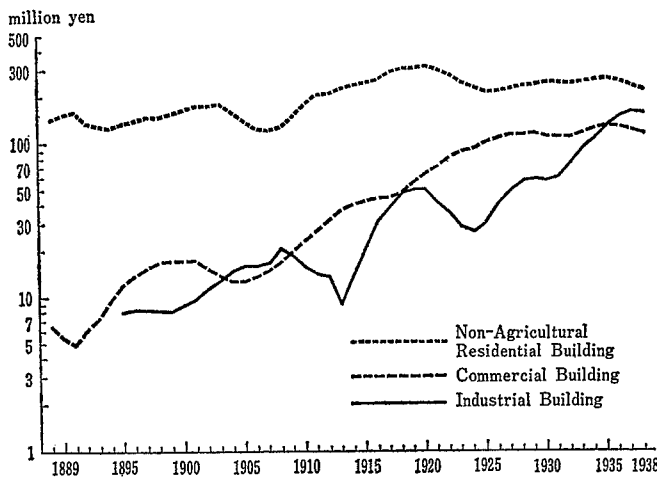
Note: The figure are interms of five-year moving averages.

Table 10. BREAKDOWN OF VALUE INVESTED IN BUILDING BY PRIVATE SECTOR

	Gross Value Invested (1934–36 prices)	As % of Gross Value Invested		
		Non-Agri-cultural Housing	Commercial Building	Industrial Building
	(million yen)	(%)	(%)	(%)
1887–1896	144.6	94.4	5.6	...
1892–1901	164.8	86.5	8.3	5.2
1897–1906	185.7	85.5	8.3	6.2
1902–1911	189.3	82.3	8.8	8.9
1907–1916	243.8	80.8	12.4	6.8
1912–1921	258.9	77.5	13.5	9.0
1917–1926	387.7	70.9	19.1	10.0
1922–1931	387.3	61.9	26.9	11.2
1927–1936	458.1	55.0	26.4	18.6
1931–1940	485.6	49.3	24.3	26.4

Note: To estimate the gross value of total building investment in the private sector, we must add investment in agricultural housing, private nonprofit institutions, privately-operated transportation and electricity, to the above components.

Source: K. Emi, *Shihon keisei.*

that changes in industrial building are extremely cyclical may be due to their being closely connected with fluctuations in equipment investment, the heart of the business cycle. Again, it appears that there is some time-lag between investment in commercial building and in industrial building. It is not appropriate, however, to connect the figure with the building cycle, and a separate study is required for the purpose of obtaining the building cycle.[10]

These long-term trends in shares of building investment in the pre-war years have changed considerably since the Second World War. In the latter half of the 1950's the share of housing in total value invested in building by private sector rose to almost 60%, while the share of commercial and industrial buildings declined to a level of 20%. This increase in housing investment is a characteristic of building investment after the war.

IV. INVESTMENT IN PRODUCERS' DURABLE EQUIPMENT

When we roughly divide capital formation into construction and equipment, equipment primarily represents private enterprise investment in producers' durable equipment. In concrete terms this means that the purchase of such items as machinery and tools, vehicles, and ships. However, as we have already pointed out, unlike government investment, this portion is estimated by the commodity flow method. For the pre-war period we take as our basic source-material the Factory Statistics available from 1910, and for the post-war period the *Kōgyō tōkeihyō* (Census of Manufactures), and abstract the value of producers' durable equipment from the total value produced by the machine and tool industry. Adding to this the income from processing and repairs accruing to the machinery producing industry and the value of machinery and tools produced by government-operated factories, we get the value of producers' durable equipment produced in Japan. If we add imports of machinery and deduct exports of machinery we get a figure for equipment investment in Japan. This method was developed by Professor Simon Kuznets.[11] In Japan estimates for the years 1914–1936 have been carried out by Professor Miyohei Shinohara, and series are available for construction investment as well as for equipment investment. A portion of government investment is included in these figures for equipment and construction investment, and consequently it is necessary to distinguish between that of the government and the private sector. A simple and convenient method of doing this is to obtain private investment by deducting government investment in construction and equipment as estimated by the author from investment in construction and equipment as estimated by the commodity

[10] In Professor Shōzaburō Fujino's analysis of the business cycle, it is pointed out that waves of the building cycle in Japan occur at intervals of approximately 15 years. Shōzaburō Fujino, *Nippon no keiki junkan* (The Business Cycle in Japan), Tokyo, Keisō-shobō, 1965, p. 22.

[11] Simon Kuznets, *Commodity Flow and Capital Formation*, Vol. I., New York, NBER, 1938.

flow method. Let us present, in Table 11, the figures estimated by Professor Miyohei Shinohara.

The table shows that the fluctuations in equipment investment have a shorter cycle than that of construction investment, for construction investment exhibits long-term mild fluctuations. This fact shows a supplementary role of construction investment in relation to equipment investment, and we see evidence of this in the fact that, while equipment investment remained static after the First World War, construction investment on the contrary rose. Looking at the proportion of GNP represented by capital formation (including investment in both equipment and construction), we find this to have been between 10.5% and 21.7% with a long-term rise in the percentage. If annual average growth rates for real construction investment and real equipment investment are worked out for the years 1923–1936, the lowest years for equipment investment, the rate for equipment investment is 10.0% and that for construction 8.9%. In particular it is to be noted that there was no great fall in the figures during the business depression in the 1930's. Our estimates extend those of Shinohara's in both directions in time, and we will give these

Table 11. SHINOHARA'S ESTIMATIONS OF CAPITAL FORMATION

(in million yen)

	Producers' Durable Equipment (A)	Construction (B)	Capital Formation (C)	GNP (D)	$\frac{(C)}{(D)}$ (E)	Real Producers' Durable Equipment (F)	Real Construction (G)
1914	267	181	448	4,253	10.5	555	386
1919	1,213	912	2,126	14,924	14.2	1,021	834
1920	1,547	1,003	2,550	13,125	19.4	1,184	732
1921	1,085	980	2,065	12,140	17.0	1,074	977
1922	940	1,100	2,040	12,355	16.5	952	1,110
1923	691	1,278	1,969	13,053	15.1	688	1,208
1924	793	1,444	2,237	14,403	15.5	762	1,480
1925	754	1,230	1,984	15,112	13.1	742	1,452
1926	822	1,422	2,244	14,670	15.3	912	1,805
1927	856	1,327	2,183	14,611	14.9	1,000	1,810
1928	922	1,445	2,367	14,852	15.9	1,083	1,877
1929	1,090	1,466	2,556	14,799	17.3	1,302	1,901
1930	896	1,056	1,952	13,850	14.1	1,300	1,751
1931	619	869	1,488	12,520	11.9	1,062	1,583
1932	763	969	1,732	13,043	13.3	1,245	1,634
1933	1,065	1,257	2,322	14,334	16.2	1,557	1,838
1934	1,380	1,495	2,875	15,672	18.3	2,038	2,186
1935	1,441	1,648	3,089	16,734	18.5	2,041	2,478
1936	1,787	2,072	3,859	17,800	21.7	2,376	3,065

Note: 1. Fluctuations in inventory are ignored.
2. (F) and (G) are real values in 1921–23 prices.

Source: Miyohei Shinohara, " Nihon no shihon keisei " (Capital Formation in Japan), *Keizai kenkyū*, Vol. 4, No. 1 (Jan., 1953).

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later in our summary of capital formation.

Let us now compare the patterns of fluctuation of construction and equipment investment in the pre-war period with those of the post-war period (1951–1965).

In the post-war period both construction and equipment have shown a strong growth trend, and there are only slight signs of the cyclical fluctuations characteristic of the pre-war period. Equipment investment shows wider fluctuations than construction investment, as we have already pointed out, and this also appears in the post-war period.

Figure 4. PATTERNS OF OF FLUCTUATION OF CONSTRUCTION AND EQUIPMENT INVESUMENT (in 1934–36 Prices)
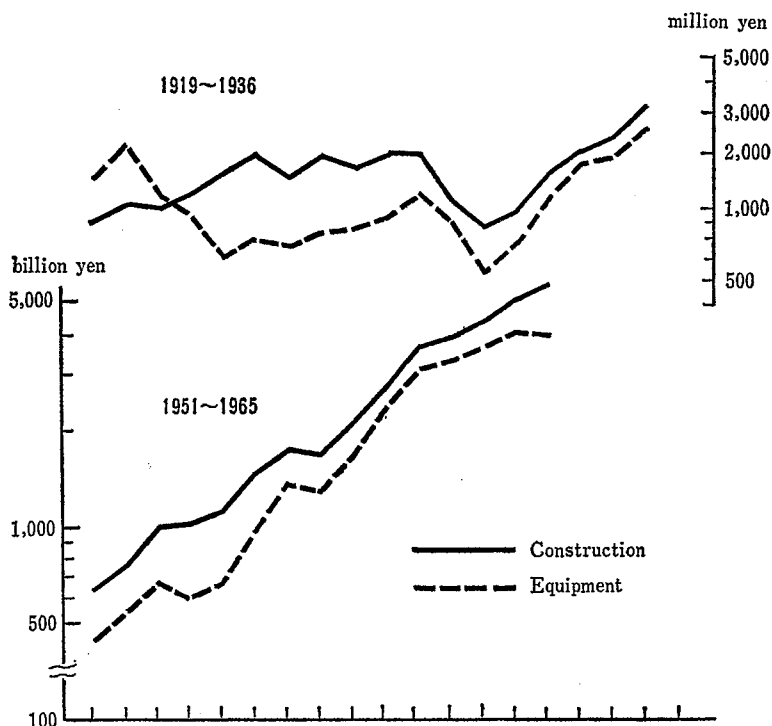
Note: The Values for 1919–1936 are measured on the right-hand scale, and those for 1951–1965 on the left-hand scale.

V. INVESTMENT IN TRANSPORTATION, TELECOMMU- NICATIONS, AND PUBLIC UTILITIES

The greater part of transportation, telecommunications, and public utilities are run by the state and by local public organizations, and since these are included in government capital formation the items we shall take up here

are private enterprise investment in electricity supply and private railways. One method of obtaining figures on investment in electricity is to take fixed assets appearing in the balance-sheets of the electricity companies and regard the annual increases as capital formation. A second method is to select a number of bench-mark years, finding construction expenditures per kilowatt by hydro- and solid fuel electrical generating stations in these years, and on the other hand, finding the annual increases in electricity generated by hydro- and solid fuel generating stations and multiply these two together, regarding the result as capital formation. Neither method is complete in itself, and it is necessary to use them to complement one another.

Table 12. PRIVATE ENTERPRISE INVESTMENT IN ELECTRICITY AND RAILWAYS (in thousand yen)

	Electricity	Private Railways	Total
1905	16,167	22,593	38,760
1901	37,115	30,669	67,784
1915	29,786	28,122	57,908
1920	77,625	62,254	139,879
1925	179,845	103,485	283,330
1930	209,657	155,854	365,511
1935	66,881	21,808	88,689
1940	83,656	138,958	222,614

Source: H. Rosovsky, *Capital Formation in Japan, 1868–1940*, Tables X-7, X-8, pp. 302–305.

Next, with regard to expenditures for the construction of private railways, it will be sufficient if we take the construction costs of lines opened for traffic as given in the local railway statistical reports. However, for equipment investment in vehicles (rolling-stock) and other items, we must employ the method of inferring on the basis of the proportion between construction and equipment investment on the national railways. We note, however, that since this portion is included under equipment investment when we use the commodity flow method we must take care not to duplicate it in our calculations. The rapid growth between 1905 and 1930 is conspicuous when viewed in the table. The low figures for 1935–1940 appear to be due to institutional factors, rather than to the effects of fluctuations in the state of business.

VI. OTHER PRIVATE CONSTRUCTION

Here we shall be concerned with estimates for items not included in Sections IV and V above, and among these the main item is building by private non-profitmaking institutions. For this item fragmentary information can be obtained from the statistical publications of local public organizations, but in the present case we have based our estimates on the Ministry of

Education's annual report of statistics, using the following formula:

$$\frac{Number\ of\ pupils\ at}{private\ schools} \times \frac{Expenditure\ for\ construction\ of\ new\ public\ schools}{Number\ of\ pupils\ in\ public\ schools}$$

It is assumed that in the building of schools the area per pupil in private schools is the same as in that in public schools. Equipment investment in schools is regarded as trifling, and no particular account is taken of it. Our estimations are given in the following table.

The proportion of total investment in the building of schools carried out by private schools is, in the last analysis, the same as the proportion of

Table 13. INVESTMENT IN THE BUILDING OF SCHOOLS, 1880–1937

(in thousand yen)

	Private Schools (A)	Public Schools (B)	Total (C)=(A)+(B)	Private Residential (Building) (D)	$\frac{(A)}{(C)}$ (%)	$\frac{(A)}{(D)}$ (%)
1880	26	799	825	...	3.2	...
1890	15	737	752	18,617	2.0	4.0
1900	178	10,877	11,055	45,546	.6	24.3
1910	272	20,167	20,439	51,960	1.3	39.3
1920	768	54,341	55,109	260,010	1.4	21.2
1930	1,072	45,089	46,161	189,378	2.4	24.4
1937	2,492	82,002	84,494	341,139	3.0	24.8

Source: Kōichi Emi, *Nihon no shihon keisei*–I– (Capital Formation in Japan-Part I), Long-term Economic Statistics B. 33, Institute of Economic Research, Hitotsu-bashi University, July, 1959 (mimeographed).

private school pupils in the total number of both public and private school pupils. This is a trifling magnitude of 1–3%. If, now, we look at the proportion of private building investment in the sum of private and public school construction, we see that it has been more or less constant at between 21% and 24% since 1900, when the compulsory education system was put into effect, with the exception of the period 1910–1919. The relationship here represented is that new investment in the building of schools is a function of the increase in numbers of pupils, and is the same as that private new investment in housing is a function of population increase. Since, of course, the numbers of pupils are a function of population it is to be inferred that the building of schools will exhibit a pattern of fluctuation more or less the same as that of private investment in housing with some time-lag.

VII. FLUCTUATIONS IN FIXED CAPITAL FORMATION

In addition to the items considered above, the increase in inventory stocks as a part of capital formation remains to be estimated. But as we have already pointed out, we cannot obtain reliable results because of the lack of data for the pre-war period. Accordingly, by way of summary, I now wish

to take a general view of the long-term trend of gross fixed capital formation over the pre- and post-war periods, inventory stocks excepted. Table 14 shows fixed capital formation. The figures for the pre-war period are overlapping ten-year averages and those for the post-war period five-year averages. The data presented here are non-military in character. It is to be noted, however, that since the Economic Planning Agency estimates for 1931–1940 include inventory, it is necessary to reduce them by approximately 10% in order to adjust them to the pre-war series estimated by the author. First, in viewing the trend of the proportion of GNP occupied by gross fixed capital formation in Japan we find that from a figure of 10% in the 1890's, by which time the foundations of a capitalist economy had been firmly laid down in Japan, there have been steady annual increases going up to 18.7% before the Second World War. It was this consistently rising trend which constituted the driving force behind the growth of the Japanese economy. Looking at the shares of the private and government sectors in this process of growth we may say that the government share was on the average 30%.

Table 14. TREND OF FIXED CAPITAL FORMATION IN JAPAN
(1887–1940: in million yen; 1951–1965: in thousand million yen)

	Fixed Capital Formation in Japan (A)	As % of Fixed Capital Formation in Japan		GNP (B)	$\frac{(A)}{(B)}$ (%)
		Private Enterprise (%)	Government (%)		
1887–1896	111	80.2	19.8	975	11.4
1892–1901	173	69.9	30.1	1,585	10.9
1897–1906	230	68.3	31.7	2,235	10.3
1902–1911	357	65.8	34.2	2,927	12.2
1907–1916	497	66.0	30.4	3,973	12.5
1912–1921	1,166	73.5	26.5	7,980	14.6
1917–1926	1,982	68.8	31.2	12,667	15.6
1922–1931	2,322	67.1	32.9	14,023	16.6
1927–1936	2,431	71.0	29.0	14,822	16.4
1931–1940	3,983	79.6	20.4	21,280	18.7
1931–1940	4,562	84.4	15.6	21,280	21.4
1951–1955	1,504	66.1	33.9	7,127	21.1
1956–1960	3,502	72.9	27.1	12,385	28.3
1961–1965	8,230	69.9	30.1	24,995	32.9

Sources: 1. For 1887–1940, Kōichi Emi & Yūichi Shionoya, *Zaisei shishutsu* (Expenditures in Public Finance), Tokyo Tōyōkeizai shimpō-sha, 1966, p. 33, and Kōichi Emi, *Government Fiscal Activity and Economic Growth in Japan, 1868–1960*, Tokyo, Kinokuniya, 1963, Appendix Table.

2. For 1931–1940, Economic Planning Agency, *Kokumin shotoku hakusho* (White Paper on National Income), 1963, Table 5, pp. 154–155.

3. For 1951–1965, Economic Planning Agency, *Kokumin shotoku tōkei nempō*, 1967, Table 3.

We note, however, that the reason why the government share was so small in the periods 1912–1921 and 1931–1940 were that the former period included the quasi-wartime years of the First World War and the latter the quasi-wartime years leading up to the Second World War. If we include military equipment investment in our consideration of capital formation, the drops in the figures in these two periods will disappear.

It is shown that the proportion of GNP occupied by fixed capital formation in the post-war period rose at a still more rapid tempo than in the pre-war period, being particularly marked in the period of rapid economic growth between 1956 and 1960 and in the last five years when it exceeded 30%. This level of over 30% is on the long-term trend of capital formation in pre-war Japan, including military items. In terms of macro-distribution of national resources we may regard it as representing an increase due to substitution resulting from decreased military investment. The ratio between private and government investment in the post-war period more or less coincide with that of normal times before the war. We note, however, that the reason for the private sector's share increasing during stages 1 and 2 and declining again in stage 3 of the post-war period is that the importance of private equipment investment and of construction investment carried out mainly by the government have changed places.

As we have already noted, inventory investment is not included in our consideration of capital formation. But if we were to include inventory investment we might amend the figures from 1951 as follows. Since the greater part of inventory investment is carried out by private enterprises the result will be that the private sector's share of investment will be increased by about 2–3% and the government share correspondingly reduced. However, there will be no effect on the long-term trend of growth.

Table 15.　GROSS DOMESTIC CAPITAL FORMATION IN JAPAN, AND
BREAKDOWN, 1951–65　　　　　　　　　　　(in million yen)

	Gross Domestic Capital Formation (A)	As % of (A)		GNP (C)	$\frac{(A)}{(C)}$ (%)
		Private (%)	Government (%)		
1951–1955	1,789	69.9	30.1	7,127	25.1
1956–1960	4,030	75.8	24.2	12,385	32.9
1961–1965	8,991	72.2	27.8	24,995	36.0

Source: Economic Planning Agency, *Kokumin shotoku tōkei nemō*, 1967, pp. 46–47.

Thus it appears that capital formation has risen throughout the pre-war and post-war periods, both absolutely and relatively, and, furthermore, that the government's contribution of 30% is by no means a characteristic confined to the post-war period but may be said to have been maintained more or less constant from before the war.

VIII. CONCLUSION

In the above we have presented something in the nature of a general interpretation of the results of estimations of capital formation in Japan, centred on the pre-war period. We may summarize these results as follows:

(1) The basic factor sustaining the high rate of growth in Japan's economy over the pre- and post-war periods was a constantly maintained capital formation based on a high rate of saving.

(2) Throughout the whole pre-war period the government's share in gross domestic fixed capital formation in Japan, including military items, was never less than 40%. Within this government investment in the broad sense of the term it is estimated that in peacetime around 10% of construction investment and 70% of equipment investment was directed to military purposes, and that the latter in particular exerted a strong demand effect on the growth of heavy industry in Japan.

(3) Confining our attention to non-military investment, the government's share in gross domestic fixed capital formation is seen to have maintained long-term figures in the region of 30%. The central government directed its main efforts to transportation and telecommunications while local governments directed theirs to public works and the building of schools.

(4) The main part of capital formation by the private sector during the first-half of the period observed here is represented by building, but there was a marked growth in producers' durable equipment seen from the 1910's.

(5) Within private investment in building the share occupied by residential buildings has gradually declined, while the construction of commercial and industrial buildings has progressively increased.

(6) Within private investment in productive equipment the share of shipping, which was predominant in the first-half of the period, declined, and after the First World War progressive increases took place in machinery and electrical equipment.

(7) While there were mild long-term fluctuations in construction carried out in either government or private investment, productive equipment rose rapidly from the 1910's, accompanied by fluctuations deriving from the so-called " equipment cycle."

(8) After the Second World War, the proportion of GNP represented by gross domestic fixed capital formation in Japan has risen in excess of 30%, and the highest relative importance in investment items has gone from contruction connected with national reconstruction in the first stage of the post-war period; to equipment investment for the purposes of rationalization which accompanied technical innovation in the second stage; and then to construction investment for the purposes of social development in response to the enlargement of productive potential in the third stage. As we pointed out in Figure 4, the cycles in construction and equipment were growth cycles, and it is expected that the trends towards increases in capital formation will continue into the future.