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# A STUDY ON THE CAPITAL COSTS IN THE JAPANESE ENTERPRISES FOR LONG-RANGE PLANNING

by

*Ryûei Shimizu*

## ***Foreword***

Enterprises need a large amount of money to carry plans for equipment investment, research and development or long-range personnel program. To raise such money, they issue stocks and bonds or make borrowings of long- and short-terms directly from financial institutions such as banks and insurance companies. Furthermore they utilize their money which comes from depreciation allowance and other internal reserves in a large measure. So, the long-range business planning becomes possible only when the capital costs of these various kinds of money are made clear. Up to the present, positive studies on the nominal cost of capital, taking forms of dividend, interest payment or annual interest rate, have been performed to a certain degree. However, few studies have been made on the capital cost in its substantial sense. This has been an obstacle to reasonable long-range planning, including plans of capital structure and equipment investment.

To fill such gap, in this paper firstly the capital costs of various kinds for some selected Japanese companies will be studied. Next, aggregate capital cost for each of these companies will be computed on the base of the capital structure for 1962-63. Such aggregate capital cost based on respective capital structures may be useful also as the foundation for many sorts of operation research calculation, e.g. minimum discount rate for equipment investment or capital cost in inventory planning, we believe.\*

## ***Section 1. The Capital Cost of Stock***

As for the capital cost of stock, we have presented already the formula of computation (we call it "Shimizu's Formula") and illustrated some results

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\* Refer also the writer; "Waribikiritsu oyobi shihon cost no santei process" (The Calculating Process of the Discount Rate and Capital Cost) Mita Shogaku Kenkyu, Vol. 6, No. 1.

in the Mita Shogaku Kenkyu, Vol. 6, No. 6. As my comments there were not complete about the basic concept and details of computation, we received many questions and inquiries. So, we shall here again explain the basic ideas and computation process.

As the base for computing the capital cost of stock, we take four fundamental assumptions. First, today most stockholders, especially "investment companies" such as insurance companies, regard the dividend as stable interest income. They look themselves not as the owners of enterprise, but as the receivers of interest for invested capital. Such concept may not conform to the basic principle of stock, that is, enterprise divides profit to stockholders when it is gained but the dividend is needless when there is no profit. However, such principle of stock in its primitive sense must be modified today, in view of the present state of matters that stocks are widely distributed to the mass stockholders with petty-bourgeois sense, or stocks are held by investment companies, and both of them regard the dividend as stable interest.

The second assumption is: the stockholders appraise the service potentials of enterprise in terms of stock dividend and allocation of newly issued capital stock with non-payment in a long period. The long-term average price of a stock represents the value of appraisal by these numerous stockholders.

Third: enterprise behaves so as to maintain such long-term average price of stock, namely the stockholders' appraised value on the enterprise's service potentials, at a certain stable point. Otherwise, external factors work to support such price. In fact, the prices of many stocks, especially those of enterprises selected in this study, have shown stable average values over a period of one or two business cycles, though not without some up-and-down. This is because the Japanese enterprises, in the midst of rapid growth, have been constantly worried by money shortage and found resort in capital increase, as soon as some rises in stock prices make it possible, resulting in the same position of stock price as before the capital increase. Of course, in some cases the prices after capital increases became quite different. Such cases have been considered to reflect structural changes in enterprises themselves and the values of appraisal as well, and maintenance of new average prices after the changes has been pursued. (Cases of Nissan Auto and Kubota Ironworks). In other case where the appraisal value tends to decline due to declining profit, enterprise tries to prevent drop of stock price by way of allocating to the stockholders the same amount of newly issued stock with non-payment as dividend, instead of cash outlay. (Cases of Yawata Iron & Steel Co. and Fuji Iron & Steel Co.). Such measures are taken in order to avoid financial disadvantages at the time of offering stocks for public subscription, for instance, rise in the stock capital cost, and besides to prevent visible and invisible losses in-and outside of business, such as decline of enterprise's image in sales or deterioration of employees' morale. Furthermore, when market price of all stocks falls widely due to factors other than business fluctuation, various steps to sustain the market are taken by the government and financial institutions, under the name of protection for numberless

small investors, security business circle, financial institutions and even enterprises themselves. (For example the establishment of Kyodo Shoken Co. which has been established by many security business corporated with banks in order to prevent dropping down of the market price of stocks.) Such peculiar characters of the Japanese enterprises and surrounding interest groups help to maintain the long-term average prices of stocks. This is the third assumption.

The fourth assumption is: the pattern of business cycles and the structure of enterprise and demands structure of the past one to two business-cycle periods will not be changed during the coming projected period, namely a period of one business cycle. This assumption may be admittable so long as no definite cause can be found, that would bring about such fundamental changes in the future. Assumptions above are underlying our computation.

From the first assumption is born the character of cost of stock capital. From the second, third and fourth assumptions it may be said that the appraisal of stockholders upon an enterprise's service potentials will not change, so long as an enterprise behaves for the coming one business-cycle period similarly with the past one to two business-cycle periods. To speak more concretely, if the dividend and the gratis allocation of newly issued stocks with non-payment or newly issued gratis shares are continued as in the past, the average stock price will remain unchanged and steady growth of the enterprise will be possible, unless structural transformations in-and outside occur. On the ground of such policy of business, that is, a business expansion under stable stock price, the possibility of computing capital stock cost that has the sense of average is born.

The computation practice is made as follows.

(1) Monthly average prices of a stock for the past 8 to 9 years are plotted on graph.

(2) On the graph, a past similar fluctuation phase with the similar price with that of the present time-point (bold line P) is searched for in the period foregoing one to two cycles (bold line Q). (See Graph 1).

(3) Factually business cycles in Japan are seen with periodical time of 4 years; so, computation is made with respect to a term of 3 to 4 or 7 to 8 years. And, if the trend of stock price takes a pattern as is shown in Graph 2, the computation term is 8 years; if the pattern is Graph 3 (for example Nissan Auto and Kubota Iron-works), the term is 4 years, since supposedly a big change in the structure of enterprise or demand has occurred during the two periods.

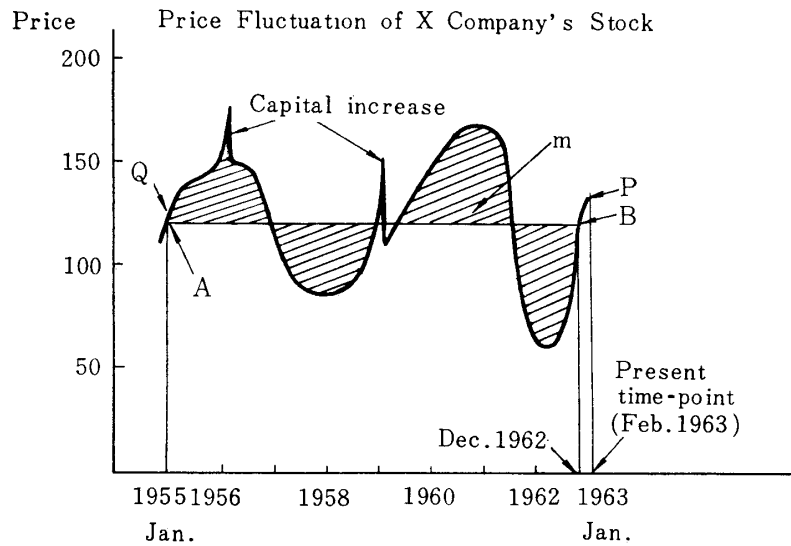
(4) Then, the average of prices through past and present phases is estimated. In this calculation, abnormal prices due to speculation or new share allocation are excluded. As an actual means a line is drawn in parallel to the horizontal axis, so that the above-line and below-line parts of the shaded portion get equal space (see the parallel line m in Graph 1).

(5) The intersecting point of the line m and the selected past phase Q is denoted with A, and that of the line m and the present phase P with B. The term AB is taken as the exact period of computation. In this study the present time-point is incidently put at a market recovering period, around

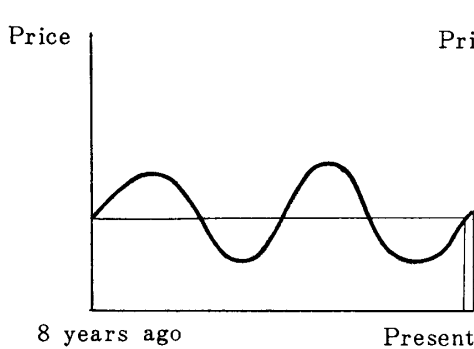
January, 1963, with the result that the current price and the average thus calculated have shown near values each other.

(6) Next, the capital cost is calculated, on the assumption that the past behaviors of the enterprise will be sustained. By projecting the past behaviors, computation is made on how much money the enterprise would raise by stock issue at present, and how much money it would have to pay in future as dividend or allocation of gratis shares increase. The equation of next page is an example of computation.

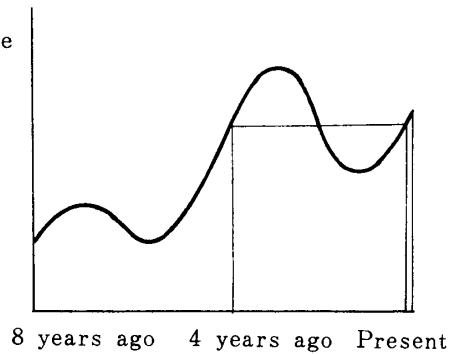
Graph 1.



Graph 2.



Graph 3.



## A Case of Computing Capital Cost of Stock, in x Company

Capital amount; Jan. 1955.	1,000,000,000 yen <sup>③</sup>
"    1963.	1,650,000,000 "
Rate of issue price; Average of (past issue prices/market prices at respective issues)=0.8 <sup>②</sup>	
Par value; 50 yen <sup>④</sup>	
Market price; Jan., 1955.	120 yen <sup>①</sup>
Dec., 1962.	122 " <sup>⑦</sup>
interim period. As shown in Graph 1	
Settlement; March and September	
Expense of stock issue; 0.025 yen per a share <sup>⑥</sup>	
1955-Jan. 31. (Capital raising by stock issue)	$120 \times 0.8 \times 1,000,000,000 / 50$ <sup>①②③④</sup>
-May 31. Payment of dividend (5 %)	$= 1,000,000,000 \times 0.05 / (1+r)^{4/12}$ <sup>⑤</sup>
-Nov. 30. " " "	$+ 1,000,000,000 \times 0.05 / (1+r)^{10/12}$
1956-Feb. 28. Capital increase-with payment 300,000,000 gratis 200,000,000	$- 300,000,000 + 0.025 \times 500,000,000 / 50 / (1+r)^{13/12}$ <sup>⑥</sup>
-May 31. Payment of dividend (5 %)	$+ 1,500,000,000 \times 0.05 / (1+r)^{16/12}$
-Nov. 30. " " "	$+ 1,500,000,000 \times 0.05 / (1+r)^{22/11}$
1957-May 31. " (4 %)	$+ 1,500,000,000 \times 0.04 / (1+r)^{28/12}$
-Nov. 30. " " "	$+ 1,500,000,000 \times 0.04 / (1+r)^{34/12}$
1958-May 31. " " "	$+ 1,500,000,000 \times 0.04 / (1+r)^{40/12}$
-Nov. 30. " (6 %)	$+ 1,500,000,000 \times 0.06 / (1+r)^{46/12}$
1959-Mar. 31. Gratis capital increase 150,000,000 yen	$+ 0.025 \times 150,000,000 / 50 / (1+r)^{50/12}$ <sup>⑥</sup>
-May 31. Payment of dividend (6 %)	$+ 1,650,000,000 \times 0.06 / (1+r)^{52/12}$
-Nov. 30. " " "	$+ 1,650,000,000 \times 0.06 / (1+r)^{58/12}$
1960-May 31. " " "	$+ 1,650,000,000 \times 0.06 / (1+r)^{64/12}$
-Nov. 30. " (5 %)	$+ 1,650,000,000 \times 0.05 / (1+r)^{70/12}$
1961-May 31. " " "	$+ 1,650,000,000 \times 0.05 / (1+r)^{76/12}$
-Nov. 30. " " "	$+ 1,650,000,000 \times 0.05 / (1+r)^{82/12}$
1962-May 31. " " "	$+ 1,650,000,000 \times 0.05 / (1+r)^{88/12}$
-Nov. 30. " " "	$+ 1,650,000,000 \times 0.05 / (1+r)^{94/12}$
-Dec. 31. (Repayment of stock capital)	$+ \{120 - (122 - 120)\} \times 1,650,000 / 50 / (1-r)^{95/12}$ <sup>⑦</sup>
	$r = \text{the capital cost}$

(7) As is seen in the last row of this formula, the computation assumes that the cash principal raised by stock is repayed after one to two business cycles. The amount of this repayment is supposed to be the "present value" of the total cash payments for the future infinite period after the assumed one to two business cycles. Under the above said first assumption, if an enterprise has raised money by stock issue it bears afterwards an

obligation to the public of making regular dividend payment and some measure of allocation of gratis share increase for infinite period. In order to conclude the computation to a period of one to two business cycles, such obligation for infinite period must be counted in at its "present value."

(8) The adjustment term in the last row is entered on the ground of the following concept. As stated above, the computation is made with respect to the period AB, but it would be rare that the intersecting points of the totally averaged stock price (line m) and the phases P and Q coincide with the respective monthly averaged prices; instead in most cases they would come to the deviated points from monthly averages. However, if the intersecting points differ from the factual stock prices at both P and Q phases, the case would contradict our object of computing capital cost by directly projecting past changes in the capital structure. Therefore, I have attempted to adjust the divergence at phase P, keeping the identity at phase Q, because an adjustment at phase P appears to have smaller influence upon capital cost than that at phase Q; for the power  $n$  in  $(1+r)^n$  is larger. And, the sign (positive or negative) is determined as follows. If the stock price at point B is slightly lower than the average, it tells that the stock-holders' appraisal on the enterprise's service potentials has been lower than expected despite delivered dividend and the like; that is, efforts of the enterprise have been insufficient, and so, for the sake of raising money by stock issue, more efforts than in the past would be required. Accordingly, in the computation, the stock price must be increased to the extent of price drop, in the "repayment term". Conversely, if the current price is slightly higher than that of the initial time-point, it is taken to reflect extra efforts of the enterprise, and the margin is reduced from the stock price of "repayment term" in the computation.

On the above explained grounds, the values of capital cost of stock for selected companies are computed as shown in Table 1. These 52 listed companies are chosen, because price fluctuations of their stocks have been depending mainly on business cycle and profitability, with little speculation in the market. The details of the computation have been given in the materials in Mita Shogaku Kenkyu, Vol. 6, No. 6.

Table 1 reveals firstly that the capital cost of stock is generally very high, the average being 0.292. This will mean a high cost, all the more, if taxation is taken into account, for the cost of other kinds of capital such as loan and bond can be counted into loss in Tax law.

The values listed have following features, if we view classifying them into three major sectors of "stagnant industries" (food, spinning, coal, movie film), "growth industries" (steel, glass & cement, electric power, gas) and "technical innovation industries" (electric machinery, chemicals, auto). In the stagnant sector, all values are below the average; those in food group are below 0.2 and in spinning below 0.25. In the growth sector, those in steel and glass & cement are around 0.30, near the average, but some companies with public nature show values below 0.20. In innovation industries, electric machinery, chemicals and auto are alike over 0.35, appreciably higher than the average.

Table 1. Values of Capital Cost of Stock for Selected Companies, by capital scales and industries

	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	average of industry
Nippon Suisan Kaisha				0.196		
Nichiro Gyogyo Kaisha -fishery-			0.182			0.189
Sapporo Breweries -brewery-			0.140			0.140
Daiwa Spinning Co.		0.213				
Kureha Spinning Co.			0.231			
Shikishima Spinnig Co.		0.361				
Nitto Spinning Co. -spinning-		0.192				0.249
Asahi Chemical Industry Co.			0.207			
Teijin				0.200		
Toyo Rayon Co.				0.286		
Kurashiki Rayon Co.			0.272			
Nihon Rayon Co. -synthetic fibre-			0.243			0.242
Oji Paper Co.			0.200			
Mitsubishi Paper Mills -paper-		0.225				0.213
Yawata Iron & Steel Co.					0.278	
Japan Steel & Tube Corp.					0.274	
Kubota Iron & Machinery Works				0.471		
Yodogawa Steel Works Co.		0.270				
Nippon Stainless Steel Co.	0.222					
Daido Steel Co. -steel-			0.371			0.314
Asahi Glass Co.				0.287		
Nippon Sheet Glass Co.			0.290			
Onoda Cement Co.				0.145		
Shinagawa Hakurenga (Brick) -glass & pottery-		0.511				0.309
Sumitomo Chemical Co.				0.337		
Mitsubishi Chemical Industries				0.367		
Shinetsu Chemical Ind. Co.				0.350		
Ibigawa Electric Ind. Co.				0.212		
Tokuyama Soda Co.				0.407		
Sekisui Chemical Co. -chemicals-				0.567		0.373
Nissan Motor Co.				0.332		

(Continue)



	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	average of industry
Toyota Motor Co.				0.356		
Daihatsu Kogyo -vehicles-				0.371		0.354
Hitachi					0.512	
Tokyo Shibaura Electric Co.					0.495	
Mitsubishi Electric Corp.				0.309		
Matsushita Electric Ind. Co.				0.374		
Nippon Electric Co.				0.380		
Hokushin Electric Works		0.322				
Japan Storage Battery		0.269				
Fujikura Cable Works -electric-			0.294			0.370
Mitsubishi Shoji Kaisha				0.315		
C. Itoh and Co. -trading-				0.286		0.301
Nippon Express Co. -freight transport-				0.334		0.334
Tokyo Elect. Express Railway				0.186		
Odakyu Elect. Railway Co.		0.353				
Kinki Nippon Railway Co. -elect. railway-				0.208		0.249
Tokyo Elect. Power Co.					0.218	
Chubu Elect. Power Co.					0.202	
Kyushu Elect. Power Co. -electric power-				0.163		0.194
Tokyo Gas Co.				0.200		
Osaka Gas Co. -gas-				0.209		0.205
Average by Scales	0.222	0.302	0.243	0.302	0.324	

Total Average of 52 companies 0.292

To group companies by the public nature, including electric power, gas and railway, the values are below 25%, lower than the average, as may be expected. An unexpected fact is that chemical fibre industry belonging to the innovation group has a low value of below 25%.

## Section 2. The Capital Cost of Bond

Formerly bonds with numerous types of terms were issued, but currently they are reduced to about fifty sorts, with regard to corporate bonds issued since 1962, including electric power bond with general mortgage, bond with

enterprise property, bond with factory mortgage, and bond with mortgage on real estate or ship. First we compute the capital costs of these common types of bonds on the base of materials published by the Bonds Underwriter's Association (Kôshasai Hikiuke Kyôkai), and next applied the results to selected companies, using their Reports of Securities (Yûkashôken Hôkoku Sho).

Hitherto, in the computation of the capital cost of bond the factor of "time" was rather ignored. This is the way being taken also in the computation of the bond capital cost, called "issuers' yield rates of bonds," published by the Association. It is calculated at simple interest.

In this study, for the standpoint of long-range planning, we re-calculated it at compound interest in order to take the "time" factor into account (capital cost of bond (2) in Table 2 and 3). We found by this re-calculation that the costs based on compound rate calculation are generally higher than those not based on it (capital cost (1) in Table 2 and 3), and in some case, a cost of higher rate (when it is calculated at simple interest) compared with another has proved to be lower when compound rate is introduced, for example, B<sub>4</sub> and B<sub>5</sub>, B<sub>7</sub> and B<sub>8</sub>, C<sub>3</sub> and C<sub>4</sub>, C<sub>9</sub> and C<sub>10</sub>, and D<sub>9</sub> and D<sub>16</sub>. Table 2 and 3 show basic data and results of computation.

Table 2. Basic Data for the Capital Cost of Bond

Sort	Nominal Interest Rate	Issue Price	Redemption Rate (Semi-annual)	Mortgage Register Tax (per 100yen)	Initial Register Charge (per 100yen)	Acceptance Charge (per 100yen)	Trustee Charge (per 100yen)	Printing & Adv. Exp.	Trustee Remuneration (per 100 yen)	Interest Payment Charge	Redemption Charge (per 100yen)	Cost of Bond Capital	
												(1)	(2)
General mort.													
Nine Elect. Power Co. bond													
A <sub>1</sub>	7.3	99.50	3	—	10	160	30	1	—	130	50	8.07	8.14
Special bond													
A <sub>2</sub>	7.3	99.00	3	—	10	160	30	1	—	130	50	8.19	8.25
With enterprise property													
B <sub>1</sub>	7.3	99.50	3	15	10	160	30	1	15	130	50	8.26	8.49
B <sub>2</sub>	"	"	"	"	"	"	"	"	20	"	"	8.31	8.59
B <sub>3</sub>	"	99.00	"	"	"	"	"	"	"	"	"	8.44	8.71
B <sub>4</sub>	"	98.75	"	"	"	"	"	"	"	"	"	8.50	8.76
B <sub>5</sub>	"	99.50	4	"	"	"	"	"	"	"	"	8.33	8.87
B <sub>6</sub>	"	99.00	"	"	"	"	"	"	"	"	"	8.46	8.98
B <sub>7</sub>	"	98.75	"	"	"	"	"	"	"	"	"	8.52	9.04
B <sub>8</sub>	"	99.50	5	"	"	"	"	"	"	"	"	8.35	9.15
B <sub>9</sub>	"	99.00	"	"	"	"	"	"	"	"	"	8.48	9.27
B <sub>10</sub>	"	98.75	"	"	"	"	"	"	"	"	"	8.55	9.33
Factory mortgage													
C <sub>1</sub>	7.3	99.50	3	15	10	160	30	1	25	130	50	8.36	8.70
C <sub>2</sub>	"	99.00	"	"	"	"	"	"	"	"	"	8.49	8.81
C <sub>3</sub>	"	98.75	"	"	"	"	"	"	"	"	"	8.55	8.77
C <sub>4</sub>	"	99.50	4	"	"	"	"	"	"	"	"	8.38	8.98
C <sub>5</sub>	"	99.00	"	"	"	"	"	"	"	"	"	8.51	9.09
C <sub>6</sub>	"	98.75	"	"	"	"	"	"	"	"	"	8.58	9.15
C <sub>7</sub>	"	99.50	5	"	"	"	"	"	"	"	"	8.40	9.26
C <sub>8</sub>	"	99.00	"	"	"	"	"	"	"	"	"	8.54	9.38
C <sub>9</sub>	"	98.75	"	"	"	"	"	"	"	"	"	8.60	9.44
C <sub>10</sub>	7.5	99.00	3	"	"	"	"	"	"	"	"	8.70	9.03
C <sub>11</sub>	"	98.50	"	"	"	"	"	"	"	"	"	8.83	9.14
C <sub>12</sub>	"	99.00	4	"	"	"	"	"	"	"	"	8.72	9.31
C <sub>13</sub>	"	98.50	"	"	"	"	"	"	"	"	"	8.85	9.43
C <sub>14</sub>	"	99.00	5	"	"	"	"	"	"	"	"	8.74	9.61
C <sub>15</sub>	"	98.50	"	"	"	"	"	"	"	"	"	8.88	9.73

Table 3. Basic Data for the Capital Cost of Bond

Sort	Nominal Interest Rate	Issue Price	Redemption Rate (Semi-annual)	Mortgage Register Tax (per 100yen)	Initial Register Charge (per 100yen)	Acceptance Charge (per 100yen)	Trustee Charge (per 100yen)	Printing & Adv. Exp.	Trustee Remuneration (per 100 yen)	Interest Payment Charge	Redemption Charge (per 100yen)	Cost of Bond Capital	
												(1)	(2)
	%	yen	%	sen	sen	sen	sen	sen	sen	sen	sen	%	%
Real estate · ship mortgage													
D <sub>1</sub>	7.3	99.50	3	65	10	160	30	1	25	130	50	8.49	8.81
D <sub>2</sub>	"	96.00	"	"	"	"	"	"	"	"	"	8.66	8.92
D <sub>3</sub>	"	98.75	"	"	"	"	"	"	"	"	"	8.68	8.98
D <sub>4</sub>	"	99.50	4	"	"	"	"	"	"	"	"	8.51	9.09
D <sub>5</sub>	"	99.00	"	"	"	"	"	"	"	"	"	8.64	9.21
D <sub>6</sub>	"	98.75	"	"	"	"	"	"	"	"	"	8.71	9.26
D <sub>7</sub>	"	99.50	5	"	"	"	"	"	"	"	"	8.54	9.38
D <sub>8</sub>	"	99.00	"	"	"	"	"	"	"	"	"	8.67	9.50
D <sub>9</sub>	"	98.75	"	"	"	"	"	"	"	"	"	8.73	9.56
D <sub>10</sub>	7.5	99.00	3	"	"	"	"	"	"	"	"	8.83	9.14
D <sub>11</sub>	"	98.50	"	"	"	"	"	"	"	"	"	8.95	9.25
D <sub>12</sub>	"	99.00	4	"	"	"	"	"	"	"	"	8.85	9.43
D <sub>13</sub>	"	98.50	"	"	"	"	"	"	"	"	"	8.98	9.55
D <sub>14</sub>	"	99.00	5	"	"	"	"	"	"	"	"	8.88	9.73
D <sub>15</sub>	"	98.50	"	"	"	"	"	"	"	"	"	9.01	9.85

We shall make some comments on Tables. Par values of the listed bonds are all 100 yen. All is with redemption term of full seven years and unredeemed term of two years. Note may be needless for interest rate and issue par. Redemption rate is the portion of semi-annual redemption amount to the principal, to be redeemed after passing two and half years including two unredeemable years. Mortgage register tax, initial register charge, acceptance charge, trustee charge and printing and advertisement expenses are all initial costs at the time of issue. Trustee remuneration is a cost charged on the remaining amount at the end of each semi-annual term, being "going" cost which occurs in the redemption period. Interest payment charge is paid semi-annually and principal redemption charge is for the redemption amount semi-annually after two and half years, both being "going" costs. Data on these items are obtained from the Monthly Bond Report (Kôshasai Geppô) No. 81 published by the Bond Underwriter's Association, except printing and advertisement expenses by a study of Japan Industrial Bank (Nippon Kogyô Ginkô). Advertisement expense (for subscription and redemption) is very difficult to estimate because generally an advertisement concerns many companies' bonds at the same time. It is so also with printing because the number of printed sheets of a bond is very diversified by cases and has few relation with the issue amount. We have set it at 0.001 yen per 1 yen bond issue, taking various materials into consideration.

The capital cost (1) of bond is computed by the following formula.

$$\text{capital cost of bond(1)} = (\text{discount at issue} + \text{initial register charge} + \text{acceptance charge} + \text{trustee charge} + \text{interest payment charge} + \text{principal redemption charge} + \text{nominal interest rate}) / (\text{issue amount} - \text{discount at issue} - \text{initial register charge} - \text{acceptance charge} - \text{trustee charge}) \times \text{average years.}$$

where average years = redemption term years - (redemption amount at due times) × (redemption term years - unredeemed years) (redemption term years - unredeemed years - 1/2) / issue amount

This is the formula taken in the computation of the Bond Underwriter's Association.

The capital cost (2) is computed on the base of compound interest rate, putting focus on in-and out-flows of cash. The formula is shown below with respect, as an example, to an issue of C<sub>6</sub> type bond with an amount of 400 million yen.

$$\begin{aligned}
& 400,000,000 \times 0.9875^{\textcircled{1}} - (400,000,000 \times 0.126^{\textcircled{2}}) \\
& = \{400,000,000 \times 0.0365 \times (1 + 0.013)^{\textcircled{3}} + 400,000,000 \times 0.0025^{\textcircled{5}}\} / (1+r)^{1/2} \\
& + \{400,000,000 \times 0.0365 \times (1 + 0.013)^{\textcircled{4}} + 400,000,000 \times 0.0025\} / (1+r)^{2/2} \\
& + \{400,000,000 \times 0.0365 \times (1 + 0.013) + 400,000,000 \times 0.0025\} / (1+r)^{3/2} \\
& + \{400,000,000 \times 0.0365 \times (1 + 0.013) + 400,000,000 \times 0.0025\} / (1+r)^{4/2} \\
& + \{400,000,000 \times (1 - 0.00) \times 0.0365 \times (1 + 0.013) + 400,000,000 \times (1 - 0.00) \times 0.0025 + 400,000,000 \times 0.04^{\textcircled{6}} \\
& \quad \times (1 + 0.005)^{\textcircled{7}}\} / (1+r)^{5/2} \\
& + \{400,000,000 \times (1 - 0.04) \times 0.0365 \times (1 + 0.013) + 400,000,000 \times (1 - 0.04) \times 0.0025 + 400,000,000 \\
& \quad \times 0.04 \times (1 + 0.005)\} / (1+r)^{6/2} \\
& + \{400,000,000 \times (1 - 0.08) \times 0.0365 \times (1 + 0.013) + 400,000,000 \times (1 - 0.08) \times 0.0025 + 400,000,000 \\
& \quad \times 0.04 \times (1 + 0.005)\} / (1+r)^{7/2} \\
& + \{400,000,000 \times (1 - 0.12) \times 0.0365 \times (1 + 0.013) + 400,000,000 \times (1 - 0.12) \times 0.0025 + 400,000,000 \\
& \quad \times 0.04 \times (1 + 0.005)\} / (1+r)^{8/2} \\
& + \{400,000,000 \times (1 - 0.16) \times 0.0365 \times (1 + 0.013) + 400,000,000 \times (1 - 0.16) \times 0.0025 + 400,000,000 \\
& \quad \times 0.04 \times (1 + 0.005)\} / (1+r)^{9/2} \\
& + \{400,000,000 \times (1 - 0.20) \times 0.0365 \times (1 + 0.013) + 400,000,000 \times (1 - 0.20) \times 0.0025 + 400,000,000 \\
& \quad \times 0.04 \times (1 + 0.005)\} / (1+r)^{10/2} \\
& + \{400,000,000 \times (1 - 0.24) \times 0.0365 \times (1 + 0.013) + 400,000,000 \times (1 - 0.24) \times 0.0025 + 400,000,000 \\
& \quad \times 0.04 \times (1 + 0.005)\} / (1+r)^{11/2} \\
& + \{400,000,000 \times (1 - 0.28) \times 0.0365 \times (1 + 0.013) + 400,000,000 \times (1 - 0.28) \times 0.0025 + 400,000,000 \\
& \quad \times 0.04 \times (1 + 0.005)\} / (1+r)^{12/2} \\
& + \{400,000,000 \times (1 - 0.32) \times 0.0365 \times (1 + 0.013) + 400,000,000 \times (1 - 0.32) \times 0.0025 + 400,000,000 \\
& \quad \times 0.04 \times (1 + 0.005)\} / (1+r)^{13/2} \\
& + \{400,000,000 \times (1 - 0.36) \times 0.0365 \times (1 + 0.013) + 400,000,000 \times (1 - 0.36) \times 0.0025 + 400,000,000 \\
& \quad \times (1 - 0.36) \times (1 + 0.005)\} / (1+r)^{14/2}
\end{aligned}$$

$r$  = the capital cost of bond (2) to be computed = 0.0915

where 0.9875<sup>①</sup>; issue price/par value  
0.0216<sup>②</sup>; mortgage register tax (0.0015) + initial register charge  
(0.0010) + acceptance charge (0.0160) + trustee charge (0.0030)  
+ printing and advertisement expenses (0.0001) = initial cost  
0.0365<sup>③</sup>; nominal interest rate payable (semi-annual)  
0.013<sup>④</sup>; interest payment charge  
0.0025<sup>⑤</sup>; trustee remuneration  
0.04<sup>⑥</sup>; rate of redemption (semi-annual)  
0.005<sup>⑦</sup>; principal redemption charge

This capital cost of bond (2) is usable for long-range planning. In Table 4, the formula is applied to selected companies.

Table 4 reveals that the capital cost of bond is far lower than that of capital stock and appreciably low compared with that of loans to be explained later. All of the values are below 10%. And, so far as the studied enterprises are concerned, they show a fair degree of concentration; 8.14 to 9.56%. The small differences among them cannot be regarded as reflecting the particularities of enterprises. However, it is seen, among enterprises with each capital of 5 to 100 billion yen the cost declines slightly as the capital scale is larger. The costs in the public nature group—electric

Table 4. Values of Capital Cost of Bond for Selected Companies, by capital scales and industries

	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	Av. for Industry
Nippon Suisan Kaisha				0.0944		
Nichiro Gyogyo Kaisha -fishery-			0.0956			0.0950
Sapporo Breweries			—			
Daiwa Spinning Co.		0.0887				
Kureha Spinning Co.			0.0887			
Shikishima Spinning Co.		0.0887				
Nitto Spinning Co. -spinning-		0.0887				0.0887
Asahi Chemical Industry Co.			0.0944			
Teijin				0.0944		
Toyo Rayon Co.				0.0944		
Kurashiki Rayon Co.			0.0944			
Nihon Rayon Co. -synthetic fibre-			0.0944			0.0944
Oji Paper Co.			—			
Mitsubishi Paper Mills* -paper-		0.0944				0.0944
Yawata Iron & Steel Co.					0.0849	
Japan Steel & Tube Corp.					0.0849	
Kubota Iron & Machinery Works				0.0951		
Yodogawa Steel Works Co.		—				
Nihon Stainless Steel Co.	—					
Daido Steel Co. -steel-			—			0.0871
Asahi Glass Co.			—			
Nippon Sheet Glass Co.				—		
Onoda Cement Co.				0.0915		
Shinagawa Brick -glass & pottery-		—				0.0915
Sumitomo Chemical Co.				0.0915		
Mitsubishi Chemical Indu- stries				0.0915		
Shinetsu Chemical Ind. Co.				0.0944		
Ibigawa Electric Ind. Co.				0.0931		
Sekisui Chemical Co. -chemicals-				—		0.0926
Nissan Motor Co.				0.0915		
Toyota Motor Co.				0.0915		
Daihatsu Kogyo				0.0915		

(Continue)

	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	Av. of for Industry
-vehicles-						0.0915
Hitachi					0.0898	
Tokyo Shibaura Electric Co.					0.0898	
Mitsubishi Electric Corp.				0.0915		
Matsushita Electric Ind. Co.				0.0915		
Nippon Electric Co.				0.0915		
Hokushin Electric Works		0.0915				
Japan Storage Battery**		unknown				
Fujikura Cable Works			0.0915			
-electric-						0.0909
Mitsubishi Shoji Kaisha				—		
C. Itoh and Co.				—		
-trading-						—
Nippon Express Co.				0.0875		
Tokyo Elect. Express Railway				0.0875		
Odakyu Express Railway Co.		0.0875				
Kinki Nippon Railway Co.				0.0875		
-communication-						0.0875
Tokyo Electric Power Co.					0.0814	
Chubu Electric Power Co.					0.0814	
Kyushu Electric Power Co.				0.0814		
-electric power-						0.0814
Tokyo Gas Co.				0.0870		
Osaka Gas Co.				0.0870		
-gas-						0.0870
Av. by scales	—	0.0899	0.0931	0.0907	0.0854	

Total av. of 39 companies 0.0904

Note: No bond issue by mark (—) companies.

\* Issue in 1964.

\*\*No issue since 1962.

power, gas, railway—are all below 9%, the lowest as a group. In “innovation” industries all the values are higher than the average, and, interesting to note, chemical fibre industry has the highest value in contrast to its low position in the stock capital cost. In “growth and stagnant” sectors the costs are divergent. Fishery in “stagnant” sector, with a very low value of capital stock cost, presents a very high value here similarly with the cases of long- and short-term loans as will be shown later.

### *Section 3. The Capital Cost of Long-term Loan (Borrowing)*

As the basic data for computing the capital cost of long-term loan we

Table 5. Basic Data for Computing Capital Cost Values of Long Term Loans

	Lenders of Long-Term Loans	Av. Nominal Rate of Interest
Nippon Suisan Kaisha	Kogin, Chogin, Kangin	0.09238
Nichiro Gyogyo Kaisha	Chogin, Mitsubishi Trust Bank, Kogin	0.09285
Sapporo Breweries	Yasuda Trust Bank, Daiichi Bank, Fuji Bank	0.09003
Daiwa Spinning Co.	Sumitomo Trust Bank, Toyo Trust Bank	0.09308
Kureha Spinning Co.	Kogin, Yasuda Trust Bank, Kaigin, Sumitomo Trust Bank	0.08836
Shikishima Spinning Co.	Chogin, Sumitomo Trust Bank, Daiwa Bank	0.08850
Nitto Spinning Co.	Kogin, Mitsui Trust Bank	0.09102
Asashi Chemical Industry Co.	Kogin, Chogin, Sumitomo Trust Bank	0.09233
Teijin	Toyo Trust Bank, Chogin, Kogin	0.09125
Toyo Rayon Co.	Chogin, Mitsui Trust Bank, Toyo Trust Bank	0.08933
Kurashiki Rayon Co.	Kogin, city banks consortium	0.08875
Nihon Rayon Co.	Kogin, Toyo Trust Bank, Chogin	0.09088
Oji Paper Co.	Chogin, Mitsui Trust Bank, Sumitomo Trust Bank	0.08933
Mitsubishi Paper Mills	Mitsubishi Trust Bank, Mitsubishi Bank	0.09034
Yawata Iron & Steel Co.	Chogin, Kogin, Kaigin	0.09002
Japan Steel & Tube Corp.	Kogin, Chogin, IRDB, Mitsui Trust Bank	0.08972
Kubota Iron & Machinery Works	Sumitomo Trust Bank, Kogin, Daiwa Bank	0.09105
Yodogawa Steel Works Co.	Chogin, Daiwa Bank, Yasuda Trust Bank	0.09553
Nihon Stainless Steel Co.	Sumitomo Trust Bank, Hokkaido-Tohoku Development Fund	0.09095
Daido Steel Co.	Kogin, Tokai Bank, Mitsubitshi Trust Bank	0.09115
Asahi Glass Co.	Mitsubishi Trust Bank, Chogin, Kogin	0.08720
Nippon Sheet Glass Co.	Sumitomo Trust Bank, Kogin	0.08760
Onoda Cement Co.	Kogin, Sumitomo Trust Bank, Mitsui Trust Bank, Kyowa Bank, Mitsui Bank	0.09303
Shinagawa Brick	Fukoku Mutual Life Insurance, Girad, Sumitomo Trust Bank	0.08448
Sumitomo Chemical Co.	Kogin, Sumitomo Trust Bank	0.08983
Mitsubishi Chemical Industries	Mitsubishi Bank, Mitsubishi Trust Bank, Kogin, Chogin	0.08896
Shinetsu Chemical Ind. Co.	Chogin, Mitsubishi Trust Bank, Agricultural Central Fund	0.09490
Ibigawa Electric Ind. Co.	Kogin	0.09290
Tokuyama Soda Co.	Kogin, Sumitomo Trust Bank, Sanwa Bank	0.08010
Sekisui Chemical Co.	Kogin, Chogin, Daiichi Life Insurance	0.09484
Nissan Motor Co.	Washington Ex-Im Bank, Kogin, Yasuda Trust Bank, Mitsubishi Trust Bank	0.07914
Toyota Motor Co.	Washington Ex-Im Bank, Chogin, Mitsui Trust Bank	0.07858
Daihatsu Kogyo	Kogin, Toyo Trust Bank	0.09395

(Continue)

	Lenders of Long-Term Loans	Av. Nominal Rate of Interest
Hitachi	Kogin, Ex-Im Bank, Yasuda Trust Bank, Sumitomo Trust Bank, Mitsubishi Trust Bank	0.08059
Tokyo Shibaura Electric Co.	Chogin, Kogin, Mitsui Trust Bank, Daiichi Life Insurance	0.09156
Mitsubishi Electric Corp.	Chogin, Mitsubishi Trust Bank, Mitsui Trust Bank, Chase-Manhattan Bank, Meiji Mutual Life Insurance	0.08271
Matsushita Electric Ind. Co.	Chase-Manhattan Bank, Kogin, Chogin	0.07647
Nippon Electric Co.	Sumitomo Trust Bank, Chogin	0.09115
Hokushin Electric Works	Sumitomo Trust Bank, Sumitomo Mutual Life Insurance	0.09581
Japan Storage Battery	Mitsubishi Trust Bank	0.09490
Fujikura Cable Works	Mitsui Trust Bank	0.09392
Mitsubishi Shoji Kaisha	Ex-Im Bank, Mitsubishi Trust Bank	0.07005
C. Itoh and Co.	Nippon Life Insurance Co., Sumitomo Trust Bank	0.09490
Nippon Express Co.	Chogin	0.08913
Tokyo Elect. Express Railway	Daiichi Life Insurance, Nippon Life Insurance, Mitsubishi Trust Bank	0.09673
Odakyu Express Railway Co.	Daiichi Life Insurance, Kogin, Sumitomo Bank, Mitsubishi Bank	0.08955
Kinki Nippon Railway Co.	Mitsubishi Bank, Sumitomo Bank	0.09125
Tokyo Electric Power Co.	Kaigin, life insurance consortium, Kogin	0.08109
Chubu Electric Power Co.	Kaigin, Kogin, Meiji Mutual Life Insurance	0.07725
Kyushu Electric Power Co.	Kaigin, Kogin, life insurance consortium	0.08191
Tokyo Gas Co.	Kogin, Chogin, Mitsubishi Trust Bank, Mitsui Trust Bank	0.09016
Osaka Gas Co.	Chogin, Daiwa Bank, Sanwa Bank	0.07686

## Foot note

Abbreviation	Full name
Kogin	Industrial Bank of Japan, Ltd.
Chogin	Long-Term Credit Bank of Japan
Kangin	Nippon Kangyo Bank
Kaigin	Japan Development Bank
Mitsubishi Trust Bank	Mitsubishi Trust & Banking Corp.
Yasuda Trust Bank	Yasuda Trust & Banking Co.
Sumitomo Trust Bank	Sumitomo Trust & Banking Co.
Toyo Trust Bank	Toyo Trust & Banking Co.
Mitsui Trust Bank	Mitsui Trust & Banking Co.
Daiichi Life Insurance	Daiichi Mutual Life Insurance Co.
Ex-Im Bank	Export-Import Bank of Japan



use the average of values shown in the detailed statement of loans compiled in the Reports of Securities of each enterprise, or, to speak more exactly, the simple average of nominal interest rates of loans from main one to five financial institutions covering about 60% of total borrowing amount of the enterprise. This is because long-term loans from the main banks with which the enterprise has an account are supposed to be renewed in succession, and hence make the most stable borrowing. Further, some minor loans are to be excluded because these are often for particular purposes such as housing or afforestation of paper manufacturer, the rates being widely different from ordinary ones. An example of computation is as below:

Shikishima Spinning Co. (Oct. 26, 1962 to April 25, 1963)  
Long-term loan 1,211,887 yen

	Loan amount	Nominal interest rate	Average nominal interest rate
(1) Choki Shinyo Bank	300,000	0.08700	} 0.08850
(2) Sumitomo Shintaku Bank	200,000	0.09490	
(3) Daiwa Bank	200,000	0.08359	

The average nominal interest rates for selected companies are illustrated on Table 5.

By the Table the average rate is comparatively low, where loans from foreign banks and Export-Import Bank of Japan account for a substantial part of the company's total borrowing. This owes to the particularly low loan rates of these banks as shown below:

Girard Bank	→Shinagawa Hakurenga	.....0.0600
Chase-Manhattan Bank	{→Mitsubishi Electric, Corp.	.....0.0525
	{→Matsushita Electric Ind. Co.	.....0.0550
Ex-Im Bank of Washington	{→Nissan Motor Co.	.....0.0575
	{→Toyota Motor Co.	.....0.0590
Ex-Im Bank	{→Hitachi	.....0.0400
	{→Mitsubishi Shoji Kaisha	.....0.0650

In computing the real capital cost on the base of such nominal average interest rate, our ideas are as follows. First, on the so-called "buzumi" deposit, that is, counter-deposit by the borrower. It is Japanese particular convention which comes from bank's aim to avoid government regulation substantially to fix upper limits of nominal interest rate. Generally long-term loans are provided by Industrial (Nihon Kogyo) Bank of Japan, Long-Term Credit Bank of Japan, several trust banks and the like that are serving as medium for saving and primarily not aiming at finance creation as in the case of common banks. The financing resources of Industrial Bank and Long-Term Credit Bank of Japan, are bond and deposit, and those of trust banks are trust money and deposit. For these banks the former resources, namely bond and trust money (loan trust and cash trust), make principal ones and the latter, namely deposit, is secondary. Hence it is generally accepted that the "debtor's ratio" for these banks themselves can be lower than the case

Table 6. Values of Capital Cost of Long-Term Loan for Selected Companies, by capital scales and industries

	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	Av. of Industry
Nippon Suisan Kaisha				0.1310		
Nichiro Gyogyo Kaisha -fishery-			0.1319			0.1315
Nippon Breweries -brewery-			0.1273			0.1273
Daiwa Spinning Co.		0.1321				
Kureha Spinning Co.			0.1246			
Shikishima Spinning Co.		0.1248				
Nitto Spinning Co. -spinning-		0.1289				0.1276
Asahi Chemical Industry Co.			0.1310			
Teijin				0.1293		
Toyo Rayon Co.				0.1262		
Kurashiki Rayon Co.			0.1252			
Nihon Rayon Co. -synthetic fibre-			0.1286			0.1281
Oji Paper Co.			0.1262			
Mitsubishi Paper Mills -paper-		0.1310				0.1286
Yawata Iron & Steel Co.					0.1273	
Japan Steel & Tube Corp.					0.1268	
Kubota Iron & Machinery Works				0.1289		
Yodogawa Steel Works Co.		0.1363				
Nippon Stainless Steel Co.	0.1288					
Daido Steel Co. -steel-			0.1291			0.1295
Asahi Glass Co.				0.1227		
Nippon Sheet Glass Co.			0.1233			
Onoda Cement Co.				0.1321		
Shinagawa Brick -glass and pottery-		0.1183				0.1241
Sumitomo Chemical Co.				0.1270		
Mitsubishi Chemical Indu- stries				0.1256		
Shinetsu Chemical Ind. Co.				0.1352		
Ibigawa Electric Ind. Co.				0.1319		
Tokuyama Soda Co.				0.1113		
Sekisui Chemical Co. -chemicals-				0.1353		0.1277
Nissan Motor Co.				0.1098		

(Continue)

	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	Av. of Industry
Toyota Motor Co.				0.1089		
Daihatsu Kogyo -vehicles-				0.1337		0.1175
Hitachi					0.1121	
Tokyo Shibaura Electric Co.					0.1297	
Mitsubishi Electric Corp.				0.1151		
Matsushita Electric Ind. Co.				0.1055		
Nippon Electric Co.				0.1291		
Hokushin Electric Works		0.1367				
Japan Storage Battery		0.1352				
Fujikura Cable Works -electric-			0.1336			0.1246
Mitsubishi Shoji Kaisha				0.0955		
C. Itoh and Co. -trading-				0.1352		0.1154
Nippon Express Co. -freight transport-				0.1258		0.1258
Tokyo Elect. Epress Rail- way				0.1382		
Odakyu Elect. Railway Co.		0.1265				
Kinki Nippon Railway Co. -communication-				0.1293		0.1313
Tokyo Electric Power Co.					0.1129	
Chubu Electric Power Co.					0.1068	
Kyushu Electric Power Co. -electric power-				0.1142		0.1113
Tokyo Gas Co.				0.1276		
Osaka Gas Co. -gas-				0.1062		0.1169
Av. by scales	0.1288	0.1300	0.1281	0.1235	0.1193	

Total av. of 52 companies 0.1251

of common banks. Therefore, we assume 10% as the rate of "buzumi deposit", much lower than the 30% rate we assume as to short-term loan from common banks which will be explained later. Although such convention and its rate, if any, are supposed to be different with respect to foreign banks, we treat samely with Japanese banks because we cannot make them clear.

The term for long-term loan is usually five years. The way of repayment is very diversified, including monthly installment on even or uneven amounts, monthly or yearly installment on even amounts after a certain unredeemed term (one to two years), lump sum repayment at due time and so on. Interest is paid generally in advance but in some cases at term end. As such details

are difficult to research and, particularly almost nothing can be ascertained with "buzumi", we assume arbitrarily: 10% for the rate of "buzumi"; 5.5%—market interest rate in Japan—for receivable interest for "buzumi" deposit; advance payment of interest; five years as term; two years as unredeemed period; yearly installment on even amounts at each year end.

On these assumptions, putting focus on the in-and out-flows of cash money, we have following equation between nominal interest rate  $P$  and real capital cost  $r$ .

$$(1-0.1-P) = \frac{P-0.1 \times 0.055}{(1+r)} + \frac{P-0.1 \times 0.055}{(1+r)^2} + \frac{(1-0.1) \div (5-2) + P-0.1 \times 0.055}{(1+r)^3} \\ + \frac{(1-0.1) \div (5-2) + P-0.1 \times 0.055}{(1+r)^4} + \frac{(1-0.1) \div (5-2) - 0.1 \times 0.055}{(1+r)^5}$$

The left side of this equation represents the amount of cash in-flow to enterprise when 1 yen is borrowed on the above terms, the numerators of the right side terms; the amounts of cash out-flow in respective years,  $0.1 \times 0.055$ ; interest receivable for "buzumi",  $(1 - 0.1) \div (5 - 2)$ ; the amount of yearly even installment redemption after the unredeemable period of two years.

The capital costs of selected companies computed by this formula are illustrated in Table 6.

In the Table we can find no distinct features distinguishing "stagnant," "growth" and "innovation" sectors, or sorts of industries. If viewed from capital scale, the cost shows gradual decline with scales from 2 billion to 100 billion yen. Naturally the costs for electric power and gas enterprises with public nature are low, but unexpectedly high for railway with the same nature.

#### *Section 4. The Capital Cost of Short-Term Loan (Borrowing)*

Also as for short-term loan, the basic material is the average value of nominal interest rates described in the detailed statement of loans compiled in each company's Reports of Securites, or, the simple average of interest rates of loans from major banks, with which it has an account covering about 60% of total short-term loans. This is because, as in the case of long-term loan, other minor loans often involve extraordinary ones, and further nominal rates for short-term loans are of only one to two patterns. An example of computation is:

Shikishima Spinning Co. (Oct. 26, 1962 to April 25, 1963)  
Short-term loan 3,605,000,000 yen

	Loan Amount	Nominal interest rate	Average Nominal interest rate
(1) Daiwa Bank	789,000	} 0.06205—0.06935 (per diem 1.7-1.9 sen)	0.06570
(2) Mitsui Bank	414,000		
(3) Sanwa Bank	406,000		
(4) Kyowa Bank	399,000		

Table 7. Basic Data for Computing Capital Cost Values of Short-Term Loans

	Lenders of Short-Term Loans	Av. Nominal Rate of Interest
Nippon Suisan Kaisha	Kangin, Sanwa Bank, Fuji Bank, Agricultural Central Fund	0.07766
Nichiro Gyogyo Kaisha	Agricultural Central Fund, Hokkaido Takushoku Bank, Mitsubishi Bank	unknown
Sapporo Breweries	Daiichi Bank, Fuji Bank	0.06388
Daiwa Spinning Co.	Sanwa Bank, Kangin	0.06935
Kureha Spinning Co.	Sumitomo Bank, Fuji Bank, Bank of Tokyo	0.07118
Shikishima Spinning Co.	Daiwa Bank, Mitsui Bank, Sanwa Bank, Kyowa Bank	0.06570
Nitto Spinning Co.	Kogin, Bank of Tokyo, Bank of Kobe	0.06935
Asashi Chemical Industry Co.	Sumitomo Bank, Daiich Bank, Kangin	0.06570
Teijin	Sanwa Bank, Fuji Bank, Daiichi Bank, Daiwa Bank	0.06205
Toyo Rayon Co.	Mitsui Bank, Kangin, Mitsubishi Bank, Sanwa Bank	0.06570
Kurashiki Rayon Co.	Kogin, Fuji Bank, Mitsubishi Bank, Sanwa Bank	0.06570
Nihon Rayon Co.	Sanwa Bank, Tokai Bank, Kyowa Bank	0.06965
Oji Paper Co.	Mitsui Bank, Daiichi Bank, Hokkaido-Takushoku Bank	0.07118
Mitsubishi Paper Mills	Mitsubishi Bank, Joyo Bank, Hachijuni Bank	0.07391
Yawata Iron & Steel Co.	Fuji Bank, Mitsubishi Bank, Sumitomo Bank, Sanwa Bank	0.06205
Japan Steel & Tube Corp.	Sumitomo Bank, Sanwa Bank, Tokai Bank, Fuji Bank, Mitsubishi Bank	0.06753
Kubota Iron & Machinery Works	Sumitomo Bank, Fuji Bank	0.06570
Yodogawa Steel Works Co.	Fuji Bank, Daiwa Bank, Saitama Bank	0.07665
Nihon Stainless Steel Co.	Sumitomo Bank, Daishi Bank, Sumitomo Life Insurance	0.08273
Daido Steel Co.	Kogin, Tokai Bank, Kangin, Fuji Bank	0.07437
Asahi Glass Co.	Mitsubishi Bank, Kangin, Fuji Bank	0.05657
Nippon Sheet Glass Co.	Sumitomo Bank, Sumitomo Trust Bank	0.07300
Onoda Cement Co.	Mitsui Bank, Yamaguchi Bank, Kyowa Bank, Sanwa Bank	0.07483
Shinagawa Brick	Sumitomo Bank, Fuji Bank, Shichijushichi Bank, Saitama Bank, Sumitomo Trust Bank	0.07801
Sumitomo Chemical Co.	Sumitomo Bank	0.06935
Mitsubishi Chemical Industries	Agricultural Central Fund, Mitsubishi Bank, Kangin, Joyo Bank	0.07255
Shinetsu Chemical Ind. Co.	Mitsubishi Bank, Hachijuni Bank, Agricultural Central Fund	0.07325
Ibigawa Electric Ind. Co.	Mitsui Bank, Agricultural Central Fund	0.07665
Tokuyama Soda Co.	Sanwa Bank, Yamaguchi Bank, Kangin	unknown
Sekisui Chemical Co.	Sanwa Bank, Daiwa Bank	0.07118
Nissan Motor Co.	Fuji Bank, etc.	0.06935

(Continue)

	Lenders of Short-Term Loans	Av. Nominal Rate of Interest
Toyota Motor Co.	Mitsui Bank, Tokai Bank	0.04198
Daihatsu Kogyo	Sanwa Bank, Bank of Kobe, Daiwa Bank	0.06935
Hitachi	Daiichi Bank, Sanwa Bank, Fuji Bank, Kogin	0.06388
Tokyo Shibaura Electric Co.	Mitsui Bank, Kyowa Bank, Daiichi Bank	0.06662
Mitsubishi Electric Corp.	Mitsubishi Bank, Kangin, Mitsui Trust Bank	0.06570
Matsushita Electric Ind. Co.	unknown	
Nippon Electric Co.	Sumitomo Bank, Bank of Yokohama, Kyowa Bank, Mitsubishi Bank, Sumitomo Trust Bank	0.07081
Hokushin Electric Works	Sumitomo Bank	0.08578
Japan Storage Battery	Mitsubishi Bank	0.07209
Fujikura Cable Works	Mitsui Bank, Shizuoka Bank	0.06753
Mitsubishi Shoji Kaisha	Fuji Bank, Mitsubishi Bank	0.06479
C. Itoh and Co.	Sumitomo Bank, Bank of Tokyo, Kangin	0.07665
Nippon Express Co.	Kangin, Sanwa Bank, Fuji Bank	0.06205
Tokyo Elect. Express Railway	Mitsubishi Bank, Mitsui Trust Bank	0.08760
Odakyu Express Railway Co.	Sumitomo Bank, Mitsubishi Bank	0.07300
Kinki Nippon Railway Co.	Mitsubishi Bank, Sanwa Bank, Daiwa Bank	0.07848
Tokyo Electric Power Co.	Mitsui Bank, Mitsubishi Bank, Fuji Bank, Daiichi Bank	0.06668
Chubu Electric Power Co.	Mitsui Bank, Tokai Bank, Kogin, Fuji Bank	0.06388
Kyushu Electric Power Co.	Sumitomo Bank, Kangin, Bank of Fukuoka, Sanwa Bank, Daiichi Bank	0.06570
Tokyo Gas Co.	Daiichi Bank, Mitsui Bank, Mitsubishi Bank	0.06114
Osaka Gas Co.	Daiwa Bank, Sanwa Bank, Fuji Bank	0.06058

The average nominal interest rates for selected companies are shown in Table 7. A noticeable feature in the Table is the exceptionally low rate for Toyota Motor Co., annual rate of 0.04198, borrowing from Mitsui Bank and Tokai Bank.

We assume as to "buzumi" as follows; the rate is 30%, and receivable interest rate for it is 0.055. Conditions on "buzumi" are very different with both lenders and borrowers and hard to investigate. We assume 30% after our visitings to a number of enterprises including financial ones. We also assume advance payment of interest.

On these assumptions the relation between nominal interest rate  $P$  and capital cost  $r$  of short-term loan stands as follows.

$$(1 - 0.3 - P) = \{(1 - 0.3) - 0.3 \times 0.055\} / (1 + r)$$

where the left side represents the amount of cash in-flow to enterprise when 1 yen is borrowed; the numerator of the right side the amount of cash out-flow after one year.

By this formula, we obtain capital costs of short-term loans for selected companies as presented in Table 8.

Table 8 shows following facts. On the average value the capital cost of

Table 8. Values of Capital Cost of Short-Term Loan for  
Selected Companies, by capital scales and industries

	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	Av. of Industry
Nippon Suisan Kaisha				0.0965		
Nichiro Gyogyo Kaisha -fishery-			uncertain			0.0965
Nippon Breweries -brewery-			0.0745			0.0745
Daiwa Spinning Co.		0.0843				
Kureha Spinning Co.			0.0870			
Shikishima Spinning Co.		0.0776				
Nitto Spinning Co. -spinning-		0.0843				0.0833
Asahi Chemical Industry Co.			0.0776			
Teijin				0.0714		
Toyo Rayon Co.				0.0776		
Kurashiki Rayon Co.			0.0776			
Nihon Rayon Co. -synthetic fibre-			0.0843			0.0777
Oji Paper Co.			0.0870			
Mitsubishi Paper Mills -paper-		0.0917				0.0894
Yawata Iron & Steel Co.					0.0714	
Japan Steel & Tube Corp.					0.0870	
Kubota Iron & Machinery Works				0.0776		
Yodogawa Steel Works Co.		0.0965				
Nippon Stainless Steel Co.	0.1073					
Daido Steel Co. -steel-			0.0925			0.0887
Asahi Glass Co.				0.0623		
Nippon Sheet Glass Co.			0.0901			
Onoda Cement Co.				0.0933		
Shinagawa Brick -glass & pottery-		0.0989				0.0862
Sumitomo Chemical Co.				0.0843		
Mitsubishi Chemical Industries				0.0893		
Shinetsu Chemical Ind. Co.				0.0906		
Ibigawa Electric Ind. Co.				0.0965		
Tokuyama Soda Co.				unknown		
Sekisui Chemical Co. -chemicals-				0.0870		0.0895
Nissan Motor Co.				0.0843		

(Continue)

	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	Av. of Industry
Toyota Motor Co.*				0.0455		
Daihatsu Kogyo -vehicles-				0.0843		0.0714
Hitachi					0.0745	
Tokyo Shibaura Electric Co.					0.0791	
Mitsubishi Electric Corp.				0.0776		
Matsushita Electric Ind. Co.				unknown		
Nippon Electric Co.				0.0863		
Hokushin Electric Works		0.1128				
Japan Storage Battery		0.0885				
Fujikura Cable Works -electric-			0.0807			0.0856
Mitsubishi Shoji Kaisha				0.0760		
C. Itoh and Co. -trading-				0.0965		0.0863
Nippon Express Co. -freight transport-				0.0714		0.0714
Tokyo Elect. Express Railway				0.1161		
Odakyu Elect. Railway Co.		0.0901				
Kinki Nippon Railway Co. -communication-				0.0997		0.1020
Tokyo Electric Power Co.					0.0792	
Chubu Electric Power Co.					0.0745	
Kyushu Electric Power Co. -electric power-				0.0776		0.0771
Tokyo Gas Co.				0.0699		
Osaka Gas Co. -gas-				0.0690		0.0695
Av. by scales	0.1073	0.0916	0.0835	0.0825	0.0776	

Total av. of 49 companies 0.0843

\* The interest rate receivable of "counter-deposit" for Toyota Motor is assumed 0.04, since the nominal rate of short-term loan is 0.4198 (diem rate 1.15 sen).

short-term loans is the lowest compared with that of stock capital, bond or long-term loan. Only for steel and fishery industries it is slightly higher than that of bond. The Table clearly reveals that the cost declines with the scale of business. It is random with regard to the classification by "stagnant", "growth" and "innovation" sectors, with few connection with respective characteristics. For railway, despite its public nature, the cost is very high, exceeding 10% and being higher than bond, similarly with the case of long-term loan.



### *Section 5. The Aggregate Capital Cost*

Funds to be employed by an enterprise (cash or its equivalents) are used as a pool regardless of the difference of sources from which funds are raised. The capital cost of such funds must be aggregate one computed on weighted base by sources. For this weighting an assumption is necessary that costs of various kinds of capital are independent one another. For instance, if, with a change in the ratio of owned capital, stock price fluctuates and so stock capital cost is changed, the method of weighted average will become meaningless. Factually, however, stock price and ratio of owned capital are in non-correlation in Japan. (See the writer, *op. cit.* the Calculating Process of the Discount Rate and Capital Cost.) Also a change in the amount of borrowing exerts few significant effect upon the capital cost of loan. Thus, computation of the aggregate capital cost on weighted base becomes meaning.

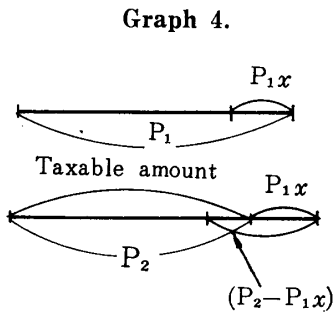
The weight here used is obtained on the base of capital sources presented in the term-end balance sheet of the term containing January 1, 1963 in it. This means that the aggregate cost here computed will be applied in future when the capital composition is identical with that of January, 1963.

We sort sources of capital raising into seven broad items, i.e. short-term loan, other current debts (account payable, accrued amount payable, accrued expense, advance received, deposit received, securities received, reserve for tax payment), bond, long-term loan, other fixed debts (retirement pay allowance, repair allowance, etc.), capital at market price (average stock price multiplied by number of issued shares), and total internal reserves (capital surplus, earned surplus, depreciation allowance). In Report of Securities the item of current liabilities includes bond and long-term loans due in one year, which, in this study, are transferred to the items of bond and long-term loan respectively. In the Report foreign exchange borrowed from foreign banks is presented in foreign currency denomination, which, in this study, is converted into yen value and added to the loan item. The capital at market value is used because, as stated already, enterprises want to maintain stable average stock prices, and in future, increases of stock are supposed to be designed on the base of average market price.

In addition to the above, another factor of tax must be taken into account for computing the aggregate cost. Most items of expense such as the capital costs of bond and loan are charged off to profit and loss account, but not dividend and gratis share (newly issued capital stock with non-payment) that make the main element of the stock capital cost.

Under Japanese tax law in 1963, corporate tax of 38% is levied on profit of more than 2,000 thousand yen excluding dividend, and on the amount of dividend 28% is levied as a lessened corporate tax. Also a local tax of 13.5% is charged on the amount of corporate income tax excluding that on dividend. In addition, enterprise tax of progressively 6 to 11% is levied on total net profit. As the enterprise tax is charged off to profit and loss account, by tax law, in the next year, the substantial tax rate becomes in so far less.

We calculate the substantial rate of the enterprise tax as follows, letting  $x$  denote the nominal rate. The enterprise tax is charged off to profit and loss account in the next year, the effect of which spreads successively over subsequent years, converging to a certain value. We consider this convergence value as an appropriate average value of substantial rate. The concrete way of calculation is as follows. Suppose a net profit  $P_1$  is gained in the first year, and the tax for the year will be  $P_1x$ . In the second year, if the "formal net profit" (before deducting the tax of preceding year) is represented by  $P_2$ , the taxable amount will be  $P_2 - P_1x$ , because  $P_1x$  can be charged off. Then the tax will be  $(P_2 - P_1x)x = P_2x - P_1x^2$  (see Graph 4). Similarly in the third year the formal net profit is  $P_3$ , the taxable amount will be  $P_3 - (P_2x - P_1x^2)x = P_3 - P_2x + P_1x^2$ , and the tax will be  $P_3x - P_2x^2 + P_1x^3$  ..... In the  $n$ th year, with net profit  $P_n$ , the tax will be  $P_nx - P_{n-1}x^2 + \dots + (-1)^{n+1}P_1x^n$ . If we assume  $P_1 = P_2 = \dots = P_n$ , the tax =  $P(x - x^2 + x^3 - \dots + (-1)^{n+1}x^n)$ . Further, if  $n \rightarrow \infty$ , the tax  $\doteq P \cdot \frac{x}{x+1}$ . This represents that, denoting the nominal rate with  $x$  and assuming  $n \rightarrow \infty$ , the convergence value of enterprise tax, and hence the substantial rate is



$$P \cdot \frac{x}{1+x} / P = \frac{x}{1+x}$$

Providing the dividend is one third of total profit, and the nominal rate of the local tax is 38%, the total tax of an enterprise with profit of more than 2,000 thousand yen (excluding dividend) will be:

$$T = P \times \frac{1}{3} \times 0.28 + P \times \frac{2}{3} \times 0.38 \times (1 + 0.135) + P \times 0.741$$

where  $P$ ; net profit, 0.741; substantial rate of enterprise tax. Then we have  $T = P \times 0.4549$ .

So, to simplify calculation, we assume total tax of 45% on net profit in the case of computing aggregate capital cost below.

In order to compute the aggregate capital cost taking the tax effect into consideration, the concept of each year's profit, on which the aggregate cost works as discount rate, must be made definite. "To work as discount rate" means a deduction from each year's net profit as capital cost. The profit amount, to which the discount rate of capital cost is to be applied, must be the cash profit before deducting taxes and various capital costs that an enterprise may hold as profit at term-end.

Then we can write;

$$\text{cash profit} = \text{revenue (in cash and its equivalent)} - \{ \text{various cash outlays for expenses (not including payable interest)} + \text{payable interest} + \text{depreciation} \} \times (1 - \text{tax rate}) - \text{officer's bonuses etc.} + (\text{payable interest} + \text{depreciation}) (1 - \text{tax rate})$$

As the formula shows, the capital cost of stock is deducted from cash profit as dividend as it is, while the capital costs of bond and loan are deducted being discounted by  $(1 - \text{tax rate})$  as interest. Therefore, in computing aggregate cost, the costs of bond and long-and short-term loans must be taken

into the weighted average after multiplying by  $(1-0.45)=0.55$ , in the case of the above tax rate.

An example of aggregate capital cost  $C_1$  is presented below, assuming the cost of current liabilities other than short-term loan and that of fixed liabilities other than bond and long-term loans are nil, and also the cost of internal reserves, without taking opportunity cost into account, is nil. The example is the case of Yawata Steel Co.

	Short-term loan	Other current debts	Bond	Long-term loan	Other fixed debts	(Capital price)	Av. stock price
Amount (1000 yen)	51,043,000	73,839,546	27,227,400	111,300,583	13,212,777	88,740,000	58.80 (yen)
Share (%)	9.78	14.14	5.21	21.32	2.53	—	—

	Capital at market price	(Capital surplus)	Earned surplus	Depreciation allowance	Internal reserves	Total capital in use
Amount (1000 yen)	104,358,240	17,276,410	16,660,036	107,347,946	141,284,392	522,165,937
Share (%)	19.99	(6.50)		(20.56)	27.06	100.00

$$\begin{aligned} \text{Aggregate Capital Cost } C_1 &= 0.0978 \times 0.00714 \times 0.55 + 0.1414 \times 0 + 0.0521 \times 0.0849 \\ &\quad \times 0.55 + 0.0253 \times 0 + 0.2132 \times 0.1273 \times 0.55 + 0.1999 \times 0.2780 + \\ &\quad 0.2706 \times 0 = 0.0768 \end{aligned}$$

If we take a duely receivable profit for internal reserves, namely the opportunity cost, at a market interest rate of 0.055, the result will be different. In this case, as may be known from the above formula of cash profit, the effect of depreciation allowance must be discounted with 0.55, since depreciations on the process of its formation have been charged off to profit and loss account. Then, the aggregate cost is;

$$\begin{aligned} \text{Aggregate Capital Cost } C_2 &= 0.0978 \times 0.0714 \times 0.55 + 0.1414 \times 0 + 0.0521 \times 0.0849 \\ &\quad \times 0.55 + 0.0253 \times 0 + 0.2132 \times 0.1273 \times 0.55 + 0.1999 \times 0.2780 \\ &\quad + 0.065 \times 0.055 + 0.2056 \times 0.055 \times 0.55 \\ &= C_1 + 0.065 \times 0.055 + 0.2056 \times 0.055 \times 0.55 \\ &= 0.0866 \end{aligned}$$

Table 9 presents the sources of capital raising of each enterprise and their ratios. Table 10 and 11 show the results of computing  $C_1$  and  $C_2$  respectively.

It appears from Table 10 and 11 that both  $C_1$  and  $C_2$  are not reflecting characteristics of the enterprise when viewed from capital scales, but they are markedly reflecting them if viewed by industrial sorts. For instance, while the cost  $C_1$  is 12% or a little more for "innovation" industries—chemicals, auto, electric machinery—, it is 4% level for trade enterprises, being one third of the former. As shown previously as to stock capital, "innovation" industries and trading are alike showing 30% level. Such difference in aggregate cost seems to be attributable to the following fact. While the stock capital cost of trading companies is high due to high profit and hence high rate dividend and gratis share allocation, they are relying as main finance source much on the standing amounts of current liabilities with no interest such as note payable and accounts payable. Therefore their aggregate cost is low. Also the ground of high aggregate cost for innovation sector, more than 12%, lies

Table 9. Basic Data for Computing Aggregate Capital Cost

	Short-Term Loan	Other Current Debts	Bond	Long-Term Loan	Other Fixed Debts	Capital	Market Price	Capital at Market Price	Capital Surplus	Farned Surplus	Depreciation Allowance	Total Internal Reserves	Total Capital in Use
Nippon Suisan Kaisha	100 Million ¥ 8,996 10.70	17,915 21.32	4,334 5.16	10,363 12.33	5,566 6.62	(10,000	72.86)	14,572 17.34	( 89 ( 2.64)	2,126 (23.88)	20,671)	22,286 26.52	84,032
Nichiro Gyogyo Kaisha	10,856 19.20	11,428 20.21	1,364 2.41	10,201 18.04	1,589 2.80	( 7,000	69.16)	9,682 17.12	( 392 ( 3.63)	1,662 (16.58)	9,373)	11,427 20.21	56,547
Nippon Breweries	3,945 5.15	20,264 26.48	—	7,928 10.36	1,062 1.39	( 6,720	245.48)	32,993 43.11	( 868 ( 7.40)	4,790 ( 6.11)	4,678)	10,336 13.51	76,528
Daiwa Spinning Co.	5,215 13.08	5,064 12.70	1,762 4.42	926 2.32	508 1.27	( 2,340	231.90)	10,853 27.22	( 719 (18.69)	6,734 (8.08)	8,084)	15,537 38.97	39,865
Kureha Spinning Co.	11,238 26.33	7,362 17.25	3,580 8.39	2,700 6.33	435 1.02	( 3,412.5	76.73)	5,237 12.27	( 1,438 (11.60)	3,523 (16.80)	7,169)	12,130 28.42	42,682
Shikishima Spinning Co.	3,605 13.26	5,233 19.43	1,441 5.30	1,131 4.15	472 1.74	( 2,250	112.54)	5,064 18.62	( 562 (20.97)	5,128 (16.57)	4,506)	10,196 37.50	27,192
Nitto Spinning Co.	7,675 16.78	8,820 19.29	5,723 12.51	7,333 16.04	115 0.25	( 3,500	73.81)	5,167 11.30	( 1,358 ( 5.84)	1,312 (17.99)	8,228)	10,898 23.83	45,731
Asahi Chemical Industry Co.	11,633 8.65	21,395 15.91	8,602 6.40	9,813 7.30	1,369 1.02	( 9,300	274.68)	51,420 38.23	( 1,786 ( 6.90)	7,488 (15.61)	21,003)	30,277 22.51	134,509
Teijin	14,685 10.38	40,544 28.67	7,314 5.17	10,192 7.21	1,748 1.24	(12,600	119.19)	30,036 21.23	( 2,824 (10.22)	11,627 (22.45)	22,455)	36,906 26.10	141,425
Toyo Rayon Co.	16,000 5.49	36,375 12.49	6,896 2.37	10,628 3.65	2,248 0.77	(30,000	155.04)	93,024 31.94	( 3,268 (14.02)	66,664 (56.130)	56,130)	126,062 43.29	291,233
Kurashiki Rayon Co.	6,890 8.83	14,825 19.00	5,001 6.41	11,522 14.76	849 1.09	( 6,000	119.97)	14,396 18.45	( 1,040 ( 9.30)	6,224 (17.291)	7,291)	24,555 31.46	78,038
Nihon Rayon Co.	6,861 12.42	11,493 20.81	3,616 6.55	5,526 10.01	899 1.63	( 5,700	115.12)	13,124 23.76	( 945 (11.10)	5,180 (13.72)	7,577)	13,706 24.82	55,225
Oji Paper Co.	9,183 11.93	10,549 13.70	10,549 12.43	9,571 12.43	1,648 2.14	( 5,000	171.83)	17,183 22.32	( 10,376 (21.31)	6,009 (16.16)	12,440)	28,845 37.47	76,980
Mitsubishi Paper Mills	3,764 15.17	5,635 22.72	594 2.39	2,494 10.05	1,425 5.75	( 2,300	110.25)	5,072 20.45	( 652 ( 9.26)	1,647 (14.20)	3,521)	5,820 23.46	24,804
Yawata Iron & Steel Co.	51,043 9.78	73,840 14.14	27,227 5.21	111,301 21.32	13,213 2.53	(88,740	58.80)	104,358 19.99	( 17,276 ( 6.50)	16,660 (20.56)	107,348)	141,284 27.06	522,166
Japan Steel & Tube Corp.	36,950 11.72	58,264 18.48	19,532 6.20	50,640 16.06	5,966 1.89	(57,289	60.77)	69,629 22.08	( 2,857 ( 4.80)	12,257 (18.77)	59,185)	74,299 23.57	315,280
Kubota Iron & Machinery Works	8,168 7.23	19,367 17.14	3,495 3.09	9,406 8.32	927 0.82	(20,625	122.67)	50,601 44.78	( 1,489 (11.73)	11,770 ( 7.770)	7,770)	21,029 18.61	112,993
Yodogawa Steel Works Co.	1,180 6.98	5,539 32.74	—	1,320 7.80	292 1.73	( 2,000	69.22)	2,769 16.37	( 218 (10.21)	1,508 (24.18)	4,091)	5,817 34.39	16,917
Nihon Stainless Steel Co.	1,859 15.95	3,422 29.37	—	1,748 15.00	188 1.61	( 1,500	67.96)	2,039 17.50	( 403 ( 6.81)	390 (13.75)	1,603)	2,396 20.56	11,652
Daido Steel Co.	4,231 8.93	15,293 32.28	—	13,171 27.80	546 1.15	( 5,100	74.58)	7,607 16.06	( 977 ( 4.32)	1,068 ( 4.483)	4,483)	6,528 13.78	47,376
Asahi Glass Co.	9,752 8.54	15,785 13.82	—	5,870 5.14	9,536 8.35	(14,400	145.33)	41,855 36.64	( 2,816 (21.19)	10,969 (15.45)	17,652)	31,437 66.64	114,228
Nippon Sheet Glass Co.	6,643 10.37	4,062 6.34	—	3,457 5.40	3,200 5.00	( 5,000	207.87)	20,787 32.46	( 302 ( 8.05)	5,058 ( 5.288)	5,288)	10,448 16.31	64,045
Onoda Cement Co.	11,959 9.99	13,109 10.95	6,280 5.25	23,136 19.33	17,834 14.90	(13,042	88.00)	22,954 19.18	( 1,686 ( 5.03)	4,342 (15.36)	18,377)	24,405 20.39	119,677
Shinagawa Brick	2,594 17.52	1,162 7.85	—	3,083 20.82	140 0.95	( 2,100	121.18)	5,090 34.38	( 117 ( 6.29)	815 (12.19)	1,804)	2,736 18.48	14,805
Sumitomo Chemical Co.	13,119 9.16	44,167 16.87	8,248 5.76	19,224 13.42	3,536 2.47	(16,800	99.46)	33,419 23.33	( 4,241 ( 7.13)	5,971 (21.86)	31,310)	41,522 28.99	143,235
Mitsubishi Chemical Industries	13,437 12.42	17,265 15.96	6,083 5.62	14,757 13.64	4,207 3.89	(15,148	96.42)	29,211 27.00	( 3,320 ( 7.65)	4,960 (14.938)	14,938)	23,219 21.46	108,179
Shinetsu Chemical Ind. Co.	7,345 19.73	6,286 16.89	1,300 3.49	7,420 19.94	306 0.82	( 3,672	100.00)	7,344 19.73	( 448 ( 4.23)	1,126 (15.15)	5,638)	7,212 19.38	37,213
Ibigawa Electric Ind. Co.	1,182 10.37	1,347 11.82	691 6.06	768 6.74	97 0.85	(1,750.485	77.35)	2,700 23.69	( 1,356 (16.43)	516 (24.03)	2,739)	4,611 40.46	11,396
Tokuyama Soda Co.	2,443 7.24	3,456 10.24	—	4,183 12.39	974 2.88	( 3,000	166.97)	10,018 29.67	( 953 (12.74)	3,346 (24.85)	8,392)	12,691 37.59	33,765
Sekisui Chemical Co.	3,230 7.98	10,207 25.21	—	5,768 14.24	318 0.79	( 5,700	143.36)	16,343 40.36	( 369 ( 3.50)	1,046 ( 7.93)	3,213)	4,628 11.43	40,494
Nissan Motor Co.	36,451 16.34	44,256 19.84	5,917 2.65	16,225 7.27	4,088 1.83	(23,100	123.97)	57,274 25.68	( 4,575 (11.69)	21,507 (14.68)	32,338)	58,820 26.37	223,031
Toyota Motor Co.	1,000 0.52	24,563 12.89	4,657 2.44	15,694 8.23	1,829 0.96	(25,500	138.04)	70,400 36.93	( 6,267 (18.57)	28,953 (37.260)	37,260)	72,480 38.02	190,623
Daihatsu Kogyo	15,476 22.13	13,432 19.21	2,243 3.21	4,592 6.57	514 0.74	( 9,600	106.55)	20,458 29.26	( 401 (11.10)	7,361 ( 7.79)	5,447)	13,209 18.89	69,924
Hitachi	88,504 18.62	105,216 22.14	22,087 4.65	38,520 8.10	5,596 1.18	(75,000	8.700)	117,000 24.61	( 11,103 ( 8.98)	30,332 (11.72)	56,977)	98,412 20.70	475,335
Tokyo Shibaura Electric Co.	56,492 13.88	106,267 26.11	25,239 6.20	17,909 4.40	2,780 0.68	(69,300	90.33)	125,197 30.76	( 8,299 ( 9.31)	29,772 ( 8.63)	35,115)	73,186 17.98	407,070
Mitsubishi Electric Corp.	38,628 15.64	67,942 27.52	8,295 3.36	16,972 6.79	1,975 0.80	(43,200	92.80)	80,179 32.48	( 2,613 ( 5.66)	112,772 ( 7.64)	17,437)	32,822 13.30	246,813
Matsushita Electric Ind. Co.	2,499 1.13	69,462 31.36	7,811 3.53	7,425 3.35	4,021 1.82	(22,500	194.41)	87,485 99.49	( 671 (14.42)	31,253 ( 4.91)	10,894)	42,808 19.33	221,511
Nippon Electric Co.	21,142 14.28	23,921 16.16	4,937 3.34	11,907 8.04	1,899 1.28	(12,000	279.70)	67,128 45.35	( 2,826 ( 5.62)	5,500 ( 8.771)	8,771)	17,097 11.55	148,031
Hokushin Electric Works	1,115 10.39	1,485 13.84	73 0.68	302 2.81	116 1.08	( 2,000	145.79)	5,832 54.34	( 594 ( 9.80)	460 ( 6.69)	716)	1,770 16.49	10,697
Japan Storage Battery	965 9.29	1,773 17.07	467 4.50	954 9.19	329 3.17	( 2,000	89.35)	3,574 34.42	( 427 (15.00)	4,131 ( 7.36)	764)	2,332 22.36	10,384
Fujikura Cable Works	3,134 14.06	3,927 17.62	1,828 8.20	1,233 5.53	846 3.80	( 3,000	65.83)	3,950 17.72	( 336 (17.34)	3,525 (15.72)	3,505)	7,366 33.06	22,284
Mitsubishi Shoji Kaisha	69,529 18.27	242,502 63.74	—	12,130 3.19	470 0.12	(15,000	149.47)	44,841 11.79	( 829 (22.34)	7,601 ( 6.57)	2,501)	11,001 28.91	380,473
C. Itoh and Co.	43,977 19.13	148,832 64.75	—	4,971 2.16	390 0.13	(10,925	113.40)	24,778 10.78	( 316 ( 2.29)	4,955 ( 0.76)	1,739)	7,009 3.05	229,867
Nippon Express Co.	18,229 8.20	27,533 12.39	9,427 4.24	5,423 2.44	2,592 1.17	(32,400	168.42)	109,136 49.10	( 238 ( 3.01)	6,440 (19.45)	43,237)	49,915 22.46	222,255
Tokyo Elect. Express Railway	10,376 15.13	7,959 11.60	4,290 6.26	9,643 14.06	9,131 13.31	( 7,000	104.07)	14,570 21.24	( 3,052 ( 7.09)	1,813 (11.30)	7,747)	12,612 18.39	68,581
Odakyu Elect. Railway Co.	3,350 8.00	2,998 6.94	3,574 8.53	2,301 5.49	5,433 12.97	( 4,500	202.91)	18,262 43.60	( 1,541 ( 5.82)	898 ( 8.63)	3,614)	6,053 14.45	41,881
Kinki Nippon Railway Co.	12,436 14.77	6,439 7.65	4,167 4.95	7,765 9.22	2,294 2.72	( 9,997	147.00)	29,391 34.90	( 7,273 (11.52)	2,427 (14.26)	12,011)	21,711 25.78	84,203
Tokyo Electric Power Co.	44,300 4.20	114,718 10.88	146,008 13.85	209,053 19.83	95 0.01	(90,000	575.26)	103,547 9.82	( 78,087 ( 8.03)	6,552 (33.37)	351,730)	436,369 41.40	1,054,090
Chubu Electric Power Co.	13,132 3.04	24,668 5.72	63,680 14.76	98,221 22.76	363 0.08	(60,750	527.43)	64,083 14.84	( 34,997 ( 9.16)	4,528 (29.63)	127,893)	167,418 38.79	431,565
Kyushu Electric Power Co.	1,200 0.37	9,139 2.79	48,833 14.91	88,241 26.94	200 0.06	(40,500	530.71)	42,988 13.12	( 29,627 ( 9.90)	2,816 (31.92)	104,547)	136,991 41.82	327,592
Tokyo Gas Co.	3,300 2.53	15,635 12.00	15,566 11.95	14,164 10.87	1,941 1.49	(20,280	80.33)	32,582 25.01	( 3,747 ( 8.15)	6,869 (27.99)	36,470)	47,086 36.14	130,274
Osaka Gas Co.	4,400 4.44	13,364 13.49	6,352 6.41	11,749 11.86	110 0.11	(16,800	72.72)	24,434 24.67	( 3,215 (10.15)	6,837 (28.86)	28,587)	38,639 39.01	99,048

Table 10. Values of Aggregate Capital Cost  $C_1$  for Selected Companies, by capital scales and industries

	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	Av. of Industry
Nippon Suisan Kaisha				0.0512		
Nichiro Gyogyo Kaisha -fishery-			0.0544			0.0528
Nippon Breweries			0.0697			
Daiwa Spinning Co.		0.0679				
Kureha Spinning Co.			0.0494			
Shikishima Spinning Co.		0.0783				
Nitto Spinning Co. -spinning-		0.0470				0.0607
Asahi Chemical Ind. Co. Teijin			0.0791	0.0543		
Toyo Rayon Co.				0.0975		
Kurashiki Rayon Co.			0.0674			
Nihon Rayon Co. -synthetic fibre-			0.0740			0.0745
Oji Paper Co.			0.0590			
Mitsubishi Paper Mills -paper-		0.0621				0.0606
Yawata Iron & Steel Co.					0.0768	
Japan Steel & Tube Corp.					0.0802	
Kubota Iron & Machinery Works				0.2215		
Yodogawa Steel Works Co.		0.0531				
Nihon Stainless Steel Co.	0.0589					
Daido Steel Co. -steel-			0.0839			0.0957
Asahi Glass Co.				0.1116		
Nippon Sheet Glass Co.			0.1029			
Onoda Cement Co.				0.0496		
Shinagawa Brick -glass & pottery-		0.1988				0.1175
Sumitomo Chemicals Co.				0.0951		
Mitsubishi Chemical Industries				0.1174		
Shinetsu Chemical Ind. Co.				0.0955		
Ibigawa Electric Ind. Co.				0.0637		
Tokuyama Soda Co.				0.1317		
Sekisui Chemical Co. -chemicals-				0.2433		0.1245
Nissan Motor Co.				0.1359		
Toyota Motor Co.				0.1378		
Daihatsu Kogyo				0.1252		

(Continue)

	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	Av. of Industry
-vehicles-						0.1330
Hitachi					0.1409	
Tokyo Shibaura Electric Co.					0.1645	
Mitsubishi Electric Corp.				0.1130		
Matsushita Electric Ind. Co.				0.1519		
Nippon Electric Co.				0.1865		
Hokushin Electric Works		0.1839				
Japan Storage Battery		0.1062				
Fujikura Cable Works			0.0665			
-electric-						0.1391
Mitsubishi Shoji Kaisha				0.0464		
C. Itoh and Co.				0.0426		
-trading-						0.0445
Nippon Express Co.				0.1709		
-freight transport-						0.1079
Tokyo Elect. Express Railway				0.0629		
Odakyu Elect. Railway Co.		0.1658				
Kinki Nippon Railway Co.				0.0896		
-railway-						0.1061
Tokyo Electric Power Co.					0.0418	
Chubu Electric Power Co.					0.0512	
Kyushu Electric Power Co.				0.0451		
-electric power-						0.0460
Tokyo Gas Co.				0.0643		
Osaka Gas Co.				0.0632		
-gas-						0.0638
Av. by scales	0.0589	0.1070	0.0706	0.1065	0.0926	

Total av. of 52 companies 0.0971

on the high profit owing to innovation activities, resulting in high rate dividend and gratis share, and hence high stock capital cost. And, in addition, the relative portion of stock capital to total capital must be increased in order to cover possible risks inherent in innovational investment. When such behavior of "innovation" enterprise is recognised as an established pattern, stock capital is rendered a nature of cost, by which a severe condition is inevitable that cash profit of at least 12 to 13% must be envisioned for investment plans.

The above result also reveals that "general" discount rate of 10% or less, that has been applied to equipment investment plans, is theoretically not appropriate for innovation industry. On the other side, long-range plans of trading firms, e.g. personnel plans, may be established on the base of a discount rate of 4 to 5%, that is, lower than "general" discount rate.

Table 11. Values of Aggregate Capital Cost  $C_2$  for Selected Companies, by capital scales and industries

	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	Av. of Industry
Nippon Suisan Kaisha				0.0598		
Nichiro Gyogyo Kaisha -fishery-			0.0614			0.0606
Nippon Breweries -brewery-			0.0756			0.0756
Daiwa Spinning Co.		0.0843				
Kureha Spinning Co.			0.0609			
Shikishima Spinning Co.		0.0948				
Nitto Spinning Co. -spinning-		0.0556				0.0739
Asahi Chemical Ind. Co. Teijin			0.0876	0.0647		
Toyo Rayon Co.				0.1110		
Kurashiki Rayon Co.			0.0792			
Nihon Rayon Co. -synthetic fibre-			0.0843			0.0854
Oji Paper Co.			0.0756			
Mitsubishi Paper Mills -paper-		0.0715				0.0736
Yawata Iron & Steel Co.					0.0866	
Japan Steel & Tube Corp.					0.0885	
Kubota Iron & Machinery Works				0.2300		
Yodogawa Steel Works Co.		0.0660				
Nihon Stainless Steel Co.	0.0668					
Daido Steel Co. -steel-			0.0891			0.1045
Asahi Glass Co.				0.1279		
Nippon Sheet Glass Co.			0.1098			
Onoda Cement Co.				0.0570		
Shinagawa Brick -glass & pottery-		0.2059				0.1252
Sumitomo Chemical Co.				0.1056		
Mitsubishi Chemical Indu- stries				0.1258		
Shinetsu Chemical Ind. Co.				0.1024		
Ibigawa Electric Ind. Co.				0.0800		
Tokuyama Soda Co.				0.1462		
Sekisui Chemical Co. -chemicals-				0.2476		0.1346
Nissan Motor Co.				0.1468		
Toyota Motor Co.				0.1539		

(Continue)

	0-1.9 billion yen	2-4.9 billion yen	5-9.9 billion yen	10-49.9 billion yen	50-100 billion yen	Av. of Industry
Daihatsu Kogyo -vehicles-				0.1337		0.1448
Hitachi					0.1493	
Tokyo Shibaura Electric Co.					0.1722	
Mitsubishi Electric Corp.				0.1184		
Matsushita Electric Ind. Co.				0.1613		
Nippon Electric Co.				0.1914		
Hokushin Electric Works		0.1913				
Japan Storage Battery		0.1167				
Fujikura Cable Works -electric-			0.0808			0.1477
Mitsubishi Shoji Kaisha				0.0607		
C. Itoh & Co. -trading-				0.0441		0.0524
Nippon Express Co. -freight transport-				0.1784		0.1784
Tokyo Elect. Express Railway				0.0702		
Odakyu Elect. Railway Co.		0.1716				
Kinki Nippon Railway Co. -railway-				0.1002		0.1140
Tokyo Electric Power Co.					0.0563	
Chubu Electric Power Co.					0.0652	
Kyushu Electric Power Co. -electric power-				0.0602		0.0606
Tokyo Gas Co.				0.0772		
Osaka Gas Co. -gas-				0.0775		0.0774
Av. by scales	0.0668	0.1175	0.0804	0.1166	0.1030	

Total av. of 52 companies 0.1073

The aggregate cost  $C_2$ , taking the opportunity cost into account, is on the average higher than the aggregate cost  $C_1$  excluding the opportunity cost, by about 1%. Such differential, however, is less than 1% for some of innovation industries, while it is over 1% for spinning, a "stagnant" industry. This suggests the larger proportion of internal reserves, especially capital surplus and earned surplus in spinning compared with chemicals or electric machinery enterprises. The differential between  $C_1$  and  $C_2$  varies also as to enterprises of the same industry, for instance, Mitsubishi Shoji Kaisha and C. Itoh & Co. In such case Mitsubishi, with a larger differential, is able to establish more elastic plans than C. Itoh & Co. can at least with regard to capital cost.



We want to discuss the problem of opportunity cost more thoroughly in other occasion, but here we must stress that the opportunity cost has different uses for controlling and planning. It represents not the next best interest in a given scope system as used in the case of controlling, but the due interest regardless of place and time in ordinary business activities in the case of planning. Hence it is of substantially objective nature, and so  $C_2$  is to be used for planning generally. However, when competition between enterprises is severe and an allowance for such capital cost is intolerable to win price and equipment investment competition,  $C_1$  may be used as the minimum discount rate.

### ***Additional Remarks***

The capital costs of various kinds we have discussed in this paper, namely that of stock, bond and long-term and short-term loans, may serve for comprehensive, long-range planning involving the plan on capital structure. The aggregate cost, based on a given capital structure, may be useful for various sorts of particular plans. It is indispensable for project planning or operation researches such as planning on inventory, equipment investment, equipment replacement, research and development, or personnel administration.

In our study many estimated values are used to compute the aggregate cost, i.e. pattern of repaying long-term loan, "buzumi" deposit for loan or the ratio of dividend to total profit. In the actual computation by enterprise itself, more accurate approach to such values will be possible. However, we suppose the divergence between our estimates and actual values may not be so wide. Therefore, in the case where the calculation of future capital structure of a company is impossible, or where a planning is not so comprehensive but particular one, an aggregate capital cost of the same sort of industry may be utilized. Also, our result that the average value of aggregate cost is about 10% will contribute as a base for developing the theory for "project planning". In the case of such planning that definitely presupposes the character of an industry, full care must be taken of the appreciably wide differentials of aggregate cost between industries.

It must be especially noted, in planning capital structure, that, on the average, there exist relations among them such as, stock capital cost > long-term loan capital cost > bond capital cost > short-term loan capital cost. Such planning of capital structure that attempts to increase stock capital only because of a declining ratio of owned capital is not necessarily reasonable.\* Contrastively, some, or even a sizable, amount of short-term loan is not always objectionable in view of the lowness of its cost, contradictorily to the view of the so-called business analysis. In some cases, the ordinarily standing amount of short-term loan may be utilized for a fixed amount of working fund to

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\* Ref. The writer; "Nihon Kigyo no Shihonkozo to Kabushikishihon Cost no Jisshokenkyu" (The Study of the Capital Structure and the Cost of Capital Stock in Japanese Enterprises), in Mita Shôgaku Kenkyû, Vol. 6, No. 6.

operate newly invested equipment or for its replacement.

The divergence of values is narrow with respect to the bond capital cost, but is wide with respect to the long-term loan between that from foreign banks or Ex-Im Bank and that from Industrial Bank, Long-Term Credit Bank or trust banks. In order to obtain the low-cost loan, from foreign banks or Ex-Im Bank so-called financial ratios gain high esteem. In other words, the ratio of owned capital in the balance sheet must be increased. Thus, the inducement of the low cost foreign capital requires the increase in owned capital, while the highness of the stock capital cost necessitates the decline in owned capital. Therefore, the most reasonable plan of capital structure, so far as capital cost is concerned, must be such one that can adjust these contradictory requires and bring about the smallest cost of the aggregate capital. To the purpose of attaining such optimum capital structure, this study on the process and some results of the computation of capital cost will be contributory.