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EVALUATION OF BUSINESS FIRM

——An Approach to Quantitative Analysis of Business Performances——

by

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1. Financial-Statements Analysis and Evaluation of Company;
2. Implications of the Function of Company and its Variables;
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1. Financial-Statements Analysis and Evaluation of Company

Evaluation of performances of a company is made variously according to its purpose and viewpoint. Stockholders may attempt evaluation in the sense of his own stock evaluation and financial organs giving loans to the firm do the evaluation for the aim of judging firm's capacity to repay. Related traders try it in order to see the propriety and prospect of dealing with the firm. Company's manager himself may make evaluation of present and past performances to decide future course of management. Furthermore critical students will put evaluation for the purpose of finding characteristics or inside problems of the company. Naturally the view point for analysis are also varied by these different aims. Stockholders may chiefly be interested in dividends or stock prices. Financial organs may develop analysis especially related to businesses' mortgage potentiality or financial liquidity. Trader's interest may lie in the superiority of commodities or terms of payment. The utmost concern of managers may be improvement of business position to sustenance and growth of their companies.

As above, evaluation of company is made for these various aims and angles separately, but the common tool of analysis seems to have been the so-called financial-statements analysis. It has been adopted not only by stockholders and financial organs but also by managers and economists as a method of finding out inside problems or, at least, of obtaining data to support their findings. True it has been an effective tool of analysis — the more effective since the enforcement of the generally accepted Accounting Principles and the Securities Transaction Law, in which financial statements were given consist-

ency and have been made public in uniform style by all companies. And the usefulness of such financial analysis has been increased by the publishing of many information to be utilized for it, such as the Analyses of Business Performances (Kigyō Keiei no Bunseki) by the Mitsubishi Economic Institute, the Analyses of Business Performances of Major Enterprises (Shuyō Kigyō Keiei Bunseki) by the Bank of Japan, and so on.

In this way the financial-statements analysis has grown precise and become a potent method yet not without essential defects. First, many problematic points are involved in the selection of ratios for analysis. Second, relations on cause and effect of the accounting information and the grounds deriving them are unobservable.

The first defect concerns the criterion with which ratios are to be compared. As is well known, the financial analysis was born in America against the backgrounds of her economy of the 1920–30s. Then, the prevalent analysis set the criterion at, for example, a liquidity ratio of more than 2, a current ratio of more than 1, a fixed assets ratio of less than 1, a debit ratio of less than 1, a profit rate to total capital of higher than 6%, and so forth. Taking the level of satisfaction at these indicators, the numbers of good (i.e., over the standard) items and bad (below the standard) items were compared each other to make judgement on a company as the whole. In Japan today, however, such criterions are not held by economists. In place of them time-series data for several past years are analized, and comparisons are made with other company in the same industry. The time-series comparison (between-terms comparison) can show the trends of improvement and deterioration as against past years, yet the meanings of such trends are in no way intelligible. And similarly differentials in ratio from some certain company in the same industry, and their directions — better or worse — can be seen, but the grades of significance implied in such differentials are quite unclear. And to evaluate a company on the aggregation of such ratios is not so easy a task. So supposedly the method most commonly in use is to find satisfaction in case every ratio shows better than its standard rate, or in case ratios are better than in past terms on same company or in the same terms on other company of same industry, in other words, judgement on the so-called satisfaction bases.

Some measures have been devised to remedy these shortcomings. For instance, by the system of the Nihon Kaihatsu Ginkō (Japan Development Bank) average values of ratios for each industrial sector are computed and, assuming normal distribution, deviations from the averages are scored — ± 1 points within a certain deviation, ± 2 points for a further deviation, and ± 3 points for a much further deviation — in short giving significance to the deviation from the standard value (average). This system may be said an excellent method with merit in that the deviations from the averages can be made meaningful and, by aggregating them, overall evaluation of a company is possible. In practice the Bank takes seven financial ratios of sales amount, productivity

of added value, total capital employed, ratio of current profit and loss, ratio of debit, ratio of fixed assets per net worth and long-term liability, and ratio of interest burden.

An excellent method as it is, the Bank's system seems to be unable to be exempt from the defect deriving from its outright reliance on accounting data. It must be similar with customary methods with regard to the above-mentioned second defect, that is, uselessness for clarifying causal relations. This is a defect inherent in accounting data. Data for financial-statements analysis are of course financial values. Accounting data start from conversion of all physical flows involved within management into money value. The basic idea lying therein is that every physical flow bears a counter-flow of money. Data of such money-conversed flows are collected and arranged as financial statements. Let's us put aside the point that there are not a few managerial matters that cannot be given monetary expression for a while, yet we must say that such compiled financial data do not alloy us to pursue their reasons tracing back to original physical values. There is an unreturning character of accounting data.

Suppose, for example, the turnover of inventory has deteriorated. What this can suggest is only that inventory has grown large as against sales amount. Physical causations are hardly clarified — whether the general business cycles have turned downward, or the managerial system is inadequate to the social change, or the sales mix has grown unmatched to changes in demand structure. While being a compilation of physical data by means of common measure of money, financial data, once compiled up, do not permit retrogressive analysis of the causes — an inherent defect.

And, what should not be ignored after all are those factors that cannot be placed on monetary evaluation as counter-flows of physical ones. For instance, to effectiveness of a company's organization, that provides the ground of flows, monetary evaluation is impossible to apply, if some quantitative appraisal is possible. Against this saying, an opposite argument seems to be prepared that, if any appraisal of organization is impossible by itself, the effectiveness, or ineffectiveness, of organization may express itself as figures of profit, output and sales as the whole. Even on this argument, however, it is impossible to inquire into, for example, the reasons for big or small profit. Causal relations (or at least correlations) between organization and profit should be explained. In these points financial data are defective.

An opinion may be possible that, if internal information other than publicated financial statements were available, relations between the statements and underlying causes would be clarified. If so, however, there would be no need of converting quantitative and substantial data into financial data that might be unable to cover them in all. Substantial data prior to the conversion might suffice for the clarification. It is doubtful if financial analyses performed by companies themselves could have something of more significance

than subsidiary role of confirming already-known problemes or faults of companies on the base of financial data.

The above mentioned defects must have existed since long before. Why in recent years they have come to be faced with sincere discussion? Supposedly this is due to the overmuch fluidity of circumstances surrounding companies, notably in Japan. Financial analysis seems to have truly been an effective method in static unchangiable economic structure times. Extension of past trends might have served for explaining present positions as well as for prospecting futures, since physical flows making the background would have been the same with past ones. However, in a dynamic business society as today, businesses are obliged to behave in line with social dynamism. In particular the fluidity of environments seems to be emerging most markedly on the aspect of marketing. Therein have come to the fore such problems as whether sales forecast has been made in conformity with structural changes in demands, whether good sales mix is provided, and whether production structure and organization are adequate. It may be said that the result of an equipment investment depend on the propriety of sales forecast that supplies its ground. In a period when marketing, that makes the starting point of planning and control for business, fluctuates due to structural changes of demands, it will increasingly become an essential matter to grasp businesse's problemes resolutely.

The less clear are the physical causal relations expressed in the past financial data, the less easy to find are the measures to meet external structural changes. In view of the dynamism of modern economic society, the possibility is really thinkable that the customary analysis of business performances based on financial statements would fail to clarify defective points of management, and hence to provide counter-measures to be taken. Letting alone such cases of window dressing statements, we can find not a few companies that, having good appearances on financial analysis, suddenly turned to worsening of business. This attests to the fact that financial analysis cannot cope with structural changes.

As above observed, the customary financial analysis has the largest defect in its inability to fully clarify the significance and causes of financial data. As to the method of the Kaihatsu Ginkō its superiority is visible only on the points that the deviations of data from averages are given significance by the standard deviation unit, and that overall appraisal of a company is possible. However, even with such overall appraisal, which may be useful for comparison with other company, it is doubtful whether any increase in the score can testify so much improvement in the company. More than that, the problem remains still unobvious from what causes ratios are derived, the most essential shortcoming. Changes in individual as well as overall indicators are observable, yet their reasons are unclear. The reason for this unclearness can be found in the double restraint that factors other than appropriate to

monetary evaluation are not induced into data, and the pile-up of monetary evaluation rejects back-tracing researches of physical data.

That in the recent these defects have come to be decisive may be due to structural changes of economy. To many enterprises such changes may take form of those of demand structure. For this reason, marketing is given emphasis. Enterprises are now being faced with an age that requires evaluation of "physical" managerial ability; whether their commodities are provided with assortment that can follow the structural changes notably of demands; how are marketing system, production capacity, financial power and the like corresponding? Hence monetary data evaluation, though a synthesization with moneary measure may be possible, results possibly in a failure to point out focal points of management. We think physical appraisal, that renders possible finding out the causes, must be done.

2. *Implications of the Function of Company and its Variables*

Now, confronting with the above two points of criticism, we have to prepare replaceable devices. To speak frankly this is a difficult task. We ourselves do not think one attempt or a few would succeed in complete removal of the defects of the customary method, yet the intention of our evaluation of company is founded on the above reasons.

We have criticized the customary method of company evaluation mainly with respect to two points. First, causal relations are not presented; second, the customary analysis makes judgement of business conditions by setting individual, independent criterion separately. The first point relates to the nature of accounting data themselves. In case some ratios have proved unfavorable, inquiry into the causes is often very difficult. This is so because physical flows, that make the background of monetary flows, cannot be traced back by medium of financial data. It means that monetary evaluation, which is an efficient means of integration, is not always potent for causal inquiry, and the method of causal inquiry dependent on past experiences is not appropriate in times when, as in recent years, economic and business change is great. The second point concerns the method of aggregating individual indicators. The customary analysis takes some number of separate criterion, from subjective standard or with industrial averages — for instance, a profit ratio to total capital of more than 6% is favorable, or a liquidity ratio of more than 200% is desirable, and so on. And such standards of the company are compared in order to make overall evaluation of the company. Then, how to take standards is a big problem.

As a substitute device regarding the second point, we think a formula of function with the so-called multiple correlation regression, that is, a multiple correlation equation:

$$Y=ax_1+bx_2+cx_3+dx_4.....$$

Letting each factors be the explanatory variables, the dependent variables, e.g., ratio of profit to total capital, are explained. In this multiple correlation regression equation, characteristics of a company in question — such as excellent techniques, superior marketing system, or boom condition of the industry — present themselves as parameters a, b, c, d, ..., which may serve to appraise the company. Economists and managers are especially interested in these points because constitutions and structures of the company are clarified therein. (The formula of function ought to be derived with each firm or at least with each industry; yet this first model represents all industries cross-sectionally.)

First let's consider the point that the factors to be selected for indicators must be physical ones. A big problem here is how to quantify such indicators. Whether a new attempt of evaluation can be successful or not depends on the possibility of quantitative expression of indicators (factors).

Such indicators can be classified into three groups; (1) Factors concerning industry, (2) factors concerning business position, (3) inside-company factors (in our actual model, however, the groups 1 and 2 are combined as "factors of company's environments", not being distinguished).

(*1*) *Factors of industry*

The first problem for company evaluation is the business trend of industry to which the company in question belongs. Regard must be paid to market conditions, changes in demand structures, labor-intensive vs. capital-intensive industry, international surroundings, and relations to government. These factors exert different influences by industries. For instance, there are differences of the ways of undergoing market fluctuations; in a downward phase producer-goods sector (e.g., machinery) is washed more severely while consumer-goods sector is affected less severely. Beside business cycles, there may lie a big difference of evaluation between a sector matched to the general structure of demand and one unmatched, independently of possible superiority in other factors such as marketing power, financial base or technological ability of individual companies. We know many instances that companies of "sunny-side industries" were able to show good performances despite some inferiority in other features. In view of prospective labor shortage, labor-intensive industries will be unfavorably affected. Other industrial factors conceivable may be effects of international circumstances, e.g., trade liberalization, and of protection by governmental policy and so forth.

(*2*) *Factors of business position*

These are indicators showing the position of a company within the industry concerned. It is measured by, for example, share in the market. Another one is independency of a company. A company of specified production and marketing must be said questionable, however favorable its today's posi-

tions may be. It is especially so when company relies on some specified customers.

An example of the indicator for this purpose may be the proportion of sales toward two largest customers to total sales, which may possibly harm independency (excepting owned sales company controllable by the company). And another indicator may be found in the stability of market position, to be expressed by regression coefficient of least squares estimation curve of market-share rates for, say, past four years.

(*3*) ***Inside-company factors***

Various inside-company factors are thinkable. Marketing, production, finance, personnel affairs and organization make up its contents. Commodities are classified into quality goods and brand goods on the base of clues for marketing. As to the quality goods evaluation is made on the base of esteem that the quality enjoys in the market relative to the price. In the case of the brand goods, the brand can be taken to represent the quality itself. For the measurement of marketing and production capacity, such factors as capacity of equipment, potentiality of new products, number of sales bases and efforts for public relations should be taken into account. For the financial base, connections with banks must be attached importance in respect of particular situations in our country. By observing whether bank transactions for past several years have been stabilized or not, quantification may be expectable.

As above, we considered the factors of company evaluation classifying into three groups — industrial, positional and inside-company ones. We did not treat the factor of "manager" separating from other factors because, we think, it is implied in other factors already. In principle manager's task is to combine various factors such as technology, finance, labor and others, and compile them into an organization. He is also responsible for the selection itself on techniques, finance, personnel affairs and so forth. So the factor of manager — the results of his selection and combination — is almost wholly woven into other factors. To take it up independently may result in a duplicated evaluation. There is another point beside this, that is, manager's ability, which is not reflected in other factors. This is right to the point on which quantitative appraisal is impossible; we were obliged to abandon evaluation. Yet our opinion is that such evaluation is needless because it is nothing but evaluation of company itself on which the manager makes decisions including it structure.

After all, we adopted the following factors, on theoretical examination and in respect of the possibility of quantification.

10000 Growth of the industry — GROWTH RATIO
11000 Business sensitibity of the industry — BUSINESS SENSITIVITY
12000 Orderliness of the industry — EQUIPMENT RATIO

20000 Technological ability of company — ENGINEER RATIO
30000 Marketing ability of company — SALES AMOUNT
40000 Financial power of company — FINANCIAL RATIO
41000 Liquidity of company — LIQUIDITY RATIO
50000 Morale of administrative personnel — AVERAGE AGE (MGT)
52000 Efficiency of organization I — BUDGET PREPARING PERIOD
53000 Efficiency of organization II — DATA SPEED

Below these factors will be explained one by one.

Growth of the industry — GROWTH RATIO 10000

Business performances of a company depend foremostly on the business conditions — upward or downward — of the related industry, although efforts of the company are not to be ignored. Environments, in which a company is placed, work more important effects than the company can do. In the case of an economy with a high rate of growth, as is appreciable in Japan, further observation may be necessary dividing industries into (1) industries of high-rate growth, that is, higher than the growth rate of the national economy, (2) industries of average-rate growth, that is, growth nearly parallel to the national economy, (3) stagnant-type industries, that is, slower-tempo growth than the national economy. So we attached importance to the factors of industry taking up three of them — beside GROWTH RATE, also BUSINESS SENSITIVITY 11000 and EQUIPMENT RATIO 12000. Hence, companies coming under the same industry are the same values as to these factors. We computed the growth of the industry factor as:

(sales of industry for 1st-half of 1966)/(sales of industry for 2nd-half of 1962)

This simpleness in selecting computations was adopted on the ground that these two terms — the first and last terms of the eight terms (four years) covered in this study — were not abnormal times in view of the BUSINESS SENSITIVITY calculated beforehand (to be explained later).

For the classification of industries we followed data of the Mitsubishi Economic Institute. Companies that were changed in grouping during the four years were grouped under industries that covered larger number of terms, and new-entry companies were excluded. The sales of industry were taken from (1) data by the Mitsubishi, and (2), when data are insufficient, in particular for the 2nd-half of 1962 and 1st-half of 1963, figures were taken from the Jōjō Kaisha Sōran (Survey of Listed Companies of Stock Exchange), Kaisha Sōran (Directory of Companies) and Yūka Shōken Hōkoku-sho (Report of Securities), and further by annual reports of respective companies.

Of course the indicator of growth ratio thus calculated is not without questionable points. One problem concerns the classification of industries. (This applies not only to grawth rate but also to all factors of industry including sensitivity and orderliness.) As mentioned above we followed the

classification by the Mitsubishi's Analyses of Business Performances (which conforms to the Japanese standard classification of industries). However, in many cases enterprises intending "multiple business" may have advanced into industries other than proper one, and some companies have had more sales in subsidiary fields.

A few examples. The small-auto industry comprises six companies — Tōyō Kōgyō, Daihatsu, Aichi Machine, Honda Motor, Suzuki Motor, and Fuji Heavy Industry — most of which, however, recently have changed main product from "small" vehicle (including bicycle, three-wheeler, and four-wheeler of below-360cc exhausting) to ordinary type.

The fiber industry in Japan is divided, in the Mitsubishi's data, into five sectors of cotton and staple-fiber spinning, wool spinning and weaving, hemp spinning and weaving, chemical fiber, and miscellaneous fibers. However, only on fiber itself further classification by production processes is applicable — rayon staple, rayon group (ordinary), vinylon, polyester, nylon, polypropylene, all-cotton group, polyethylene, poly-vinyl chloride, acryl and nitril, at least (by the Tōyō Keizai Tōkei Geppō). Kanegafuchi Spinning, for example, which belongs to the group of cotton and staplefiber spinning industry, produces nylon and polyethylene to an appreciably important extent beside rayon staple of all-cotton group, and furthermore is advancing into other fields than fiber, such as cosmetics.

Thus it is obviously problematic to classify an enterprise combining various fields into one industry alone.

Business sensitivity of industry — BUSINESS SENSITIVITY 11000

Some industries, while showing growth as the broad trend, may be exposed to marked fluctuation in short-run. Long-run trend movement and short-run cyclical movement must be distinguished in recognition. We name the mode of this latter movement the business sensitivity of industry. It was calculated by the method below.

(1) To fit a straight line through the eight business terms from the 2nd-half of 1962 to 1st-half of 1966.

(2) To take the sum of squares of the residuals between the theoretical values (of 1) and actual values.

Thus: $\sum_{\text{2nd-62}}^{\text{1st-66}}$ (actual value − theoretical value)^2.

(3) To divide (2) by the average of theoretical values.

That is:

$$\sum_{\text{2nd-62}}^{\text{1st-66}} (\text{actual value} - \text{theoretical value})^2 \Big/ \left[(\text{1st-66 theoretical value} + \text{2nd-62 theoretical value}) \times \frac{1}{2} \right].$$

The reason for the division — of the sum of squared values of residuals by the average of theoretical values — lies in an aim of adjusting differentials

between industries with large absolute values and those with small values, by taking ratios.

Values computed on the formula by industries are shown below;

Coal mining	1351	Glass	749
Metal mining	85	Cement	1440
Construction	4552	Iron & steel	20710
Sugar refining	1690	Non-ferrous metal	7175
Beer brewery	4169	Industrial machinery	6885
Milk products	666	Home machinery	1524
Cotton spinning	9799	Ball bearing	570
Chemical fiber	1336	Transport equipment	263
Paper & pulp	2371	Motor vehicles	3727
Inorganic chemicals	624	Small-type auto	6640
Organic chemicals	639	Watch	97
Medicines	1838	Camera	903
Other chemical industry	169	Department store	2424
Oil refining	2837		

(Some of the above figures are different from the data annexed at the end of this paper due to differences of the number of companies covered.)

In the above, the highest value is 20710 for iron & steel, the lowest 85 for metal mining, average of all industries 4411.7, and standard deviation 6011.0. Excepting an abnormal figure for iron & steel, the so-called trunk industries — metal mining, chemicals, transport equipment — are relatively insensitive to business fluctuation while construction, beer brewery, cotton spinning and industrial machinery are appreciably sensitive. (A question of this value is that an industry with weak sensitivity can take a large value in case sales show a sudden rise in which the rising curve comes to present convex with small radius of curvature.)

Orderliness of industry — EQUIPMENT RATIO 12000

To high profit industries new entry is naturally supposable. So, if free entry is possible, present high profit in an industry will not be ensured in the future. Hence inquiry must be made into the degree of barrier against new entry being built in each industry.

The greater is the equipment ratio per a worker, the more difficult is new entry, because so much bigger amount of fixed capital is required. Where new entry is difficult, the orderliness of industry would be maintained supporting the profit rate. We adopted for the barrier against new entry, the equipment ratios adapted from Mitsubishi's material, that is;

$$\frac{\text{total tangible fixed assets (av. of beginning and end of the period)}}{\text{number of regular workers (av. of beginning and end of the period)}}$$

(see List of Data).

A few problems may be presented also with respect to taking equipment

ratio for the barrier against entry.

i) True the magnitude of capital invested in production may provide barrier, but the same invested in marketing, too, makes barrier. To adopt the equipment ratio alone is insufficient. In fact in camera and watch industries, with low equipment ratio, there are barriers of marketing, e.g., brand, which make immediate new entry unsupposable.

ii) There is another view that the barrier in production side is not the equipment ratio per worker but the smallest, undivisible unit of equipment. In assembly industries, which need huge equipment and large numbr of workers as well, the equipment ratio is not so large (for example, motor vehicle, 2212) yet new entry is prevented by the bigness of the smallest unit of equipment.

Technological ability of company — ENGINEERING RATIO 20000

Appraisal of technological ability of a company is very difficult. A method thinkable is to substitute it by the company's attitude toward technology, as potential technological power. For its concrete indicator, proportion of research investment (R & D expenditure) to sales amount, payment of loyalty, number of research staff, degree of cost-down or capacity of equipment are usable. However, these indicators have difficulty of quantification. For instance, the R & D expenditure grasped in financial statement is of unique nature; payments to research personnel are not reflected in it, but in the item of salary; its treatment in accounting is often irregular, being some times counted up in the term of expenditure but some times deferred to later terms, which makes accurate grasp impossible. Other indicators of this factor are still more unclear.

Therefore, we attempted to measure the weight a company places on technology by counting the proportion of graduates of science and engineering faculties of universities and colleges to total personnel of positions of section-chief and above in its head-office. Putting aside chiefs of production division or section or factory, who may naturally be technicians or engineers, appointment of engineer staff to chiefs of head-office section or division or company's director indicates the emphasis put on technology, we thought.

This indicator, named ENGINEER RATIO, was calculated as:

$$\frac{\text{number of administrative personnel from science and engineer school}}{\text{total number of administrative personnel}}.$$

Data were adapted from Kaisha Shokuin-roku (Personnel Lists of Companies), Diamond-sha.

Marketing ability of company — SALES AMOUNT 30000

The marketing ability of firms was measured by sales amount in the end. The process of thinking up to this decision was as follows.

Our first device. Commodities are grouped under two types; (1) brand

type, (2) quality-price type.

Brand type goods mean those goods on which the brand works influential effect on sale. Typical ones of them are cosmetics, sanitary and medical goods, dairy foods, confectionary, wears and electrical appliances. Purchasers cannot make perfect appraisal of quality on these goods, so they place confidence on brand, say, transformation of quality into brand.

Quality-price type includes those goods for which quality and/or price can affect on sale most effectively. Producer goods, such as machine tool, steel and etc. come under this group. In principle quality is spoken in a relative sense to price, but in some commodities, such as analytical instruments, electronic microscope and etc., absolute priority is placed on technological quality irrespective of price (technology-type goods).

Thus dividing into two groups, as for the brand type goods enquête is sent to consumers, "What brand do you choose from among products of the same kind and price?", and by taking average of the rankings answered, values of brands are measured. Similarly as to quality-price goods enquête is sent, "Which is superior in quality providing the same price?" This method involves a difficulty, however, in that clear distinction of the two types is unadaptable to all commodities (e.g., the said technology-type goods). We have alternatively considered other methods, such as number of marketing bases and advertisement expense, which also had to abandoned because of many problematic points involved.

Our second device. As the second thought of the above method, we considered, whether brand goods or quality-price goods, demands for commodities are rooted to consumers' habits (the so-called habit hypothesis in econometrics). So market shares of commodities may represent marketing power respectively. This idea seems to have reasonableness in itself. However, if the marketing power of a commodity is measureable by this means, aggregate ability of a company selling various kinds of goods is very difficult to measure.

For instance: Let's define the marketing ability of a company as "arithmetic average of market shares of its major products, each making up more than 20% of total sales. If in company X the sales of comodity A count 30 (market share 10%) and commodity B 20 (share 40%), the marketing ability of this company is calculated as $\frac{(0.1+0.4)}{2}=0.25$. Contrastively suppose another company Y with only one major product A (share 28%). This company's marketing ability is 0.28. If the two companies compete in commodity A alone, Y should win (30 vs. 28), whereas the above calculations show 25 vs. 20. Is this result justifiable? When a company markets several kinds of goods, supposedly these goods are marketable through the same sales channel. Then, it seems that the marketing ability should be shown by the sum of shares, not by average. The conclusion is that the marketing ability is nothing but the

sales amount itself. Thus the market share involves too many problems to use for the indicator of aggregate marketing ability of a company selling a number of goods.

Another problem lying in the market share as the criterion of marketing ability is that a large share is not always favorable. Often it tells delated retreat from market. For example, Tōyō kōgyō once had an increasing share in the market of three-wheeler while the sales declined year by year. And a third problem is on the applicability of market share. There is a difficulty in identifying names of commodities between the data from the Tōyō Keizai and the Report of Securities (if identified, very complexed).

For the above reasons we were unable to find any other way than taking total sales to indicate marketing ability, and did so.

Financial power of company — FINANCIAL RATIO 40000
Liquidity of company — LIQUIDITY RATIO 41000

It seems to have been customary to judge a company's ability of capital raising by means of various rates such as liquidity rate (current assets/current debits) or acid test ratio (quick assets/current debits), that represent ability of repayment. Importance has been attached to these ratios in the sense that loan shall be given provided repayment ability exists. We took up, and re-examined, liquidity ratio from such standpoint. There is a point to be noticed on it. It has been said that high-rate growth is accompanied by low liquidity ratio, in other words, profitability and liquidity contradict each other. In so far as our data show, however, this is not always true; a correlation of 0.322 is found between growth rate and liquidy ratio, and the correlation between liquidity ratio and profit ratio is very high.

Liquidity ratio seems to have lost its importance as the indicator of the power of raising capital (power of repayment) just on account of growth of company. That is to say, indicators of the period of stabilized economy have become useless following economic growth. In fact it may be said that liquidity does not need to be so high if increasing cash receipts are expected by growing sales. Then, what an indicator of financial power can be found to replace for it?

Our device is a ratio to be called "credit reserve". To companies in the process of economic growth as today, the security power as *stock* is not so essential as the power of raising cash as *flow* (including potential power). So long as a firm's business condition is favorable and its sales are showing expected growth, its finance will be protected from failure by means of money rotation. Difficulties will arise only when sales increase is not satisfactory or bills happen to become dishonoured.

Along with growth power and sensitivity which we had already counted as the factors, we considered it important whether a firm has any financial organs that would support it in case of unfavorable conditions, and called

it credit reserve. It is said that financing by a few specified organs is more helpful in time of emergency than by randomly numerous organs. Supposedly this is because the latter case involves a fear of allout stop of finance. So we define that financing by "main banks" represents stronger financial power. And, as for the power of raising capital by stock issue we think as follows. In Japan there is strong correlation between raising capital by credit and that by stock issue, and in fact linked creditors are making stockholders. So credit can represent stock issue. Furthermore, often raising capital by stock issue does not constitute short-run financial power we have in mind. So we placed this out of consideration. Thus financial power of a company was calculated as:

$$\frac{\text{sum of credit from organs of rankings 1st and 2nd}}{\text{sum total of credit}}$$

Data for this formula were adopted from the Keizai Chōsa-kai, Keiretsu no Kenkyū (Study of the Business Linkage). In the organs of 1st and 2nd rankings we included not only financial organs but also linked or parent companies; for example, Nissan Auto for Aichi Machines, and Sumitomo Metal Industry for Sumitomo Light Metal. Temporary credits, e.g., government loan, were excluded; for example, credit from the Economic Cooperation Fund to sugar refining companies such as Osaka Sugar and Shibaura Sugar.

The financial ratios thus computed are shown in the annexed List of Input Data. The highest is 71.0% for watch makers, the lowest 21.2% for organic chemical industry, the average 41.42%, and the standard deviation 17.35.

A debatable thing is that precise study was not made on the reasonable number of the main financial organs — whether top-ranking one or two or three. We tentatively took upper two in view of the fact that generally the so-called main banks comprise two banks, the third and lower ones showing sharp decline in positions.

Factors of organization and personnel affairs:

Attempts of quantification on the factors of organization and personnel affairs have been done very few, and that, most of them are experimental, not practical. We dared to try quantification despite supposable difficulty. It is said that organization is to be oriented to higher management-efficiency. Then, to what extent is it contributing? Its quantification should be regarded worthwhile.

We think of four such factors, which can be divided into two groups. The first group includes average age of administrative personnel and turnover rate of labor (labor moving ratio), which may bethought to present the grade of morale of the people. The second group comprise "budget preparing period" and "data speed", in which the efficiency of organization is reflected.

AVERAGE AGE of management personnel (MGT) 50000
LABOR MOVING RATIO 51000

Management personnel and operative personnel are supposed to be very different in behaviors, on which many studies have been made. To management or would-be management personnel quick promotion would work as the greatest motive to high morale. We thought the speed of promotion is the most efficient incentive to their morale. In Japan where most enterprises are adopting seniority promotion system, that is, step-by-step rises from lower classes, the speed of promotion for management personnel can be measured by their ages. Younger average age implies possibility of averagedly higher speed of promotion, and hence higher morale so much.

In the practice, management persons in the Kaisha Shokuin-roku (Personnel Lists of Companies), 1968 ed., Diamond-sha, were taken for population, whose average ages were computed. Management personnel denotes the people of section-chief and upper position in principle.

The results are shown below:

Average Ages of Administrative Staff, by industries

Coal mining	50.3	Glass	50.1
Metal mining	55.3	Cement	52.3
Construction	54.3	Iron & steel	48.4
Sugar refining	49.5	Beer brewery	53.1
Confectionary	51.5	Non-ferrous metal	49.9
Milk products	50.7	Industrial machinery	49.4
Cotton spinning	48.1	Home machinery	46.5
Wool weaving	51.4	Bearing	46.5
Chemical fiber	46.5	Transport equipment	50.6
Paper & pulp	48.8	Motor vehicles	48.2
Inorganic chemicals	49.6	Small-type auto	50.2
Organic chemicals	50.0	Watch	45.7
Medicines	47.0	Camera	46.8
Other chemical industry	49.3	Total wholesale	49.1
Oil refining	48.4	Department store	49.3
		Total industries	47.2

(Figures are different from those on the List of Input Data. The above table covers all companies to which enquête was sent.)

While to management personnels (white collar) opportunities of quick promotion seem to have utmost importance on their morale, by what means can the morale of operative employees (blue collar) be measured? For this various factors are supposable such as average wages of the company (or deviation from industrial or local average), environments of work, excellent superior personnel and challenging jobs. What makes the most essential one among these is suggested variously by cases of survey. But a point identical throughout all surveys is that wages do not hold so superior position as may

a priori be conceived.* We considered these various factors but were unable to find any decisive one. So we took turn-over rate of labor, in which the morale of operative workers is supposed to be reflected as the result, for the indicator.

Statistics of turn-over rate of labor by enterprises are unavailable. so we sent enquête to companies, with a form below:

Please show the numbers of operative workers (principly graduate of high school or lower class), job quit and new hire		
	Male Worker	Female Worker
At the beginning of 1965		
〃 1966		
〃 1967		
Job-quit during 1965		
New hire during 1965		

From figures filled in this table we adopted those of male worker and for 1965. Thus:

$$\frac{\text{number of quit of male worker in 1965 (excl. age-limit retirement)}}{\text{total number of male worker at the beginning of 1965}}$$

Female workers were excluded because they quit for reasons with no relation with morale, e.g., marriage, and the patern of their quit is different from that of male workers. (Actually a marked difference of turn-over rate of labor is seen between male and female workers in the answers to our enquête.) Workers of casual hire were excluded. Where data for 1965 were inadequate due to personnel cut or other reasons, data for 1966 were used. Age-limit retirement was excluded. In case the number of quit was uncertain, estimation was made:

number of quit=number of workers at the beginning of 1965+new hire during 1965−number of workers at the beginning of 1966−age-limit retirement during 1965

Turn-Over Rates of Labor by Industries, male worker for 1965

Coal mining	11.2%	Milk products	3.5 %
Metal mining	4.1	Medicines	4.0
Construction	4.8	Industrial machinery	7.3
Sugar refining	5.3	Home machinery	11.8
Cotton spinning	2.7	Bearing	7.0
Paper & pulp	2.9	Transport equipment	9.1
Beer brewery	1.1	Motor vehicles	17.4
Organic chemicals	3.6	Small-type auto	3.4
Inorganic chemicals	2.9	Chemical fiber	3.1
Oil refining	1.1	Other chemicals	1.8

*Tazaki, Jūgyōin no Morale Chōsa (A Survey of Employees' Morale), Keizai Shūshi, Vol. 35, No. 5.

Glass	3.4	Watch	1.7
Cement	6.8	Camera	2.7
Iron & steel	8.0	Department store	3.0
Non-ferrous metal	2.8	All industries	4.56

BUDGET PREPARING PERIOD 52000
DATA SPEED 53000

Most of theory about the organization of company speak of delegation of authority and clarification of responsibility. Gradual delegation of authority from top-management to lower-class personnel, in accompany with growing scale of enterprise, has been accepted as a favorable way for smooth management of business. However, the superior-class personnel, having delegated authority to the lower class, must receive reports on the relevant matters. Other conditions being equal, the speedier such reports, the better they are. In many cases of inefficient management it takes too much time for the reports. We adopted this speediness in submitting report data to superior competent personnel for quantifying the efficiency of management. And we took as another element of efficiency the neccessiated period for preparing yearly budget, which is to control a company as the whole. Every year some new ideas may be introduced into budget necessiating extra days for considering, but budget preparation itself may be a routine work by the same procedure every year. So this period may be taken to express the efficiency of budget design system, and, since budget relates to the entire organization, the efficiency of budget system outrightly reflects that of the whole organization.

The BUDGET PREPARING PERIOD was computed by way of enquête below:

1. Is your budget term a half-year or a year ?
   (half-yearly, yearly) from A day B month to C day D month
2. For the present business term, on what day of what month the president (president's room, planning room, management room, secretary's room, etc. —general staff—) informed budget principles to the operative positions (business-section chief, factory chief, etc. —chief of line—) ?
   (month day)
3. On what day of what month was the present term's budget finally approved by the budget committee ?
   (month day)
4. In case the budgeting data varies every year, generally how many days have been taken for the preparation ?

In so far as a budget preparing period calculated by questions 2 and 3 (for example, if answers are July 20th and August 20th, the period is 31 days) was not abnormal, it was adopted. When abnormal, answer to question 4 was used to acknowledge the period.

Budget Preparing Period, by industries

Coal mining	47.3 days	Non-ferrous metal	62.6 days
Metal mining	45.0	Industrial Machinery	33.0
Construction	20.0	Home machinery	50.5
Sugar refining	48.2	Bearng	42.5
Gotton spinning	30.0	Transport equipment	32.0
Chemical fiber	30.0	Motor vehicles	52.0
Paper & pulp	28.0	Small-type auto	45.3
Inorganic chemicals	56.3	Watch	56.0
Oil refining	50.3	Camera	86.7
Glass	60.0	Department store	40.5
Cement	46.5	All industries	48.6
Iron & steel	43.3		

As to data speed, another indicator of the efficiency of organization, our enquête was:

Do your president (president's room, planning room, management room, secretary's room, etc.) ○, division chiefs (division-chief's room) △, and business-section and factory chiefs ×, receive data from operative positions, and are they daily, weekly, 10 days or monthly?

	Daily Data	Weekly Data	10-day Data	Monthly Data
Sales				
Recovery of accounts receivable				
Production				

We had the above enquête filled, by which the data speed was computed as follows. In general form speed$=\frac{\text{distance}}{\text{time}}$. 1 point was assigned to a distance from operative position to section chief, 2 points to that from the same to division chief, and 3 points to that to president. It is assumed that authority is delegated downward through the line of president — division chief — section chief, and to inverse direction data come back. As for the *time* we assigned 1 point to daily data, 2 to weekly and 10-day data, and 3 to monthly data (weekly and 10-day report were made equivalent because actually one of the two is made alternatively). It may be thinkable to assign 1, 7, 10 and 30 to these four kinds of data respectively, but we did not apply these values, adopting instead ordinal numbers of 1, 2 and 3 because of a fear that the former values would result in overmuch effect of time factor and under-appreciation of distance. As for the contents of data we took up three kinds, namely sales, recovery of accounts receivable and production (inventory in commerce) which are supposed to be applicable to every company. For example, what a figure of data speed is given to a company below?

By the table, as to sales the section-chief, receiving daily data, has values of distance-1 and time-1, so $\frac{1}{1}$; the division-chief, receiving 10-day data, has dis-

Company	Daily	Weekly	10-day	Monthly
Sales	×		× △	× △ ○
Recovery of accounts receivable	×		×	× △ ○
Production	×		× △	× △ ○

tance-2 and time-2, so $\frac{2}{2}$; the president, with monthly data, has distance-3 and time-3, so, $\frac{3}{3}$. Thus the firm has $\frac{1}{1}+\frac{2}{2}+\frac{3}{3}=\frac{9}{3}$ for sales data. In this calculation 10-day and monthly data to section-chief and monthly data to division-chief were ignored, since these may be naturally provided in view of the existence of daily report.

By similar computation, values of credit receipt are $\frac{1}{1}$ for the section chief, $\frac{2}{3}$ for the division chief and $\frac{3}{3}$ for the president, so $\frac{1}{1}+\frac{2}{3}+\frac{3}{3}=\frac{8}{3}$. As to production, $\frac{1}{1}+\frac{2}{2}+\frac{3}{3}=\frac{9}{3}$.

Thus the company has $\frac{9}{3}+\frac{8}{3}+\frac{9}{3}=\frac{26}{3}$ (in the actual computation the numerator was made 52, on the common denominator 6). Needless to say, in this formula smaller figure represents higher data speed.

In case of industries without these data some convenient methods were adopted. For example, as to the sugar industry, in which there is a fixed commercial usage that producers send bill within 3 days after sale and cash (incl. check) payment is made within 7 days, so actually there is no account receivable in this industry, hence the same data of sales were adapted to accounts receivable. Also, as department stores have little inventory (to be substituted for production) the same speed with sales was assigned to inventory. Department stores usually put orders to wholesalers according to sale, immediately receiving wares.

Data Speed, by industries, 1967

Coal mining	76.3	Non-ferrous metal	27.0
Metal mining	52.0	Industrial machinery	48.0
Construction	36.0	Home machinery	52.0
Sugar refining	69.2	Bearing	87.0
Cotton spining	48.0	Transport equipment	45.0
Chemical fiber	90.0	Motor vehicles	53.0
Paper & pulp	81.0	Small-type auto	72.6
Inorganic chemicals	38.3	Watch	54.5
Oil refining	31.0	Camera	54.0
Glass	30.0	Department store	75.0
Cement	70.5	All industries	58.8
Iron & steel	58.3		

Problematic points concerning the budget prepating period and the data speed may be pointed out as follows.

1. Whether the three data taken up — sales, recovery of accounts receivable and production — are necessary and satisfactory, or not.

2. The time required for preparing information and that for transmitting it are mixed and unseparable.

3. Direct line of organization of president-division chief-section chief is assumed as the route of information, yet this must be re-examined.

4. It is assumed that longer distance for the same time means higher speed. Yet it is questionable whether a long distance — e.g., three steps are taken, when two steps are sufficient — can be taken to represent higher efficiency, or not.

Variables to be explained —dependent variables—

—Profit Ratio (1), Profit Ratio (2), Profit Ratio (3)—

We adopted profit ratio for the dependent variables of the business appraisal function.

For overall appraisal of a business firm various indicators are conceivable. In fact business men make appreciation of "good firm" or "bad firm" depending on each individual's intuition based on particular grounds. Such grounds may be continued dividends of $x\%$ or above for y business terms, or improvement of a firm's position in the industry shown by rising market share and the like, or the so-called "increased income and profit" denoting absolute and relative improvements of sales and profit.

Each of those indicators, after our examination, has difficulty which makes it unadaptable to our purpose. So we decided to use tentatively *net* profit ratio to total capital — Profit Ratio (1), *gross profit* ratio to total capital — Profit Ratio (2), and *operating* profit ratio to total capital — Profit Ratio (3).

Net Profit Ratio to Total Capital — PROFIT RATIO (1) 90010

Data for this were taken from the Mitsubishi Economic Institute, The Analysis of Japanese Company in 1966 (2nd half year). It is

$$\frac{(\text{net profit}) \times 2}{\frac{1}{2}(\text{total capital at beginning} + \text{total capital at end})}.$$

We checked this ratio because of its popularity as the measure of appreciating business performances.

Gross Profit Ratio to Total Capital — PROFIT RATIO (2) 90020

This was computed by a formula

$$\frac{(\text{net profit} + \text{depreciation}) \times 2}{\frac{1}{2}(\text{total capital at beginning} + \text{total capital at end})},$$

using the data of the Mitsubishi Economic Institute. In recent years the depreciation allowance is showing a big amount, notably for manufacturing,

almost equalling net profit. And it fluctuates according to company's policy to "make small profit" in order to reduce the tax, partly for the reason that the tax law defines only its highest limit and often taxable depreciation is made. To avoid these artificial profit we returned to the profit including depreciation. Also other reserves — such as provision for price fluctuation, employees' retirement allowance, allowance for uncollectable accounts etc. — may affect profit accounting but these are of small amount as compared with depreciation allowance, so neglected here. (According to a source of the National Tax Agency, the sum of those three reserves accounts for 46.6% of depreciation allowance.)

However, the effect of depreciation on profit has proved to be smaller than we conceived; the correlation coefficient between net profit ratio and gross profit ratio, that is, Profit Ratios (1) and (2), is about 0.9606.

Operational Profit Ratio — PROFIT RATIO (3) 90030

The said operational profit denotes profit before deducting various financial expenses. There is a view that the real profit of enterprise should be considered excluding financial income and loss such as interest for borrowings, discount of notes and the likes.* We thought it worthwhile to make calculation upon this view. Actual calculation was made by

$$\frac{\text{(operational profit)}\times 2}{\frac{1}{2}\text{ (total capital at beginning + total capital at end)}}.$$

Data concerning the above variables are compiled in the Material 1, List of Input Data, at the end of this paper.

3. Process of Computation on the Function and the Results

Our computation is the usual analysis of multiple regression.

(1) Adjustment of data. Data by enquête were collected from 174 companies. But after excluding those lacking in reliability and fulfilment of the variables, company with complete data for all the variables counted only 83 companies.

(2) Each of the three dependents variables were explained by all the explanatory variables — independent variables — respectively. The formulae of function are as follows (the subscript of variable X shows DATA NO, omitting 1000 each).

$$\begin{aligned} Y_1 = &-15.3535665 + 4.9570990\,X_{10} + 0.0000238\,X_{11} - 0.0004269\,X_{12} \\ &- 0.0145381\,X_{20} + 0.0000228\,X_{30} + 0.0231955\,X_{40} + 0.0375718\,X_{41} \\ &+ 0.1153176\,X_{50} - 0.0799372\,X_{51} + 0.0034041\,X_{52} + 0.0226560\,X_{53} \\ &(R = 0.635) \end{aligned}$$

*Nakanishi & Nabeshima, Keiei no Rinen to Tokushitsu (Ideas and Features of Enterprise).

$$Y_2 = -13.5500131 + 7.2801913\,X_{10} - 0.0000806\,X_{11} - 0.0005377\,X_{12} + 0.0130434\,X_{20} + 0.0000302\,X_{30} + 0.0109582\,X_{40} + 0.0107324\,X_{41} + 0.1483913\,X_{50} - 0.0136220\,X_{51} + 0.0003109\,X_{52} + 0.0233856\,X_{53} \quad (R = 0.552)$$

$$Y_3 = -12.1714468 + 2.5262699\,X_{10} - 0.0001449\,X_{11} - 0.0004562\,X_{12} - 0.0264399\,X_{20} + 0.0000130\,X_{30} + 0.0156212\,X_{40} + 0.0555019\,X_{41} + 0.2033107\,X_{50} - 0.1788366\,X_{51} + 0.0020198\,X_{52} + 0.0203938\,X_{53} \quad (R = 0.515)$$

For details, see Materials 2, 3 and 4 at the end of this paper.

(3) Observing parameters and others of the above functions, analyses were made with respect to major combinations of the variables. The combinations are shown in the annexed List. Among the 26 varieties of combinations shown the most significant ones are Nos. 21, 22 and 23, whose function formulae are respectively:

$$Y_1 = -13.3295119 + 4.6894186\,X_{10} + 0.0000325\,X_{11} - 0.0004933\,X_{12} - 0.0184534\,X_{20} + 0.0000226\,X_{30} + 0.0278933\,X_{40} + 0.356403\,X_{41} + 0.1176659\,X_{50} - 0.0797428\,X_{51} \quad (R = 0.625)$$

$$Y_1 = -14.1805475 + 5.017548\,X_{10} + 0.0000250\,X_{11} - 0.0004147\,X_{12} - 0.0164310\,X_{20} + 0.0000205\,X_{30} + 0.0294650\,X_{40} + 0.0351508\,X_{41} + 0.1114865\,X_{50} + 0.0023832\,X_{52} \quad (R = 0.618)$$

$$Y_1 = -9.1852385 + 4.9207899\,X_{10} + 0.0000276\,X_{11} - 0.0004113\,X_{12} - 0.0177011\,X_{20} + 0.0000227\,X_{30} + 0.0233747\,X_{40} + 0.0362330\,X_{41} - 0.0791169\,X_{51} + 0.0221161\,X_{53} \quad (R = 0.631)$$

(4) Considering the result of experiment (3), we excluded companies with differences between estimated and observed values of more than ±5. As the result all companies of the sugar refining and some others were omitted, leaving 73 companies. This was made for the aim of consolidating data to those of more homogeneous group of companies. The combinations of variables on these reduced sample are shown in the List of Combinations of Variables on 73 companies. Among the 17 varieties of combinations shown the most significant ones are Nos. 2, 3 and 6, whose formulae of functions are:

$$Y_1 = -6.0709851 + 2.9683451\,X_{10} - 0.0000050\,X_{11} - 0.0003146\,X_{12} + 0.0006351\,X_{20} + 0.0000180\,X_{30} + 0.0407635\,X_{40} + 0.0263808\,X_{41} - 0.1050006\,X_{51} + 0.0201257\,X_{53} \quad (R = 0.645)$$

$$Y_1 = -4.0834776 + 2.7486988\,X_{10} + 0.0000090\,X_{11} - 0.003777\,X_{12} - 0.0025576\,X_{20} + 0.0000174\,X_{30} + 0.0443891\,X_{40} + 0.0240431\,X_{41} - 0.0041859\,X_{50} - 0.1088959\,X_{51} \quad (R = 0.630)$$

$$Y_1 = -6.8354706 + 2.7601196\,X_{10} + 0.0000142\,X_{30} + 0.432919\,X_{40} + 0.0317303\,X_{41} - 0.0198515\,X_{50} - 0.0588510\,X_{51} + 0.0049476\,X_{52} + 0.0257648\,X_{53} \quad (R = 0.622)$$

For details, see List at the end of this paper.

4. Conclusion

In this short article we have studied a new method of firm appraisal in place of the customary business analysis. Yet this is merely a first step, whose aim is to erect an idea of over-all appraisal and to try quantitative tests on it. Our ultimate objective is, as has been stated at the outset, to devise effectively quantifiable explanatory variables and to make quantitative estimation of their weights of contribution to business performances.

Such objective is, however, the ultimate one, for whose attainment it would take a fairly long time. So we want to illustrate problematic points lying on the road to its attainment here. The biggest problem concerns the multiple regression analysis itself. By the usual theories of management, demand for a commodity is said to be determined by price, income and etc.. The sensitivity (or elasticity) of these factors to demand is expressed as respective regression coefficients of a multiple regression model that takes these factors for explanatory variables. It must not be forgotten, however, that this idea is significant only in so far as the multiple regression model is "complete." The completeness means that the causal relations in terms of economic theory can be expressed as functional relations. Actual testification on it is that the multiple correlation coefficient is 100%. On these two assumptions, that is, the existence of economic-theoretical relations and the multiple correlation coefficient of 100%, we can conclude that the regression coefficients of a multiple regression model represent the sensitivity.

Then, how is it about a case where the multiple regression correlation coefficient is below 100%, say, about 95%. In intuition it may be possible to think the regression coefficients of the model can indicate sensitivity at a confidence interval of more than 90%. However, a model with multiple correlation coefficient of 95% may actually present estimation with a confidence interval of 95% so far as the values of dependent variables are concerned, but as to the sensitivity such confidence interval is unexpectable. We cannot yet testify a general theory explaining the relation among the magnitude and dispersion of multiple regression coefficients, the multicolinear relations among explanatory variables and the multiple correlation coefficients. But in view of our past experiences on the formulation of multiple regression model, we know that, even in case of correlation of higher than 95%, the regression coefficients widely fluctuate if the variables are replaced, increased or decreased. This phenomenon is seen in particular where high multicolinear relations exist among explanatory variables. Hence we do not intend to make uncautious argument on the rates of contribution by each variable to business performances, on the base of regression coefficients of a model with multiple correlation coefficient of 64% that we have formulated here. However, we have made trial calculations on this multiple regression model and examined

the state of fitness, in order to find out what degrees of contribution are made by variables here quantified, which explanatory variables are relatively stabilized, and what variables should be included or removed. Questions on the multiple regression analysis and our attitude toward them have been described above. There are many questions, but these do not tell that our multiple regression equations and simple correlation matrices are wholly meaningless. In particular the simple correlation matrices are useful, for they can give quantitative explanation to the relations between various managerial phenomena that have hitherto been mentioned only intuitionally.

In the below we will examine the results obtained by our study (on the base of models formulated on data of 73 companies.)

1) As to Profit Ratio to Total Capital the highest correlation is seen in Liquidity Ratio, followed by Growth Ratio of industry and next by Finance Ratio. The result suggests that financial environments and business trends of the industry to which the company belongs — external factors — have influences of high degree upon present management of individual company. And a general commonsense that company with high Equipment Ratio have low Profit Ratio is testified by the negative correlation between the two. Further, the negative correlation between Profit Ratio and Turn-Over Rate of Labor shows that in low-profit companies Turn-Over Rate of Labor is high, hence low morale of employees.

2) As to Growth Ratio, negative correlation is seen with Financial Ratio, Turn-Over Rate of Labor and Data Speed. The negative correlation to Financial Ratio tells that high growth ratio requires diffusioned borrowing from many financial organs. It is to be noticed, however, that such diffusion has been performed not always unjustifiably, but is related to increasing profit ratio (the above-said positive correlation of Financial Ratio to Total Profit Ratio). The negative correlation between Turn-Over Rate of Labor and Growth Ratio is intuitively acceptable, for in a high-rate growth expanding organization and increasing opportunities of promotion and pay-up will bring about fewer job changes to outside. As to the negative correlation between Data Speed and Growth Ratio, this seems to derive from instability of information route accompanying continued expansion of organization in growth period.

As for Growth Rate high positive correlation is shown by Engineer Ratio and Liquidity Ratio. The former tells the numerousness of such managements who graduated from "Engineering" course, as may be supposable. But the latter upsets a popular view that Liquidity Ratio of growing companies may well be low.

3) Business Sensitivity presents positive correlation to Growth Ratio and Liquidity Ratio. The former seems to have been affected by the method of measurement to some extent as observed already, yet it is also understandable from a viewpoint of business theory, because generally insensitive industries concern products of stable demand, hence low Growth Ratio. The

latter is well plausible by the fact that sensitive companies must maintain high Liquidity Ratio.

4) Equipment Ratio shows negative correlation to other variables most numerously, and at high values, compared with other explanatory variables, that is, negative correlation to six variables of Profit Ratio, Engineer Ratio, Financial Ratio, Liquidity Ratio, Turn-Over Rate of Labor and Data Speed. Among these, Engineer Ratio is difficult to understand, but the magnitude of correlation is very low, suggesting a possible data error. The relation to Financial Ratio means that larger equipment requires diffused borrowing, similarly with the case of Growth Ratio. And, in capital-intensive industries Turn-Over Rate of Labor declines supposedly on account of better labor conditions. The negative correlation between Equipment Ratio and Data Speed seems to tell that in a high Equipment Ratio, being accompanied by high feedback function of equipment itself, information for controlling becomes less necessary than is in the case of labor-intensive industries. But this view is not so much obvious since possibly there may lie a problem of measuring Data Speed.

5) Engineer Ratio is in high positive correlation with Growth Ratio and Liquidity Ratio. The former is acceptable but the latter is hardly understandable. And, the high negative correlation to Financial Ratio may be said to reflect scarce contacts with financial organs. Since Liquidity Ratio, Growth Ratio and Financial Ratio affect most heavily on Profit Ratio as observed above, a higher Engineer Ratio, that has positive correlation with the former two Ratios, may work favorably on companies, but this is confined to a certain extent because of disadvantages on the side of finance.

6) Sales Amount has high positive correlation to Equipment Ratio and high negative correlation to Financial Ratio. The former correlation is easy to understand. Also the latter is explainable since increased sales may necessiate borrowing from a larger number of financial organs.

7) Financial Ratio shows negative correlation of high degree to Growth Ratio, Equipment Ratio, Engineer Ratio and Sales Amount, on which explanation has been made already. The positive correlation to Data Speed is supposed to reflect that the data observed here, or those of actuals, are mostly comprised from financial standpoint, and hence the speed is strongly required where Financial Ratio is high, that is, the connection with main banks is close and the control by them is heavy.

8) As to Liquidity Ratio, Turn-Over Rate of Labor and Data Speed, their remarkable points of relations to other variables have already been observed, so there may be no need of repetition.

9) The variables showing high negative correlation to Average Age are Profit Ratio, Growth Ratio, Engineer Ratio and Liquidity Ratio. This obviously tells that the younger are managements, the higher is their morale, resulting in higher Profit Ratio, Growth Ratio and Liquidity Ratio, all favor-

able to companies. Its correlation to Engineer Ratio is impossible to explain.

10) Budget Preparation Period shows no correlation of high degree to any other variables. It is in positive correlation of some degree to Profit Ratio, which is unable to interpret theoretically. And, in view of its negative correlation to Data Speed this is illogical; perhaps this is due to errors in enquête preparation or in the way of getting answer.

In the above we have examined the relations between various variables on simple correlation matrices. In any way, definite estimation is impossible since the correlation is 40% or so at the highest. Yet we could say that the directions of casual relations have been studied vaguely.

Next let us consider the results of the multiple regression equation. As already mentioned, even where multiple correlation coefficient is as his as 90%, it is difficult to conceive that the regression coefficient of each explanatory variable directly presents the degree of elasticity. Still less here the regression coefficients may have only small significance as the ratio of contribution to profit ratio, since the multiple correlation coefficient is only 64%. On the other hand, since correlation of 40% can hardly be found between variables as seen in the above simple correlation matrices, effects on the multicolinear relations are weak, and the regression coefficients are relatively stabilized.

The regression coefficient of Growth Ratio is relatively stable, showing, for the three models (I, II, III), respectively 2,968, 2,749 and 2,760; and also is stable the standard deviation showing 1,084, 1,100 and 1,057 — less than half of the regression coefficient. That this Growth Ratio of industry contributes most greatly to Profit Ratio corresponds to the customary fact that banks make discrimination on loan terms first by industries. Also Equipment Ratio (which is involved in the models I and II only) has regression coefficients of −0.0003146 and −0.0003777, and the standard deviations of 0.0001755 and 0.0001731, the latter being below half of the former, too. And, this negative sign conforms to the universal axiom of economics that profit ratio declines with expanding business scale and rising ratio of equipment per labor. Sales Amount also, on the three models, has standard deviations of about 30% of regression coefficients, being stabilized at 0.0000142~0.0000180. Similarly as to Financial Ratio, on the three models, standard deviations are about 40% of regression coefficients, being 0.0264~0.0317. Turn-Over Rate of Labor with negative regression coefficients on all three models, has unstable regression coefficients −0.0589~−0.1089, and relative large standard deviations. For Data Speed, involved only in the model I and III, regression coefficients are stabilized at 0.02021~0.02576, and standard deviations are near 70% of regression coefficients, say stable ones.

For other variables than the above-mentioned, standard deviation is larger than regression coefficient, so they are not conceived significant. Accordingly those variables that have enough stability to explain profit ratio count six, namely Growth Ratio, Equipment Ratio, Sales Amount, Financial Ratio,

Liquidity Ratio and Data Speed. The signs of these variables (positive or negative) are theoretically plausible. The last named Data Speed is, however, somewhat problematic as an explanatory variable, for its correlation coefficient to Profit Ratio is 0.112, that is, about half the values of other five variables.

Thus there remain five variables — Growth Ratio, Equipment Ratio, Sales Amount, Financial Ratio and Liquidity Ratio. Among them Equipment Ratio and Sales Amount have contribution rates to profit much smaller than other variables, in so far as our present data are concerned. Yet all these five variables are feasible for future study as stabilized ones, we think.

A point to be noticed here is that the dependent variable takes form of profit ratio, even though for the avowed theme of company appraisal. Of course we think in no way that an over-all appraisal is possible simply by profit ratio. Rather we are skeptic about the question whether the concept of profit based on the current accounting system, in which stockholders' standpoint is markedly underlined, is effective as the indicator to evalue overall efficency of a company. Yet it is an awfully difficult task to erect a new concept of profit, or a new purposive indicator, for our purpose. So we had to adopt the ecurrent indicator, the profit ratio. For this reason we tentatively took up three categories of Profit Ratio — net, gross and operational —, on each of which functional relation was formulated.

We want to mention further two important points for future study. Firstly as a theoretical problem, in company appraisal it makes an urgent task to formulate systematic causal relations with respect to the attainment of a object of a company. It must be clarified by what indicators company appraisal is rendered possible, by what variables the indicators are influenced and what concrete causes lie under the variables, in short, structures of causal relations. This means, however, to constitute a new system of economics, which is naturally impossible in a short time. So in our present device current ideas of business economics have been kept in mind. For instance, in management theory managerial structures are taken up by functional divisions, such as financial management, personnel administration, production management, sales management and so forth. It may be said that here various theories of management are illustrated only planely, internal connections between managerial functions being left unclarified. And another school that intends, contrastively to such traditional approach, to grasp business as one process does not always seem useful for our present aim. Therefore at the present level of study it was unavoidable for us to fall into a plane-some treatment of factors. It seems necessary, along with efforts for ingeneous quantification of factors, to transform the said plane-some structure of the theory into causal structure on the base of real activities of business.

Another problem is the method of analysis, in conjunction with the above problem of theoretical framework. A new method must be preceded by set-up

of theoretical framework. In particular, a theme of future study may be to examine whether some multi-variate analysis such as Canonical analysis, Factor analysis, Principal Component analysis or Latent Structure analysis could be adaptable.

And, if present method is to be followed, two points must be taken into consideration. The first is to extract companies of kindred constitution by industries and scales, and to devise formulae of function proper to such individual groups. Notably industrial grouping seems very significant in view of our present experience. In our graphs of output data by computer we find good fitness as for inorganic chemicals industry, organic chemicals industry or iron & steel industry, whereas it is very bad for coal mining or sugar refining. Hence a singular approach as regards all industries seems questionable; additional testing by industries might bring about better results (in this case the small number of sample companies may pose a problem).

Another task is to construct function formulae of individual companies on time-series data. This was a method we thought of at first, but had to be abandoned because consistent data were unavailable. And, it is also necessary to take adequate time-gaps of data between independent and dependent variables. In the present computation we took gaps of one year — 1st-half of 1967 for dependent and 1st-half of 1966 for explanatory variables — excepting data by enquête. However, the propriety of such one-year gap for, e.g., Ratio of Equipment per Labor, must be reexamined.

It is undeniable that our attempt, being a starting step, involves many problems. We will continue our study of the company appraisal function beginning at this introductory performance.

Input Data List (73 companies) ( ); number of companies, second line of each industry is a standard deviation

	Growth ratio	Business sensitivity	Equipment ratio	Engineer ratio	Sales amount	Financial ratio	Liquidity ratio	Average age (MGT)	Labor moving ratio (NON-MGT)	Budget Preparing period	Data speed	Profit ratio (1)	Profit ratio (2)	Profit ratio (3)
coal mining (4)	1.0930	1351.0	1291.0	39.07	26603.3	57.07	85.3	50.35	7.55	48.0	70.5	0.517	5.750	4.400
	0.0	0.0	0.0	7.88	13917.6	2.95	34.8	1.60	7.37	12.0	15.5	3.695	4.328	3.760
basic metal (1)	1.1400	85.0	1161.0	40.00	1890.0	38.30	71.0	56.00	4.10	45.0	52.0	0.440	6.000	4.400
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
construction (1)	1.3680	4552.0	1444.0	62.40	140114.0	40.60	104.0	53.80	4.80	20.0	36.0	2.650	5.000	2.700
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
brewery (3)	1.3320	4169.0	5664.0	29.67	110159.7	37.00	86.3	53.10	1.07	64.7	54.3	5.093	10.733	11.133
	0.0	0.0	0.0	1.21	36657.1	10.18	15.2	2.16	0.53	24.9	10.2	0.780	1.636	11.81
milk products (2)	2.0960	666.0	1225.0	39.00	70242.0	36.10	98.0	50.90	3.45	78.5	50.0	9.640	15.350	10.450
	0.0	0.0	0.0	0.40	7684.0	8.00	7.0	0.40	0.95	21.5	4.0	1.060	0.950	3.850
cotton spinning (3)	1.4430	9799.0	991.0	37.80	47118.0	35.60	122.3	48.67	3.97	99.3	58.0	1.293	5.133	5.200
	0.0	0.0	0.0	4.46	15380.5	13.45	10.2	1.17	1.33	60.9	10.4	2.286	2.604	2.998
rayon spinning (3)	1.7420	1336.0	2402.0	47.73	98453.7	26.03	112.0	45.63	3.07	54.7	36.3	3.907	15.267	8.533
	0.0	0.0	0.0	3.72	31841.9	0.91	8.6	0.87	0.76	28.5	9.7	1.462	6.325	1.652
papers & pulps (9)	1.4550	2371.0	3781.0	41.53	23199.8	33.16	86.7	49.64	3.09	57.8	55.7	1.152	6.400	3.122
	0.0	0.0	0.0	7.57	11483.6	7.82	11.3	2.02	2.93	30.5	16.9	1.141	2.063	0.900
inorganic chemicals (12)	1.6330	624.0	3191.0	46.00	31491.3	33.10	88.8	48.92	2.04	56.9	38.5	2.711	8.125	6.817
	0.0	0.0	0.0	15.59	24968.3	11.04	17.9	1.38	1.13	32.9	12.4	1.603	3.243	3.199
organic chemicals (1)	1.5760	631.0	2698.0	46.50	71259.0	21.20	82.0	53.70	3.60	97.0	36.0	1.260	6.600	5.800
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
pharmaceutical (2)	1.7350	1838.0	1318.0	62.00	14820.0	43.45	136.0	46.55	4.05	45.0	60.5	4.975	8.100	12.100
	0.0	0.0	0.0	10.80	568.0	7.75	13.0	0.35	1.55	25.0	15.5	0.125	0.900	2.100
petroleum (3)	1.6430	2837.0	9432.0	28.40	126523.3	33.23	88.7	49.60	1.13	50.3	31.0	1.637	4.867	3.867
	0.0	0.0	0.0	3.23	71003.0	12.29	3.3	0.70	0.54	29.4	13.9	0.646	0.525	0.957
glass (1)	1.3180	746.0	2622.0	35.50	22154.0	32.50	105.0	50.30	3.40	60.0	30.0	2.330	5.200	5.800
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	Growth ratio	Business sensitivity	Equipment ratio	Engineer ratio	Sales amount	Financial ratio	Liquidity ratio	Average age (MGT)	Labor moving ratio (NON-MGT)	Budget Preparing period	Data speed	Profit ratio (1)	Profit ratio (2)	Profit ratio (3)
cement (2)	1.1170	1440.0	1013.0	45.70	32509.0	36.00	86.0	49.75	6.80	46.5	70.5	5.040	10.200	9.800
	0.0	0.0	0.0	1.50	14898.0	4.30	9.0	3.35	6.20	13.5	10.5	0.570	0.200	1.800
iron and steel (6)	1.7200	20710.0	3435.0	49.98	62231.3	42.62	114.2	49.98	4.80	47.5	55.0	5.402	8.850	5.200
	0.0	0.0	0.0	9.61	70841.3	13.86	26.8	2.25	2.85	15.1	18.8	1.923	2.285	1.436
nonferrous metals (3)	2.0800	7175.0	1892.0	41.33	23752.0	34.67	134.0	49.90	2.80	62.7	27.0	3.417	7.333	4.000
	0.0	0.0	0.0	4.00	4575.7	3.08	16.1	1.35	0.86	13.1	9.9	0.593	0.899	0.787
industrial machines (1)	1.2120	6855.0	1115.0	53.80	6052.0	65.70	125.0	49.40	7.30	33.0	48.0	2.370	2.500	5.800
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
office & home machine (2)	1.2440	1524.0	822.0	17.35	21069.0	62.10	96.5	46.10	11.75	50.5	52.0	5.055	6.400	5.200
	0.0	0.0	0.0	4.15	2337.0	37.90	11.5	0.80	2.15	10.5	3.0	1.495	1.800	0.0
bearing (2)	1.3490	570.0	1522.0	35.50	17762.0	40.80	110.5	46.80	7.00	42.5	87.0	3.280	8.750	9.200
	0.0	0.0	0.0	7.90	2354.0	5.80	27.5	3.90	3.30	7.5	3.0	0.930	0.050	1.200
transportation equipments (1)	1.1210	263.0	862.0	52.60	14988.0	23.50	141.0	49.80	9.10	32.0	45.0	1.810	3.800	2.900
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
automobils (1) (1)	1.5270	3727.0	2212.0	55.20	214927.0	14.80	127.0	47.30	19.00	64.0	42.0	5.220	11.000	4.100
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
automobils (2) (2)	2.2820	6640.0	1811.0	52.75	58747.0	42.20	121.5	48.15	3.85	52.5	90.0	6.715	11.600	6.000
	0.0	0.0	0.0	1.95	9345.0	1.00	20.5	0.95	1.15	27.5	18.0	0.405	2.200	0.400
watches (2)	1.3080	97.0	721.0	35.95	30238.5	71.00	154.0	47.00	1.65	56.0	54.5	8.485	10.500	14.050
	0.0	0.0	0.0	24.05	15605.5	6.70	16.0	0.90	1.15	26.0	3.5	0.615	0.900	0.450
cameras (1)	1.5190	903.0	741.0	52.20	8591.0	67.80	143.0	47.70	0.10	110.0	45.0	5.870	10.200	12.600
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
department stores (5)	1.2500	2424.0	1470.0	4.18	47606.4	50.26	74.0	50.70	3.88	47.0	81.2	3.346	7.440	8.120
	0.0	0.0	0.0	2.26	26932.2	26.50	11.5	1.61	2.18	4.0	9.4	1.561	2.239	3.377
all industry (73)	1.5260	3970.8	2689.1	40.17	47853.4	39.70	101.0	49.42	4.05	56.4	52.9	3.404	8.089	6.510
	0.2816	5523.6	1859.7	15.77	48348.0	16.85	26.6	2.52	3.92	29.6	20.5	2.627	3.703	3.587

Combination of variables ∨ which explain data of 83 companies

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
GROWTH RATIO	10000	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨
BUSINESS SENSITIVITY	11000	∨	∨	∨											∨	∨	∨		∨	∨		∨	∨	∨	∨	∨	∨
EQUIPMENT RATIO	12000	∨	∨	∨		∨					∨						∨			∨		∨	∨	∨	∨	∨	∨
ENGINEER RATIO	20000	∨	∨	∨											∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨
SALES AMOUNT	30000	∨	∨	∨			∨					∨			∨	∨	∨		∨	∨		∨	∨	∨	∨	∨	∨
FINANCIAL RATIO	40000	∨	∨	∨		∨			∨		∨			∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨
LIQUIDITY RATIO	41000				∨		∨	∨		∨		∨	∨		∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨
AVERAGE AGE (MGT)	50000	∨	∨	∨					∨					∨	∨		∨	∨		∨	∨	∨	∨		∨	∨	∨
LABOR MOVING RATIO (NON-MGT)	51000														∨	∨	∨		∨	∨		∨		∨	∨	∨	∨
BUDGET PREPARING PERIOD	52000						∨		∨			∨		∨	∨	∨	∨		∨				∨		∨	∨	∨
DATA SPEED	53000					∨					∨				∨	∨			∨					∨	∨	∨	∨
PROFIT RATIO (1)	90010	○			○	○	○	○	○						○	○	○				○	○	○	○	○		
PROFIT RATIO (2)	90020		○							○	○	○	○	○				○	○	○						○	
PROFIT RATIO (3)	90030			○																							○
multiple correlation coefficient	R	.578	.543	.371	.526	.497	.565	.526	.493	.434	.449	.492	.434	.417	.613	.611	.625	.438	.524	.545	.549	.625	.618	.631	.635	.552	.515
adjusted coefficient of determination	$\bar{R}^2$	.272	.229	.058	.259	.209	.284	.259	.171	.168	.161	.203	.168	.132	.289	.296	.307	.139	.185	.210	.256	.316	.306	.323	.558	.444	.389

∨: independent variables
○: dependent variables

Combination of variables ∨ which explain data of 73 companies

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
GROWTH RATIO	10000	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨	∨
BUSINESS SENSITIVITY	11000	∨	∨	∨		∨	∨			∨			∨	∨	∨	∨		
EQUIPMENT RATIO	12000	∨	∨	∨		∨	∨		∨	∨	∨			∨	∨			
ENGINEER RATIO	20000	∨	∨	∨		∨	∨						∨	∨	∨	∨		
SALES AMOUNT	30000	∨	∨	∨		∨	∨		∨	∨		∨	∨	∨	∨	∨	∨	
FINANCIAL RATIO	40000	∨	∨	∨		∨	∨				∨		∨	∨	∨	∨	∨	∨
LIQUIDITY RATIO	41000	∨	∨	∨	∨	∨	∨	∨		∨		∨	∨	∨	∨	∨	∨	∨
AVERAGE AGE (MGT)	50000	∨		∨	∨	∨								∨	∨	∨	∨	
LABOR MOVING RATIO (NON MGT)	51000		∨	∨			∨						∨	∨	∨	∨	∨	∨
BUDGET PREPARING PERIOD	52000	∨				∨				∨		∨	∨		∨	∨	∨	
DATA SPEED	53000		∨				∨			∨	∨		∨			∨	∨	∨
PROFIT RATIO (2)	90010	○	○	○	○			○	○	○	○	○	○	○	○	○	○	○
PROFIT RATIO (2)	90020																	
PROFIT RATIO (2)	90030					○	○											
	R	.615	.645	.630	.465	.493	.550	.465	.479	.581	.511	.502	.624	.630	.630	.624	.622	.566
	$\bar{R}^2$	.289	.332	.311	.182	.135	.203	.194	.195	.267	.217	.208	.302	.311	.300	.291	.310	.270