# THE DETERMINATION OF WHOLESALE PRICE IN JAPANESE ECONOMY

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## PREFACE

This paper aims to clarify what factors influence the determination of wholesale price, to analyse what has made wholesale prices rise steadily since 1963 and also whether a problem of industrial organization is related to rises in prices or not.

First of all, the general relation between wholesale prices and the factors, on which wholesale price depends, is mentioned in Section I. In Section II, I am going to take up the features of trends and fluctuations of prices since 1955, and in Section III, I would like to survey recent studies about pricing in industries. In Section IV, I assume the price equation and test it on twenty-one Japanese industries in the four digit classification. Finally, in Section V, I will present the results of the same analysis of thirteen industries in the three digit classification.

## § I. THE FACTORS WHICH INFLUENCE ON WHOLESALE PRICE

The factors which influence wholesale prices in each industry can be classified mainly into two groups, one is a demand factor and the other is a cost factor.[1] We can adopt such index showing the demand factor as an excess demand or supply, a degree of utilization, the level of inventory, the growth rate of sales, and so on. On the other hand, as the index of the cost factor there are unit labor cost, unit material cost and unit profit.

It would be difficult to say definitely whether a rate of profit should be regarded as a cost factor or not. If prices are determined competitively, it should be treated as a residual. In contrast to this, if a firm sets a price according to cost factors, profit should be counted among these. It can be also said that prices of competitive industries are "market determined", but that in the case of oligopolistic industries, "cost determined". Particularly

1) To take up a macroscopic general price level, a monetary factor must not be neglected. One finds inflation caused by an excessive quantity of money compared with commodities. Usually it is called demand-pull inflation. But it is not obvious what effect an excess supply of money has on a rise in prices in each different industry. Consequently it would be better to regard a quantity of money as something influencing an exogeneous demand factor for each industry.

in the case of the former, namely, "market determined", the profit is nothing but a residual, but in "cost determined", it can be counted among costs. Therefore the problem is whether a market is competitive or not.

It would be true that a market structure has no or little influence on pricing. If so, we have to think of another factor, a market structure, except demand and cost factors. To connect the problem of price determination with inflation, demand factors cause demand-pull inflation, and cost factors, cause cost-push inflation.

Thus, it is a feature of a price determination in a competitive market that prices fluctuate by excess and shortage of demand or supply. In this situation we can call the process of deciding price "market determined". Contrast to this, when prices are determined by cost factors, this process we can call "cost determined". This, however, presupposes that the market is more or less non-competitive, or that a firm has market power. Therefore, cost determined prices are determined with a non-competitive market structure for a background.

## § II. FLUCTUATION AND TREND OF WHOLESALE PRICE IN JAPAN

As you know, the Japanese economy has been rapidly expanding since 1955. It is a distinguishing characteristic of the fluctuation and trend of price level in the Japanese economy, that the wholesale price level has remained stable in the long-run although it has fluctuated in the short-run. In contrast consumers' price level has shown a rise in both the long and short run. This has caused the difference between the wholesale price level and consumers' price level. As far as the wholesale price level is concerned, we can conclude that there is no inflation in Japan.[2)]

In fact, however, wholesale price of manufacturing has begun to rise steadily since the period of depression in 1962. That is why we find the difference between the pre-1962 and the post-1962. What made this difference? All of our interests are focussed on the question of what effect a factor of industrial organization, which brought the difference between the two periods, has. If so, the following facts prove to us that a factor of industrial organization acts on the rise in wholesale prices after 1962; the first of all, the determination of prices depends on a cost factor more than a demand factor and the next, a factor of market structure, such as, con-

2) Although wholesale price level fluctuate in the short-run, in the long-run, it has been stable, or at least downward. But it has begun to show a rising tendency after 1962. It is since 1960 that consumers' price level has rapidly rised. This period corresponds exactly to the period of transition when Japanese economy turned from labor surplus economy into labor shortage one.

centration ratio, has a relation to the rise in prices. Though the former is an indirect proof, the latter is a direct proof.

## § III. PRICE EQUATION AND ITS ESTIMATION

The determinations of price in a competitive market can be generally represented by next relation.

Demand Equation

$$D = D(P, Y) \tag{1}$$

Supply Equation

$$S = S(P, Z) \tag{2}$$

Equilibrium Condition

$$D = S \tag{3}$$

thus, we can draw equation (4).

$$P = f(Y, Z) \tag{4}$$

$P$: price $Y$: demand factor $Z$: supply factor

If we treat the general price level, $Y$ means national income, and $Z$ means productive capacity as a whole of national economy, or labor productivity and other various cost factors. Let us take a particular industry $i$ for example, and then $Y_i$ is demand for the product of $i$th industry and $Z_i$ is a typical index to represent the capacity of the industry. Generally speaking, following relationship is shown in equation (4).

$$\frac{\partial P_i}{\partial Y_i} > 0, \quad \frac{\partial P_i}{\partial Z_i} < 0$$

If $Z_i$ is capacity output, we can draw the following equation.

$$Y - Z = E$$

$E$ is excess demand.

Similarly we obtain the next.

$$P = \phi(E), \qquad \frac{dP}{dE} > 0$$

On the other hand, if it is possible to say that price is "cost determined", it is represented by the sum of each cost.

$$P = ULC + UMC + \pi \tag{5}$$

$ULC$: unit labor cost $UMC$: unit material cost $\pi$: unit profit

This is, however, no more than an identity. If $ULC$, $UMC$, $\pi$ are based

on an actual statistical data, $P$ in this case becomes ex post value.[3]

In consequence, $P$ of equation (5) is market price, not supply price. If we try to explain price by cost factors, $\pi$ must be replaced by $\pi^*$ which an entrepreneur intends to earn.[4]

Thus the relationship between costs and price will be as below:

$$P=\phi(ULC^N,\ UMC^N,\ \pi^*) \tag{6}$$

or

$$P=\lambda(ULC,\ UMC,\ \pi^*) \tag{7}$$

$ULC^N$, $UMC^N$, represent respectively a standard unit labor cost and standard unit material cost, both of which are costs based on standard productivity. $\pi^*$ is a target return per output. The formula (6) signifies that price depends on a cost on the basis of standard productivity with a normal degree of utilization or skill, while the formula (7) signifies that it depends on actual costs and a target return. They show that prices are set in order to achieve the target return even if $ULC$ and $UMC$ change in accordance with the change of utilization ratio. Taking a measurement of the target return $\pi^*$ is, as it is, hardly possible. Assuming that $\pi^*$ is stable, we can simplify the above formula:

$$P=X(ULC,\ UMC)$$

If we can find co-relation between $P$ and $ULC$, $UMC$, price will be regarded as "cost determined".

Eckstein and Fromm studied target return pricing and corroborated their findings with data from the U.S.A.[5]

They found the following results:

The price equation is:

$$P=\frac{\bar{\pi}K}{Q^N}+ULC^N+UMC^N$$

$P$: price $K$: capital stock $\bar{\pi}$: a rate of target return to capital
$Q^N$: standard output $UMC^N$: standard unit labor cost
$UMC^N$: standard unit material cost

3) The actual output from the published statistical data is not always the same as that of the standard degree of utilization. Even though a standard utilization is determined, the utilization cannot help undergoing a change as demand conditions change. The actual $ULC$ and $UMC$ are those that divide wage bills and raw material costs by an actual output.

4) $\pi$ is residual in a competitive market, because the relation of demand and supply in a competitive market determines $P$ apart from $ULC$ and $UMC$. If prices are "cost determined," firms determine $\pi$ in their own way.

5) O. Eckstein and G. Fromm, "The Price Equation", The American Economic Review, December, 1968.

This target return pricing can be transformed to full cost pricing easily. Namely the above formula becomes as follows:

$$P=(1+\lambda)\ (ULC^{N}+UMC^{N})$$

$\lambda$ is mark-up rate.

Selden and Depodwin analysed whether or not the concentration ratio affects the rise in prices.[6] They intended to have explained prices in relation to only a concentration ratio. But they could not succeed in finding the relationship between prices and concentration ratio.

Weiss attempted to explain the rising rate of prices with each cost factor and concentration ratio in two periods, from 1953 to 1959 and from 1953 to 1961.[7]

It is the following formula that he estimated:

$$\frac{P_{1959}}{P_{1953}}=a+b\frac{Q_{1959}}{Q_{1953}}+c\frac{(S-V)_{1959}}{(S-V)_{1953}}\Big/\frac{Q_{1959}}{Q_{1953}}+d\frac{W_{1959}}{W_{1953}}\Big/\frac{Q_{1959}}{Q_{1953}}+eC$$

$Q$: real output $S$: sales $V$: value added $W$: wage bill
$C$: concentration ratio

$(S-V_A)$ of above equation corresponds to material cost.
similarly

$$\frac{P_{1961}}{P_{1953}}=a+b\frac{Q_{1961}}{Q_{1953}}+c\frac{(S-V)_{1961}}{(S-V)_{1953}}\Big/\frac{Q_{1961}}{Q_{1953}}+d\frac{W_{1961}}{W_{1953}}\Big/\frac{Q_{1961}}{Q_{1953}}+eC$$

The results of the above equation indicates that the coefficient signs of both $\frac{Q_{1959}}{Q_{1953}}$ and $\frac{Q_{1961}}{Q_{1953}}$ were negative and insignificant. The influence of the concentration ratio was so slight that it should be disregarded. It is the increasing rate of unit labor costs and unit material costs that has the greatest influence on rise of $P$. In particular, the influence of the latter must not be ignored.

After dividing fourteen industries into two groups, concentrated industries and non-concentrated industries, Yordon examined in each industry the responce prices show to demand and cost.[8] Consequently he proved that, in either group, prices act only on cost regardless of demand. Now we find the point of agreement in their studies that the cost factor is far more

6) H. J. Depodwin and R. T. Selden, "Business Pricing Policies and Inflation", Journal of Political Economy, April, 1963.

7) L. W. Weiss, "Business Pricing Policies and Inflation Reconsidered", Journal of Political Economy, April, 1969.

8) W. J. Yordon, "Industrial Concentration and Price Flexibility in Inflation: Price Responce Rates in Fourteen Industries, 1947-1958", Review of Economics and Statistics, August, 1961.

important than the demand factor because of its relatively greater influence on prices.

TABLE 1. FUNDAMENTAL DATA FOR REGRESSION

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1. Chemical seasoning | 92.8 | 1,215 | 1.117 | 0.940 | 1.615 | 1.446 | 88.3 |
| 2. Beer | 112.1 | 1.407 | 1.127 | 1.020 | 1.493 | 1.325 | 96.0 |
| 3. Cotton & spun rayon fabrics | 117.6 | 1.070 | 1.118 | 1.150 | 1.716 | 1.535 | 8.8 |
| 4. Wool yarn | 102.4 | 0.991 | 0.991 | 0.996 | 1.714 | 17.29 | 14.8 |
| 5. Photographic sensitized materials | 106.9 | 1.723 | 1.012 | 1.057 | 1.721 | 1.701 | 100.0 |
| 6. Petroleum products | 94.9 | 1.854 | 0.861 | 0.965 | 1.498 | 1.739 | 36.0 |
| 7. Textile machinery | 109.3 | 1.678 | 1.040 | 1.120 | 1.743 | 1.676 | 53.1 |
| 8. Ferro-alloys | 106.4 | 2.153 | 0.793 | 1.094 | 1.646 | 2.076 | 31.8 |
| 9. Aluminium ingots | 108.1 | 1.888 | 1.167 | 1.037 | 1.479 | 1.267 | 84.5 |
| 10. Medicines | 93.3 | 2.184 | 0.852 | 0.808 | 1.656 | 1.945 | 23.6 |
| 11. Pulp | 105.6 | 1.622 | 0.928 | 0.998 | 1.571 | 1.693 | 32.9 |
| 12. Automotive passenger cars | 93.4 | 2.394 | 0.878 | 0.893 | 1.533 | 1.745 | 79.2 |
| 13. Motorcycles | 96.7 | 1.717 | 0.840 | 1.049 | 1.576 | 1.877 | 92.3 |
| 14. Tractors | 99.5 | 3.311 | 0.715 | 1.012 | 1.520 | 2.127 | 73.2 |
| 15. Cargo handling & conveying machinery | 104.4 | 2.869 | 0.946 | 1.071 | 1.750 | 1.850 | 52.4 |
| 16. Cameras | 85.9 | 1.847 | 0.872 | 0.833 | 1.678 | 1.924 | 45.5 |
| 17. Watches | 105.5 | 1.736 | 1.016 | 1.021 | 1.531 | 1.507 | 94.4 |
| 18. Television receivers | 95.3 | 3.363 | 0.795 | 0.989 | 1.597 | 2.009 | 49.4 |
| 19. Storage batteries | 75.4 | 2.237 | 0.887 | 0.739 | 1.827 | 2.060 | 77.3 |
| 20. Sheet glass | 93.3 | 1.388 | 0.753 | 0.656 | 1.318 | 1.750 | 100.0 |
| 21. Cement | 106.4 | 1.482 | 0.933 | 0.928 | 1.502 | 1.609 | 43.6 |
| 22. Sewing machines | 101.7 | 1.301 | 1.173 | 1.085 | 1.726 | 1.472 | 35.7 |
| (reference) | | | | | | | |
| 23. Iron steel industry | 120.0 | 1.773 | 1.144 | 1.037 | 1.730 | 1.513 | 56.6 |
| 24. Spun cotton industry | 109.4 | 0.959 | 1.325 | 1.021 | 1.621 | 1.223 | 20.4 |

1. $P^{1969}/P_{1965}\times 100$
2. $Q^{1969}/Q^{1965}$: growth rate of real output
3. $(W/Q)^{1969}/(W/Q)^{1965}$: growth rate of unit labor cost
4. $(R/Q)^{1969}/(R/Q)^{1965}$: growth rate of unit material cost
5. $w^{1969}/w^{1965}$ $(w=W/N)$: growth rate of money wage
6. $(Q/N)^{1969}/(Q/N)^{1965}$: growth rate of labor productivity
7. $C$: concentration ratio of top three firms (%)

Data

1: Wholesale Price Index from The Bank of Japan
2-6: Census of Manufacturing
7: data from The Fair Trade Committee

## § IV. THE TREND ON WHOLESALE PRICE IN JAPAN

First, we will discuss the factors which increased wholesale manufacturing prices from 1965. By Weiss' method, let us calculate the ratio of each wholesale price of all industries in 1965 and 1969, and then analyse the factor which has effected the ratio. Twenty-two industries were selected on the basis of four digit classification to respond to the data of concentration from The Fair Trade Committee.

Table 1 represents data for a regression. Column 1 is a wholesale price index in 1969 which use the percentage in 1965 as one hundred. Column 2 represents $\frac{Q_{1969}}{Q_{1965}}$. Column 3, $\frac{(W/Q)_{1969}}{(W/Q)_{1965}}$, and $\frac{(R/Q)_{1969}}{(R/Q)_{1965}}$ in Column 4 stand for the changing rate of unit labor cost and unit material cost. Similarly $\frac{(Q/N)_{1969}}{(Q/N)_{1965}}$ stands for the changing rate of labor productivity. Column 7 stands for the concentration ratio of top three firms in each industry in 1966.

TABLE 2.

| Regression equation | Regression coefficient of independent variables | $T$ value | Coefficient of determination | Coefficient of determination on adjusted degree of freedom |
|---|---|---|---|---|
| | $\alpha_1$ | $T_1$ | $R^2$ | $\bar{R}^2$ |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}$ | −4.8477<br>(3.1348) | −1.5464 | 0.0980 | 0.0570 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{(W/Q)^{1969}}{(W/Q)^{1965}}$ | 35.6679<br>(11.3974) | 3.1295 | 0.3080 | 0.2766 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{(R/Q)^{1969}}{(R/Q)^{1965}}$ | 62.2853<br>(11.8657) | 5.2492 | 0.5560 | 0.5359 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\cdot C$ | −0.0690<br>(0.0713) | −0.9681 | 0.0409 | 0.0027 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{(Q/N)^{1969}}{(Q/N)^{1965}}$ | −22.1494<br>(6.9043) | −3.2081 | 0.3187 | 0.2877 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{w^{1969}}{w^{1965}}$ | −2.1287<br>(4.6482) | −0.4580 | 0.0094 | −0.0000 |

( ): standard error

We calculate a single correlation between each independent variable and $\frac{P_{1969}}{P_{1965}}$ respectively, and the result is represented in Table 2. As far as this research is concerned, we find no significant relationship between $\frac{P_{1969}}{P_{1965}}$ and the increasing ratio of a real output as an index of demand factor. What is worse still, the sign of the coefficient is negative. On the other hand,

TABLE 3.

| Regression equation | Regression coefficient of independent variables | | | | | $T$ value | | | | | $R^2$ | $\bar{R}^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\alpha_4$ | $\alpha_5$ | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | | |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}+\alpha_2\frac{(W/Q)^{1969}}{(W/Q)^{1965}}$ | 0.8469 | −37.8627 | | | | 0.2357 | 2.5388 | | | | 0.3099 | 0.2441 |
| | (3.5928) | (14.9138) | | | | | | | | | | |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}+\alpha_2\frac{(R/Q)^{1969}}{(R/Q)^{1965}}$ | −4.0404 | 60.7218 | | | | −1.9448 | 5.4174 | | | | 0.6238 | 0.5880 |
| | (2.0775) | (11.2087) | | | | | | | | | | |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}+\alpha_2\frac{(W/Q)^{1969}}{(W/Q)^{1965}}+\alpha_3\frac{(R/Q)^{1969}}{(R/Q)^{1965}}$ | −2..6668 | 9.5790 | 55.6798 | | | −0.9493 | 0.7365 | 4.2053 | | | 0.6337 | 0.5788 |
| | (2.8091) | (13.0069) | (13.2403) | | | | | | | | | |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}+\alpha_2\frac{(W/Q)^{1969}}{(W/Q)^{1965}}+\alpha_3\cdot C$ | 1.1259 | 37.4599 | −0.0481 | | | 0.3086 | 2.4849 | −0.7604 | | | 0.3293 | 0.2286 |
| | (3.6479) | (15.0751) | (0.0633) | | | | | | | | | |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}+\alpha_2\frac{(R/Q)^{1969}}{(R/Q)^{1965}}+\alpha_3\cdot C$ | −4.0737 | 61.0218 | 0.0053 | | | −1.8946 | 5.1667 | 0.1085 | | | 0.6240 | 0.5676 |
| | (2.1502) | (11.8105) | (0.0487) | | | | | | | | | |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}+\alpha_2\frac{(W/Q)^{1969}}{(W/Q)^{1965}}+\alpha_3\frac{(R/Q)^{1969}}{(R/Q)^{1965}}+\alpha_4\cdot C$ | −2.6837 | 9.5331 | 55.7972 | 0.0016 | | −0.9169 | 0.7106 | 3.9745 | 0.0331 | | 0.6338 | 0.5566 |
| | (2.9270) | (13.4162) | (14.0388) | (0.0496) | | | | | | | | |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}+\alpha_2\frac{w^{1969}}{w^{1965}}+\alpha_3\frac{(Q/N)^{1969}}{(Q/N)^{1965}}+\alpha_4\cdot C$ | 1.3395 | 2.8298 | −27.0451 | −0.0976 | | 0.1067 | 0.2059 | −1.7649 | −1.5441 | | 0.4073 | 0.2825 |
| | (12.5492) | (13.7419) | (15.3238) | (0.0632) | | | | | | | | |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}+\alpha_2\frac{w^{1969}}{w^{1965}}+\alpha_3\frac{(Q/N)^{1969}}{(Q/N)^{1965}}+\alpha_4\frac{(R/Q)^{1969}}{(R/Q)^{1965}}+\alpha_5\cdot C$ | 5.5353 | −6.3037 | −20.3687 | 52.3078 | −0.0293 | 0.5933 | −0.6063 | −1.7805 | 4.0982 | −0.5900 | 0.6943 | 0.6082 |
| | (9.3295) | (10.3963) | (11.4401) | (12.7635) | (0.0496) | | | | | | | |

$R^2$: coefficient of determination

$\bar{R}^2$: coefficient of determination on adjusted degree of freedom

unit labor cost and unit material cost as an index of cost factor are significant. When unit labor cost is divided into two parts, money wage rate and average productivity, there is a negative correlation between the latter and price index, but almost no relation between the former and price index. Finally, we can conclude that the concentration ratio has no relation to price index at all.

Table 3 represents the result of regression analysis which explains the price index by each variable. The changing rate of unit material cost, as you see, has greatest effect on the wholesale price index.

The next formula is the result of dividing unit labor cost into wage ratio and average productivity and of seeking regression.

$$\frac{P_{1969}}{P_{1965}} = \alpha_0 + 5.5353\frac{Q_{1969}}{Q_{1965}} - 6.3037\frac{w_{1969}}{w_{1965}} - 20.3687\frac{(Q/N)_{1969}}{(Q/N)_{1965}} + 52.3078\frac{(R/Q)_{1969}}{(R/Q)_{1965}} - 0.0293\,C$$

$$R^2 = 0.6934$$

Though the productivity is reversely correlated to prices of commodities, a wage rate has no significant relation to prices, much less to the concentration ratio.

From these analyses, it can be determined that the cost factor, above all, the rise in material cost has had a great effect upon the rise in wholesale prices since 1965.

## § V. PRE-1962 AND POST-1962

Next, we will explain the trend of wholesale prices by demand and cost factors on the basis of three digit classification, as before. I would like to state some reasons why three digit classification should be used:

1. In the case of using the four digit classification, the cost factor lacks accuracy. That is because today's firms are diversified and related to many industries in four digit calssification. Therefore, the cost of a firm does not correspond to the cost of a four digit industry. In the case of the three digit classification, a firm's cost corresponds approximately to industrial costs as a whole.
2. My first purpose is to include the profit rate which is derived not from commodity bases but from firms bases in the price equation.
3. A long-term price index is easily obtained from the wholesale price index of The Bank of Japan.

The analysis in Section IV is related only from 1965 to 1969. This periods correspond to the upswing phase of business cycles. We will go

further and make a more detailed study of the course of prices over a longer period than five years, particularly upon whether it is "market determined" or "cost determined".

Looking back to the trend of wholesale prices from 1956 to 1969, we find two critical depression periods. The first took place in 1962 and the second in 1965. We can draw a line of demarcation between pre-1962 and post-1962. In spite of the largest depression in 1965, wholesale price of manufacturing did not fall at all. Let us analyse the factor which had an effect upon the trend of wholesale prices, setting up the border line between two periods.

At first, we are going to choose thirteen industries in three digit classification, and then examine the factor that caused the rise in wholesale prices for six years from 1956 to 1961. Main equations to examine are as follows:

$$P_{1956\sim1961}=\alpha_0+\alpha_1\frac{Q_{1961}}{Q_{1956}}+\alpha_2\frac{(W/Q)_{1961}}{(W/Q)_{1956}}+\alpha_3\frac{(R/Q)_{1961}}{(R/Q)_{1956}}$$

and also

$$P_{1956\sim1961}=\alpha_0+\alpha_1\frac{Q_{1961}}{Q_{1956}}+\alpha_2\frac{w_{1961}}{w_{1956}}+\alpha_3\frac{q_{1961}}{q_{1956}}+\alpha_4\frac{(R/Q)_{1961}}{(R/Q)_{1956}}\qquad(q=Q/N)$$

I, first of all, examined single correlation between each independent variable and $P_{1956\sim1961}$.

It is the changing rate of unit labor cost and unit material cost that has a significant correlation to rising rate of price and it is the average productivity that has a negative correlation.

The result of estimation of the relationship between a rising rate of prices and each cost factor during the period from 1956 to 1961 is represented in Table 4. Although a rising rate of prices can be explained by cost factors, it is apparent that the demand factor is not significant. The rising rate of unit material cost has more effect upon the rise of $P$ than that of unit labor cost.

Let us examine about the period from 1962 to 1969. The relationship of the rising rate of prices from 1962 to 1969 and each factor is represent in Table 5. Hence, looking for single correlation among variables, we find a significant negative correlation between $\frac{Q_{1969}}{Q_{1962}}$ and $P_{1962\sim1969}$. In comparison to changing rates of unit labor cost and unit material cost, though both of them more or less influence $P_{1962\sim1969}$, the influence of the latter is larger than that of the former, Although money wage rate has no significant relationship to the rise in prices, the changing rate of productivity has a negative correlation to it.

Then I examined what factor in an upswing phase of a business cycle

TABLE 4.

| Regression equation | Regression coefficient of independent variables | | | | | $T$ value | | | | $R^2$ | $\bar{R}^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\alpha_0$ | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\alpha_4$ | $T_1$ | $T_2$ | $T_3$ | $T_4$ | | |
| $\frac{P^{1961}}{P^{1956}}=\alpha_0+\alpha_1\frac{Q^{1961}}{Q^{1956}}$ | 1.307 | −0.144<br>(0.089) | | | | −1.621 | | | | 0.226 | 0.140 |
| $\frac{P^{1961}}{P^{1956}}=\alpha_0+\alpha_1\frac{(W/Q)^{1961}}{(W/Q)^{1956}}$ | 0.213 | 0.814<br>(0.257) | | | | 3.170 | | | | 0.527 | 0.475 |
| $\frac{P^{1961}}{P^{1956}}=\alpha_0+\alpha_1\frac{(R/Q)^{1961}}{(R/Q)^{1956}}$ | 0.029 | 1.034<br>(0.213) | | | | 4.851 | | | | 0.723 | 0.693 |
| $\frac{P^{1961}}{P^{1956}}=\alpha_0+\alpha_1\frac{w^{1961}}{w^{1956}}$ | −0.116 | 0.721<br>(0.503) | | | | 1.433 | | | | 0.186 | 0.095 |
| $\frac{P^{1961}}{P^{1956}}=\alpha_0+\alpha_1\frac{q^{1961}}{q^{1956}}$ | 1.556 | −0.346<br>(0.212) | | | | −1.630 | | | | 0.228 | 0.142 |
| $\frac{P^{1961}}{P^{1956}}=\alpha_0+\alpha_1\frac{w^{1961}}{w^{1956}}+\alpha_2\frac{q^{1961}}{q^{1956}}$ | 0.458 | 0.714<br>(0.455) | −0.343<br>(0.197) | | | 1.569 | −1.742 | | | 0.410 | 0.262 |
| $\frac{P^{1961}}{P^{1956}}=\alpha_0+\alpha_1\frac{Q^{1961}}{Q^{1956}}+\alpha_2\frac{(W/Q)^{1961}}{(W/Q)^{1956}}+\alpha_3\frac{(R/Q)^{1961}}{(R/Q)^{1956}}$ | 0.009 | −0.009<br>(0.073) | 0.280<br>(0.332) | 0.810<br>(0.308) | | −0.129 | 0.842 | 2.628 | | 0.762 | 0.660 |
| $\frac{P^{1961}}{P^{1956}}=\alpha_0+\alpha_1\frac{Q^{1961}}{Q^{1956}}+\alpha_2\frac{w^{1961}}{w^{1956}}+\alpha_3\frac{q^{1961}}{q^{1956}}+R_4\frac{(R/Q)^{1961}}{(R/Q)^{1956}}$ | −0.228 | −0.073<br>(0.084) | 0.285<br>(0.378) | −0.070<br>(0.215) | 0.893<br>(0.328) | −0.872 | 0.753 | 0.324 | 2.722 | 0.767 | 0.611 |

$R^2$: coefficient of determination

$\bar{R}^2$: coefficient of determination on adjusted degree of freedom

TABLE 5.

| Regression equation | Regression coefficient of independent variables | | | | | $T$ value | | | | $R^2$ | $\bar{R}^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\alpha_0$ | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\alpha_4$ | $T_1$ | $T_2$ | $T_3$ | $T_4$ | | |
| $\frac{P^{1969}}{P^{1962}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1962}}$ | 1.660 | −0.219<br>(0.079) | | | | −2.782 | | | | 0.462 | 0.403 |
| $\frac{P^{1969}}{P^{1962}}=\alpha_0+\alpha_1\frac{(W/Q)^{1969}}{(W/Q)^{1962}}$ | 0.553 | 0.518<br>(0.175) | | | | 2.952 | | | | 0.492 | 0.435 |
| $\frac{P^{1969}}{P^{1962}}=\alpha_0+\alpha_1\frac{(R/Q)^{1969}}{(R/Q)^{1962}}$ | 0.236 | 0.803<br>(0.057) | | | | 14.077 | | | | 0.957 | 0.952 |
| $\frac{P^{1969}}{P^{1962}}=\alpha_0+\alpha_1\frac{w^{1969}}{w^{1962}}$ | −0.485 | 0.706<br>(0.636) | | | | 1.109 | | | | 0.120 | 0.022 |
| $\frac{P^{1969}}{P^{1962}}=\alpha_0+\alpha_1\frac{q^{1969}}{q^{1962}}$ | 1.806 | −0.317<br>(0.096) | | | | −3.321 | | | | 0.551 | 0.501 |
| $\frac{P^{1969}}{P^{1962}}=\alpha_0+\alpha_1\frac{w^{1969}}{w^{1962}}+\alpha_2\frac{q^{1969}}{q^{1692}}$ | 4.719 | −1.109<br>(0.643) | −0.496<br>(0.135) | | | −1.723 | −3.671 | | | 0.672 | 0.590 |
| $\frac{P^{1969}}{P^{1962}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1962}}+\alpha_2\frac{(W/Q)^{1969}}{(W/Q)^{1962}}+\alpha_3\frac{(R/Q)^{1969}}{(R/Q)^{1962}}$ | 0.432 | −0.048<br>(0.047) | 0.009<br>(0.111) | 0.724<br>(0.065) | | −1.035 | 0.081 | 11.116 | | 0.973 | 0.962 |
| $\frac{P^{1969}}{P^{1962}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1962}}+\alpha_2\frac{w^{1969}}{w^{1962}}+\alpha_3\frac{q^{1969}}{q^{1962}}+\alpha_4\frac{(R/Q)^{1969}}{(R/Q)^{1962}}$ | 0.820 | −0.028<br>(0.049) | −0.114<br>(0.241) | −0.063<br>(0.096) | 0.694<br>(0.081) | −0.564 | −0.474 | −0.657 | 8.521 | 0.975 | 0.959 |

$R^2$: coefficient of determination

$\bar{R}^2$: coefficient of determination on adjusted degree of freedom

TABLE 6.

| Regression equation | Regression coefficient of independent variables | | | | | $T$ value | | | | $R^2$ | $\bar{R}^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\alpha_0$ | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\alpha_4$ | $T_1$ | $T_2$ | $T_3$ | $T_4$ | | |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}$ | 1.455 | −0.208<br>(0.101) | | | | −2.063 | | | | 0.321 | 0.246 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{(W/Q)^{1969}}{(W/Q)^{1965}}$ | 0.346 | 0.721<br>(0.146) | | | | 4.930 | | | | 0.730 | 0.700 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{(R/Q)^{1969}}{(R/Q)^{1965}}$ | 0.221 | 0.798<br>(0.070) | | | | 11.465 | | | | 0.936 | 0.929 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{w^{1969}}{w^{1965}}$ | 0.419 | 0.403<br>(0.942) | | | | 0.428 | | | | 0.020 | −0.089 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{q^{1969}}{q^{1965}}$ | 1.854 | −0.700<br>(0.104) | | | | −4.540 | | | | 0.696 | 0.662 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{w^{1969}}{w^{1965}}+\alpha_2\frac{q^{1969}}{q^{1965}}$ | 0.818 | 0.640<br>(0.511) | −0.482<br>(0.101) | | | 1.252 | −4.781 | | | 0.746 | 0.682 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}+\alpha_2\frac{(W/Q)^{1969}}{(W/Q)^{1965}}+\alpha_3\frac{(R/Q)^{1969}}{(R/Q)^{1965}}$ | 0.293 | −0.036<br>(0.050) | 0.135<br>(0.161) | 0.663<br>(0.100) | | −0.719 | 0.839 | 6.623 | | 0.970 | 0.957 |
| $\frac{P^{1969}}{P^{1965}}=\alpha_0+\alpha_1\frac{Q^{1969}}{Q^{1965}}+\alpha_2\frac{w^{1969}}{w^{1965}}+\alpha_3\frac{q^{1969}}{q^{1965}}+\alpha_4\frac{(R/Q)^{1969}}{(R/Q)^{1965}}$ | 0.520 | −0.018<br>(0.061) | 0.070<br>(0.213) | −0.128<br>(0.126) | 0.640<br>(0.108) | −0.301 | 0.326 | −1.016 | 5.929 | 0.972 | 0.953 |

$R^2$: coefficient of determination

$\bar{R}^2$: coefficient of determination on adjusted degree of freedom

TABLE 7.

| Regression equation | Regression coefficient of independent variables | | | | | $T$ value | | | | $R^2$ | $\bar{R}^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\alpha_0$ | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\alpha_4$ | $T_1$ | $T_2$ | $T_3$ | $T_4$ | | |
| $\frac{P^{1961}}{P^{1958}}=\alpha_0+\alpha_1\frac{Q^{1961}}{Q^{1958}}$ | 1.252 | −0.122<br>(0.066) | | | | −1.831 | | | | 0.271 | 0.190 |
| $\frac{P^{1961}}{P^{1958}}=\alpha_0+\alpha_1\frac{(W/Q)^{1961}}{(W/Q)^{1958}}$ | 0.533 | 0.526<br>(0.133) | | | | 3.968 | | | | 0.636 | 0.596 |
| $\frac{P^{1961}}{P^{1958}}=\alpha_0+\alpha_1\frac{(R/Q)^{1961}}{(R/Q)^{1958}}$ | 0.355 | 0.668<br>(0.100) | | | | 6.652 | | | | 0.831 | 0.812 |
| $\frac{P^{1961}}{P^{1958}}=\alpha_0+\alpha_1\frac{w^{1961}}{w^{1958}}$ | 0.321 | 0.516<br>(0.409) | | | | 1.262 | | | | 0.150 | 0.056 |
| $\frac{P^{1961}}{P^{1958}}=\alpha_0+\alpha_1\frac{q^{1961}}{q^{1958}}$ | 1.593 | −0.380<br>(0.122) | | | | −3.115 | | | | 0.519 | 0.465 |
| $\frac{P^{1961}}{P^{1958}}=\alpha_0+\alpha_1\frac{w^{1961}}{w^{1958}}+\alpha_2\frac{q^{1961}}{q^{1958}}$ | 1.097 | 0.331<br>(0.313) | −0.353<br>(0.124) | | | 1.057 | −2.846 | | | 0.578 | 0.472 |
| $\frac{P^{1961}}{P^{1958}}=\alpha_0+\alpha_1\frac{Q^{1961}}{Q^{1958}}+\alpha_2\frac{(W/Q)^{1961}}{(W/Q)^{1958}}+\alpha_3\frac{(R/Q)^{1961}}{(R/Q)^{1958}}$ | 0.597 | −0.089<br>(0.079) | −0.053<br>(0.280) | 0.637<br>(0.158) | | −1.118 | −0.189 | 4.026 | | 0.927 | 0.896 |
| $\frac{P^{1961}}{P^{1958}}=\alpha_0+\alpha_1\frac{Q^{1961}}{Q^{1958}}+\alpha_2\frac{w^{1961}}{w^{1958}}+\alpha_3\frac{q^{1961}}{q^{1958}}+\alpha_4\frac{(R/Q)^{1961}}{(R/Q)^{1958}}$ | 0.708 | −0.065<br>(0.095) | −0.095<br>(0.209) | −0.035<br>(0.232) | 0.616<br>(0.149) | −0.688 | −0.457 | −0.153 | 4.148 | 0.933 | 0.888 |

$R^2$: coefficient of determination

$\bar{R}^2$: coefficient of determination on adjusted degree of freedom

determines the rise in prices. Table 6 represents the relationship of a rise in prices to each factor in the upswing of business cycle from 1965 to 1969. Demand factor is inversely related to the rising rate of prices, while unit labor cost and unit material cost are a significantly related to it. Although the rising rate of money wage is not significant, the rising rate of productivity is inversely correlated to the rising price rate. Similarly in this period, nothing is more strongly related to rising rate of prices than unit material cost.

A phase of upswing in business cycle before 1961 is the period from 1958 to 1961. The result of the estimation in this period is presented at Table 7. It is unit material cost that has the most significant relationship to a rising rate in prices. There is little significance in a changing rate of unit labor cost in this period, much less influence.

Though all these analyses in this section, we come to the following conclusion:

1) The rise in prices is related to cost factors.
2) Uuit material cost is the most significant of all cost factors.
3) The tendency of "cost determined" appears clearly in post-1962 as compared to pre-1962.

## CONCLUDING REMARKS

At the end of this study, we can conclude as follows:

1) In Japan, the trend of wholesale prices is explained by cost factors.
2) In spite of this, there is no significant relationship between the concentration ratio and the trend of prices.
3) The relationship between an increase in the money wage rate and a rise in prices is rather insignificant.
4) Changes in unit material cost have the greatest influence on the trend of prices.
5) Demand factor has little effect upon a trend of prices.
6) In post-1962 compared to pre-1962, wholesale prices have become more "cost determined".