THE CAUSES OF THE HIGH ECONOMIC GROWTH OF JAPAN

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PREFACE

Many of today's most significant socioeconomic problems, such as slower economic growth, the decline of some established industries, and shifts in patterns of foreign trade, are international or transnational in nature. But these problems manifest themselves in a variety of ways; both the intensities and the perceptions of the problems differ from one country to another, so that intercountry comparative analyses of recent historical developments are necessary. Through these analyses we attempt to identify the underlying processes of economic structural change and formulate useful hypotheses concerning future developments. The understanding of these processes and future prospects provides the focus for IIASA's project on Comparative Analysis of Economic Structure and Growth.

Our research concentrates primarily on the empirical analysis of interregional and intertemporal economic structural change, on the sources of and constraints on economic growth, on problems of adaptation to sudden changes, and especially on problems arising from changing patterns of international trade, resource availability, and technology. The project relies on IIASA's accumulated expertise in related fields and, in particular, on the data bases and systems of models that have been developed in the recent past.

In this paper, Mitsuo Saito and Ryoichi Nishimiya present a quantitative evaluation of the contributions of various factors to Japanese economic growth over the period 1962–73. The method adopted involves simulations using a macroeconometric model, which combines the Keynesian theory of effective demand with elements of neoclassical growth theory to describe both short-term fluctuations and long-term tendencies of the economy. The advantages of this new method over the traditional approach are discussed. According to Saito and Nishimiya's estimates, the contribution of technical progress to Japanese economic growth is larger than that suggested by the traditional method of growth accounting.

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1. INTRODUCTION

This paper reports the results of a quantitative analysis carried out in order to identify the causes of Japan's rapid economic growth during the period 1962–73, on the basis of simulations using an econometric model. Japan enjoyed a particularly high rate of economic growth during the 1960s, when the average annual growth rate of GNP was about 10 percent. It is important to note, however, that this was not a "miracle", but rather an example of a fairly common pattern of economic growth. In fact, economic growth paths of this sort have recently been followed by several other East and Southeast Asian countries, such as Hong Kong, Singapore, South Korea, and Taiwan.[1]

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[1] For details of the pattern of high economic growth in Japan and the newly industrialized countries in East and Southeast Asia, see Section 1 of the companion IIASA Working Paper (WP-85-16), *Growth and Technology: Interdependence Between Taiwan and Japan*, by the same authors. From the viewpoint of development strategy it may be very important to know the contribution of a particular factor to the growth rate of GNP and also to identify the most crucial factor in high economic growth.

One well-known technique for evaluating the contribution of individual factors to economic growth is the growth accounting method.[2] The method we present here has an advantage over growth accounting in that it takes into consideration the interdependence among growth factors, while growth accounting treats these factors as mutually independent. In addition, our method enables us to examine the feasibility of a specific growth path from the viewpoint of government and external deficits, while growth accounting does not.

The main findings of our study may be summarized as follows. A one-percent decrease in the rate of technical progress of the labor-augmenting type, in the growth rate of the labor force and population, and in the rate of capital accumulation would historically have resulted in reductions of 0.74 percent, 2.35 percent, and 0.24 percent, respectively, in the growth rate of real GNP according to our calculations; the corresponding estimates derived from growth accounting are 0.56 percent, 0.64 percent, and 0.36 percent, respectively. According to our simulations, the relative contributions of technical progress, labor force, and capital accumulation to the total average growth rate of real GNP are 53.5, 23.3, and 23.2 percent, respectively, while they are found to be 49.7, 8.2, and 42.1 percent, respectively, using growth accounting.

In Section 2 the conventional growth accounting method is briefly reviewed and the contributions of individual growth factors to the GNP growth rate are calculated using this method for both demand and supply accounting schemes. Section 3 explains the outline of the model. Sections 4 and 5 then present estimates for the contributions to GNP growth rate of demand and supply factors, respectively, based on simulations using the econometric model of Japan. In Section 6 we examine whether government or trade-balance deficits would have placed any obstacles in the way of the growth paths described in the preceding sections. Our study indicates that a high rate of technical progress is of extreme importance among the various factors contributing to economic growth.

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[2] See E.F. Denison, *The Sources of Economic Growth in the United States and the Alternatives Before Us* (New York: Committee for Economic Development, 1962), and E.F. Denison and W.K. Chung, *How Japan's Economy Grew So Fast* (Washington, DC: The Brookings Institution, 1976).

2. THE GROWTH ACCOUNTING METHOD

The contribution of the growth of individual factors to the total growth rate of GNP has frequently been calculated using the growth accounting method for both demand and supply factors. Let us first apply this method to the economic growth of Japan over the period 1962–73. The components of GNP on the demand or expenditure side satisfy the following accounting identity for each year:

$$V_t = C_t + I_t + G_t + X_t - M_t \tag{1}$$

where V_t, C_t, I_t, G_t, X_t, and M_t are, respectively, GNP, private consumption, private investment, government expenditure, exports, and imports in year t. The first difference of equation (1) gives:

$$\Delta V_t = \Delta C_t + \Delta I_t + \Delta G_t + \Delta X_t - \Delta M_t \tag{2}$$

where $\Delta V_t = V_t - V_{t-1}$, etc. Dividing both sides of the equation by V_{t-1} yields:

$$\frac{\Delta V_t}{V_{t-1}} = c\frac{\Delta C_t}{C_{t-1}} + i\frac{\Delta I_t}{I_{t-1}} + g\frac{\Delta G_t}{G_{t-1}} + x\frac{\Delta X_t}{X_{t-1}} - m\frac{\Delta M_t}{M_{t-1}} \tag{3}$$

where $c = C_{t-1}/V_{t-1}$, etc. Equation (3) shows that the growth rate of GNP is the weighted sum of the growth rates of each demand component, and thus that each term of the right-hand side of equation (3) may be interpreted as the contribution of an individual demand factor to the total growth rate of GNP. This method will be extended to the separation of the components of the growth rate over a longer period, in which the growth rates of equation (3) may be the average growth rates for the relevant period, and c, i, etc., may be evaluated as averages for the whole period. **Table 1** presents the results of applying such a method to the economic growth path followed by Japan over the period 1962–73; columns (1), (2), and (3) show, respectively, the observed average growth rate of each demand factor, the weight (c, etc.), and the calculated value of each term on the right-hand side of equation (3) ($c(\Delta C_t / C_{t-1})$, etc.). Column (4) gives the relative contribution of each factor to GNP growth. It can be seen from the table that private consumption demand is responsible for the highest contribution with private investment demand in second place.

TABLE 1. Growth accounting for the demand side, 1962–73 (in percent).

	(1) Growth rate of factor	(2) Coefficient in eq. (3)	(3) Contribution of factor to GNP growth (1) × (2)	(4) Share of (3)
(1) C: Private consumption	9.5	0.58	5.51	54.7
(2) I: Private investment	13.7	0.24	3.29	32.5
(3) G: Government expenditure	8.4	0.21	1.76	17.5
(4) X: Exports	14.5	0.09	1.31	13.0
(5) M: Imports	14.8	-0.12	-1.77	-17.7
(6) V: Total (GNP)	–	1.00	10.10	100.0

The contribution of supply-side factors to GNP growth is calculated using the well-known Denison method. The production function for GNP may be written as a function of labor input N, capital input K, and the level of technology t:

$$V_t = f(N_t, K_t, t) \tag{4}$$

Under the assumption of homogeneity of degree one, the first-difference form of equation (4) is approximated by:

$$\frac{\Delta V_t}{V_{t-1}} = n\frac{\partial f}{\partial N}\frac{\Delta N_t}{N_{t-1}} + k\frac{\partial f}{\partial k}\frac{\Delta K_t}{K_{t-1}} + \frac{\partial f/\partial t}{V_{t-1}} \tag{5}$$

where $n = N_{t-1}/V_{t-1}$ and $k = K_{t-1}/V_{t-1}$. Assuming the marginal productivity relationship we obtain the formula:

$$\frac{\Delta V_t}{V_{t-1}} = w_n\frac{\Delta N_t}{N_{t-1}} + w_k\frac{\Delta K_t}{K_{t-1}} + \frac{\partial f/\partial t}{V_{t-1}} \tag{6}$$

where w_n and w_k are, respectively, the shares of labor and capital in the total value of GNP. Therefore, the growth rate of GNP is separated into the contributions of three factors – labor, capital, and technological progress – which are represented, respectively, by the first, second, and third terms of the right-hand side of the equation.[3]

[3] Since $\partial f/\partial t$ is not directly observable, this part is calculated as a residual, i.e., the value that is obtained by subtracting the first two terms of equation (6) from the observed rate of growth of GNP.

Table 2 shows the results of applying this method to the GNP growth of Japan over the period 1962–73. Note that about one-half of the total, ten-percent GNP growth rate is attributed to technical progress. This large contribution from technical progress coincides with findings from research on a number of other countries.

TABLE 2. Growth accounting for the supply side, 1962–73 (in percent).

	(1) Growth rate of factor	(2) Coefficient in eq. (6) (w)	(3) Contribution of factor to GNP growth (1) × (2)	(4) Share of (3)
(1) N: Labor	1.3	0.64	0.8	8.2
(2) K: Capital	11.8	0.36	4.3	42.1
(3) t: Technical progress	5.0	-	5.0	49.7
(4) V: Total (GNP)	-	-	10.1	100.0

It is true that the method of growth accounting offers an easy and straightforward way of evaluating the contributions of individual growth factors to the overall growth rate of GNP. It must be emphasized, however, that the calculated results have only limited significance from the viewpoint of economic development strategies. A few examples will demonstrate this very clearly.

First, the method of growth accounting neglects the interdependence among growth factors, and is therefore likely to lead to unrealistic conclusions regarding development strategy. Column (2) of **Table 1** states that a one-percent increase in the growth rate of government expenditure will increase the growth rate of GNP by 0.21 percent. But it is well known that there exist very stable relationships between the growth rates of GNP and consumption and between those of GNP and imports. Therefore, the effect of an increase in the growth rate of government expenditure will be more accurately evaluated by introducing the so-called multiplier effect into the growth accounting scheme.[4]

[4] Substitution of $\Delta C_t / C_{t-1} = u(\Delta V_t / V_{t-1})$ and $\Delta M_t / M_{t-1} = v(\Delta V_t / V_{t-1})$ into equation (3) yields:

$$\Delta V_t / V_{t-1} = k\left[i\frac{\Delta I_t}{I_{t-1}} + g\frac{\Delta G_t}{G_{t-1}} + x\frac{\Delta X_t}{X_{t-1}}\right] \tag{3a}$$

where $k = 1/(1 - uc + vm)$. k is calculated as 1.61 by substituting estimates for u (0.88) and v (1.10). In this case, a one-percent increase in investment, government expenditure, and exports would give rise to increases in GNP growth rate of 0.39, 0.34, and 0.15 percent, respectively.

Second, the growth accounting for the demand side is completely separate from that for the supply side, thus greatly limiting the usefulness for policy making of any quantitative results. Growth accounting for the demand side states that an increase of one percent in the growth rate of government expenditure will lead to a 0.21-percent increase in the growth rate of GNP. If, however, the level of capacity output falls short of the growth path envisaged by such an expansionary policy, the associated increase in GNP growth rate will not be realized. On the other hand, growth accounting on the supply side states that an increase in the rate of technical progress will lead to the same percentage increase in the growth rate of GNP. If, however, the level of effective demand falls short of the level of the expanded capacity, the expected increase in the growth rate of GNP will not materialize in the real economy. It is also important to note that a change in a given factor on the demand side will effect a change in a related factor on the supply side. For example, an increase in the growth rate of investment is directly related to an increase in the growth rate of capital stock, by definition.

Third, some important obstacles to growth are completely neglected by growth accounting. Over the period 1962–73, balance-of-payment deficits constituted an important obstacle to the faster growth of GNP. Therefore, in the real economy an increase of one percent in the growth rate of government expenditure would actually not give rise to an increase of 0.21 percent in GNP, if the expansionary policy caused the balance-of-payment position to deteriorate beyond a certain point. Also, it should be remembered that, after the oil crisis, government deficits imposed a serious brake on expansionary policies, which was not the case before 1973.

The method we adopt here to calculate the contribution of each factor to the growth rate of GNP is based on simulations using an econometric model of the Japanese economy. More specifically, we first simulate the historical path of the Japanese economy over the period 1961–79. We then simulate a hypothetical growth path within which the growth rate of a given factor is changed by one percent, and calculate the contribution of the factor to the growth rate of GNP by comparing the hypothetical path with the original one. The calculated values of each factor for both the demand and supply sides satisfy structural equations, such as the consumption functions, the investment function, and the import functions, and are constrained by the production function; in other words, feedback effects among the factors are comprehensively taken into account. Therefore, our method is free from the first two drawbacks of the growth accounting technique. In addition, the simulated path is examined to find out whether it violates the restrictions on either government or balance-of-payment deficits. If it does, the path is discarded as an unrealistic variant. In this way, our method also avoids the third major drawback of growth accounting.

3. THE OUTLINE OF THE MODEL

We begin by summarizing the special features of the model, which is essentially an annual aggregative model of the Keynesian type, with a sample period of 1961–79. The estimated equations and variables of the model are listed in the Appendix.[5] In general, estimations are performed using the ordinary least-squares method. $\bar{R}^2$ is the measure of goodness of fit adjusted for degrees of freedom and D.W. is the Durbin–Watson statistic. The figure in parentheses below each regression coefficient is the corresponding t-value. Some of the equations are estimated by the Cochrane–Orcutt iterative method, where ρ is the serial correlation coefficient of first order in error terms.

The first special characteristic of the model is the disaggregation of final demand. Since the energy problem is one of the most serious facing the Japanese economy, final demand is disaggregated so as to treat the energy question in more depth. There are four consumption items, namely foods, autos and auto fuel, heating fuel, and others; imports are disaggregated into fuels and nonfuels.

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[5] A detailed explanation of the model and results of tests of its workability are presented in a separate paper, M. Saito and T. Oono, *An Energy Model of the Japanese Economy, 1961–1979*.

The second feature of the model is the application of the input–output technique to the price equations. Industry as a whole is disaggregated into six separate industries: (1) primary, excluding crude oil, (2) crude oil, (3) manufacturing, excluding petroleum and coal products, (4) petroleum and coal products, (5) tertiary, and (6) electricity and gas. The price of each industry is explained mainly in terms of a cost variable for the industry concerned, which is defined as the sum of the material, labor, and capital costs. Material costs are calculated as the sum of the products of material input coefficients and the corresponding prices, labor cost is the product of the labor input coefficient and wage, and capital cost is the product of the depreciation ratio and the rental price of capital. This setup enables us to describe the interdependence between the prices of different industries and to trace out the effects of import prices, and particularly the oil price, on the price configuration of the whole economy. The wage is given by a version of the Phillips curve.

The third characteristic of the model is that the supply side of the economy is represented by a neoclassical production function of the two-level, CES type.[6] Within the framework of this production function and cost minimization on the part of the firms, the material input coefficients of each industry are flexible with respect to the relative prices of outputs and inputs; and the degree of flexibility, i.e. the elasticity of substitution, can be estimated from the time series of input coefficients and relative prices. The estimate of the elasticity of substitution among material inputs is close to unity for industries 1 (1.161), 4 (0.900), and 6 (1.094), while it is 1.346 and 0.627 for industries 3 and 5, respectively.

The elasticity of substitution for value added is estimated via an aggregate production function for total supply, i.e. GNP plus imports. More specifically, the output is total supply, while the inputs are labor, capital, oil imports, and other imports. The elasticity of substitution is estimated as 0.36. Technical progress of a labor-augmenting type is allowed for by the term T_t, i.e.,

$$T_t = \sum_{t=0}^{9} \exp(\lambda(t-i)) \cdot IF_{t-i} / \sum_{t=0}^{9} IF_{t-i}$$

[6] K. Sato, A Two-Level CES Production Function, *Review of Economic Studies*, Vol. 34 (2), 1967, pp. 201–218.

where t = time trend and IF_t = gross fixed investment. If the levels of IF are kept unchanged, T will grow at the rate of λ percent per year. But if the levels of IF in recent years are higher than those in past years, the rate of change of T will be accelerated, implying that the newer vintage of capital stock raises the average level of technology. The estimates of the rate of technical progress, λ, are 9.0 and 3.0 percent per year for the periods before and after the oil crisis, respectively. These estimates are obtained from the marginal productivity relationship between the input requirement per unit output and the relative prices. Thus, the equation related to labor input will determine the labor input coefficient of industry as a whole, or its reciprocal, labor productivity. The labor input coefficient of each individual industry is regressed on that of industry as a whole under the assumption that a stable relationship exists between the two.

The cost-minimization equation for the capital input of industry as a whole gives us a formula for the quantity of capital required. Together with expected profits, this will determine observed levels of investment. Finally, the cost-minimization equation for fuel imports will also determine the quantity of these imports.

4. THE CONTRIBUTION OF DEMAND FACTORS TO ECONOMIC PERFORMANCE

The demand components considered are private consumption, private investment, government expenditure, exports, and (the negative of) imports. As we mentioned in the previous section, very stable relationships exist between GNP and private consumption and between GNP and imports. Therefore, we will concentrate on private investment, government expenditure, and exports as the main demand factors affecting the growth of GNP.[7]

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[7] Private investment and exports are endogenous variables in the model. But, since they are much more affected by exogenous factors than are private consumption and imports, the contribution of such exogenous factors to economic growth will be evaluated in what follows.

4.1. Government Expenditure

Both consumption (*CG*) and investment (*IG*) expenditures of government in constant prices are exogenous variables in our model. Thus the contribution to the growth rate of GNP of an increase in government expenditure will be calculated by simulating a hypothetical path in which the average growth rates of both *CG* and *IG* are one percent higher than their actual values. The results are given in **Table 3**, in which column (4) presents the difference in growth rates between the control solution (column (2)) and the increased government expenditure solution (column (3)). It can be seen that a one-percent rise in the growth rate of *CG* and *IG* will give rise to a 0.33-percent rise in the growth rate of GNP. This figure is higher than the 0.21 percent (column (2) of **Table 1**) quoted earlier, but very close to the 0.34 percent value of **Footnote 4**, which is obtained by taking into account the multiplier effect of government expenditures. Also, the increase of 0.33 percent in the growth rate of GNP is accompanied by increases of 0.15, 0.16, and 0.14 percent in the inflation rates for the GNP deflator, the consumption deflator, and the growth rate of employment, respectively.

TABLE 3. Contribution of government expenditure to economic performance, 1962–73 (in percent per annum).

	(1) Observed	(2) Control solution	(3) Increased government expenditure	(4) (3) – (2)
(1) *CG*: Government consumption	5.39	5.39	6.39	+1.00
(2) *IG*: Government investment	12.75	12.75	13.75	+1.00
(3) *V*: GNP	10.10	9.66	9.99	+0.33
(4) *C*: Private consumption	9.48	8.87	9.02	+0.15
(5) *IF*: Fixed investment	13.26	12.68	12.95	+0.27
(6) *X*: Exports	14.47	14.24	14.15	−0.09
(7) *M*: Imports	14.84	15.24	15.52	+0.28
(8) *P*: GNP deflator	5.77	6.26	6.41	+0.15
(9) *PC*: Consumption deflator	5.97	6.47	6.63	+0.16
(10) *N*: Persons engaged	1.32	0.93	1.07	+0.14
(11) *W*: Wage rate	14.10	14.41	14.60	+0.19

It is important to note that the increase of 0.14 percent in the average growth rate of employment implies an increase in employment of 1.55 ($\approx$ 0.14 × 11 years) percent, or some 784 thousand persons in 1973, and this is essentially impossible since the observed number of unemployed in 1973 was only 670 thousand persons.[8]

This suggests that it may be very difficult to raise the average rate of GNP growth by continuously expanding government expenditure over a fairly long period, of say ten years, unless a large pool of unemployment exists at the starting point. It must be added, however, that this result does not contradict the short-run effectiveness of adjustments in the level of government expenditure. Another simulation shows that a one-percent increase in the growth rate of GNP caused by an increase in government expenditure would give rise to an increase of 0.18 percent or 83 thousand persons in employment in the *first* year.

4.2. Exports

In our model commodity exports are represented by an endogenous variable or a log-linear function of the world trade index and relative prices. If we add to the export function a trend variable that raises commodity exports by one percent every year, we can calculate the contribution of export demand to the growth rate of GNP. Column (2) of **Table 4** presents the results of such a calculation.[9]

As shown in Column (3) of the table, the average growth rates of exports and GNP in this simulation exceed those of the control solution by 0.70 and 0.11 percent, respectively.[10] Therefore, a one-percent increase in the growth rate of exports would give rise to an increase of 0.15 (= 0.11/0.70) percent in the growth rate of GNP, which is higher than the 0.09 percent of Column (2) of **Table 1**, but practically the same as the figure in **Footnote 4**. Another simulation shows that, if a one-percent increase in the growth rate of GNP is brought about solely by an increase in the growth rate of exports, the required increase in the average annual growth rate of employment would be 0.67 percent, which is again impossible for the same reason as stated above.

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[8] Another simulation, based upon a 3-percent increase in the growth rate of government expenditure, indicates that the growth rates of GNP and employment would be increased by 1.06 and 0.45 percent, respectively, implying an approximately linear relationship between cause and effect.

[9] This assumes that the stochastic term of the export function has a systematic increasing trend.

[10] The final increase of 0.70 percent is lower than the shift of 1.00 percent in the export function. This is because the increase in exports will lead to an increase in GNP and a rise in the export price and the latter will tend to make exports decrease.

TABLE 4. Contribution of exports and private investment to economic performance, 1962–73 (in percent per annum).

		(1) Control solution	(2) Increased exports	(3) (2) − (1)	(4) Increased investment	(5) (4) − (1)
(1)	Exogenous export rise	0.00	1.00	+1.00	0.00	0.00
(2)	Exogenous investment rise	0.00	0.00	0.00	1.00	+1.00
(3) V:	GNP	9.66	9.77	+0.11	9.76	+0.10
(4) C:	Private consumption	8.87	8.94	+0.07	9.00	+0.13
(5) IF:	Private investment	12.68	12.77	+0.09	12.93	+0.25
(6) X:	Exports	14.24	14.94	+0.70	14.10	−0.14
(7) M:	Imports	15.24	15.46	+0.22	15.34	+0.10
(8) P:	GNP deflator	6.26	6.36	+0.10	6.44	+0.18
(9) PC:	Consumption deflator	6.47	6.59	+0.12	6.64	+0.17
(10) N:	Persons engaged	0.93	0.99	+0.06	1.03	+0.10
(11) W:	Wage rate	14.41	14.50	+0.09	14.68	+0.27

4.3. Investment

Although private fixed investment is endogenously determined by the equation explaining the ratio of new investment to beginning-of-year capital stock, the addition of a constant term 0.01 to the right-hand side of the equation enables us to calculate the effect on economic performance of an autonomous increase in the rate of capital accumulation.[11] The results of this simulation are shown in column (4) of **Table 4**. An increase of one percent in the rate of capital accumulation would lead to increases of 0.10, 0.25, and 0.10 percent in the growth rates of GNP, investment, and employment, respectively. Another simulation with the addition of a constant term 0.033 shows that a one-percent increase in the growth rate of investment would lead to an increase of 0.39 percent in the GNP growth rate, which is practically the same as the figure in **Footnote 4**. Again, the 0.39-percent increase in GNP growth rate must be accompanied by an increase of 0.35 percent in the average growth rate of employment, which is clearly impossible.

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[11] This assumes that the stochastic term of the investment function has a systematic positive value rather than zero.

Our analysis of the contribution of demand factors to the growth rate of GNP may be summarized as follows:

(1) The contributions of each demand factor to the growth rate of GNP are much larger than the figures derived from growth accounting in **Table 1**, and are very close to the values of **Footnote 4**, which are obtained by taking the multiplier effect into account.

(2) It is almost impossible to raise the average growth rate of GNP in eleven years by one percent per year through a sustained increase in the demand factor alone, since the labor shortages implied by such a growth path would be very great.

5. THE CONTRIBUTION OF SUPPLY FACTORS TO ECONOMIC PERFORMANCE

5.1. Technical Progress

Let us begin by evaluating the contribution of technical progress to Japanese economic growth. In our model, technical progress is represented by a coefficient λ in the formula for T_t, and the estimated value of λ for 1962–73 is 9 percent per year. **Table 5** presents the results of a simulation in which the value of λ is set at 0.08, other exogenous variables being kept unchanged. It can be seen from column (3) of the table that a decrease of one percent in λ will reduce the growth rate of GNP by 0.45 percent, while it will increase the growth rate of employment by 0.12 percent and the inflation rate of the private consumption deflator by 0.72 percent. These results may be traced out in our model as follows. The decrease in the rate of technical progress will lead to a decrease in expected profits, due to a rise in unit labor cost, and thus to a fall in private investment. The fall in investment demand will lead to a fall in the level of effective demand and therefore to a decline in GNP.[12] The decline in GNP will reduce the level of employment, while the slowdown of technical progress will increase the quantity of labor required to meet a given level of effective demand; the simulation results show that the latter effect will predominate. Finally, the rise in unit labor cost will increase the prices of

[12] The fall in investment will also lead to a slowdown in the growth rate of T_t. (See the definition of T_t in Section 3.)

individual industries and thereby raise the deflators of the individual components of GNP.

TABLE 5. Effects on economic performance of a change in the rate of technical progress, 1962–73 (in percent per annum).

		(1) Control solution	(2) Slower tech. progress	(3) (2) – (1)	(4) Slower tech. progress	(5) (4) – (1)
(1)	λ: Rate of technical progress	9.00	8.00	–1.00	8.00	–1.00
(2)	*CG*: Government consumption	5.39	5.39	0.00	4.46	–0.93
(3)	*IG*: Government investment	12.75	12.75	0.00	11.82	–0.93
(4)	*V*: GNP	9.66	9.22	–0.45	8.92	–0.74
(5)	*C*: Private consumption	8.87	8.51	–0.36	8.37	–0.50
(6)	*IF*: Private investment	12.68	11.93	–0.75	11.70	–0.98
(7)	*X*: Exports	14.24	13.37	–0.87	13.46	–0.78
(8)	*M*: Imports	15.24	14.96	–0.28	14.72	–0.51
(9)	*P*: GNP deflator	6.26	7.04	+0.78	6.90	+0.64
(10)	*PC*: Consumption deflator	6.47	7.19	+0.72	7.04	+0.57
(11)	*N*: Persons engaged	0.93	1.05	+0.12	0.92	–0.01
(12)	*W*: Wage rate	14.41	14.69	+0.28	14.51	–0.10

It is important to note that the increase of 0.12 percent in the annual growth rate of employment implies an increase in employment of 1.36 percent after eleven years or an increase of 690 thousand persons in 1973 alone, and this is impossible because the observed number of unemployed in 1973 was only 670 thousand persons. Therefore it is clear that an economy with a slower rate of technical progress would not have been able to meet the same level of effective demand as that actually observed in 1962–73 and that, for example, it would have been necessary to slow down the growth rate of government expenditure so as to avoid extreme excess demand in the labor market, overheating caused by inflationary pressures, and so on. Suppose that government expenditure were slowed down so as to keep the labor market as tight as it was in the observed situation (or in the control solution).[13] The result of such a simulation is shown in columns (4) and (5) of **Table 5**.

[13] The Japanese economy moved from a position of labor abundance to one of labor shortage around 1955. The rate of unemployment over the period 1962–73 was between 1.36 and 1.40 percent, and further mobilization of any substantial amount of labor would have been very difficult. Therefore, in what follows the observed level of employment will be regarded as a standard level of full employment.

It may be seen from the table that a one-percent slowdown in technical progress will, in effect, lead to a decrease of 0.74 percent in GNP growth rate, and to increases of 0.57, 0.64, and 0.10 percent in the growth rates of the consumption deflator, the GNP deflator, and the wage rate, respectively. A one-percent decrease in the rate of technical progress of the labor-augmenting type corresponds to a 0.56- (= 5.0/9.0) percent decrease in the rate of technical progress according to growth accounting, which would lead to a reduction of the same percentage in GNP growth rate. It is interesting to note that, while a slowdown of one percent in the rate of labor-augmenting technical change means a loss of 0.56 percent in the GNP growth rate according to growth accounting, the same slowdown would imply a loss of 0.74 percent using our approach. Our method suggests that a very high rate of technical progress explains the greater part of the high rate of GNP growth observed in Japan during the 1960s. In fact, one simulation indicates that, if the rate of technical progress were to have been zero and employment had been kept at the level of the control solution by reducing government expenditure, the average annual growth rate of GNP and the average annual inflation rate of the consumption deflator would have been 3.40 and 11.73 percent, respectively.

5.2. Population and Labor Force

We now consider the contribution of the growth rate of population to the growth rate of Japan's GNP. **Table 6** presents the results of a hypothetical simulation in which the growth rates of both population and labor force are increased by one percent from their actual values, other exogenous variables being kept unchanged. Column (3) of the table shows the difference between the control and hypothetical solutions. It can be seen that a one-percent increase in population would yield an increase of 0.27 percent in the consumption growth rate and an increase of 0.36 percent in the GNP growth rate. On the other hand, an increase of 0.16 percent in the employment growth rate is considerably smaller than the increase of one percent in labor-force growth rate. As a result, the growth rates of wage and thus the consumption deflator would be reduced by 1.14 and 0.82 percent, respectively.

TABLE 6. Effects on economic performance of a change in labor force, 1962–73 (in percent per annum).

		(1) Control solution	(2) Increased labor force and population	(3) (2) – (1)	(4) Increased labor force and population	(5) (4) – (1)
(1) *POP*:	Population	1.25	2.25	+1.00	2.25	+1.00
(2) *LF*:	Labor force	1.31	2.31	+1.00	2.31	+1.00
(3) *CG*:	Government consumption	5.39	5.39	0.00	10.79	+5.40
(4) *IG*:	Government investment	12.75	12.75	0.00	18.15	+5.40
(5) *V*:	GNP	9.66	10.02	+0.36	12.01	+2.35
(6) *C*:	Private consumption	8.87	9.14	+0.27	10.03	+1.16
(7) *IF*:	Private investment	12.68	13.14	+0.46	14.85	+2.17
(8) *X*:	Exports	14.24	15.13	+0.89	14.66	+0.42
(9) *M*:	Imports	15.24	15.43	+0.19	17.17	+1.93
(10)*P*:	GNP deflator	6.26	5.35	–0.91	6.21	–0.05
(11)*PC*:	Consumption deflator	6.47	5.65	–0.82	6.55	+0.08
(12)*N*:	Persons engaged	0.93	1.09	+0.16	1.93	+1.00
(13)*W*:	Wage rate	14.41	13.26	–1.15	14.36	–0.05

The simulation implies that a simple increase in the growth rate of the population and labor force would give rise to a substantial amount of unemployment. Let us suppose that the growth rates of government expenditures were increased so as to keep the level of employment growing at the same rate as the labor force. According to our calculations, this would require an increase of 5.4 percent in the growth rate of government expenditure. Column (5) presents the results of this simulation in terms of the difference in growth rates between the hypothetical and control solutions. It is interesting to note that the expansion of the economy caused by a one-percent increase in population and labor force would lead to a 2.35-percent increase in GNP growth rate and one of 1.16 percent in the growth rate of consumption (overall, a slight increase in the growth rate of per capita consumption). Since the state of the labor market is kept unchanged, the increases in the growth rates of the wage rate and the consumption deflator would be relatively moderate.

By means of a similar calculation for a 1.25-percent decrease in population and labor force,[14] it was found that, if there had been no growth in population and labor force during the period 1962–73 with government expenditures reduced so as to keep the unemployment rate unchanged, the growth rate of GNP would have been 6.93 percent, in other words, that the GNP growth rate would have been 2.73 percentage points lower than in the control solution.

Growth accounting for the supply side in Section 2 indicated that a one-percent increase in the employment growth rate would give rise to an increase of 0.64 percent in GNP growth rate (see column (2) of **Table 2**). Our calculations indicate that a one-percent increase in both population and labor force would yield an increase of 2.35 percent in the GNP growth rate, if the increased labor force were fully mobilized by expansionary government policies. But it is very likely that such policies would lead to problems of either government or balance-of-payment deficits, which will be discussed in the next section.

5.3. Capital Stock

The effects on economic performance of capital accumulation are best examined by simulating the model with an autonomous shift in the investment function and this device has already been adopted in the analysis of the contribution of investment increase to economic growth. **Table 7** presents the results of a simulation in which an autonomous shift of 1.7 percent in the rate of capital accumulation is added to the original model. Column (3) of the table shows that a one-percent increase in the accumulation rate will lead to 0.18-, 0.17-, and 0.44-percent rises in the growth rates of GNP, employment, and investment, respectively. The 0.17-percent rise in the average growth rate of employment is clearly impossible for the reasons given above. This implies that a one-percent increase in the growth rate of capital stock would necessitate a complementary increase in the growth rate of the labor force. Columns (4) and (5) present the results of a simulation

[14] The observed average annual growth rates of labor force and population were 1.25 and 1.31 percent, respectively. In this simulation the growth rate of government expenditure was reduced by 9.8 percent.

that incorporates an autonomous shift of 1.6 percent in the rate of capital accumulation and a supplementary increase of 0.19 percent in both labor force and population. It can be seen that a one-percent rise in the growth rate of capital stock, together with the 0.19-percent increase in the growth rates of labor force and population, will give rise to increases of 0.24, 0.50, and 0.19 percent in the growth rates of GNP, investment, and employment, respectively.

TABLE 7. Effects on economic performance of capital accumulation, 1962–73 (in percent per annum).

		(1) Control solution	(2) 1.7-percent shift in the capital accumulation rate	(3) (2) – (1)	(4) 1.6-percent shift in the capital accumulation rate	(5) (4) – (1)
(1) *POP*:	Population	1.25	1.25	0.0	1.44	+0.19
(2) *LF*:	Labor force	1.31	1.31	0.0	1.50	+0.19
(3) *V*:	GNP	9.66	9.84	+0.18	9.90	+0.24
(4) *C*:	Private consumption	8.87	9.10	+0.23	9.14	+0.27
(5) *IF*:	Private investment	12.68	13.13	+0.44	13.18	+0.50
(6) *X*:	Exports	14.24	14.01	–0.23	14.19	–0.05
(7) *M*:	Imports	15.24	15.43	+0.19	15.45	+0.21
(8) *P*:	GNP deflator	6.26	6.57	+0.31	6.37	+0.11
(9) *PC*:	Consumption deflator	6.47	6.76	+0.29	6.57	+0.10
(10)*N*:	Persons engaged	0.93	1.10	+0.17	1.12	+0.19
(11)*W*:	Wage rate	14.41	14.88	+0.47	14.62	+0.21
(12)*KIF*:	Capital stock	10.28	11.28	+1.00	11.26	+0.98

Another simulation for a similar scheme indicates that, if there were no increase in capital stock, the reductions in the growth rates of GNP and employment would have been 2.72 and 2.41 percent, respectively. **Table 8** summarizes the results of separating total GNP growth over the period 1962–73 into the contributions of individual factors. Column (1) of the table corresponds to column (3) of **Table 2**. It is interesting to note that, according to our calculations, the contributions of technical progress and employment are larger than those arrived at using the conventional method, while the effect of capital accumulation is smaller.[15]

[15] Since labor, capital, and technology do not exhaust the list of growth factors in our econometric model, and the contribution of each supply factor includes the effect of supplementary changes in the demand factors, there remains a discrepancy in the average GNP growth rate between the control solution and the total of the three contributions. The 2.05-percent value for the discrepancy, however, implies that the contributions of these three factors account for a substantial part of the total.

TABLE 8. Contribution of supply factors to the growth of GNP, 1962–73 (in percent).

	(1) Contribution of factor to GNP growth	(2) Share of (1)
(1) N: Persons engaged	2.73	23.3
(2) K: Capital stock	2.72	23.2
(3) t: Technical progress	6.26	53.5
(4) Discrepancy	-2.05	-
(5) V: GNP (control solution)	9.66	100.0

6. OBSTACLES TO GROWTH

In the preceding sections the contributions to economic performance of demand and supply factors have been evaluated. It must be emphasized, however, that the economic paths discussed above cannot be realized if they encounter serious government or external deficits.

6.1. Government Deficits

Before the 1973 oil crisis, deficits in the government budget imposed no practical limitations on the adoption of an expansionary policy in Japan; this was largely because the growth rate of nominal government expenditure did not significantly exceed the growth rate of nominal government revenue. On the other hand after the oil crisis, the slowdown in the growth rate of GNP and thus tax receipts, together with the establishment of "big government" during the 1960s, caused a great accumulation of government bonds within the economy and restrictions on any further expansion of government expenditure.

We adopt as a measure of the restriction of government expenditure the relative magnitudes of the growth rates of government outlay and revenue. **Table 9** presents the growth rates of nominal government revenue and nominal government outlay over the period 1962–73. Column (1) of the table indicates that revenue is only slightly exceeded by outlay in the control solution during this period. This is consistent with the fact that expansionary government policy was not restricted by the deficit problem before 1973. Let us assume that an excess of outlay growth rate over revenue growth rate is tolerable so long as it does not exceed 2.0 percent.[16] The figures in column (2) allow us to examine the feasibility of the growth path presented in columns (3) and (4) of **Table 3**. They indicate that when the growth rate of real government expenditure is increased by one percent, the growth rate of government outlay will exceed that of government revenue by 1.06 percent. Therefore, according to our measure, the expansionary policy of a one-percent increase in real government outlay is feasible from the viewpoint of government budget, although, as shown above, it is impossible due to the shortage of labor.

TABLE 9. Feasibility of various growth rates, 1962–73 (in percent per annum).

		(1) Control solution	(2) Government outlay increase	(3) 1.0 % rise in labor force
(1) *CG*:	Government consumption	5.39	6.39	10.79
(2) *IG*:	Government investment	12.75	13.75	18.15
(3) *POP*:	Population	1.25	1.25	2.25
(4) *LF*:	Labor force	1.31	1.31	2.31
(5)	Government revenue (nominal)	18.21	18.88	21.70
(6)	Government outlay (nominal)	18.97	19.94	23.79
(7) =	(5) – (6)	–0.76	–1.06	–2.09

[16] In fact, the actual growth rate of outlay exceeded that of revenue by 1.4 percent over the period 1962–73, and the government deficit problem was not serious.

The figures in column (3) of **Table 9** trace the feasibility of the growth path presented in column (5) of **Table 6**. In this path, with a one-percent rise in labor force and a 5.4-percent rise in the growth rate of government expenditure, the growth rate of government revenue will be 2.09 percent smaller than the growth rate of government outlay. Therefore, one may conclude that if the growth rates of labor force and population had been one percent (or more) larger than those observed, the economy would have experienced either a significant amount of unemployment or serious government deficits.

6.2. Trade-Balance Deficits

During the 1960s the Japanese government tightened up on expenditures by both fiscal and monetary policy measures when the country experienced a deterioration of its external trade balance in 1961, 1964, and 1968. Examination of our simulations, however, reveals that negative trade balances do not occur in any year for any of the paths described above, with the exception of the one that incorporates a 1.0-percent rise in the labor force and a 5.4-percent rise in government expenditure; this latter path would have led to a trade deficit of 3 billion dollars in 1973. Therefore, except for this one case we need not modify the estimations presented in the preceding sections from the viewpoint of obstacles posed by the trade deficit. Although rapid increases in imports, and particularly large, speculative purchases of imported materials, brought about by sudden changes in the trade balance situation have been known, they have been temporary phenomena that occurred only at the peak of prosperity. Our simulations indicate that, as far as the long-term factors such as technology, labor force, and the rate of accumulation are concerned, the Japanese economy exhibited a very stable tendency toward positive trade balances throughout the period studied.

List of Equations

Equation No.	Equation	$\bar{R}^2$	D.W.	ρ
I. Expenditure				
Gross National Product				
(1.1)	V=C+IF+IH+JP+JPG+X-M+IG+CG			
(1.2)	VP=C·PC+IF·PIF+IH·PIH+JP·PJP+JPG·PJPG+X·PX-M·PM+IG·PIG+CG·PCG			
(1.3)	VM=V+M			
Consumption				
(1.4)	C=CF+CEH+CEA+CO			
(1.5)	CPC=CF·PCF+CEH·PCEH+CEA·PECA+CO·PCO			
(1.6)	$\ln(C/POP)=-0.298+0.792\ \ln(YDP/PC/POP)+0.069\ \ln(SMP2_{-1}/PC/POP)+0.095\ \ln(C/POP)_{-1}$ (1.52) $-0.150\ \ln(G)-0.053D7079-0.026D74$ (1.27) (3.34) (2.07)	0.849	1.122	0.78
(1.7)	$\ln(CF/POP)=0.129+0.431\ \ln(C/POP)-0.768\ \ln(PCF/PC)+0.072D6579$ (2.20) (2.72) (3.24)	0.982	1.403	0.94
(1.8)	$\ln(CEH/POP)=-2.936+0.511\ \ln(C/POP)-1.188\ \ln(PCEH/PC)$ (28.7) (2.41)	0.840	1.471	0.82
(1.9)	$\ln(CEA/POP)=-118.936+1.216\ \ln(C/POP)-(3.781-2.693D7479)\ \ln(PCEA/PC)+0.0581\ TIME$ (4.97) (5.86) (4.80) (4.79)	0.983	1.678	
(1.10)	SMP2=-5983.5+0.113SM2 (2.91) (53.2)	0.995	0.510	

Equation No.	Equation	$\bar{R}^2$	D.W.	ρ
Fixed Business investment				
(1.11)	$\ln KIF^{*}=0.206+0.314\cdot\{\frac{1}{2}(\ln(PVM/PK)_{-1}+\ln(PVM/PK)_{-2})\}+\ln VM-\ln(1.25)$			
(1.12)	$IF/KIF_{-1}=\underset{(14.8)}{0.103}+\underset{(5.12)}{0.116}\cdot\{(KIF^{*}/KIF_{-1})-1\}+\underset{(7.31)}{0.858}\cdot\{\frac{1}{2}(YCD/KIF_{-1}+YCD_{-1}/KIF_{-2})\}$	0.892	1.164	
(1.13)	$KIF=KIF_{-1}+IF+OTHER$			
Inventory investment				
(1.14)	$JP=\underset{(1.85)}{1063.0}+(\underset{(2.92)}{0.077}-\underset{(2.44)}{0.013}D7579)V-\underset{(2.47)}{0.227}KJP_{-1}+\underset{(1.98)}{4184.23}(R-(P-P_{-1})/P_{-1})+\underset{(0.54)}{563.7}D6579$	0.744	1.826	
(1.15)	$KJP=KJP_{-1}+JP$			
Residential construction				
(1.16)	$(IH\cdot PIH)/YDP=\{0.0533+0.0194(SMP2_{-1}/YDP)\}+\underset{(3.02)}{0.0660}LN1+\underset{(5.58)}{0.0161}LN2-\underset{(2.65)}{1.083}\{1000/(YDP/PC)\}$ $-\underset{(3.13)}{0.374}G+\underset{(5.29)}{0.0171}D73+\underset{(3.47)}{0.0113}D74+\underset{(4.73)}{0.0978}$	0.949	1.365	
(1.17)	$KIH=KIH_{-1}+IH-DH$			

II. The Foreign Sector

Imports

(2.1) $M\cdot PM=MGPMG+MSPMS$

Equation No.	Equation	$\bar{R}^2$	D.W.	ρ
(2.2)	$MGPMG=-287.0+0.938MCGPMCG-286.5D6579$ (0.98) (38.9) (0.73)	0.991	0.989	
(2.3)	$MCGPMCG=MC\cdot PMC\cdot RATET/1000$			
(2.4)	$MC=ME+MO$			
(2.5)	$PMC=(ME\cdot PME+MO\cdot PMO)/MC$			
(2.6)	$\ln ME=-2.878+1.050\ \ln IE+0.026\ \ln(RF/MC\cdot PMC)_{-1}-0.096D6579$ (4.96) (20.3) (0.53) (1.14)	0.988	1.458	
(2.7)	$PME=0.045+0.963PM2$ (0.05) (158.8)	0.999	1.354	
(2.8)	$\ln IE=1.459+1.255\ \ln AIE-0.314(\frac{1}{2}\ln(P2/PVM)_{-1}+\frac{1}{2}\ln(P2/PVM)_{-2})$ (2.21) (15.9)	0.981	1.315	0.564
(2.9)	$AIE=0.0340CF+0.1374(CEH+CEA)+0.0261CO+0.0275(IF+IH+IG)+0.0209CG+0.0416X+0.0510JP$			
(2.10)	$\ln MO=-1.800+1.024\ \ln V-0.314(\frac{1}{2}\ln(PMO\cdot RATE/PVM)_{-1}+\frac{1}{2}\ln(PMO\cdot RATE/PVM)_{-2})$ (3.97) (26.1)	0.974	1.577	
(2.11)	$\ln PM=-0.0185+0.954\ \ln(PMC\cdot RATE)-0.0212D6579$ (2.32) (11.1) (3.06)	0.999	0.907	
Exports				
(2.12)	$X\cdot PX=XGPXG+XOPXO$			
(2.13)	$XGPXG=9.081+1.021XCGPXCG-134.952D6579$ (0.03) (44.5) (0.35)	0.994	1.412	
(2.14)	$XCGPXCG=XC\cdot PXC\cdot RATET/1000$			
(2.15)	$\ln XC=11.307+1.805\ \ln WT+\sum_{i=0}^{2}\alpha_i\cdot\ln(PXC/PWT)_{-i}$ for 1962-1972 (73.4) (42.7)	0.995	1.826	

Equation No.	Equation		$\bar{R}^2$	D.W.	ρ
	ALMON LAG (degree=2, $\alpha_{-1}=\alpha_3=0$)				
	$\alpha_0=-0.457(2.79)$, $\alpha_1=-0.609(2.79)$, $\alpha_2=-0.457(2.79)$; $\Sigma\alpha_i=-1.523(2.79)$				
	$\ln XC=11.033+0.962 \ln WT+\sum_{i=0}^{2}\alpha_i \ln(PXC/PWT)_{-i}$ (327.) (6.08)	for 1973-1980	0.988	2.086	
	ALMON LAG (degree=2, $\alpha_{-1}=\alpha_3=0$)				
	$\alpha_0=-0.307(6.63)$, $\alpha_1=-0.410(6.63)$, $\alpha_2=-0.307(6.63)$; $\Sigma\alpha_i=-1.025(6.63)$				
(2.16)	$\ln PXC=0.0468+0.993 \ln PX-0.827 \ln RATE_{-1}$ (1.18) (7.13) (4.93)		0.948	1.635	
Trade balances					
(2.17)	$BPT=1803.9+0.894(XC\cdot PXC-MC\cdot PMC)+2613.8D7179+2697.2D7475+3923.7D7679$ (7.31) (22.0) (4.79) (3.38) (6.18)		0.984	0.844	
Exchange rate					
(2.18)	$RATET=212.0+0.369RATET_{-1}-0.0027BPT+0.0030BPC-22.8D77$ (2.12) (4.66) (3.31) (0.51)	for 1971-1981	0.794	2.538	
(2.19)	$RATE=RATET/306.15$				

III. Distribution

Equation No.	Equation	$\bar{R}^2$	D.W.	ρ
(3.1)	TIP=205.0+0.067(VP-DISC)	0.994	1.088	
	(1.60) (58.1)			
(3.2)	SUB=-226.7+0.015(VP-DISC)	0.984	1.868	
	(4.77) (33.8)			
(3.3)	DEP=52.7+0.129(VP-DISC)	0.998	0.44	
	(0.35) (96.3)			
(3.4)	YPY=-30.9+0.790(VP-DISC)	0.999	1.236	
	(0.16) (448.8)			
(3.5)	YRP=145.5+0.098(YPY-YCG-YRG-YRN-RED)-1416.2D7078+335.0D6578	0.981	1.052	
	(0.51) (18.1) (2.80) (0.85)			
(3.6)	YUP=2079.4+0.132(YPY-YCG-YRG-YRN-RED)+1215.8D7078+2781.5D6578	0.985	1.300	
	(4.57) (15.1) (1.49) (4.40)			
(3.7)	YCP=YPY-YCG-YRG-YRN-RED-YRP-YUP-WN			
(3.8)	YPP=WN+YRP+YUP+YRN			
(3.9)	YDP=YPP-TRP			
(3.10)	TRP=TPP+SSC-SSP+TRPO			
(3.11)	YCD=(YCP-TCP+IVA+DIVD)/PIF			
(3.12)	lnTPP=-4.956+1.206 lnYPP-0.011D6579	0.997	1.446	0.60
	(10.3) (26.6) (1.74)			
(3.13)	lnSSC=-4.182+1.159 lnWN+0.241D6579	0.998	0.700	
	(22.2) (56.5) (5.50)			
(3.14)	TCP=-253.8+0.603YCP-154.0D6579	0.771	0.791	
	(0.41) (6.34) (0.18)			
(3.15)	DIVD=33.909+0.030(YCP-TCP+IVA+DIVD)+0.965$DIVD_{-1}$	0.994	1.864	
	(1.20) (4.76) (31.1)			
(3.16)	lnG=-1.190-0.299 ln(WN/YPY)+0.339 lnG_{-1}-0.089D6873	0.911	1.799	
	(4.81) (3.53) (2.52) (5.09)			

Equation No.	Equation		$\bar{R}^2$	D.W.	ρ
IV. The Price Sector					
(4.1)	$PiIO = \left(\sum_{\substack{j=1 \\ j\neq i}}^{6} A(j,i)\cdot Pj + WNVi\cdot W + D(i)\cdot PIF\right)/(1-A(i,i)-T(i)-S(i))$				
(4.2)	lnP1D=-0.0550+1.340 lnP1IO+0.435 lnOCR		0.989	0.821	
	(2.34) (42.9) (2.86)				
(4.3)	P1=0.717 P1D+0.283P1M				
(4.4)	P2=PM2·RATE				
(4.5)	lnP3=-0.0722+1.0135 lnP3IO+0.0535(OCR)+0.0225D65	for 1960-1973	0.961	1.842	
	(0.75) (13.8) (0.82) (1.56)				
	lnP3=-0.149+0.387 lnP3IO+0.147(OCR)	for 1974-1979	0.949	2.724	
	(1.93) (7.40) (2.05)				
(4.6)	lnP4=0.0568+(1.066-0.322D7479)lnP4IO-0.114D74		0.997	1.455	
	(3.64) (68.8) (1.71) (3.32)				
(4.7)	lnP5=-0.0892+(0.980+0.632D7479)lnP5IO+0.0324D75+0.0569(OCR)		0.999	1.899	
	(1.46) (71.1) (7.09) (1.66) (1.12)				
(4.8)	lnP6D=-0.0024+(0.925+0.336D7479)lnP6IO-0.0902D74		0.979	1.326	
	(0.06) (15.3) (0.93) (1.53)				
(4.9)	P6M=0.050+0.938P2		0.986	1.536	
	(3.37) (36.2)				
(4.10)	P6=0.886P6D+0.114P6M				
(4.11)	PWH=0.1168P1+0.0413P2+0.7643P3+0.0521P4+0.0255P6				
(4.12)	PWHI=0.9362P3+0.0638P4				
(4.13)	P=VP/V				
(4.14)	PVM=(VP+M·PM)/VM				
(4.15)	PC=CPC/C				

Equation No.	Eauation	$\bar{R}^2$	D.W.	ρ
(4.16)	$\ln PCF=-0.0433+0.7271\ \ln PCFIO+0.4038\ \ln PCF_{-1}+0.0666D6579$	0.998	1.883	0.78
	(1.25) (7.35) (5.30) (2.81)			
(4.17)	$PCFIO=0.1268P1+0.5863P3+0.2869P5$			
(4.18)	$\ln PCEH=0.0857+0.4184\ \ln PCEHIO+0.1355\ \ln PCEH_{-1}+0.0380D6579$	0.996	2.554	0.94
	(1.17) (12.6) (1.84) (2.21)			
(4.19)	$PCEHIO=0.0041P1+0.0029P2+0.2089P4+0.0776P5+0.7065P6$			
(4.20)	$\ln PCEA=-0.0188+0.8615\ \ln PCEAIO$	0.995	1.779	0.71
	(0.91) (22.3)			
(4.21)	$PCEAIO=0.4463P3+0.2455P4+0.3082P5$			
(4.22)	$\ln PCO=0.2446+0.5923\ \ln PCOIO+0.2883\ \ln PCO_{-1}-0.0585$	0.999	2.332	0.94
	(4.13) (8.88) (3.76) (4.42)			
(4.23)	$PCOIO=0.0025P1+0.2099P3+0.7876P5$			
(4.24)	$\ln PIF=0.0374+0.7103\ \ln PIFIO-0.0800D6579$	0.991	1.578	0.55
	(1.35) (21.79) (3.40)			
(4.25)	$PIFIO=0.0026P1+0.3122P3+0.6852P5$			
(4.26)	$\ln PIH=-0.0597+0.7531\ \ln PIHIO+0.3061\ \ln PIH_{-1}+0.0750D6579$	0.987	1.092	
	(1.10) (3.32) (1.45) (1.99)			
(4.27)	$PIHIO=0.0026P1+0.3122P3+0.6852P5$			
(4.28)	$\ln PJP=-0.0955+0.8453\ \ln PWH+0.1165D6579$	0.989	1.780	0.17
	(3.97) (27.4) (5.70)			
(4.29)	$\ln PX=0.0085+0.911\ \ln PXIO-0.0581D73-0.134D7579$	0.979	1.664	
	(0.43) (21.0) (1.88) (4.80)			
(4.30)	$PXIO=0.0029P1+0.7730P3+0.0143P4+0.2097P5+0.0001P6$			
(4.31)	$\ln PIG=0.0178+0.9508\ \ln PIGIO-0.0502D6579$	0.996	1.689	0.33
	(0.86) (43.0) (2.79)			
(4.32)	$PIGIO=0.0026P1+0.3122P3+0.6852P5$			
(4.33)	$\ln PCG=0.0651+0.6328\ \ln P5+0.3421\ \ln PCG_{-1}$	0.997	1.353	0.92
	(0.58) (3.13) (1.90)			

Equation No.	Equation	$\bar{R}^2$	D.W.	ρ
(4.34)	$\ln PJPG = -0.0377 + 0.5424 \ln PWH + 0.5197 \ln PJPG_{-1} + 0.0965 D6579$ (1.43) (7.67) (7.79) (4.45)	0.994	2.131	0.13
(4.35)	$PK = PIF(R/100 + DFR)/0.161$			

V. Production Function

Input Coefficients (Materials and Value Added)

Equation No.	Equation	$\bar{R}^2$
(5.1)	$\ln Q(j,1) = -2.148 + 0.251 DA(3,1) - 1.807 DA(4,1) - 0.556 DA(5,1) - 3.132 DA(6,1) + 2.055 DV(1)$ (16.0) (1.16) (6.94) (2.86) (16.4) (10.7) $+1.161 \cdot \left[\sum_{k=1}^{2} \frac{1}{2} \ln PQ(j,1)_{-k}\right],\ j=1,\cdots,7 \text{(excl. 2)}$ (2.70)	0.972
(5.2)	$\ln Q(j,3) = -0.844 - 1.463 DA(1,3) - 3.523 DA(4,3) - 1.458 DA(5,3) - 3.553 DA(6,3) - 0.329 DV(3)$ (14.0) (15.6) (25.8) (14.4) (36.5) (3.37) $+1.346 \cdot \left[\sum_{k=1}^{2} \frac{1}{2} \ln PQ(j,3)_{-k}\right],\ j=1,\cdots,7 \text{(excl. 2)}$ (8.28)	0.991
(5.3)	$\ln Q(j,4) = (-3.507 + 0.126 D7579) + (1.340 + 0.085 D7579) \cdot DA(1,4) + (2.337 + 0.448 D7579) \cdot DA(2,4)$ (30.7) (0.55) (7.06) (0.37) (12.8) (1.93) $+(-0.076 + 0.208 D7579) \cdot DA(3,4) + (0.968 + 0.170 D7579) \cdot DA(5,4)$ (0.32) (0.89) (5.47) (0.74) $+(-1.957 + 0.330 D7579) \cdot DA(6,4) + (2.926 + 0.289 D7579) \cdot DV(5)$ (10.2) (1.40) (16.1) (1.26) $+0.900 \cdot \left[\sum_{k=1}^{2} \frac{1}{2} \ln PQ(j,4)_{-k}\right],\ j=1,\cdots,7$ (3.66)	0.986

Equation No.	Equation	$\bar{R}^2$	D.W.	ρ
(5.4)	$\ln Q(j,5)=-1.829-2.781DA(1,5)+0.022DA(3,5)-2.188DA(4,5)-2.987DA(6,5)+1.682DV(5)$ (17.7) (18.7) (0.13) (12.6) (20.3) (11.4)			
	$+0.627\cdot\{\sum_{k=1}^{2} -\ln PQ(j,5)_{-k}\}$, $j=1,\cdots,7$ (excl. 2) (2.18)	0.986		
(5.5)	$\ln Q(j,6)=-4.380+1.898DA(1,6)+(-1.380+0.232TIM6)\cdot DA(2,6)+0.817DA(3,6)+1.771DA(4,6)$ (19.4) (5.93) (2.81) (5.61) (2.37) (4.76)			
	$+2.289DA(5,6)+3.846DV(6)+1.094\cdot\{\sum_{k=1}^{2} -\ln PQ(j,6)_{-k}\}$, $j=1,\cdots,7$ (7.16) (12.1) (2.09)	0.886		

$Q(j,i)=A(j,i)$: material input coefficient for $j=1,2,\cdots,6$;
$=VA(i)$: value added ratio for $j=7$.
$PQ(j,i)=Pi/Pj$, for $j=1,2,\cdots,6$
$=Pi/PVM$, for $j=7$.

Aggregate Production Function

Equation No.	Equation	$\bar{R}^2$	D.W.	ρ
(5.6)	$\ln\{\frac{N\ H}{VM/OCR}\cdot T\}=const+0.3143\{\frac{1}{2}\ln(PVM\cdot H/W1)_{-1}+\frac{1}{2}\ln(PVM\cdot H/W1)_{-2}+\ln T\}$ (4.74)			
	$\ln\{\frac{KIF}{VM/OCR}\}=const+0.3143\{\frac{1}{2}\ln(PVM/PK)_{-1}+\frac{1}{2}\ln(PVM/PK)_{-2}\}$ (4.74)			
	$\ln\{\frac{IE}{VM/OCR}\}=const+0.3143\{\frac{1}{2}\ln(PVM/P2)_{-1}+\frac{1}{2}\ln(PVM/P2)_{-2}\}$ (4.74)			
	$\ln\{\frac{MO}{VM/OCR}\}=const+0.3143\{\frac{1}{2}\ln(PVM/PMO/RATE)_{-1}+\frac{1}{2}\ln(PVM/PMO/RATE)_{-2}\}$ (4.74)			
	$const=0.206DUMK-2.236DUMN+0.219DUMME-1.509DUMMO$ (6.70) (17.7) (3.98) (48.3)	0.983		

Equation No.	Equation	$\bar{R}^2$	D.W.	ρ
	$T_t = \dfrac{\sum_{i=0}^{9} EXP[0.090\cdot(t-1)-0.060\cdot D\cdot(t-i-21)]\cdot IF_{t-i}}{\sum_{i=0}^{9} IF_{t-i}}$			
	t=time (1953=1.0); D=0 for t-i<22 (i.e., before 1973); =1 for $t-i \geq 22$ (i.e., after 1974)			
Labor Input Coefficients				
(5.7)	$\ln WNV1=2.240-0.869\ \ln(VM/NH^*)$ (27.8) (36.6)	0.997	1.540	0.61
(5.8)	$\ln WNV3=1.744-0.932\ \ln(VM/NH^*)$ (8.73) (16.6)	0.991	1.119	0.78
(5.9)	$\ln WNV4=1.018-(1.376-0.137D7479)\ln(VM/NH^*)$ (3.05) (12.4) (5.15)	0.925	1.185	
(5.10)	$\ln WNV5=1.176-0.580\ \ln(VM/NH^*)$ (1.11) (2.13)	0.778	0.728	0.89
(5.11)	$\ln WNV6=2.489-(1.279-0.130D7479)\ln(VM/NH^*)$ (8.03) (12.4) (5.28)	0.925	1.168	
VI. Employment and Wage				
(6.1)	$\ln NH^*=-2.236+0.314\cdot\{\frac{1}{2}(\ln(\frac{PVM\cdot H}{WI})_{-1}+\ln(\frac{PVM\cdot H}{WI})_{-2})+\ln T\}+\ln(VM)-\ln T-\ln 1.25$			
(6.2)	$\ln NH=1.628+0.302\ \ln NH^*+0.513\ln NH_{-1}-0.018DNH1+0.028DNH2$ (1.56) (5.03) (3.25) (3.25) (4.34)	0.893	2.196	
(6.3)	$\ln H=0.203+0.116\ln OCR-0.067\cdot PROD-0.0174D74-0.0188D75$ (51.8) (6.08) (40.2) (3.52) (3.28)	0.992	1.291	
(6.4)	$N=NH/H$			

Equation No.	Equation	$\bar{R}^2$	D.W.	ρ
(6.5)	$\ln NW = -2.326 + 0.544 \ln N + 0.717 \ln NW_{-1}$	0.998	1.925	
	(2.67) (3.30) (10.6)			
(6.6)	$RNDS = -0.473 + 2.553(NW/LF) - 0.311DRNDS - 0.684D7579 + 0.490D73$	0.894	1.612	
	(1.12) (3.76) (4.86) (9.02) (4.09)			
(6.7)	$(W-W_{-1})/W_{-1} = 0.0174 + 0.051RNDS + 0.080RNDS_{-1} + 0.242(PC_{-1}-PC_{-2})/PC_{-2} - 0.0107D7779$			
	(0.84) (2.11) (3.44) (1.59) (0.69)			
	$-0.0231D6579$	0.822	1.930	
	(1.81)			
(6.8)	$W1 = W/21.872$			
(6.9)	$NU = N - NW$			
(6.10)	$WN = W \cdot NW$			
(6.11)	$VM^{*} = 0.533\{0.488KIF_{-1}^{-\theta} + 0.0002(T \cdot LF \cdot 0.99 \cdot 1.178)^{-\theta} + 0.509IE^{-\theta} + 0.002MO^{-\theta}\}^{-1/\theta}$ $\theta = 1.934$			
(6.12)	$\ln COI = 0.021 + 0.820 \ln(VM^{*}/VM^{*}_{75})$	0.997	0.799	
	(2.13) (70.7)			
(6.13)	$\ln OI = 0.054 + 1.101 \ln(VM/VM_{75})$	0.995	0.924	
	(4.97) (63.2)			
(6.14)	$OCR = OI/COI$			
VII. Government				
(7.1)	$SG = TIP + TPP + TCP + YRG + SSC - CG \cdot PCG - SUB - SSP - TRGO$			
(7.2)	$SIG = SG - IG \cdot PIG - SIGO$			
(7.3)	$BGS = BGS_{-1} + BG + BGO$			
(7.4)	$BG = 2553.2 - 0.992SIG$	0.917	2.569	
	(7.66) (19.6)			

List of Variables

Notation	* exogenous	Explanation	Unit
A(j,i)		input coefficient, or the amont of output j required to produce one unit of output i	
AIE		demand for crude oil	billions of 1975 yen
BGS		end-of-year balances of government long-term bonds	billions of current yen
BG		net increase in government long-term bonds	billions of current yen
BGO	*	statistical discrepancy in government bonds	billions of current yen
BPC	*	long-term capital balance	millions of current dollars
BPT		trade balance	millions of current dollars
C		total private consumption	billions of 1975 yen
CEA		automobiles and fuel consumption for automobiles	billions of 1975 yen
CEH		fuel consumption for household operation	billions of 1975 yen
CF		food consumption	billions of 1975 yen
CG	*	government consumption	billions of 1975 yen
CO		other private consumption	billions of 1975 yen
COI		production capacity index of manufacturing	1975 = 1.0
CPC		total private consumption	billions of current yen
D(i)	*	capital consumption allowances per unit of output i	
DEP		capital consumption allowances	billions of current yen
DFR	*	ratio of depreciation to capital stock	
DH	*	depreciation for houses	billions of 1975 yen
DISC	*	statistical discrepancy in GNP plus net factor income received from abroad	billions of current yen
DIVD		dividends	billions of current yen
G		gini coefficient	
H		index of hours worked per regular worker	1975 = 1.0
IE		demand for crude oil	thousands of kiloliters
IF		fixed business investment	billions of 1975 yen
IG	*	government investment	billions of 1975 yen
IH		residential construction	billions of 1975 yen
IVA	*	inventory valuation adjustment	billions of current yen
JP		increase in stocks by private enterprises	billions of 1975 yen
JPG	*	increase in stocks by public enterprises	billions of 1975 yen
KIF		end-of-year stock of business plant and equipment	billions of 1975 yen
KIF*		desired level of KIF	billions of 1975 yen
KIH		end-of-year stock of houses	billions of 1975 yen
KJP		end-of-year stock of inventories	billions of 1975 yen
LB1	*	ratio of new loans to beginning-of-year outstanding of housing credit (Housing Loan Corporation); = 0 after 1965	

Notation	* exogenous	Explanation	Unit
LB2	*	ratio of new loans to beginning-of-year outstanding of housing credit (banks); = 0 before 1966	
LF	*	number of labor force	millions of persons
M		imports of goods and services and factor income paid abroad (NI base)	billions of 1975 yen
MC		imports of commodities (customs base)	millions of 1975 dollars
MCGPMCG		imports of commodities (customs base)	billions of current yen
MGPMG		imports of commodities (NI base)	billions of current yen
ME		fuel imports (customs base)	millions of 1975 dollars
MO		other imports of commodities (customs base)	millions of 1975 dollars
MSPMS	*	imports of services and factor income paid abroad (NI base)	billions of current yen
N		number of persons engaged	millions of persosns
NH		number of persons engaged in terms of hours worked	hours worked index
NH*		desired level of NH	hours worked index
NU		number of self employed persons	millions of persons
NW		number of employees	millions of persons
OCR		index of operating ratio	1975 = 1.0
OI		production index of manufacturing	1975 = 1.0
OTHER	*	acquisition of second-hand plant and equipment less scraps of plant and equipment	billions of 1975 yen
P		deflator for GNP	1975 = 1.0
PC		deflator for total private consumption	1975 = 1.0
PECA		deflator for automobiles and fuel consumption for automobiles	1975 = 1.0
PCEAIO		weighted average of industry prices, defined by eq. (4.21)	1975 = 1.0
PCEH		deflator for fuel consumption for household operation	1975 = 1.0
PCEHIO		weighted average of industry prices, defined by eq. (4.19)	1975 = 1.0
PCF		deflator for food consumption	1975 = 1.0
PCFIO		weighted average of industry prices, defined by eq. (4.17)	1975 = 1.0
PCG		deflator for government consumption	1975 = 1.0
PCO		deflator for other private consumption	1975 = 1.0
PCOIO		weighted average of industry prices, defined by eq. (4.23)	1975 = 1.0
PIF		deflator for fixed business investment	1975 = 1.0

Notation	* exogenous	Explanation	Unit
PIFIO		weighted average of industry prices, defined by eq. (4.25)	1975 = 1.0
PIG		deflator for government investment	1975 = 1.0
PIGIO		weighted average of industry prices, defined by eq. (4.32)	1975 = 1.0
PIH		deflator for residential construction	1975 = 1.0
PIHIO		weighted average of industry prices, defined by eq. (4.27)	1975 = 1.0
PiIO		desired price of industry i, defined by eq. (4.1)	1975 = 1.0
PJP		deflator for increase in stocks by private enterprises	1975 = 1.0
PJPG		deflator for increase in stocks by public enterprises	1975 = 1.0
PK		price index for capital service	1975 = 1.0
PM		deflator for imports of goods and services and factor income paid abroad	1975 = 1.0
PMC		deflator for commodity imports (customs base, dollar base)	1975 = 1.0
PME		deflator for fuel imports (dollar base)	1975 = 1.0
PMO	*	deflator for other commodity imports (dollar base)	1975 = 1.0
PM2	*	price index of crude oil imports (dollar base)	1975 = 1.0
POP	*	population	millions of persons
PQ(j,i)		=Pi/Pj for j=1,2,···, 6; =Pi/PVM for j=7.	
PROD	*	index of technical progress, i.e. $PROD_t=1.084PROD_{t-1}$ for 1962-73, and $PROD_t=1.026PROD_{t-1}$ for 1974-79.	1962 = 1.0
PVM		deflator for gross national supply	1975 = 1.0
PWH		wholesale price index, all commodities	1975 = 1.0
PWHI		wholesale price index, manufacuring industry products	1975 = 1.0
PWT	*	price index of world trade (dollar base)	1975 = 1.0
PX		deflator for exports of goods and services and factor income received form abroad	1975 = 1.0
PXC		deflator for commodity exports (customs base, dollar base)	1975 = 1.0
PXIO		weighted average of industry prices, defined by eq. (4.30)	1975 = 1.0
P1		price index of primary industry, excluding crude oil	1975 = 1.0
P1D		domestic price index of primary industry, excluding crude oil	1975 = 1.0
P1M	*	import price index of primary industry, excluding crude oil	1975 = 1.0

Notation	* exogenous	Explanation	Unit
P2		price index of crude oil	1975 = 1.0
P3		price index of manufacturing, excluding the coal and petroleum product industry	1975 = 1.0
P4		price index of coal and petroleum products	1975 = 1.0
P5		price index of tertiary industry, excluding electric power and gas	1975 = 1.0
P6		electric power and gas	1975 = 1.0
P6D		domestic price index of electric power and gas	1975 = 1.0
P6M	*	import price index of electric power and gas	1975 = 1.0
Q(j,i)		=A(j,i) for j=1, 2,···, 6; =VA(i) for j=7.	
R	*	interest rate on short-term lendings of banks	per cent
RATE		index of exchange rate (yen per dollar)	1975 = 1.0
RATET		exchange rate (yen per dollar)	yen
RF	*	end-of-period foreign exchange reserves	billions of current dollars
RED	*	statistical discrepancy in national income before 1970	billions of current yen
RNDS		ratio of labor demand to suuply	
SIG		difference between savings and investment of government	billions of current yen
SIGO	*	other government investment	billions of current yen
SG		government savings	billions of current yen
S(i)	*	mark-up ratio, or the normal rate of business surpluses to output in industry i	
SMP2		end-of-year stock of net financial assets held by households	billions of current yen
SM2		end-of-year stock of net financial assets	billions of current yen
SUB		subsidies	billions of current yen
SSC		social security contributions of households	billions of current yen
SSP	*	social security benefits	billions of current yen
TCP		corporate business taxes	billions of current yen
T		index of technical change, defined by eq. (5.6)	1962 = 1.826
T(i)	*	ratio of indirect taxes less subsidies to output industry i	
TIME	*	time trend	1961 = 1961
TIM6	*	time trend	1960 = 1
TIP		indirect taxes	billions of current yen
TPP		personal direct taxes	billions of current yen
TRGO	*	other transfer payment of government	billions of current yen

Notation	* exogenous	Explanation	Unit
TRP		personal income tax and other household transfers	billions of current yen
TRPO	*	other transfer payments of housholds	billions current yen
V		gross national product	billions of 1975 yen
VA(i)		value added ratio of industry i	
VM		gross national supply	billions of 1975 yen
VM*		production capacity of gross national product	billions of 1975 yen
VP		gross national product	billions of current yen
W		wage rate	thousand of current yen/person
W1		index of wage rate	1975 = 1.0
WN		employee compensation	billions of current yen
WNVi		labor input coefficient, or the amount of labor input required to produce one unit of output i	
WT	*	quantity index of world trade	1975 = 1.0
X		exports of goods and services and factor income received from abroad	billions of 1975 yen
XC		exports of commodities	billions of 1975 yen
XCGPXCG		exports of commodities (customs base)	billions of current yen
XGPXG		exports of commodities (NI base)	billions of current yen
XOPXO	*	exports of services and factor income received from abroad (NI base)	billions current yen
YCD		corporate income after taxes	billions of 1975 yen
YCG	*	income of public enterprices	billions of current yen
YCP		corporate income before taxes	billions of current yen
YDP		personal disposable income	billions of current yen
YPP		personal income	billions of current yen
YPY		national income	billions of current yen
YRG	*	income of public enterprises	billions of current yen
YRN	*	income of private non-profit institutions serving households	billions of current yen
YRP		property income of households	billions of current yen
YUP		unincorporated business income	billions of current yen

Dummy Variables:

DA(j,i)	*	=1 when the explained variable in eq. (5.1)-(5.5) is lnQ(j,i); =0 otherwise
DNH1	*	=1 for 1969-75; =0 otherwise
DNH2	*	=1 for 1976-79; =0 otherwise
DRNDS	*	=1 for 1962-66; =0 otherwise
DUMK	*	=1 when the explained variable in eq. (5.6) is $\ln(\frac{KIF_{-1}}{VM/OCR})$; =0 otherwise

Notation	* exogenous	Explanation
DUMME	*	=1 when the explained variable in eq. (5.6) is $\ln\left(\frac{IE}{VM/OCR}\right)$; =0 otherwise
DUMMO	*	=1 when the explained variable in eq. (5.6) is $\ln\left(\frac{MO}{VM/OCR}\right)$; =0 otherwise
DUMN	*	=1 when the explained variable in eq. (5.6) is $\ln\left(\frac{N \cdot H}{VM/OCR} \cdot T\right)$; =0 otherwise
DV(i)	*	=1 when the explained variable in eq. (5.1)-(5.5) is lnQ(7,i); =0 otherwise
D65	*	=1 for 1965; =0 otherwise
D6579	*	=1 for 1965-79; =0 otherwise
D6873	*	=1 for 1968-73; =0 otherwise
D7079	*	=1 for 1970-79; =0 otherwise
D73	*	=1 for 1973; =0 otherwise
D74	*	=1 for 1974; =0 otherwise
D7475	*	=1 for 1974 and 1975; =0 otherwise
D7479	*	=1 for 1974-79; =0 otherwise
D75	*	=1 for 1975; =0 otherwise
D7579	*	=1 for 1975-79; =0 otherwise
D7679	*	=1 for 1976-79; =0 otherwise
D7779	*	=1 for 1977-79; =0 otherwise