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Layoff Minimization Behavior as a Macroeconomic Stabilizer: Theory, Evidence, and International Comparison

by

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ABSTRACT

Two alternative corporate behavioral principles and their macroeconomic consequences are analyzed and compared in a Keynesian framework. The two principles are the traditional profit maximization (PM) and what I call the layoff minimization (LM) in which the firm minimizes the amount of labor to be laid off subject to the nonnegative profit condition and, only to the extent that no layoff is needed, it pursues maximal profits. For an economy in which all the firms are monopolistic and identical except for the position of the demand curve (i.e., the size of the market), the macroeconomic equilibrium is investigated assuming constant saving ratios for wage income (c_ℓ) and for profits (c_π) and autonomous non-consumption expenditures. Some of the results are: (1) the total output in recession is larger in LM (unless $c_\ell = c_\pi$) implying a smaller fluctuation of national product, (2) the total employment in recession is larger in LM implying a smaller unemployment, (3) the general price level measured in wage units does not decrease in recession in PM but does decrease in LM implying a larger purchasing power of the wage, and (4) the total profits in recession are smaller in LM if $c_\ell < 1$, but are the same if $c_\ell = 1$, in which case the wage income is larger and the profits are not smaller in LM suggesting its Pareto superiority over PM. The results of the empirical analysis for five OECD countries are generally favorable to LM (particularly for Japan and France), whereas PM may be applicable in the United States only.

1. Introduction

This paper purports to analyze two alternative corporate behavioral principles to be taken during a recession and compare their macroeconomic consequences in a Keynesian framework. The two principles are the traditional profit maximization and what I call here the layoff minimization.

Consider a firm initially employing the profit-maximizing number of workers. Suppose that the demand then decreases by one percent. If production coefficients are fixed, profit maximization should imply labor input to be reduced by one percent at once. The employment reduction will be even more if labor is substitutable with capital the amount of which is fixed in the short run or if labor is subject to diminishing marginal product. However, the fact contradicts this prediction in nearly every country. Employment is observed to decrease proportionally less than output in recession and the estimated elasticity of employment with respect to output has been less than unity (see Sections 2 and 9).

Two explanations -- not mutually contradictory -- may be made to this phenomenon. The first emphasizes the fact that labor is quasi-fixed due to the skills and experiences it embodies (Oi, 1962), thus arguing that retaining seemingly superfluous workers may actually maximize the long-run profit. The other maintains that in the present-day corporate management is reflected the desire of employees even at some cost to the shareholders (Aoki, 1983; Odagiri, 1982) and that the greatest concern to the employees is the continuity of employment. Whichever the cause, an important point is that an inquiry of macroeconomic equilibrium in business cycle is misleading if short-run profit maximization is postulated.

I would like to propose in this paper to analyze the behavior of the firm in terms of layoff minimization (hereafter LM) in place of the traditional profit maximization (hereafter PM). Under LM the firm is supposed to minimize the number of workers to be laid off[1] subject to the requirement that the profit be nonnegative, and only to the extent that profit maximization does not require layoff the firm maximizes the profit. This hypothesis leads the firm to behave differently from PM in terms of not only labor employment but also output and price in an assumed monopolistic market. Consequently, given an exogenous shift in demand, namely, a reduction in autonomous expenditures, the short-run Keynesian equilibrium results in different aggregate output and price as well as employment between the LM economy in which all the firms minimize layoff in the above-mentioned sense and the PM economy in which all the firms maximize profits.

The detail of the model will be presented in Section 3. With this model we can ask several questions which, despite their importance, have not been examined before. For instance, given a downward pressure in demand, is unemployment indeed smaller in the general equilibrium of an LM economy? Does LM serve as a macroeconomic stabilizer by reducing the GNP fluctuation? Is there a case of LM being Pareto superior to PM in the sense that under LM relatively to PM both workers and capitalists are compensated with at least the same income and one of them, with a larger one? The answers to these questions will be given in Section 6 but they turn out to be all affirmative. Thus implied is a possibility that the profit maximization behavior is socially inferior to the layoff minimization behavior in nearly every respect. Contrary to the conventional wisdom, therefore, a case may be made in support of a policy measure to encourage the deviation of corporate management from PM to LM.

The analysis here is admittedly simplistic; for instance, the macroeconomic analysis is confined to the short-run aspect treating investment as exogenously given, and financial markets are ignored. Nevertheless, it is hoped to throw a new light into the relation between corporate behavior and macro equilibrium in a business cycle. Furthermore, it can contribute to international comparison of macroeconomic performance. Thus the fact that the Japanese firms behave more in line with LM than the American counterparts might explain the difference in the macroeconomic performance of the two countries.

The paper is organized as follows. Section 2 gives a preliminary discussion of such Japan-U.S. differences and the discussion of how the behavior of real corporations deviate from what the short-run profit maximization would predict. The theoretical analysis is in Sections 3 to 8, where Section 3 explains the model, Section 4 discusses the macroeconomic equilibrium under PM, Section 5 defines the layoff minimization behavior of the firm, Section 6 analyzes the macro equilibrium under LM and compares it to that under PM, Section 7 summarizes the theoretical findings and discusses their implications, and Section 8 considers the consequence of labor productivity increase. Finally, Section 9 is devoted to the empirical analysis where the macro data of five OECD countries -- the United States, Japan, West Germany, France and the United Kingdom -- are examined to investigate the relevance of the implications of the LM hypothesis as opposed to those of the PM hypothesis, and to find out the differences across these countries.

2. The Infrequency of Job Termination in Japan and Other Countries

"At whatever level of organization in the Japanese factory, the worker commits himself on entrance to the company for the rest of his working career. The company will not discharge him even temporarily except in the most extreme circumstances. He will not quit the company for industrial employment elsewhere."

When Abegglen (1973, p.62) noted this behavior of the Japanese factory by the term "lifetime commitment,"[2] he knew he exaggarated the strength of the "commitment." He thus warned that "the difference between the [Japanese system and the American system] is not, of course, absolute, but one of degree. Reluctance on the part of the worker to quit and on the part of the firm to fire him are constanct factors in the American relationship; the Japanese firm will discharge employees, and employees do occasionally quit." Nonetheless, he believed that "the magnitude of the difference is very great."

Great or not, hardly anyone will deny that such difference in fact exists. That is, in Japan, "employment security has been more important than mere improvements in wages and hours. It is true that Japan is an industrial society in which the dismissal of workers is the hardest decision that management must face" (Shirai and Shimada, 1978, p.260). Thus the management in the Japanese firms tend to avoid layoff and retain the employees even at the risk of profitability loss. Such behavior is certainly different from that presumed in the profit maximization hypothesis and implies the inflexibility of employment level to downward as well as the asymmetry of employment behavior between an expansionary phase and a contractionary phase of a business cycle.

This practice of minimizing discharge or layoff in the Japanese firm may have a root in history, society and ethics in Japan as argued by Abegglen (1973) and Morishima (1982); however, more recent thinking stresses the role of spefic skills and experiences embodied in the company employees and argues for the rationality of employing these workers through their lifetime career (Hashimoto, 1979; Odagiri, 1984), where rationality need not be identical with maximizing the company owners' wealth when the employees possess those skills indispensable to the company and the managers are those internally promoted with little ownership of the firm.

With this view it is no wonder that lifetime commitment or lifetime employment is by no means absent in countries other than Japan. In fact, the proportion of the workers holding jobs which would last twenty years or more was estimated to be about 28 percent in the United States by Hall (1982)[3] and 44 percent in Great Britain by Main (1982), revealing "stable, near-lifetime employment to an important fraction of the labor force" (Hall, 1982, p.716) in these countries. Recent management literature such as Ouchi (1981) provides a similar observation. In investigating the management of many of the excellently-managed American companies and calling them Type Z companies, he found a number of similarities with the Japanese management. In particular, "Type Z companies tend to have long-term employment, often for a lifetime, although the lifetime relationship is not formally stated. The long-term relationship often stems from the intricate nature of the business; commonly, it requires lots of learning-by-doing. Companies, therefore, want to retain employees, having invested in their training to perform well in that one unique setting. Employees tend to stay with the company, since many of their skills are specific to that one firm with the result that they could not readily find equally remunerative nor challenging work

elsewhere" (Ouchi, 1981, p.71). All these suggest that the Japanese firms are not alone in providing the employees a stable long-term employment and resisting dismissal under recession in such fashion that cannot be explained by the traditional (short-run) profit maximization hypothesis, though it may still be dubious if such practice is as much a norm in other economies as in Japan.

To this discussion is added two qualifications. First, however prevalent lifetime employment may be among large Japanese firms, it is not as prevalent among smaller firms. Galenson (1976, p.615) estimated that "it is primarily in the ... 28 percent of all male employees that permanency of employment would be the rule." Dore (1973, p.305) estimated that "at least ten million workers -- half of the total number of employees or about one-third of all those gainfully occupied in the Japanese economy -- are involved in a full version of 'the [Japanese employment] system'." A point that needs to be stressed, however, is that "this ... is the elite ten million. It includes almost all of Japan's university graduates except non-salaried doctors and free-lance lawyers, and it includes the most skilled of Japan's manual workers" (Dore, op.cit.). Thus their influences to the economy are greater than the above-quoted figures may indicate and, as Dore correctly observed, "the importance of 'the system' is to be measured not only by its gradual absorption of a larger proportion of the Japanese labour force, but also by the influence it has as a normative model for the rest of society" (Dore, op.cit.).

Second, although the Japanese firms do their best not to fire their employees, they frequently employ other means to reduce the amount of labor input in recession and save the labor cost; for instance, discharging the temporary or part-time workers, not hiring new workers to

replace those retiring, reducing over-time works, and cutting wages (or suppressing wage increase) usually by reducing bi-annual bonus payments. Furthermore, they often move the workers in response to demand slack, e.g., pulling some workers out of the now exessively-manned production sector to have them work for sales.

Notwithstanding these qualifications, the macroeconomic performance has witnessed a smaller fluctuation of employment in Japan. *The White Paper on Labor* of Japan (1983) estimated the elasticity of employment with respect to real GNP to be 0.328 (in terms of the number of employees) and 0.212 (in terms of man-hours) in Japan and, respectively, 0.818 and 0.616 in the United States with the 1966-82 annual data. Thus the elasticities were smaller than unity in both countries and smaller in Japan than in the United States as predicted by the hypothesis of layoff minimization behavior and its prevalence among the Japanese companies.

3. The Model

Consider an economy with a fixed number of potential monopolistic firms. These firms are identical in terms of demand and cost conditions except that the demand function for the firm may be to the right or left of that for another in a constant proportion. This proportion is measured by θ in the following manner; a firm with $\theta = 0$ has no demand to its product at any price, and Firm A with the value of θ twice that of Firm B has its product demanded by the amount twice that of Firm B at any price. Because θ may be nonpositive for some of the firms and these firms will opt not to operate, the number of operating firms will be the number of firms with positive θ, which usually varies as the distribution of θ varies.

The consumers' total income is the sum of total wages and total profits. Following the Kaldorian assumption of constant saving ratio to each of the two income sources, the constant proportion of wages and that of profits are assumed to be expended for consumption. This consumption expenditure plus other expenditures, such as investment, government expenditures, and export less import which are assumed autonomous and independent of the level of national income, constitute the aggregate demand to the products of the entire firms.

In the following analysis, we are not going to investigate how this aggregate demand is allocated to each firm to determine the size of the market (θ) of each firm; however, the distribution of θ must be consistent with the market condition in the sense that the total revenue for all the firms determined by that distribution as well as the output decisions of firms must equal the aggregate demand in value term. Hence, if the aggregate demand is decreased by a decrease in autonomous expenditures, the distribution of θ will generally shift to the left reducing the expected value. Our analysis will show that the extent of this shift differs according to the corporate behavioral rule, i.e., profit maximization versus layoff minimization.

The assumptions of the model are now presented in detail, starting with an assuption on demand function.

A.1. An individual firm sells its product in a monopolistic market with the following downward-sloping iso-elastic demand function:

$$x_t = \theta_t p_t^{-1/(1-k)} \qquad \theta > 0, \quad 0 < k < 1, \quad t = 0, 1$$

where x is the demand which equals output as we ignore inventory, p is the price, θ is the parameter indicating the size of the market, and subscript t indicates period. θ may vary over time and over firms but k is constant.

Note that the marginal revenue is positive for all positive x_t; that is, the larger the output the larger the revenue.

The production technology is assumed to be of the most simplistic kind:

A.2. Labor ℓ is the sole and homogeneous input and the labor-output ratio, u, is constant, where ℓ refers to the number of workers because the working hour per worker is fixed. Therefore,

$$\ell_t \geqq ux_t \qquad u \geqq 0$$

A.3. In the labor market both the workers and employers act as price takers: Without loss of generality the wage rate is normalized to unity.

This last assumption implies that p_t is the product price measured in wage unit.

If y_t denotes the revenue, $p_t x_t$, the profits π_t equals $y_t - \ell_t$, and, under profit maximization (PM), the firm determines x_t, p_t, y_t and ℓ_t given the parameters θ_t, u and k so as to maximize π_t subject to the assumptions above. From the first-order condition we have (the second-order condition is satisfied)

$$(1)\quad \begin{cases} p_t = u/k \\ x_t = \theta_t (k/u)^{1/(1-k)} \\ y_t = \theta_t (k/u)^{k/(1-k)} \\ \ell_t = \theta_t k^{1/(1-k)} u^{-k/(1-k)} = k y_t \\ \pi_t = (1-k)\theta_t (k/u)^{k/(1-k)} = (1-k) y_t \end{cases}$$

Hence k is the labor share of the revenue and 1-k, the profit share. Under PM these shares depend only on the demand elasticity.

As for the national economy, we assume as follows (capital letters denote the aggregate variables while small letters denote the variables for the individual firms):

A.4. The firms in the economy differ only in terms of θ_t; that is, one firm is with a large value of θ_t (implying a large market), another with a small value of θ_t (implying a small market), and so forth. The distribution of θ_t across firms is approximated by a continuous density function $f_t(\theta_t)$ and the number of (potential) firms is normalized to one without loss of generality.

The aggregate supply in value term is therefore

$$(2)\qquad Y_t = \int_0^\infty y_t f_t(\theta_t) d\theta_t$$

Under PM, this is rewritten as follows by (1):

$$(3)\qquad \begin{aligned} Y_t &= (k/u)^{k/(1-k)} \int_0^\infty \theta_t f_t(\theta_t) d\theta_t \\ &\equiv (k/u)^{k/(1-k)} E(\theta_t) \end{aligned}$$

where $E(\theta_t)$ denotes the expected value of θ_t conditional on $\theta_t \geq 0$.

A.5. The aggregate demand consists of two parts: autonomous expenditures A_t which are exogenous to the system (e.g., government expenditures[4], business investment, and exports less imports) and consumption out of profits and

labor income. The constant consumption ratio out of the former is c_π and the latter c_ℓ where, following the Kaldorian tradition, $0 \leq c_\pi \leq c_\ell \leq 1$ and $c_\pi < 1$.

We can now write the macro equilibrium condition as follows:

$$(4) \qquad A_t + c_\pi \Pi_t + c_\ell L_t = Y_t$$

$$\text{where } \Pi_t = \int_0^\infty \pi_t f_t(\theta_t)d\theta_t \text{ and } L_t = \int_0^\infty \ell_t f_t(\theta_t)d\theta_t$$

This is the equation that determines the density function $f_t(\theta_t)$ given A_t. To get the density function under PM, by (1), (2) and (4) we first obtain

$$(5) \qquad A_t + c_\pi \int_0^\infty (1-k)y_t f_t(\theta_t)d\theta_t + c_\ell \int_0^\infty k y_t f_t(\theta_t)d\theta_t = \int_0^\infty y_t f_t(\theta_t)d\theta_t$$

which gives

$$(6) \qquad Y_t = \int_0^\infty y_t f_t(\theta_t)d\theta_t = A_t/[1-c_\pi(1-k)-c_\ell k]$$

Substituting (3) into this equation, we finally obtain

$$(7) \qquad E(\theta_t) = (k/u)^{-k/(1-k)} A_t/[1-c_\pi(1-k)-c_\ell k]$$

It is important to note here that only the expected value $E(\theta_t)$ is determined by (7) and the shape of the distriburion -- normal, uniform, skewed, or whatever -- is irrelevant. That is, whatever the shape of the distribution, the macro equilibrium condition holds as long as the expected-value satisfies (7). Later we will show that this proposition does <u>not</u> hold under LM.

Since the denominator of the right-hand side of (6) is the consumption ratios weighted with the respective income shares subtracted from one, it is the saving ratio for the society and (6) gives nothing but the Keynesian formula of the multiplier theory.

4. Profit Maximization in a Recession

Suppose that

A.6. By the end of period 0 all the firms have adjusted their employment to the profit-maximizing level.

and

A.7. In period 1 the autonomous expenditures are decreased; that is, $A_1 < A_0$.

Corresponding to this exogenous decrease in demand, the individual firm's demand curve will shift but the extent of this shift likely varies among firms; that is, if $\theta_1 = \alpha\theta_0$, α will be different across firms. Hence the distribution of θ_1 is the joint distribution of α and θ_0. Without finding a priori ground to expect that a large market should experience proportionally larger or smaller fall in demand than a smaller market, we assume that

A.8. The probability to have a certain percentage reduction in demand is independent of the initial market size; that is, the density function of θ_1, $f_1(\theta_1)$, equals $g(\alpha)f_0(\theta_0)$, where $g(\alpha)$ is the density function of α.

By A.6 all the firms maximize profits in period 0 and in this section we assume that they all do the same in period 1. Hence all the equations in the previous section hold in both periods. Hereafter we put tilde (~) to all the variables in period 1 under the present assumption of profit maximization, to separate them from those under layoff minimization hypothesis which are to be denoted with circumflex (^).

By A.8, we have $\tilde{E}(\theta_1) = \tilde{E}(\alpha)E(\theta_0)$ where E denotes the expected value, that is, $\tilde{E}(\alpha) = \int_0^\infty \alpha\tilde{g}(\alpha)d\alpha$, etc. Hence, by (1), (3) and (6),

$$(8) \qquad \tilde{E}(\alpha) = \tilde{Y}_1/Y_0 = A_1/A_0$$

That is, if the autonomous expenditures fall, say, by ten percent, the expected value of α is 0.9. By (1) we have

$$(9) \qquad \tilde{\ell}_1 = \alpha\theta_0 k^{1/(1-k)} u^{-k/(1-k)} = \alpha\ell_0$$

and

$$(10) \quad \tilde{L}_1 = \int_0^\infty\int_0^\infty \ell_1 \tilde{g}(\alpha) f_0(\theta_0) d\alpha d\theta_0 = \int_0^\infty [\int_0^\infty \alpha \tilde{g}(\alpha) d\alpha] \ell_0 f_0(\theta_0) d\theta_0 = \tilde{E}(\alpha) L_0$$

Hence, the total employment decreases by the same percentage as the autonomous expenditures. Obviously from (1), X and Π decreases similarly but P stays the same. That is, under PM, when the autonomous expenditures decrease by a certain percentage, the output in physical term, the output in value term which is a measure of the national product in this model, employment, and profits all decrease by the same percentage in the macro equilibrium.

Finally, let the elasticity of employment with respect to output be measured by $[(L_1 - L_0)/L_0]/[(Y_1 - Y_0)/Y_0]$. Then, because both the numerator and the denominator equal $(A_1 - A_0)/A_0$, the elasticity must be one in a PM economy. This, as we have shown in Section 2, is not consistent with the fact.

5. Corporate Behavior under Layoff Minimization

Layoff minimization (PM) is hypothesized as the following lexicographic ordering: Minimize the number of workers to be laid off subject to the nonnegative profit constraint (otherwise the firm goes bankrupt and exits) and, only to the extent that no layoff is needed, maximize profits. Since $\ell_1 - \ell_0$, if positive, is the amount of layoff, four cases may be separated. In Case 1, the profit-maximizing level of employment $\tilde{\ell}_1$ exceeds ℓ_0 and no layoff is needed under PM, in which case LM agrees with PM and $\hat{\ell}_1 = \tilde{\ell}_1$. By (1) and noting that $\theta_1 = \alpha\theta_0$, we immediately find that $\ell_1 \geq \ell_0$ if and only if $\alpha \geq 1$. Hence this case applies only to those firms with $\alpha \geq 1$.

In Case 2, $\tilde{\ell}_1 < \ell_0$ but with ℓ_0 employed, the maximum profits are nonnegative. In this case, LM requires that the firm employs ℓ_0; hence, $\hat{\ell}_1 = \ell_0$. In Case 3, profits are negative if ℓ_0 is employed. In this case, to minimize $\ell_1 - \ell_0$, the firm maximizes ℓ_1 subject to the nonnegative profit condition. Because profits are decreasing with ℓ_1 for $\ell_1 > \tilde{\ell}_1$, this requires that ℓ_1 be determined by $\pi_1 = 0$. Finally, in case 4, if $\alpha < 0$, the revenue is negative and the firm simply exits. Since Case 1 is equivalent to PM and all the results in the previous section are applicable there, we only need to analyze Cases 2 and 3 in the following.

In Case 2, because ℓ_1 is set to ℓ_0 and $\pi_1 = y_1 - \ell_1$, maximizing profits π_1 is equivalent to maximizing revenue y_1 provided that the technological constraint, $x_1 \geq \ell_1/u$, is satisfied. But, because y_1 is monotonically increasing in x_1 by our assumption of iso-elastic demand function, the optimal output $\hat{x}_1$ equals $\hat{\ell}_1/u$ $(= \ell_0/u = x_0)$. The optimal price is determined by the demand function, which with the condition on ℓ_0 in (1) gives

$$\hat{p}_1 = \alpha^{1-k} u/k = \alpha^{1-k} p_0 \tag{11}$$

Since $\hat{y}_1 = \hat{p}_1\hat{x}_1$,

$$(12) \qquad \hat{y}_1 = \alpha^{1-k}p_0x_0 = \alpha^{1-k}y_0$$

Thus in Case 2, output and employment stay unchanged from the previous period but due to the downward shift in demand curve price is decreased and so is the revenue. The profits π_1 are evaluated as follows:

$$(13) \qquad \hat{\pi}_1 = \hat{y}_1 - \hat{\ell}_1 = \alpha^{1-k}y_0 - \ell_0 = (\alpha^{1-k}-k)y_0 = (\alpha^{1-k}-k)\theta_0{}^{k/(1-k)}u^{-k/(1-k)}$$

which implies that $\hat{\pi}_1 \geqq 0$ if and only if $\alpha \geqq \kappa$ where κ is defined by $k^{1/(1-k)}$.

If $0 < \alpha < \kappa$, Case 3 applies; that is, $\hat{\pi}_1 = 0$. Because $\pi_1 = p_1x_1 - \ell_1$ and $x_1 = \ell_1/u$ which holds as equality owing to the positive marginal revenue product, by using the demand function in A.1., we have

$$(14) \qquad \pi_1 = (\alpha\theta_0)^{1-k}u^{-k}\ell_1{}^k - \ell_1$$

Therefore $\hat{\pi}_1 = 0$ gives

$$(15) \qquad \hat{\ell}_1 = \alpha\theta_0u^{-k/(1-k)}$$

This is the maximum level of ℓ_1 compatible with the nonnegative profit condition. Using $\hat{x}_1 = \hat{\ell}_1/u$, the demand function, and $\hat{y}_1 = \hat{p}_1\hat{x}_1$, we can calculate $\hat{x}_1$, $\hat{p}_1$ and $\hat{y}_1$ easily.

The three cases (provided $\alpha > 0$) are summarized in Table 1. Figure 1 illustrates the values of $\hat{y}_1$, $\hat{\ell}_1$, $\hat{x}_1$ and $\hat{p}_1$ taking α in the horizontal axis. Note that the diagrams are drawn given a certain value of θ_0. Also note that under PM $\tilde{y}_1 = \alpha y_0$, $\tilde{\ell}_1 = \alpha k y_0$, $\tilde{x}_1 = \alpha x_0$, and $\tilde{p}_1 = p_0$, which are shown in the diagrams by relevant straight lines. Thus, for those firms with $\alpha < 1$, revenue, employment and output are all larger under LM than PM and the price, lower. Since $\pi_1 = y_1 - \ell_1$, the level of profits is shown by the vertical difference between y_1 and ℓ_1. For $\alpha < 1$, by definition, this is smaller under LM and and is zero if $\alpha \leqq \kappa$.

6. Macro Equilibrium

The macro equilibrium determines the extent that the demand curve for each firm shifts; namely, it determines the density function $g(\alpha)$, which varies according to the corporate behavioral rule.

Using the results in Table 1, we calculate the aggregate supply under LM as follows:

$$(16)\quad \hat{Y}_1 = \int_0^{\infty}\{\int_1^{\infty}\alpha\hat{g}(\alpha)d\alpha + \int_K^1 \alpha^{1-k}\hat{g}(\alpha)d\alpha + \int_0^K \alpha k^{-k/(1-k)}\hat{g}(\alpha)d\alpha\}y_0 f_0(\theta_0)d\theta_0$$
$$= Y_0\{\hat{E}(\alpha) + \int_K^1 \alpha(\alpha^{-k}-1)\hat{g}(\alpha)d\alpha + \int_0^K \alpha(k^{-k/(1-k)}-1)\hat{g}(\alpha)d\alpha\}$$

where $\hat{E}(\alpha) \equiv \int_0^{\infty}\alpha\hat{g}(\alpha)d\alpha$. Since $\alpha^{-k} > 1$ for $\alpha < 1$, and $k^{-k/(1-k)} > 1$, we find the second and the third terms in the bracket to be both positive; hence, $\hat{Y}_1 > \hat{E}(\alpha)Y_0$ whereas $\tilde{Y}_1 = \tilde{E}(\alpha)Y_0$ (see (8)).

A similar calculation gives

$$(17)\quad \hat{L}_1 = Y_0\{k\hat{E}(\alpha) + \int_K^1 (1-\alpha)k\hat{g}(\alpha)d\alpha + \int_0^K \alpha k(k^{-1/(1-k)}-1)\hat{g}(\alpha)d\alpha\}$$

and

$$(18)\quad \hat{\Pi}_1 = Y_0\{(1-k)\hat{E}(\alpha) + \int_K^1 (\alpha^{1-k}-k-\alpha+\alpha k)\hat{g}(\alpha)d\alpha - \int_0^K (1-k)\alpha\hat{g}(\alpha)d\alpha\}$$

Substituting these three equations into the macro equilibrium condition (4), rearranging the terms and using (6), which holds for both Y_0 and $\tilde{Y}_1$, and (8), we have

$$(19)\quad [1-c_\pi(1-k)-c_\ell k][\tilde{E}(\alpha)-\hat{E}(\alpha)] = \int_K^1 [\alpha(\alpha^{-k}-1) - c_\pi(\alpha^{1-k}-k-\alpha+\alpha k) - c_\ell(1-\alpha)k]\hat{g}(\alpha)d\alpha$$
$$+ \int_0^K [\alpha(k^{-k/(1-k)}-1) + c_\pi(1-k)\alpha - c_\ell\alpha k(k^{-1/(1-k)}-1)]\hat{g}(\alpha)d\alpha$$

If we call the right-hand side of this equation Ω and regard it as a function of c_π and c_ℓ, we find the following: (i) $\Omega > 0$ if $c_\pi = c_\ell < 1$, (ii) $\Omega < 0$ if $c_\pi < c_\ell = 1$, and (iii) given c_π, Ω is a decreasing function of c_ℓ. Hence, there must be a value of c_ℓ, given c_π, such that

for c_ℓ greater (smaller) than this value Ω is negative (positive) and, by (19), $\hat{E}(\alpha)$ is greater (smaller) than $\tilde{E}(\alpha)$. If there is no differential saving between workers and capitalists, $\tilde{E}(\alpha)$ is greater than $\hat{E}(\alpha)$.

We now compare $\hat{Y}_1$ and $\tilde{Y}_1$. From (6), (8), (16) and (19), we get the following equation:

$$
\begin{aligned}
(20)\quad & [1-c_\pi(1-k)-c_\ell k](\hat{Y}_1-\tilde{Y}_1)/Y_0 \\
&= [1-c_\pi(1-k)-c_\ell k]\{\int_K^1 \alpha(\alpha^{-k}-1)\hat{g}(\alpha)d\alpha + \int_0^K \alpha(k^{-k/(1-k)}-1)\hat{g}(\alpha)d\alpha \\
&\quad - \int_K^1 [\alpha(\alpha^{-k}-1) - c_\pi(\alpha^{1-k}-k-\alpha+\alpha k) - c_\ell(1-\alpha)k]\hat{g}(\alpha)d\alpha \\
&\quad - \int_0^K [\alpha(k^{-k/(1-k)}-1) + c_\pi\alpha(1-k) - c_\ell\alpha k(k^{-1/(1-k)}-1)]\hat{g}(\alpha)d\alpha \\
&= (c_\ell-c_\pi)[\int_K^1 (1-\alpha^{1-k})k\hat{g}(\alpha)d\alpha + \int_0^K \alpha(1-k)k^{-k/(1-k)}\hat{g}(\alpha)d\alpha]
\end{aligned}
$$

Hence, $\hat{Y}_1 \geq \tilde{Y}_1$ where the equality holds if and only if $c_\ell = c_\pi$.

Comparison on employment is not difficult because, using the results in Table 1, we have

$$
\begin{aligned}
(21)\quad \hat{L}_1 &= \int_0^\infty \{\int_1^\infty k\hat{y}_1\hat{g}(\alpha)d\alpha + \int_K^1 \alpha^{-(1-k)}k\hat{y}_1\hat{g}(\alpha)d\alpha + \int_0^K \hat{y}_1\hat{g}(\alpha)d\alpha\}f(\theta_0)d\theta_0 \\
&> \int_0^\infty \{\int_0^\infty k\hat{y}_1\hat{g}(\alpha)d\alpha\}f(\theta_0)d\theta_0 = k\hat{Y}_1
\end{aligned}
$$

which with the result proved above implies that $\hat{L}_1 > k\hat{Y}_1 \geq k\tilde{Y}_1 = \tilde{L}_1$.

Comparison between $\hat{\Pi}_1$ and $\tilde{\Pi}_1$ is more complicated but can be done analogously to that between $\hat{Y}_1$ and $\tilde{Y}_1$; the result is

$$
\begin{aligned}
(22)\quad & [1-c_\pi(1-k)-c_\ell k](\hat{\Pi}_1-\tilde{\Pi}_1)/\Pi_0 \\
&= -(1-c_\ell)\{[k/(1-k)]\int_K^1 (1-\alpha^{1-k})\hat{g}(\alpha)d\alpha + k^{-k/(1-k)}\int_0^K \alpha\hat{g}(\alpha)d\alpha\}
\end{aligned}
$$

Since the terms in the brace are positive, we find that $\hat{\Pi}_1 < \tilde{\Pi}_1$ if $c_\ell < 1$ and $\hat{\Pi}_1 = \tilde{\Pi}_1$ if $c_\ell = 1$, irrespective of c_π.

For the aggregate output level in physical units, we have

$$(23)\qquad [1-c_\pi(1-k)-c_\ell k](\hat{X}_1-\tilde{X}_1)/X_0 = (1-c_\pi)\{\int_\kappa^1 (1-\alpha^{1-k})\hat{g}(\alpha)d\alpha + \int_0^\kappa \alpha(1-k)k^{-1/(1-k)}\hat{g}(\alpha)d\alpha\} > 0$$

The last variable we want to make a comparison between LM and PM is the general price level. It is convenient to define the general price level (in terms of wage units) P by Y/X, which is equivalent to say that P is the average of individual prices weighted with the level of physical output, in agreement with the way the published price indexes are computed. Obviously by (1), $\tilde{P}_1 = P_0 = u/k$. To see if $\hat{P}_1$ is greater or smaller than this, we first note from (20) and (23) that

$$(24)\qquad [(\hat{Y}_1-\tilde{Y}_1)/Y_0]/[(\hat{X}_1-\tilde{X}_1)/X_0] = (c_\ell-c_\pi)k/(1-c_\pi) < 1$$

Since $\hat{Y}_1 = \hat{P}_1\hat{X}_1$, etc., and $\hat{X}_1 > \tilde{X}_1$, this gives

$$(25)\qquad \hat{P}_1\hat{X}_1 - \tilde{P}_1\tilde{X}_1 < P_0\hat{X}_1 - P_0\tilde{X}_1$$

With $\tilde{P}_1 = P_0$, this implies that $\hat{P}_1 < \tilde{P}_1$. Hence the general price level is lower in a LM economy.

Table 2 summarizes the results. Because $0 \leq c_\pi \leq c_\ell \leq 1$ and $c_\pi < 1$ (otherwise the multiplier becomes infinite), we find that (i) $\hat{Y}_1 \geq \tilde{Y}_1$ where the equality holds if and only if $c_\pi = c_\ell$, (ii) $\hat{X}_1 > \tilde{X}_1$, (iii) $\hat{P}_1 < \tilde{P}_1$, (iv) $\hat{L}_1 > \tilde{L}_1$, and (v) $\hat{\Pi}_1 \leq \tilde{\Pi}_1$ where the equality holds if and only if $c_\ell = 1$. Discussions on these results will be given in the next section.

Finally we consider the elasticity. Define the elasiticity of employment with respect to national product by $\eta_{LY} \equiv [(L_1-L_0)/L_0]/[(Y_1-Y_0)/Y_0]$. Then

$$(26)\qquad \hat{\eta}_{LY} - \tilde{\eta}_{LY} = [(\hat{L}_1-L_0)/L_0]/[(\hat{Y}_1-Y_0)/Y_0] - [(\tilde{L}_1-L_0)/L_0]/[(\tilde{Y}_1-Y_0)/Y_0]$$
$$= \frac{[(\hat{L}_1-\tilde{L}_1)/L_0](\tilde{Y}_1/Y_0 - 1) - (\tilde{L}_1/L_0 - 1)(\hat{Y}_1-\tilde{Y}_1)/Y_0}{(\hat{Y}_1-Y_0)(\tilde{Y}_1-Y_0)/Y_0^2}$$

The denominator of the right-hand-side is positive and, with the results in Table 2, the numerator becomes

$$(27)\qquad (1-c_\pi)\Delta(\tilde{E}(\alpha)-1) - (\tilde{E}(\alpha)-1)(c_\ell-c_\pi)k\Delta = (\tilde{E}(\alpha)-1)[1-c_\pi(1-k)-c_\ell k]\Delta < 0$$

Hence $\hat{\eta}_{LY} < \tilde{\eta}_{LY} = 1$ (see Section 4). That is, the elasticity of employment with respect to national product is smaller under LM as expected and as found for Japan in comparison to the United States. Similarly, we can easily see that $\eta_{\Pi Y} > \eta_{\Pi Y}$, which is a corollary to the above result since $L + \Pi = Y$.

7. Summary of the Theoretical Results

Let us summarize the results so far. We contrasted the layoff minimization behavior to the profit maximization behavior and compared their macroeconomic impacts when all the firms were at first employing the profit-maximizing number of workers and then the aggregate demand is exogenously decreased. We do not deny that this is a simplistic model. For one, it was ignored that actual firms may not lay off the workers but yet decrease labor input through reducing working hours. Also ignored were the heterogeneity of the skills and experiences of the workers which might be the most important cause of the layoff minimization behavior, the inventory and investment decisions of the firm, and the role of financial markets in business fluctuation. Moreover, if it is known that the demand may decrease in the future and at that time the profits must be decreased more than proportionally in order to minimize the layoff, a rational firm likely makes the employment decision at period 0 taking such probability into consideration. The oft-observed behavior of the Japanese firms to hire temporary or part-time workers and have the workers work over time during a good time may be viewed as such means to be prepared for the future hard time. Nevertheless it was ignored in our analysis.

Simplification, however, is only a cost for useful results. Thus we could obtain the following results here. First, in recession, the output is larger (unless $c_\ell = c_\pi$) in the LM economy because the firm (if $\alpha < 1$) maximizes the revenue subject to the technological and nonnegative-profit constraints, in order to secure the wage funds to be paid to the now redundant workers. This implies that given an exogenous downward shift in demand its consequence on GNP is smaller there. The fluctuation of national product is therefore smaller in the LM economy.

Second, unemployment is smaller in the LM economy not only because of the LM behavior itself but also because of the above-mentioned revenue maximization behavior which results in a larger aggregate demand and supply. The output elasticity of employment is therefore smaller in the aggregate level under LM.

Third, the general price level does not decrease in recession in the PM economy but decreases in the LM economy. Although the result heavily depends on our assumptions of constant demand elasticity and constant unit cost, a lower price level in the LM economy seems likely to result under more general assumptions because of the revenue maximization behavior above. This suggests, on the one hand, a larger purchasing power of income in recession and, on the other hand, a wider fluctuation of the price level in business cycle in the LM economy.

Fourth, the total profits are likely smaller in the LM economy, which is intuitive because of the very definitions of LM and PM: The result that is not so intuitive is that they are identical between the LM and PM economies when $c_\ell = 1$. That is, if the workers do not save, then even though the LM firms (with $\alpha < 1$) are not maximizing the level of profits, their equilibrium total level of profits is not smaller than that of the PM firms. Essentially this is because, provided $c_\ell = 1$, all the wage payouts to the workers eventually get back to the firms as consumption demands. Thus if $c_\ell = 1$, total profits are not smaller but total wages are larger in the LM economy implying its Pareto superiority over the PM economy.[5] The relative distribution, needless to say, is less favorable to the company owners under LM.

To argue that the government should adopt the policies to encourage the LM behavior, the model is perhaps too simplistic. Yet, this analysis has

clarified some important implications of the layoff minimization, which I believe is a more reasonable hypothesis as the behavioral principle of the firm in recession, and should help investigating the causes of differences in economic performance in recession across countries. To this latter topic we will turn.

8. The Effect of Labor Productivity Increase

Since productivity has historically increased due to technical progress, its effect on our results has to be examined before proceeding to the empirical analysis. Assume a decrease in the labor-output ratio over time, namely, $u_0 > u_1$. Consider PM first. By (1) we have

$$(28) \qquad \tilde{p}_1/p_0 = u_1/u_0 < 1$$

i.e., that price decreases proportionally to the productivity increase, and

$$(29) \qquad \tilde{y}_1/y_0 = (\theta_1/\theta_0)(u_0/u_1)^{k/(1-k)} > \theta_1/\theta_0$$

However, the macro equilibrium requires (6) to hold which is independent of u. Hence $\tilde{Y}_1/Y_0 = A_1/A_0$ and the national product in value term $\tilde{Y}_1$ is determined independently of the labor productivity increase.

With (29) this implies that the productivity increase generally reduces the size of the market, shifting the distribution of θ_1 to the left. Because under PM, $\tilde{L}_1 = k\tilde{Y}_1$ and $\tilde{\Pi}_1 = (1-k)\tilde{Y}_1$, neither employment nor profits is affected by the productivity increase.[6] Note that the price decrease manifested in (28) implies a greater physical amount of output (because $\tilde{X}_1 = \tilde{Y}_1/\tilde{P}_1$) and a greater purchasing power of the wage (which is $1/\tilde{P}$ because the wage is unity).

Under LM, the firm (with $\alpha < 1$) decreases the output price during recession in order to increase the amount demanded of its product and thereby increase the output and employment so as to minimize the number of workers to be laid off. Thus if the labor productivity increases during recession, the LM firm will decrease the price more than proportionally to productivity increase. For instance, when $\kappa \leq \alpha < 1$, from (1) and (11), we have

$$(30) \qquad \hat{p}_1 = \alpha^{1-k}u_1/k = \alpha^{1-k}(u_1/u_0)p_0 < (u_1/u_0)p_0$$

When $\alpha < \kappa$, $\hat{p}_1 = u_1$ (see Table 1); hence,

$$(31) \qquad \hat{p}_1 = u_1 = (u_1/u_0)kp_0 < (u_1/u_0)p_0$$

Because the aggregate price $\hat{P}_1$ is the average of $\hat{p}_1$ weighted with $\hat{x}_1$, it is also smaller than $(u_1/u_0)P_0$. In fact, because

$$\begin{aligned}(32) \qquad \hat{Y}_1 &= \int_0^\infty \{\int_1^\infty \alpha\theta_0 k^{k/(1-k)} u_1^{-k/(1-k)} \hat{g}(\alpha)d\alpha + \int_\kappa^1 \alpha^{1-k}\theta_0 k^{k/(1-k)} u_1^{-k/(1-k)} \hat{g}(\alpha)d\alpha \\ &\qquad + \int_0^\kappa \alpha\theta_0 u_1^{-k/(1-k)} \hat{g}(\alpha)d\alpha\} f_0(\theta_0)d\theta_0 \\ &< \int_0^\infty k^{-1} u_1 \{\int_1^\infty \alpha\theta_0 k^{1/(1-k)} u_1^{-1/(1-k)} \hat{g}(\alpha)d\alpha + \int_\kappa^1 \theta_0 k^{1/(1-k)} u_1^{-1/(1-k)} \hat{g}(\alpha)d\alpha \\ &\qquad + \int_0^\kappa \alpha\theta_0 u_1^{-1/(1-k)} \hat{g}(\alpha)d\alpha\} f_0(\theta_0)d\theta_0 \\ &= k^{-1} u_1 \hat{X}_1\end{aligned}$$

and $P_0 = k^{-1}u_0$ and $\hat{P}_1 \equiv \hat{Y}_1/\hat{X}_1$, we have $\hat{P}_1/P_0 < u_1/u_0$, which implies $\hat{P}_1 < \tilde{P}_1$ $(= P_0 u_1/u_0)$.

The other results for LM are not much affected by the productivity increase. That is, repeating the proof in Section 6 but noting that $u_1 < u_0$, we find that the results for $\hat{Y}_1$, $\hat{X}_1$, $\hat{L}_1$, and $\hat{\Pi}_1$ in Table 2 stand unaffected except that Δ is now multiplied by $(u_1/u_0)^{-k/(1-k)}$ which is greater than one; hence, the excess of $\hat{Y}_1$ over $\tilde{Y}_1$ is now increased and so are the excesses of $\hat{L}_1$ over $\tilde{L}_1$ and $\hat{\Pi}_1$ over $\tilde{\Pi}_1$ (provided $c_\pi < c_\ell < 1$). Equations (26) and (27) also hold if Δ is multiplied by the same and hence $\hat{\eta}_{LY} < \tilde{\eta}_{LY} = 1$ as before.

In sum, the results in the previous sections need not be modified when labor productivity increases (namely, u decreases) except that the general price level should decrease in recession by exactly the same proportion as the productivity increase in the PM economy and by more in the LM economy.

9. Empirical Analysis and International Comparison

We have now come to empirically test the relevance of our theory and make a comparison among five industrialized nations; the United States, Japan, Federal Republic of Germany, France, and the United Kingdom. We use the annual data[7] taken from *National Accounts, Main Economic Indicators: Historical Statistics* and *Labour Force Statistics* of OECD in the hope that OECD's efforts to minimize the differences in definition of the variables will make the international comparison reliable. The period of study is 1965-79 because Japan published the national accounts by S.N.A. only since 1965. As is well known, this was hardly a period of smooth economic growth with moderate business fluctuation. In particular, the oil embargo in 1973 and the following sharp rise in the price of crude oil caused severe depression in all these economies. The impact, furthermore, was not even among them reflecting the difference in the extent of the dependence on import crude oil. Therefore, serious disturbances are observed in the macro time series and this, we note, may limit the applicability of our theory.

Because wage is the numeraire in our model as was the case in Keynes's *General Theory*, we defined the national product per wage (Y) by the ratio of the gross domestic product (GDP) to the wage rate in the manufacturing industry (W).[8] The autonomous expenditure (A) was obtained by the ratio of GDP less consumption expenditure to W. The employment variable (L) was measured by the number of civilian labor force employed in whatever industry. Finally, the price (P) was defined as the ratio of consumer price index (all items) to W.[9] All the data were calculated as indexes taking 1975 as the base year. The Appendix gives these data together with the data on real gross domestic product (RGDP) and labor productivity (LP = RGDP/L), and

the mean, standard deviation (S.D.) and growth rate of each variable, where the growth rate is estimated with the regression of the variable in logarithm on time. In addition, the Appendix provides the correlation matrix of these variables.

We are most concerned with the elasticity of employment to the national product. The most straightforward estimate is obtained by regressing log L to log Y.[10] The result is given in the first column of Table 3, which shows that the United States has the largest value, followed by Germany, Japan, France, and finally the United Kingdom whose estimate is almost zero. The unreasonably large value for the United States and the unreasonably small value for the United Kingdom probably reflects the large standard deviation of L for the United States and the small one for the United Kingdom (see Appendix).

A methodological difficulty in this estimation is that Y needs to be assumed independent whereas in our model it is endogenously determined given A. It is therefore more appropriate to treat A as the independent variable that determines Y and L. The second column of Table 3 gives the elasticity of L to A and the fourth column, the elasticity of Y to A, each estimated as the slope coefficient in a log-linear regression. The fourth column gives the ratio of the former to the latter, which gives a measure of the output elasticity of employment more in line with our theoretical view. As is obvious from the table, the two measures of the elasticity, in Column 1 and Column 4, are highly correlated and the international ranking is identical between the two. The estimate for the United States has now decreased to about two thirds of the previous estimate and is now less than unity but still the largest. The estimate for the United Kingdom has also decreased and is now negative because of the negative response of L to A. On the contrary, the estimates for the other three countries have slightly increased.

Thus the output elasticity of employment is less than unity in any country (assuming that the indirect estimate is more appropriate in the case of the United States), and largest in the United States and smallest in the United Kingdom. The estimates for France, Japan, and Germany are in a reasonable range of 0.2 for France to 0.5 for Germany, where Japan (with the value of 0.3) is closer to France than to Germany. These results are favorable to the hypothesis that layoff minimization and not profit maximization is the dominant behavioral rule in these economies, and that this tendency is strongest in the United Kingdom, followed by France and Japan. In the Unites States this tendency appears weakest and the likelihood that firms pursue profits without regard to employment stability is largest.

The second important implication of our theory is the asymmetry of employment behavior of the LM firm: That is, in an expansionary phase of a business cycle there is no need for employment reduction and the firm can simply pursue profits; hence, in our model, the output elasticity of employment is unity. On the contrary, in a contractionary phase, the LM firm will make endeavors to maintain employment in sacrifice of profits resulting in the elasticity smaller than unity.

The only period during 1965-79 in which Y decreased in all of the five countries was 1973-75 and the periods in which Y increased in all the countries were 1968-69 and 1978-79. The fifth column of Table 3 shows the elasticity during 1968-69; the sixth column, 1973-35; and the seventh column, 1978-79, where the elasticity was calculated by dividing the annual rate of change in L to that in Y.

As expected, the values in the contractionary periods are smaller than those in the expansionary period except for Germany and France (1978-79 only). That is, in seven of the ten comparisons, the ranking is as expected

by the LM hypothesis. Furthermore, with the same exceptions, the elasticities in the contractionary period of 1973-75 are smaller than the elasticities estimated for the entire period (the first or fourth column), and those in the expansionary periods, larger. Thus, although the evidence is hardly conclusive, it is suggestive of the asymmetric employment behavior consistent with the LM hypothesis.

Third, the price in terms of wage P has decreased over the period 1965-79 and the rate of decrease in P roughly equaled the rate of increase in labor productivity LP in every country (see Appendix), as predicted in Section 8. In fact, the absolute value of the correlation coefficient between P and LP is 0.965 or more (see Appendix) and the elasticity of P with respect to LP is -1.15 for the United States, -0.99 for Japan, -0.97 for Germany, -1.18 for France, and -1.04 for the United Kingdom, which are all close to unity and for Japan, Germany and the United Kingdom, not significantly different from one. Our analysis predicts that, in the LM economy, P is decreased relatively to LP during recession because of the attempts of the firm to increase the amount demanded of its product and maintain the employment, thereby implying an asymmetry such that P decreases during recession but stays more or less constant at other times relatively to LP.

This prediction may be tested in two ways. First, we looked at the residuals (namely, actual values less fitted values) obtained in the log-linear regression of P on LP. In the contractionary period of 1973-75, the residuals were found negative in two of the three years in every country, making a good contrast to the expansionary period of 1968-69 during which the residuals were all positive except for France in 1968. Second, we calculated the rate of decrease in P and the rate of increase in LP in 1973-75 and found that the former rate is larger than the latter rate in every country except the United States, which made a clear contrast to 1968-69 during which the former rate is smaller than the latter rate

except, again, the United States. This finding, except for the United States, is supportive of the asymmetric pricing behavior predicted by LM (but not PM), as is the first finding.[11]

To sum up, the empirical findings for the five OECD countries in 1965-79 were by no means conclusive, yet supportive of the layoff minimization hypothesis, by showing that in most cases (i) the output elasticity of employment was less than unity, (ii) the same elasticity was lower in the contractionary period of 1973-75, and (iii) the price decreased relatively to the labor productivity in the same period but not in the expansionary period of 1968-69.

Among the exceptions to these tendencies were (i) the elasticity in the United States being the largest and close to unity, (ii) the elasticity in the United Kingdom being the smallest and almost zero reflecting the zero growth of employment during the period, (iii) the elasticity in Germany being larger during 1973-75 than during other periods, and (iv) the price in the United States during 1973-75 increasing relatively to labor productivity. With these findings the layoff minimization hypothesis seems to apply most in France and Japan, and least in the United States. This is in accord with the findings in recent years of a few Japanese researchers. In his study of the quarterly data for manufacturing industries, Ono showed that "in Japan in the recession of 1974-75, the rate of change in employment from a year before has not as sharply decreased as that in production index. A similar employment behavior is observed in France" (Ono, 1981, p.23, my English translation). Shimada, in his study of the elasticity of employment index to production index in manufacturing industry, showed that "in a comparison of Japan to the United States a wide difference is evident. However, by examining the figures in European countries such as the United Kingdom, West Germany and France, we can see that the employment adjustment

in Japan is not much different from that in these countries" (Shimada, 1976, p.11, my translation). Hence, "in short, although Japan still scores higher in this respect than the Western Europeans, it is the Americans that appear more out of line than the Japanese" as Cole (1979, p.95) has revealed after surveying a few Japanese studies and the questionnaire study commissioned by the Japanese government and carried out by Gallup International concerning the frequency of employer-changing behavior in several countries.

That is, layoff minimization behavior seems to be adopted in Japan and most European countries, while the United States, with its frequent use of temporary layoffs, seems to be the (possibly only) country whose behavior may be approximated by the profit maximization hypothesis.[12]

FOOTNOTES

1. In this paper the term "layoff" is used interchangeably with "dismissal" or "discharge", without implying that, as may be popular in the United States, layoffs are temporary and those laid off are to be mostly rehired in due time.

2. The researchers that followed him gave various names to explain virtually the same thing, such as "permanent employment" (Cole, 1979), "permanent commitment" (Galenson, 1976), "lifetime employment" (Allen, 1981, and Ouchi, 1981), and "the Japanese employment system" (Dore, 1973) of which lifetime commitment is a part.

3. Interruptions in jobs for vacation, illness, strikes, and layoffs of less than thirty days are not counted.

4. Because taxation is not in our model, an increase in government expenditures needs to be financed by government deficit. The effect of this deficit on the goods and labor markets is ignored.

5. This does not imply that all the individual firms receive the same level of profits in the two economies. In fact, we know that for those firms suffering most (i.e., those with α close to zero), the profits are zero under LM but positive under PM. Hence, if we consider <u>individual</u> firms and wage earners rather than the firms as a whole versus the wage earners as a whole, it is impossible to make a comparison <u>a la</u> Pareto.

6. Of course this is not inconsistent with the incentive for each firm to increase labor productivity, because for each firm (given the behavior of other firms) an increase in productivity increases its profit.

7. An analysis with the Japanese data revealed that the use of quarterly data in place of annual data hardly affects the results but worsens the fit, because of the wide seasonal fluctuation of wage with which many of the variables are normalized. This fluctuation is caused obviously by the bi-annual bonus payments and the wage renegotiation in spring (due to "Shunto", namely the spring offensive of the unions) prevalent in Japan.

8. Strictly speaking, this is hourly earnings in the United States, monthly earnings for regular workers in Japan, and hourly rates in the three European countries. For the seasonally-adjusted quarterly Japanese data of 1966-79, the correlation coefficient between the wage index (including bonuses) in all the industries (excluding service industry) and that in the manufacturing industry was 0.999; hence,the use of the wage rate in the manufacturing industry in place of that in all the industries unlikely affects the results.

9. For the seasonally-adjusted quarterly Japanese data of 1966-79, the correlation coefficient between the consumer price index and the wholesale price index was 0.955; hence, the choice between these two price indexes unlikely affects the results.

10. In this and all the following regressions, AR1 procedure of the TSP program was used in order to reduce the error by serial correlation. Regressing log L to log Y imposes the constraint that in a multiple regression of log L to log GDP and log W, the two independent variables should have identical coefficients except for the sign (positive for log GDP and negative for log W). This null hypothesis was accepted only for Germany and the United Kingdom; however, in none of the other countries were the two coefficients (in absolute values) widely different.

11. This exceptional pricing behavior in the United States may be explained by the observation of Wachtel and Adelsheim (1977, p.7) that in the United States "firms operating in concentrated industries will increase their price markups during recessions to the extent they can, in order to recapture revenues lost from declining sales."

12. In finding that it is the United States and not Japan that is peculiar, we agree with Gordon (1982).

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Table 1. Corporate Decisions under Layoff Minimization Hypothesis

	Case 1 $\alpha \geq 1$	Case 2 $1 > \alpha \geq k^{1/(1-k)}$	Case 3 $k^{1/(1-k)} > \alpha$
Principle	Profit maximization	Revenue maximization subject to $\hat{\ell}_1 = \ell_0$	Revenue maximization subject to $\hat{\pi}_1 = 0$
Variables			
$\hat{\ell}_1$	$\alpha\theta_0 k^{1/(1-k)} u^{-k/(1-k)}$ $(= \alpha\ell_0 = \alpha k y_0 = k\hat{y}_1)$	$\theta_0 k^{1/(1-k)} u^{-k/(1-k)}$ $(= \ell_0 = k y_0 = \alpha^{-(1-k)} k\hat{y}_1)$	$\alpha\theta_0 u^{-k/(1-k)}$ $(= \alpha k^{-1/(1-k)} \ell_0 = \hat{y}_1)$
$\hat{x}_1$	$\alpha\theta_0 k^{1/(1-k)} u^{-1/(1-k)}$ $(= \alpha x_0)$	$\theta_0 k^{1/(1-k)} u^{-1/(1-k)}$ $(= x_0)$	$\alpha\theta_0 u^{-1/(1-k)}$ $(= \alpha k^{-1/(1-k)} x_0)$
$\hat{p}_1$	$k^{-1} u$ $(= p_0)$	$\alpha^{1-k} k^{-1} u$ $(= \alpha^{1-k} p_0)$	u $(= k p_0)$
$\hat{y}_1$	$\alpha\theta_0 k^{k/(1-k)} u^{-k/(1-k)}$ $(= \alpha y_0)$	$\alpha^{1-k}\theta_0 k^{k/(1-k)} u^{-k/(1-k)}$ $(= \alpha^{1-k} y_0)$	$\alpha\theta_0 u^{-k/(1-k)}$ $(= \alpha k^{-k/(1-k)} y_0)$
$\hat{\pi}_1$	$(1-k)\alpha\theta_0 k^{k/(1-k)} u^{-k/(1-k)}$ $(= \alpha\pi_0 = \alpha(1-k) y_0)$	$(\alpha^{1-k} - k)\theta_0 k^{k/(1-k)} u^{-k/(1-k)}$ $(= (\alpha^{1-k} - k)\pi_0/(1-k))$	0

Table 2. Summary of Macro Equilibrium Values

Period	0	1	
Behavioral principle	Profit Maximization	Profit Maximization	Layoff Minimization
Variables			
$E(\alpha)$	1	$\tilde{E}(\alpha) = A_1/A_0$	$\hat{E}(\alpha) = \tilde{E}(\alpha) - \Omega/[1-c_\pi(1-k)-c_\ell k]$
Y	$Y_0 = A_0/[1-c_\pi(1-k)-c_\ell k]$	$\tilde{Y}_1 = A_1/[1-c_\pi(1-k)-c_\ell k]$ $= Y_0 A_1/A_0$	$\hat{Y}_1 = \tilde{Y}_1 + (c_\ell - c_\pi)Y_0 k\Delta$ $\gtreqless Y_1$ as $c_\ell \gtreqless c_\pi$
X	$X_0 = (k/u)Y_0$	$\tilde{X}_1 = (k/u)\tilde{Y}_1$ $= X_o A_1/A_0$	$\hat{X}_1 = \tilde{X}_1 + (1-c_\pi)X_0\Delta$ $> \tilde{X}_1$
P	$P_0 = u/k$	$\tilde{P}_1 = u/k = P_0$	$\hat{P}_1 < \tilde{P}_1$
L	$L_0 = kY_0$	$\tilde{L}_1 = k\tilde{Y}_1$ $= L_0 A_1/A_0$	$\hat{L}_1 = \tilde{L}_1 + (1-c_\pi)L_0\Delta$ $> \tilde{L}_1$
Π	$\Pi_0 = (1-k)Y_0$	$\tilde{\Pi}_1 = (1-k)\tilde{Y}_1$ $= \Pi_0 A_1/A_0$	$\hat{\Pi}_1 = \tilde{\Pi}_1 - (1-c_\ell)\Pi_0 k\Delta/(1-k)$ $\lesseqgtr \tilde{\Pi}_1$ as $c_\ell \lesseqgtr 1$

Notes: $\Omega \equiv \int_\kappa^1 [\alpha(\alpha^{-k}-1)-c_\pi(\alpha^{1-k}-k-\alpha+\alpha k)-c_\ell(1-\alpha)k]\hat{g}(\alpha)d\alpha + \int_0^\kappa [\alpha(k^{-k/(1-k)}-1)+c_\pi(1-k)\alpha-c_\ell\alpha k(k^{-1/(1-k)}-1)]\hat{g}(\alpha)d\alpha$

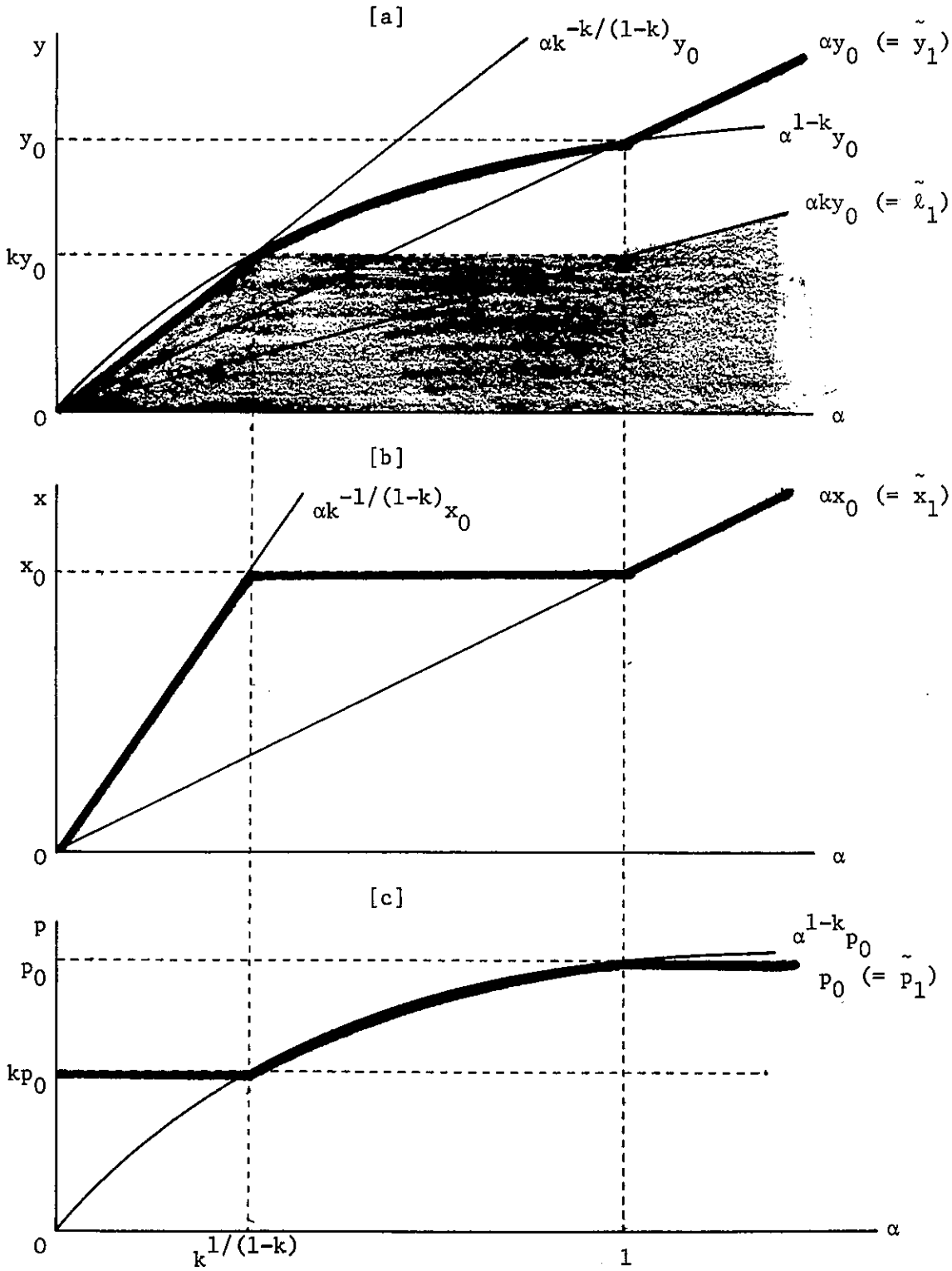
$\Delta \equiv \{\int_\kappa^1 (1-\alpha^{1-k})\hat{g}(\alpha)d\alpha + \int_0^\kappa (1-k)\alpha k^{-1/(1-k)}\hat{g}(\alpha)d\alpha\}/[1-c_\pi(1-k)-c_\ell k]$

where $\kappa \equiv k^{1/(1-k)}$

Table 3. Estimated Elasticities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Elasticity of L to Y	Elasticity of L to A	Elasticity of Y to A	(2)/(3)	Elasticity of L to Y	Elasticity of L to Y	Elasticity of L to Y
Period	1965-79	1965-79	1965-79		1968-69	1973-75	1978-79
United States	1.18	0.60	0.74	0.81	1.71	-1.64	1.08
Japan	0.26	0.15	0.49	0.30	0.86	0.11	2.11
F.R. Germany	0.40	0.28	0.60	0.47	0.31	0.68	0.46
France	0.16	0.12	0.57	0.22	0.63	0.07	-0.06
United Kingdom	0.03	-0.01	0.59	-0.01	0.13	-0.03	0.41

Figure 1. The Revenue (bold line in [a]), Employment (shaded area in [a]), Output (bold line in [b]), and Price (bold line in [c]) of the Firm under the Layoff Minimization Hypothesis



APPENDIX: DATA AND CORRELATION MATRIX

The United States

Data

year	Y	A	L	P	RGDP	LP
1965	82.8710	86.0666	82.8087	108.518	75.5947	91.2883
1966	87.4546	92.6893	84.9137	107.679	80.1573	94.3985
1967	87.8049	93.4341	86.6342	105.085	82.2306	94.9170
1968	91.2191	96.2716	88.4374	104.194	86.0847	97.3397
1969	92.6096	97.3439	90.7462	103.132	88.4570	97.4774
1970	91.7895	93.7915	91.6502	103.143	88.2621	96.3032
1971	94.2492	96.4378	92.4528	101.757	91.2908	98.7431
1972	97.0681	99.6688	95.6981	98.3544	96.3343	100.665
1973	100.560	105.251	99.0891	97.1765	101.514	102.448
1974	100.366	102.956	101.104	99.5652	100.916	99.8142
1975	100.000	100.000	100.000	100.000	100.000	100.000
1976	102.647	101.943	103.385	97.9630	105.382	101.931
1977	104.731	104.666	107.188	95.4237	111.088	103.638
1978	108.246	108.893	111.884	94.6875	115.943	103.628
1979	111.137	110.874	115.118	97.1942	119.199	103.545
Mean	96.8535	99.3526	96.7407	100.928	96.1636	99.0757
S.D.	8.08057	6.63275	9.79032	4.28610	13.1369	3.76206
Growth Rate (%)	1.85803	1.43953	2.25809	-.872384	3.05553	.813724

Correlation Matrix

	Y	A	L	P	RGDP	LP
Y	1.00000	.973681	.990437	-.940311	.996551	.960312
A	.973681	1.00000	.948665	-.923843	.963699	.957260
L	.990437	.948665	1.00000	-.916601	.995969	.922315
P	-.940311	-.923843	-.916601	1.00000	-.943045	-.978706
RGDP	.996551	.963699	.995969	-.943045	1.00000	.952600
LP	.960312	.957260	.922315	-.978706	.952600	1.00000

Japan

Data

	Y	A	L	P	RGDP	LP
1965	100.562	97.6016	90.5610	203.132	46.8084	51.6872
1966	104.430	102.665	92.4181	191.057	51.7682	56.0152
1967	108.297	109.535	94.1987	175.399	57.3461	60.8778
1968	111.925	118.559	95.7687	161.129	64.6689	67.5261
1969	112.918	122.538	96.4903	145.699	72.6024	75.2385
1970	113.287	126.249	97.5302	133.410	79.7238	81.7428
1971	109.377	116.565	98.0471	124.498	83.3960	85.0571
1972	108.257	116.245	98.1428	113.021	90.7486	92.4658
1973	106.812	115.666	100.689	102.110	98.7347	98.0588
1974	101.043	107.739	100.268	99.7770	97.7099	97.4487
1975	100.000	100.000	100.000	100.000	100.000	100.000
1976	99.7667	99.2045	100.919	97.4176	105.302	104.343
1977	102.222	101.693	102.278	97.0468	110.838	108.369
1978	106.033	105.655	103.542	95.5074	116.413	112.430
1979	106.692	104.221	104.901	92.2134	122.795	117.058
Mean	106.108	109.756	98.3840	128.798	86.5904	87.2212
S.D.	4.66386	9.20800	4.03344	37.8631	23.8903	21.0028
Growth Rate (%)	.210249	.234852	.963823	-5.67683	6.84238	5.81637

Correlation Matrix

	Y	A	L	P	RGDP	LP
Y	1.00000	.910593	-.141125	.194989	-.245021	-.245744
A	.910593	1.00000	-.918138E-01	.372305E-01	-.175478	-.162087
L	-.141125	-.918138E-01	1.00000	-.954929	.988325	.984691
P	.194969	.372305E-01	-.954929	1.00000	-.966581	-.975317
RGDP	-.245021	-.175478	.988325	-.966581	1.00000	.999088
LP	-.245744	-.162087	.984691	-.975317	.999088	1.00000

Federal Republic of Germany

Data

	Y	A	L	P	RGDP	LP
1965	103.533	102.943	106.533	152.214	72.6417	68.1872
1966	102.223	101.103	106.138	146.104	74.4546	70.1491
1967	98.3925	95.4566	102.674	140.947	74.3336	72.3980
1968	102.031	101.140	102.795	139.053	79.0064	76.8585
1969	106.908	107.929	104.327	132.963	85.1902	81.6569
1970	108.498	112.652	105.529	122.645	90.2834	85.5534
1971	106.110	110.474	105.754	113.663	93.2003	88.1289
1972	107.079	111.041	105.351	110.590	96.6055	91.6985
1973	108.470	114.161	105.658	107.692	101.335	95.9092
1974	104.105	109.761	103.589	102.944	101.882	98.3523
1975	100.000	100.000	100.000	100.000	100.000	100.000
1976	102.828	103.536	99.0241	98.9583	105.160	106.196
1977	102.269	102.446	98.8426	95.5066	108.351	109.619
1978	104.806	105.623	99.6048	93.7658	111.844	112.287
1979	107.932	110.043	100.980	92.7942	116.829	115.695
Mean	104.347	105.887	103.120	116.656	94.0744	91.5126
S.D.	3.11576	5.43301	2.78566	20.6509	14.3191	15.6358
Growth Rate (%)	.190080	.384602	-.421044	-3.63163	3.41259	3.83022

Correlation Matrix

	Y	A	L	P	RGDP	LP
Y	1.00000	.950805	.392567	-.255465	.359034	.253553
A	.950805	1.00000	.385220	-.372053	.431321	.316077
L	.392567	.385220	1.00000	.648200	-.625268	-.721573
P	-.255465	-.372053	.648200	1.00000	-.979714	-.975198
RGDP	.359034	.431321	-.625268	-.979714	1.00000	.991266
LP	.253553	.316077	-.721573	-.975198	.991266	1.00000

France

Data

	Y	A	L	P	RGDP	LP
1965	102.433	104.554	94.3516	163.077	62.9366	66.7043
1966	104.768	107.102	95.0275	158.140	66.5305	70.0644
1967	106.658	108.645	95.3606	153.151	69.7018	73.0929
1968	103.202	104.450	95.3413	142.439	72.6704	76.2213
1969	105.803	107.819	96.8572	136.404	77.7504	80.2732
1970	106.912	112.267	96.2089	129.960	82.2063	83.7055
1971	107.271	111.149	98.6676	123.214	86.6520	87.8221
1972	108.261	112.577	99.2179	117.468	91.7647	92.4880
1973	107.299	112.486	100.483	110.070	96.6889	96.2243
1974	103.186	105.247	101.183	104.924	99.8141	98.6473
1975	100.000	100.000	100.000	100.000	100.000	100.000
1976	101.260	100.705	100.686	96.0561	105.171	104.454
1977	103.397	102.648	101.554	95.5378	108.382	106.723
1978	101.516	101.271	101.926	90.0826	112.398	110.274
1979	102.356	101.589	101.878	88.2339	116.286	114.143
Mean	104.288	106.167	98.7162	120.584	89.9335	90.7225
S.D.	2.59633	4.50687	2.70397	25.4868	17.3618	15.2343
Growth Rate (%)	-.157651	-.344592	.577583	-4.55251	4.39412	3.83490

Correlation Matrix

	Y	A	L	P	RGDP	LP
Y	1.00000	.968059	-.271231	.382257	-.381915	-.387320
A	.968059	1.00000	-.305254	.423247	-.436263	-.443753
L	-.271231	-.305254	1.00000	-.930582	.981069	.977248
P	.382257	.423247	-.930582	1.00000	-.992142	-.992690
RGDP	-.381915	-.436263	.981069	-.992142	1.00000	.999705
LP	-.387320	-.443753	.977248	-.992690	.999705	1.00000

The United Kingdom

Data

	Y	A	L	P	RGDP	LP
1965	104.199	96.8956	100.523	134.969	79.6086	79.1941
1966	104.420	98.1730	101.164	131.412	81.2294	80.2944
1967	105.410	100.277	99.6876	128.650	83.3319	83.5930
1968	106.030	101.848	99.1439	125.064	86.7848	87.5341
1969	107.469	104.763	99.3143	124.697	88.0683	88.6763
1970	106.974	105.784	98.9208	120.440	90.0255	91.0077
1971	106.902	105.951	97.5007	117.417	92.4482	94.8179
1972	103.839	99.5784	97.4561	110.137	94.5019	96.9688
1973	105.953	103.347	99.8539	105.784	101.603	101.751
1974	103.102	98.6491	100.272	104.631	100.588	100.315
1975	100.000	100.000	100.000	100.000	100.000	100.000
1976	99.2006	103.361	99.2088	96.6611	103.608	104.434
1977	109.393	115.027	99.3995	107.097	104.912	105.546
1978	105.993	110.736	99.9107	98.7188	108.376	108.472
1979	107.568	110.368	100.523	97.3020	109.872	109.300
Mean	105.100	103.651	99.5253	113.535	94.9971	95.4603
S.D.	2.76378	5.21819	1.02806	13.2831	9.93539	9.97728
Growth Rate (%)	.008301	.781941	-.003392	-2.48234	2.33302	2.32824

Correlation Matrix

	Y	A	L	P	RGDP	LP
Y	1.00000	.617403	-.115630	.258727	-.214544E-01	-.121684E-01
A	.617403	1.00000	-.143367	-.464702	.645029	.654668
L	-.115630	-.143367	1.00000	.525668E-01	-.898102E-02	-.105345
P	.258727	-.464702	.525668E-01	1.00000	-.965611	-.965619
RGDP	-.214544E-01	.645029	-.898102E-02	-.965611	1.00000	.995322
LP	-.121684E-01	.654663	-.105345	-.965619	.995322	1.00000