A Correlation Between Unemployment and Wage Rates.

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I Introduction

M. Bronfenbrenner and F.D. Holzman, in their "Survey of Inflation Theory" state, [1]

"Since 1945, the geographical extent and the temporal stubborness of 'The Great Inflation' have shaken many economists' faith in the orthodoxies of preceding generations. Neo-orthodoxies, including restements, are only dimly

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in evidence."

As they have evidently addressed the very difficult problem of inflation, much has been written about the theory, problem, policies on inflation, so I wish to concentrate on a diffrent aspect of it by the econometric view-point. Econometric analyses on inflation are divided roughly into the price equation, the wage equation, and the demand equation of real cash balance.

The problem of the wage equation is especially to measure the Phillips curve expressing the relationship between unemployment and the change in money wage rates. The concept of the stable Phillips curves and their im-plications have been the objective of a series of disputes in recent econo-metric studies. Since Phillips and Lipsy introduced their model of wage determination, the theoretical bases for the intertemporal instability of esti-mated coefficients for Phillips curve variants are not clear, and some eco-nomists have participated in a neoclassical counter-attack on the existence and stability of Phillips curves from a theoretical standpoint.

The objective of this paper is to estimate aggregative wage change equa-tion in each of Japanese data, to document differences in the slope and posi-tion of the Philips curve for Japan and to offer some tentative judgements on the influence of labor productivity, trade unions, the ratio of job offers to applicants, the unemployment rate, consumer prices, etc.

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(1) M. Bronfenner and F.D. Holzman, "Survey of InflationTheory," American Economic Review, 1963, p. 594.

Ⅱ The Phillips curve in the competitive market.

In the competitive market, demand for labour is derived from demand for goods and services. The demand curve of labour shifts upward if demand for goods and services increases by Keynesian fiscal and monetary policies of the Government. The demand curve of labor in the free market is only the marginal productivity curve, and so the positions of the curve are determined by the added value per unit product and physical productivity. Treating the subject in a general way, if the prices go on rising, the added value per unit increases, and the curve therefore shifts upward with the increases of the added value per unit factor. Besides, it has become commonplace to assert that the key to increased wages without inflation lies in productivity improvements. Nonetheless, it is only by improving the nation's output per man-hour that everyone's well-being can be improved. simultaneously and unemployment can be excluded.

Concerning the labor supply function[2], we assume that for simplicity, labor supply may be function of unemployment. A curve relating the level of money wage-rates to the demand and supply of labor.

(1) $L^D = L^D(W)$

(2) $L^S = L^S(W)$

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(2) We have to study the theory of the labor supply function minutely but here first we assumed that the supply of labor increases with the change of wage rates.

where L^D and L^S respectively represent the demand for labor and the supply to labor, W, money wage rates and drawn as the curve L^D, in Figure I. Similarily we can draw a curve L^S, that corresponds to equation (2). In their intersection, the short period equilibrium level of money wage rates and employment may be determined. Now, we shall elucidate the relationship between unemployment and the wage level by using the following diagram.
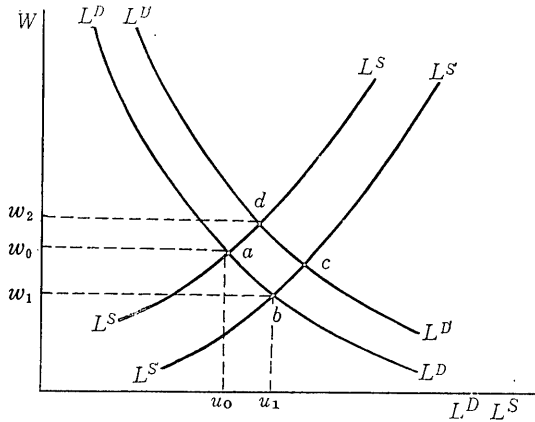
[Figure I]

Given the increases of the labor supply (e.g. the population of 15 years old and over.) with the labor demand curve constant, the equilibrium point moves from a to b, and, then, money wage rates moves from w_0 to w_1. But as explained by Keynes, while a short period reduction in real wages through an increase in prices may be temporarily accepted by the working population, a reduction in money wages is likely to be strongly resisted[3]. Hence

the labor demand is at the position u_0, its supply is at u_1, and therefore the gap between u_0 and u_1 is unemployment At the next time (from t_0 terms to t_1 terms) if the labor demand curve shifts upward by the expanstion of the economy, with the population of labor kept at u_0, the money wage rates will rise to w_2. If mobility were perfect, this would pose no problem and in the long run this may indeed be th new equilibrium position. The problem is that in the short run the persons represented by the decrease in employment from u_0 to u_1 may not readily find new jobs in other sectors of the economy. The new wage rates are higher than w_1, but they don't always amount to w_2.

To conclude: In the year of the low position of unemployment rates, the rate of the increase in wage rates is higher than that in the high position of unemployment rates. That is, when the labor demand increases by the expansion of the economy, the existence of unemployment plays a very mportant part in the shock absorber against the rising wages.

Ⅲ   The Phillips curve ane wage determinants

Let's consider the mechanism of the wage determinants. First of all, we suppose that the labor demand function and supply function can be defined as the following equations (1) and (2).

(1) $L^D = L^D(W, y)$

(3) J.M. Keynes, "The General Theory of Employment, Interest and Money." 1936.

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(2) $L^S = L^S (W, z)$

where W is the money wage rates, y the profit rate and productivity, etc., z fringe benefit, etc.

In the dynamic approach, the demand and the supply of labor are determined by the following equation (3)[4].

(3) $\dfrac{dw}{dt} = g(V)$

where V is the gap between the labor demand and the labor supply.

According to Flanagan[5], a theory of the Phillips curve is outlined to drive parameters which govern differences in the slope and position of the Phillips curve over time. The familiar dynamic hypthesis is that the rate of change in wages is proportional to the magnitude of the labor market disequilibrium, defined as the rate of excess demand.

Thus,

(4) $\dfrac{d\left(\dfrac{W}{P}\right)}{dt} = k\left(\dfrac{L^D - L^S}{L}\right)$

where $\dfrac{d\left(\dfrac{W}{P}\right)}{dt}$ is the time rate of change of real wages, L^D and L^S are the demand and supply of labor respectively and k is the reaction coeffi-

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(4) In the case of using the general form of the estimation equation, we use the next system.

$\dfrac{dw}{dt} = \theta_0 + \theta_1(L^D - L^S)$

$\dfrac{dw}{dt} = S_0 + S_1 w + S_2 y + S_3 z$

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cient which denotes the flexibility of wages in response to a given dis-equilibrium in the labor market. The appropriate measure of $\left(\dfrac{L^D - L^S}{L}\right)$ in the labor market is the job vacancy rate, V, minus the unemployment rate, U, where vacancies are defined as the difference between the demand curve and actual employment, and unemployment as the labor supply minus actual employment. Movements along the unemployment-vacancies (UV) curve correspond to cyclical changes in the rate of excess demand, while shifts in the position of the curve correspond to shift in the degree of structural maladjustment in the labor market. Both k, the cofficient indicating the flexibility of wages in response to labor market disequilibrium, and the degree of structural maladjustment in the labor force will influence the position of the Phillips curve. Given the definitions of unemployment and vacancies, the parameters of the UV relation reflect the speed and extent of adjustment of actual to potential employment and actual to potential labor supply when the labor market is in disequilibrium. The study of this process is facilitated by disaggregating the stocks of unemployment and job vacances into the flow per unit of time and average duration of each variable.

Thus, the job vacancy and unemployment rates can be defined as

(5) $V \equiv IvDv$

(6) $U \equiv IuDu$

when desired employment exceeds actual employment, the rate of incidence

of vacancies is defined as

(7) $Iv = q(Q) + y(Q) + r + \varDelta E^*(Q)$

where q is the quit rate, y the lay off rate, r the retirement rate, $\varDelta E^*$ the change in desired employment as a percentage of the employed work force, and Q the rate of excess demand in the product market.

The rate of incidence of unemployment is defined as

(8) $Iu = \alpha q(Q) + \beta y(Q) + \gamma p(Q)$

where p is the rate of gross labor force entrance, and α, β, and γ are parameters representing the propensity of each source of turnover to incur unemployment. From two equations we can show that the disequilibrium behavior of the flows of new vacancies and new unemployment is not predictable in advance.

(9) $dIv/dQ = q' + y' + \varDelta E^{*\prime} \gtreqqless 0$

     where $q', \varDelta E^* > 0, y' < 0$

(10) $dIu/dQ = \alpha q' + \beta y' + \gamma p' \gtreqqless 0$

where $p' > 0$

"It is clear that disequilibrium behavior of Iv and Iu is theoretically ambiguous because of the opposing cyclical behavior of the underlying turnover flows. The results will depend on the relative strength of the cyclical elasticity of quits and entrants on the one hand and the cyclical elasticity of layoffs on the other, as well as the proportion of quits, layoffs and the

(5) Flanagan, "The *U.S.* Phillips curve and International Unemployment Rate Differentials" p. 115~p. 117.

labor force entrants which incur some unemployment."[6]

Further,

(11) $Dv = h(Q)$ $h' > 0$

(12) $Du = j(Q)$ $j > 0$

Thus the slope of the UV relation depends critically on the cyclical sen-sitivity of quits, layoffs, and labor force entrants, the proportion of each turnover flow.

In conclusion, "the steeper or more ocurred the UV relation, the greater the change in excess demand $(U - V)$ and then $\left(\dfrac{d\left(\dfrac{W}{P}\right)}{dt}\right)$ associated with a one unit change in the unemployment rate.

Moreover, as indicated by the constant term, the proposition of the UV curve is also a function of the general level of turnover in the economy. Therefore, both the level and cyclical fluctuation in the trunover flows can be an important determinant of the slope and position of the Phillips curve..."[7]
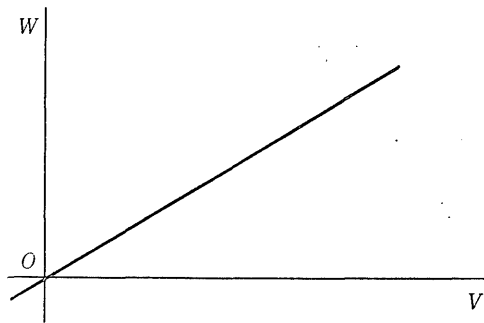
The above explanation is illustrated in Figure II.

We can show from Figure II that the larger the labor demand and supply gap is, the bigger the growth rate of wages is. We can call this relation *the wage adjustment function.*

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(6) Flanagan, Ibid., p. 116.

(7) Flanagan, Ibid., p. 117.

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[Figure II]

And also we can show that when V is zero, W is zero at the full employment point. Therefore we may see that with the decline in the unemployment rate the difference of the demand and supply becomes greater and greater. But we can't consider the possiblity of the decline of unemployment rate below zero. To analyze the (UV) relation between the unemployment rate and excess demand and supply, we refer to Figure III. Here, it is necessary for us to note that in case of making use of unemployment rate as an indicator of excess demand and supply, the fact that excess demand is zero in the labor market only means the concidence of the numbers between unfilled vacanies and the unemployed. Let us define the connection between labor supply and unemployment as

(13) $L^S = L + U$

where L is the level of employment, U the level of unemployment.

And let us assume that the connection between labor demand and unfilled

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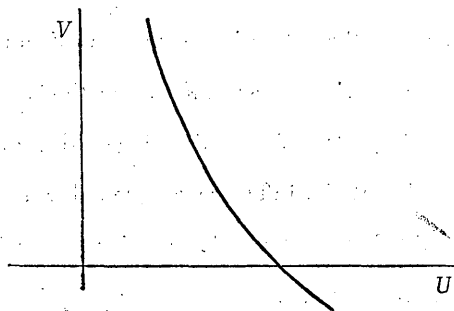
[Figure III]

vacancies is defined as

(14) $L^D = L + V$

where V is unfilled vacancies. V, in this case, is called "frictional unemployment", meaning the lack of employment in spite of the existance of the chance in employment, so that we can make out the mechanism from above equations (13) and (14).

Substituting the relation of V to U for that of W to V, we may get the relation of W to U. As we noted earlier, combinations of the rate of the changesin money wage and the rate of unemployment is what we call "the phillips curve." Morgan, in his "Is Inflation Inevitable?", remarks, [8]

"Statistical indicators of the demand for labor may be found in figures on employment or unemployment and unfilled vacances. Phillips took the view that a very high proportion of the changes in wages rates in Britain

(8) E. Victor Morgan, "Is Inflation Inevitable" *Economic Journal*. March, 1966 p. 3~4.

between 1861 and 1957 could be explained by a combination of the level of unemployment and the rate of the change of unemployment. Lipsy, treating the same material by rather different methods, maintains that the cost of living is more important (especially since 1919) than it was believed to be by Phillips, and that the influence of unemployment has been declining.

However, he still finds that the demand for labour is among the significant determinants of wage rates, and the conclusion is supported by other British studies including those of Clark"

Ⅳ Phillips and Lipsy hypotheses.

The determinants of wage-rates depend upon the other factors—e.g. the increase in profits for the entrepreneur, the impact of unionism on the average wage. etc. Let's consider the factors which have effects on the determinants of the money wage-rates.

The wage determination function is:

(1) $\dot{w}=a_0+a_1\dot{u}+a_2\dot{p}_2+\cdots; \ a_1<0, \ b_2>0$

The growth rate of consumer prices depends on the growth rate of wages-rates $(\dot{w})$ the and growth rate of labor productivity $(\dot{q})$.
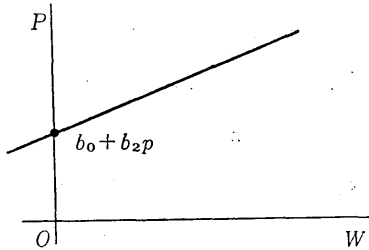
(2) $\dot{p}=b_0+b_1\dot{w}+b_2\dot{q}+\cdots; \ b_1>0, \ b_2<0$

The above equation is illustred in Figure IV.

Substitute the wage equation into the price equation so we may have

(3) $\dot{p}=c_0+c_1u+c_2\dot{q}+\cdots$

We supposed for the sake of simple argument; $(1-a_2b_2)$ was equal to 1,

[Figure IV]

$(a_0+a_1b_0)$ was equal to c_0, a_1b_1 was equal to c_1, then a_2 equal to c_2.

If labor productivity is constant, the quation shows the relation of the growth rate of consumers prices and unemployment. We can see the relation in Figure V.
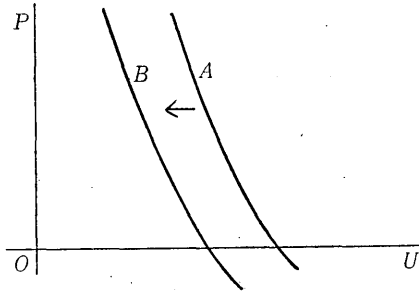
[Figure V]

The above Figure V shows the inverse correlation between the growth rate and unemployment. That is to say, the growth rate of prices would go on rising if we decrease the rate of unemployment, vice versa. This relation we usually call *the trade-off relation between prices and unemployment*. When we need the perfect stability of prices $(\dot{p}=0)$, we may point

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out the level of unemployment on the horizontal axis. The conclusion is that as wages are partially determined by the demand and supply of labor and that prices go upward or downward according to the changes of wage-rates. We can't achieve both full employment and the stability of prices. Incomes policy is the policy which may have the possibility of the movement from the curve A to the curve B, through the control by the Government.

V The Phillips curve and price expectations.

As explained in the preceding section, the Phillips curve teaches us the relation between nominal wage rates and the unemployment rate, so that when wage rates increase, and prices go up, then we have to put up with the existence of unemployment to a certain extent in order to stabilize prices.

R. Solow, in his treatise, made an attempt to verify *Frideman's hypothesis*[9] by measuring positively the trade-off between the quantity of money and the real quantity (unemployment). The relationship of trade-off between the growth rates of prices and unemployment rates temporarily is caused by the gap between the growth rateof prices and expected prices. The trade-off won't continue for a long time if the gap between the growth rates of expected value and the real value are promptly modified.

(9) R. Solow, "Price Expectations and the Behavior of the Price Level", Manchester university press, 1969.

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Let us recapitulate Frideman's monograph.[10] He presumes that in the steady-state economy which makes the change of money wage-rates equal to the change of prices, the rising rates of both of them [can be exactly estimated when the expansion policy of effective demand is taken and the total demand increases consequenlty. Thereupon the rise of unexpected product prices is temporarily brought about.If money wages rise without time lags as corresponding to this unexpected rise in prices, employment is constant as the real wages don't change. Accordingly the expansion policy of the effective demand acts only as a shock absorber. The change in the rising rates of money wages caused by the change in the rising rates of prices is in conformity with real economic conditions. The laborer doesn't expect that the speed of the rises in prices will hold out. But if we assume the expected rise in prices to correspond to the unexpected rise in prices partially, the laborer won't be at a disadvantage even if he supplies more labor under the condition of the lower rising rate of money wages. Then the rising rate in prices grows higher, and the supply curve of labor shifts upward; employment increases as output augments. Talking of the relationship between the money wage rates and unemployment rates, this is what we call the Phillips curve which represents the relationship between the increase of money wage rates and the decrease of unemployment.

Well, even if this unexpected rises in prices last long, a wage-worker

(10) M. Friedman, "The Role of Monetary policy" *American Economic Review*, March, 1968.

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acclimatizes himself to those rises in prices. As the labor supply schedule which shifts upward first turns back to the first position in a short time, the rate of money wage arguments, and the rising rate in prices may be equal to the rising level of money wages immediately. As expectation in this way is coordinated in the long run, there aren't any relationships. between wage rates and unemployment rates because the level of employ— ment doesn't enhance in such a case. That is to say, the *Phillips curve is only a phonomenon in the short run.*[11]

Ⅵ   The amendments of the Phillips-Lipsy curve.

Solow empirically verified the trade-off between the rising rates in prices. and unemployment, based on the data in U.S. and U.K.. He tested by using time series whether the difference between the expected value of the rising rates in prices and the real value as defined by Friedman produces. powerful effects on variables which explain the trade-off between the rising rates in prices and a real variable. Thereupon, Solow indicates a simple model concerning the rising rate in prices.

(1) $P = f(x) + P^*$

where P is the rising rate in prices, P^* expected rising rate in prices, x a.

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(11)   As explained by Friedman (The Role of Monetary Policy) unemploy—
ment doesn't, in the long run, have any relations to the growth of
money wages, so the Phillips curve is drawn as a line perpendicular
to an unemployment axis.

real variable, and $P=f(x)$ represents the trade-off. If the adaptive expectation is realized, $P=P^*$, that is, $f(x)=0$. This relation shows that the trade-off comes as a result of the gap between P and P^*. Taking these matters into consideration, Solow indicates the above equation as the general formula,

(2) $\quad P=f(x)+kP^*$

and adapts *the adopative expectation model*[12]

(3) $\quad P^*_{t+1}-P_t^*=\theta(P_t-P_t^*)$

which represents the determination of the expected price.

By the estimation of the present data obtained in U. S. and U. K., Solow concluded that the existence of the mechanism which adjusted the expected change in prices to the real value is recognized, but not instanly, and therefore he doesn't give his consent to Friedman's proposition, 'the Phillips curve is only a phenomenon in the short run.'

The wage adjustment function which is called the Phillips curve traced out in earlier sections is expressed by the following form.

(1) $\quad \dfrac{dw}{dt}=\alpha+\beta U^{-1}$

Now, the rate of change in wage rates in a real term symbolically can be expressed as (2) by substitating P term into (1).

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(12) The adaptive expectation is a hypothesis about an expectation for the nation which alters the next expected value partially according to the gap between real value and an expected value on the present change in prices.

$$(2) \quad \frac{d\left(\frac{W}{P}\right)}{dt} = \alpha' + \beta' U^{-1}$$

It is convenient to express this equation (2) for exposional purposes in a simple linear form

$$(3) \quad \frac{dw}{dt} = \alpha' + \beta' V^{-1} + \gamma \frac{dP}{dt}$$

where $\frac{dw}{dt}$ is the change in wages, $\frac{dP}{dt}$ the change in prices, and U the level of unemployment.

The coefficients α', β', γ are treated as constant.

"This formulation builds in the effect of the wage-price spiral, for the effects of the unemployment variables will vary with the strength of the wage-transfer mechanism, which will be reflected in the rise of the coefficients β' (which will be negative)."[13]

This equation is the wage adjustment function which we call the Phillips-Lipsey curve, which contains both the change in prices and the level of unemployment as a factor of the change in wages. In the above mentioned wage function, we assumed that the labor market might be satisfied with the condition of perfect competition. However, as the labor market is, in the condition of imperfect competition, it is not easy for us to explain the change in money wages on the ground of the mechanism of imcompectitive demand and supply adjustment.

(13) cf. R.J. Ball. *Inflation and the theory of money.* 1964.

As a result, the wage functions which include a lot of additional and substitutional variables are proposed by many economists.

"Bhatia found only a very weak relationship between unemployment and the rate of change of earnings in the United States between 1948 and 1958. Another interesting point is that, for Britain, the relationship between wages and the demand for labour appears to be less close for individual industries than it is for the economy as a whole. Dicks-Mireaux and Dow, applying their model to seven industries as well as to the whole economy, found that in only one case did special factors affecting the industry appear to be as important as demand conditions in the economy as a whole.

Phelps-Brown and Browne, using a much finer break down of no less. than 132 industrial groups, found little association between changes in earnings and unemployment and also between changes in earnings and in the size of the labour force except in a few cases where the latter was very large." [14]

We have in table I various kinds of explanatory factors about the change in wage rates. The explanatory factors of the rate of change of money wages traced out in table I come under the heads of (a)—(c)

　a. It was suggested by some writers that the main stimulus to wage increases was high profits, and productivity. They are variables to the product market, which are economic variables that have the

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(14) Morgan, E.V. "Is Inflation inevitable?" *Economic Journal*, march, 1966, p. 4.

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Table I

The Explanatory Factors of the Rate of Change of Money Wages

Economists	References	Explanatory Factors	Period
Bhatia	3	The rate of profit on equity capited changes in profit rate	1955~1959
Lipsey and Steuer	10	The rate of profit	1946~1958
Phelps-Brown	13	Productivity (in a few very capital intensive industries)	1948~1959
Dick-Mireaux and Dow	6	Pushfullness of unions	1946~1959
L.K. Klein and Y. Shinkai	9	The rate of change in prices	1930~1959
Y. Watabe	15	The unemployment rate	1929~1964
T. Uchida et all		The unemployment rate, Cousumer prices	1953~1964
Minami-Odaka		The ratio of labor demand to supply	1953~1967
A. Ono		Consumer prices, the Rate of participants to labor conflicts, Effective job hunters divided by effective job offers	1959~1963

background of wages bargaining.

b. One of the statistical indicators of the demand for labor may be found in the rates of change of unemployment, which are important indicators representing the relation between the demand and supply of labour.

c. Finally, some writers take up the position that there are those econimists who attempt to measure the extent to which unions have surpassed non-union employees in the increase of their wages.

Ⅶ Other factors of wage determinants.

Morton[15] didn't deny that labor union's calling for a raise in wages raise prices without difficulty but emphasized that the existence of unions lessens the lags of adjustment between the raise in wages the raise and in prices. In Morton's case, the proposal that the effects of labor unions on inflation aren't estimated is on the premise that the raise in prices precedes the raise in wages.

On the one hand, according to Lewis, [16]

"The impact of unionism on the average wage of all union labor relative to the average wage of all non-union labor may have exceeded 25 percent near the bottom of the Great Depression of the 1930's, was 5 percent or

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(15) Morton, "Trade unionism, Full-employments and Inflation" *American Economic Review*, March, 1950.

(16) Lewis, "Efficiency in the Labor Markets Relative Employment Effects

less in the latter 1940's and about 10 to 15 percent a decade later."

He reports the regression results. [17]

"In both the man hour and employees regressions the regression cofficients for the unionisms variable are negative, indicating that unionism tended to reduce employment in Group *a* relative to that in Group *b*. [18]

Moreover, although the unionism coefficients in the man-hour equations were larger numerically than those in the employees equations, none of the unionism coefficients differs significantly from (minus) unity, suggesting that the order of magnitude of the relative employment effects was roughly the same as that of the relative wage effects." [19]

"The postwar peak in employment (in man-days and man-hours) in bituminous coal mining came in 1947.

From 1947 to 1961 the average number of men employed on active man days declined by almost two-thirds, man-days fell by three-fifths, and man-hours by about three-fourths, unquestionably much of the decline was the result of falling demand for coal.

Yet the presence of the United Mine Workers in the industry and the

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of Unionism" *American Economic Review*, 1964, p. 123.

(17) Lewis, ibid. p. 123.

(18) Group *a* contains the mining, contract construction, manufacturing, transportation, communications and public utility industries and Group-*b* all other industries. In the period 1919~1958 more than 80 percent of the union members in the economy were employed in Group *a*.

(19) Lewis, ibid., p. 126~p. 127.

unusually larger postwar climb in wages suggest that unionism may have been a significant factor in the employment decrease".[20]

Although, in this way, many writers have emphasized the effects of trade unions on wages and employment for many years, but it is very difficult to verify whether the effect of unions on wages is effectively observed or not. From a point of view attaching importance to the structual factors of wage determinants, economic variables such as the unemployment rate and the change in prices have effects on change in wages through the influence of the relative wage bargaining of trade unions.　Wage determinants may depend upon collective bargaining pressures and the rate of trade unions' participation in labor conflicts. At any given time, the ability of a union to extract a large wage increase from management rests upon two factors: management's ability to pay and its desire to pay. Moreover, we may use the following economic indicators as variables of explaining wages determinants.

1) the rate of changes in consumer prices as an indicator which shows the change of standard of living

2) the profit, which may play a important part in deciding the attitude of the entrepreneur

3) the rate of change of the unemployment rate as an indicator showing the movement in the labor market

4) the rate of change of hours worked per month of regular workers or overtime as a business cycle indicators

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(20) Lewis, ibid., p. 128.

5) the rate of change of productivity

6) separation rate, net accession rate, job offers to applicants ratio, new job offers to applicants ratio, new job offers, rate of benefit received as variables of the unemployment rate

Concerning the profit rate as the explanatory factors of nominalmoney wage-rate, if we adapt Kaldor's explanation,[21] we can consider that wages may be determined by the collective bargaining between trade unions and the manager of the enterprise, but the level of wages is determined by the relative wage bargaining of trade unions. However, the relative wage bargaining of trade unions may be decided by the previous year's profit, so that we may say wages move with the level of the previous year's profit. Kaldor emphasized that the very profit is the real variable of wage determinants, but the unemployment rate is a proxy variable.

Ⅷ Empirical results.

8. The wage equations are estimated on comparable annual data for the period 1954∼1972 by ordinary least squares. The dependent variable (ΔW) is the rate of annual change of gross hourly earnings of production workers for total, durable, and nondurable manufacturing $[W_t - W_{t-4}/W_{t-4}]$,[22] ΔP is the four-quarter rate of change in the consumer price Index $[\sum_{i=0}^{t} P_{t-i} - P_{t-1-i}/P_{t-1-i}]$, and U^{-t}, the reciprocal of the four-equater moving aver-

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(21) N. Kaldor, "Economic growth and the problem of Inflation". *Economica*, 1959.

age of the unemployment rate, and wage equations are estimated alterna-tively using the U^{-1} and U^{-2} forms of the unemployment variable. More-ovre, $\Delta LP, \Delta L, \Delta IP, \Delta T$ and ΔPR respectively, stand for the rate of change of labor productivity, the ratio of job offers to applicants, the rate of change of import prices, the growth rate of trade unions, and the rate of profit. Each term is computed by using the ratio to the corresponding quarter of the previous year. The wage adjustment equations which were selected after experiments with alternative lags structure appear in Table II. And the trade-offs which these regressions imply are drawn in Figure (VI). Although there are no statistical grounds for favoring either specification more than others, the equation using U^{-1} is used to construct the trade-off in Figure (VI), so that comparison with some studies of predecessors may be easier.

Ⅸ Some discussions

Given the emprical results and Japanese Phillips curves, we can justify

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(22) "The percentage change in wages for each of the four seasonal groups is a function of the same set of explanatory variables (X) and error term (U) are dated in the quarter in which the wage negotiation and settlement took place (j).

That is,

$$\frac{W_j{}^h - W^h{}_{j-4}}{W^h{}_{j-4}} = aX_j + U_j$$

for $h = 1, \cdots, 4$ and $j = 4s$, where s is an integer and $W_j{}^h$ is the wage rate for the $h+n$ group in the $j+n$ quarter."

(Rowley and Wilton, "Quarterly models of wage determination: some new efficient estimates")

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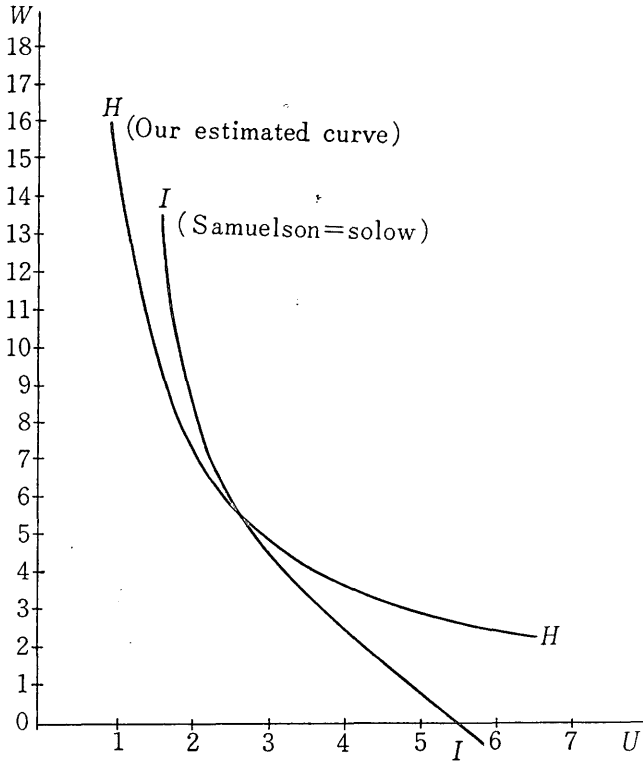
[Figure VI]

Figure (VI) Estimated phillips curve for Japan, 1957~1972.

(I) Paul A. Samuelson and Robert M. Solow. in *American Economic Review*, May, 1960, p. 192.

the following conclusions :

Over the range of observations provided by the 1957~1972 period, Japan experienced the comparatively favorable Phillips curve. By dint of the curve which we estimated, the avoidance of inflation is consistent with about fifteen percent level of unemployment. If frictional unemployment

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is 3 percent, which we must recognize in case of the level of full employ-
ment, we have to acknowledge that prices go up about 5 percent per year.
In this way, only by our monetary and fiscal polices, there is no attaining
both full employment and stability of prices. The cost-push theory tells us
thatthe main factors which move the Phillips curve to the right-ward is
the controling power of trade unions and the existence of oligopolistic

Table II Earings Change Regression for Japan 1954~1972.

Period	Re-gres-sion No.	Con-stant	Regression Cofficients.								$\overline{R}$	d
			U^{-1}	U^{-2}	ΔP	ΔLP	ΔL	ΔIP	ΔT	ΔPR		
1960~1972	1	−9.77	25.14 (2.65)			0.17 (0.9)					0.63	0.73
1957~1972	2	10.73					1.99 (0.40)	1.03 (2.37)			0.76	0.85
1960~1972	3	4.58			0.64 (4.36)	0.22 (1.64)					0.35	0.79
1960~1972	4	−7.33	25.2 (3.93)		−0.07 (1.27)				0.24 (0.6)		0.82	0.83
1957~1972	5	−9.54	26.33 (2.78)				0.73 (0.8)				0.79	1.02
1957~1972	6	3.70	18.98 (1.89)				0.73 (0.9)				0.78	0.69
1957~1972	7	2.47		13.74 (3.21)							0.76	0.87
1957~1972	8	4.23		6.21 (1.56)						0.66 (0.32)	0.81	0.96

Sources : Japanese Economic Indicators,
Economic planning Agency, Japanese Government, and others.
See Appendix.
Standard errors in parenthese, and d is the Durbin-Watson statistic.

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enterprises. Limiting wages and prices, however, involves the loss of some market freedom on the part of both trade unions and firms. The results reported in this paper confirm that in our regression analyses, we are oblized to admit the fact that the wage-rates are affected by the ratio of labor demand to labor supply, and the profit rate. We may sefely say that wages rates varies with the rate of job offers to applicants and the profit rate, to say nothing of the unemployment rate.

Appendix

Year	the rates of wages	the rates of unemployment	the ratio of labor demand to supply	labor productivity ratio	consumer prices (Tokyo)	conflict number ratio
	%	%	%	%	%	%
1957	3.6	1.90	0.39	—	3.0	26.3
1958	2.3	2.18	0.32	—	1.0	11.0
1959	7.5	2.02	0.44	—	1.4	−8.3
1960	8.0	1.52	0.59	13.1	3.7	30.0
1961	11.6	1.38	0.74	10.2	5.3	11.7
1962	9.2	1.30	0.68	2.7	6.7	−7.9
1963	10.6	1.22	0.70	9.8	7.8	−11.8
1964	10.5	1.12	0.80	12.1	4.1	20.1
1965	8.6	1.29	0.64	3.5	7.2	26.0
1966	11.7	1.30	0.74	13.0	4.8	20.8
1967	13.2	1.22	1.00	16.5	4.1	−18.0
1968	14.8	1.12	1.12	14.3	5.6	28.4
1969	16.4	1.11	1.30	15.0	5.6	36.1
1970	17.6	1.18	1.41	13.9	7.2	−13.9
1971	13.7	1.31	1.12	6.7	6.3	50.6
1972	14.3	1.34	1,12	12.6	4.7	−15.3

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Period	the rates of participants of labor conflict	reciprocal of the unemp- loyment	rate squared reciprocal of the unemp- loyment rates	the rates of change of numbers of trade unions	profit rates
	%	%	%	%	%
1957	46.1	0.53	0.28	5.9	5.14
1958	0.5	0.46	0.21	4.8	4.05
1959	−24.4	0.5	0.25	3.9	5.47
1960	21.7	0.66	0.43	5.7	6.05
1961	−8.9	0.72	0.53	8.5	5.44
1962	−11.4	0.77	0.59	6.0	4.36
1963	−5.5	0.82	0.67	4.1	4.89
1964	−8.3	0.89	0.8	3.3	4.22
1965	51.7	0.78	0.6	2.8	3.57
1966	−7.5	0.77	0.59	2.1	4.54
1967	−44.6	0.82	0.67	2.5	5.15
1968	84.1	0.89	0.8	2.2	4.98
1969	31.2	0.9	0.81	4.0	5.43
1970	−23.2	0.85	0.72	3.6	4.84
1971	53.7	0.76	0.58	2.4	3.33
1972	−26.7	0.75	0.56	2.1	4.21

(Sources) Japanese Economic Indications (Economic Planning Agency)
Labor Force Survey (Prime Minister's Office)
Economic Statistics Monthly (The Bank of Japan)
Notional Income Statistis (Economic planning Ageney)
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