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WAGE AND EMPLOYMENT FLUCTUATIONS IN DUAL LABOR MARKETS*

By TAKESHI NAKATANI

In many countries a rise in relative share of skilled labor and an increase in wage differentials between skilled and unskilled laborers are observed. We set up a model composed of two types of laborers, one is regular and organizes a labor union strong enough to bargain and another is non-regular, part-time laborers and deprived of bargaining power. We show that a decrease in the union's bargaining power coupled with negative demand shocks bring about a rise in the relative employment share of skilled labor and a reduction of wage differentials between skilled and unskilled. These findings coincide with observed facts of recent Japan.

1. Introduction

It is widely acknowledged that structural changes in labor market and the exacerbated unequal income distribution are prominent in many countries after around 1980 when the economic turning from high growth to medium or low growth started. According to an OECD report, (1) the employment share of skilled labor compared to unskilled has been increasing since the 1970s, (2) the wage differentials between skilled and unskilled are expanding in European countries, although in Japan it remains the same or is rather decreasing, and (3) the less educated and unskilled laborers suffer many decreases in wages or unemployment. This means that the growing globalization of economic activities will result in polarized effects among people; some gain from technical changes and globalization and others lose from such changes. In Japan the rate of unemployment has increased to an unprecedented level of over 5% in the stagnant nineties. One conspicuous characteristic in the Japanese economy is the structural change in the labor market, a rapid decrease of regular employment and an increase in part-time, short-term contract workers instead.

There are three different approaches to cope with these profound changes in labor markets. The first is the approach of paying attention to the quality of technical changes. Recent technologies are said to have a skill-biased character, requiring much high-quality labor, which badly affects unskilled laborers, as confirmed in research by Acemoglu(1996) and Johnson(1997). Acemoglu(1996) investigated these problems by examining trend movements of relative wages between university graduates and high school graduates from the increasing supply effect of skilled laborers and the demand effect due to skill-biased technological

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changes. The second approach is to note the global competition, especially reverse imports from developing countries which should unfavorably affect unskilled laborers of developed countries. Research includes A. Woods(1994) and E. Lai(1995). The third deals with this problem from a capital-labor bargaining framework. In Europe the organized labor union has been alleged as being responsible for high unemployment. Many papers abound in this line; McDonald & Solow(1981)(1985), Layard and Nickell(1990) and Skott(2000) are prominent examples. Skott(2000) investigated these stylized facts in labor markets (increasing skilled labor in number and increasing relative wage) from the asymmetric characters of skilled labor compared to unskilled, instead of from a biased technology viewpoint.[1)]

This paper goes along with the third approach. We cannot neglect the effect of weakened labor unions since the eighties, especially in Japan where the organization rate of unions has been falling since the seventies to under twenty percent, which is profound compared with other OECD countries. This trend is still continuing with the recent increase of part-timers, which will deteriorate the situation of the labor market in the future. However, the relative wage between labors in Japan until now is reported to remain still or rather slightly reducing contrary to European countries.[2)] It seems that the relation between these changes in labor markets and stylized facts of relative wages and relative employment has still been poorly examined. In this paper we set up a macro model composed of two different labor groups, one is regular (skilled and highly educated) unionized laborers which can bargain with capitalists and the other is non-regular (unskilled and less educated) which cannot access power to bargain. We investigate three structural changes in labor markets: (1) weakened labor union's bargaining power, (2) intensified global competition, and (3) stagnant demand condition in the relative employment share of skilled and wage differentials between skilled and unskilled. Next section we first summarize the standard bargaining model needed for subsequent discussions and then we set up our dual labor model. In section four we proceed to investigate the effects of the three factors above in order.

2. Labor-capital bargaining and product market

A standard bargaining model shown in Layard, Nickell and Jackman(1991) can be formalized as follows, assuming for simplicity that production needs only labor input and neglecting capital input. Letting A be an efficiency parameter of labor, we write the production function as

$$Y=F(AN) \qquad F'>0 \tag{1}$$

1) In Skott(2000) there is an asymmetry between skilled and unskilled laborers in a sense that skilled laborers incapable of being employed as skilled workers can have access to low skilled jobs but the opposite does not hold. As a result, it is claimed that technical changes will bring about extension of wage inequality between skilled and unskilled laborers.

2) It is observed in some research that the wage inequality has grown since the nineties.

A labor union negotiates with capitalists on a nationwide basis, namely as a national center of labor union that exerts its bargaining power to settle on labor conditions with the similarly organized nationwide capitalist organization. The bargaining procedure is assumed to maximize the Nash product composed by union utility and firms' profits. As for bargaining here we assume that the wage rate only is bargained between them and that the employment capitalists exclusively grasp the decision, namely a right-to-manage situation, which seems to agree with the reality, where unions are too weak to affect the employment. We employ this assumption to be a first approximation to reality.

The standard bargaining equilibrium is formalized as follows (see Appendix for its concrete derivation).

$$\frac{W}{P} = G(\beta, m, N)$$
$$G_\beta > 0, \qquad G_m < 0, \qquad G_n > 0 \tag{2}$$

Here W and P mean the wage rate and the price level, β is the parameter implying the union's bargaining power, and m is the elasticity of demand, where $m \leq 1$ is assumed. A bigger β raises the real wage rate due to strong wage bargaining. A rise in m decreases the real wage rate. This is easily known because m is the reciprocal of mark-up ratio to the unit cost. If competition becomes severe, m decreases and approaches unity under perfect competition. Note that Nash product maximization implies the mutual balance of benefits between capitalists and laborers, so the severe competition leads to not only profit reduction but also real wage reduction from a Nash bargaining equilibrium. Lastly, a rise in employment raises the real wage rate, which is simply due to that union's bargaining power being strengthened by lesser unemployment risks.

After wage rate bargaining, the representative firm decides employment and output level under the given wage rate. Assuming an imperfectly competitive firm with downward sloping demand function, we have the following F.O.C.

$$\frac{W}{P} = mAF'(AN) \qquad F'' < 0 \tag{3}$$

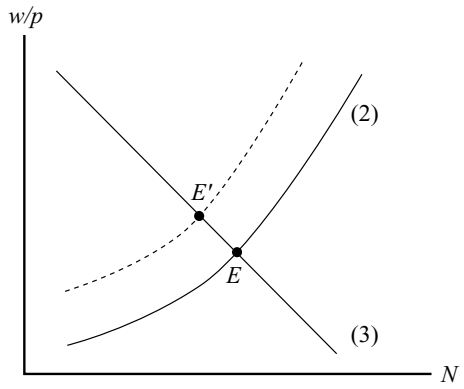

FIGURE 1. Equilibrium in labor market

The real wage rate W/P, employment N, and the output level Y are determined by the above three equations, illustrated in Fig1. The upward sloping curve (2) is the bargaining equilibrium condition (2) and the downward sloping curve (3) means the firm's equilibrium condition under right-to-manage conditions. Thus the intersection E gives the bargaining equilibrium in this model.

Now examine how the union's bargaining power, a change in productivity or intensified competition affects real wages, employment and output level. As is shown in Fig 1 an upward shift of β moves the curve (2) upwards, so the equilibrium is changed from E to E', therefore the real wage rate increases but the employment decreases. As for the total amount of wage income we have[3)]

$$\partial\left(\frac{\widehat{WN}}{P}\right)/\partial\hat{\beta} = \frac{1+\xi}{\xi-\xi_N}$$

$$\xi = F''AN/F' < 0$$

$$\xi_N = (\partial G/\partial N)(N/G) > 0$$

Here ξ is the elasticity of F' with respect to efficiency unit of labor AN and ξ_N is the elasticity of G with respect to N. Thus the effects of β on total wage income depend on the sign of $1+\xi$. If we assume a Cobb-Douglas production function, then we have $1+\xi > 0$, therefore the total wage income unambiguously decreases when β increases.

This bargaining model plays a role in showing the rigid wage rate regardless of fluctuating demand or productivity shocks, which are absorbed by quantity adjustments of employment or production levels. For example, if the bargaining function G is flat and is not influenced by employment, then the supply shocks expressed in (3) have nothing to do with the real wage rate. Another implication of bargaining model is that it does not suffice for laborers to raise nominal wages to secure the total wage income. Laborers have to proceed beyond nominal wage negotiations to employment decision-making, i.e. efficient bargaining, in other words if they stay in a right-to-manage-type situation, they could not succeed in maintaining their income.

Next in this bargaining model, the product market condition is not explicitly considered. There are three alternative ways to deal with this problem. One is to add the equilibrium commodity market condition like the following.

$$Y = c\,(W/P)\,N + D_N/P \tag{4}$$

Here D_N is constant nominal demand except consumption. Equations (1)〜(4) give a compete model, and an increase in D_N only raises the nominal price proportionately, real variables remaining the same. As is clear, equations (1)〜(3) are independent from the product market condition, so this is a classical dichotomy economy. Next is to give real demand D_R.

3) We use the following symbols, $\partial\hat{x}/\partial\hat{y} = (\partial x/\partial y)(y/x)$.

$$Y = c\,(W / P)\,N + D_R \tag{5}$$

Here there is no guarantee for the real wage rate $(W / P)_G$ determined in the commodity market and the real wage rate $(W / P)_B$ determined by capitalists and labor bargaining to coincide with. Suppose $(W / P)_G$ is less than $(W / P)_B$ due to a big real commodity demand D_R. As $(W / P)_B$ is greater than $(W / P)_G$, the union will move to raise the nominal wage rate by bargaining. Nominal wage increase will affect the commodity market by stimulating nominal demand and the price level will be pushed up. Thus this process may lead to a wage-price spiral of an increasing rate of inflation.[4] On the contrary, a low real demand will provoke a downward deflation spiral where a decline in real demand brings about a decline in wages and prices. Anyway the bargaining process does not suffice to determine the real wage rate independently from commodity market conditions.

The third way to bring in the commodity market is to take the dual labor market into consideration. There exist many non-unionized laborers along with unionized laborers, and non-unionized laborers are just passively affected by the results of the bargaining between primary laborers and capitalists. Such asymmetry between laborers is important for analysis of the effects of competition on wages. We set up such a dual labor model in the next section.

3. Basic model

Suppose that skilled laborers are organized in a union and have a bargaining power due to their indispensable skills and, on the other hand, unskilled laborers are totally left unorganized in a competitive labor market.[5] Suppose that production needs both skilled and unskilled labor. Denoting the amounts of skilled and unskilled labors as N_1, N_2 and real wage rates as ω_1, ω_2 respectively, we have the following equations.

$$Y = F(A_1N_1,\ A_2N_2) \tag{6}$$
$$\omega_1 = mA_1F_1(A_1N_1,\ A_2N_2) \tag{7}$$
$$\omega_1 = G(\beta, m, N_1) \tag{8}$$
$$\omega_2 = mA_2F_2(A_1N_1,\ A_2N_2) \tag{9}$$
$$Y = c(\omega_1N_1+\omega_2N_2)+I \tag{10}$$

Equations (7) and (9) give a firm's employment decision for skilled and unskilled laborers and (8) implies the collective bargaining equilibrium of skilled labor. Equation (10) is the demand and supply equilibrium in the commodity market under the assumption that both types of laborers will spend a constant part of total wage income. Equations from (6) to (10) give a complete model to determine employment N_1, N_2, real wage rates ω_1, ω_2 and output level Y.

4) See Nakatani(1993) for such a wage-price spiral.

5) The labor union organization rate in Japan is 21%, which is as low as that in U.S.A. This rate is 50 % in UK, 45 % in Italy, 51% in Canada, 43% in Germany and 96% in Sweden, according to Layard, Nickell and Jackman (1991). The rate for part-timers is far below that of regular laborers, 2 or 3 % in Japan.

Hereafter the CES production function with the elasticity of substitution σ between two types of labor is assumed.

$$Y^{\rho} = (A_1N_1)^{\rho} + (A_2N_2)^{\rho} \qquad 0 < \sigma = \frac{1}{1-\rho} < \infty \tag{11}$$

As is well known this becomes a Leontief-type non-substitutable production function when $\sigma = 0$, a Cobb-Douglas type when $\sigma = 1$ and a linear type when $\sigma \to \infty$.

In the case of CES, equations (7) and (9) are rewritten as

$$\omega_1 = mA_1\left(1+x^{\frac{\sigma-1}{\sigma}}\right)^{\frac{1}{\sigma-1}} \tag{12}$$

$$\omega_2 = mA_2x^{-\frac{1}{\sigma}}\left(1+x^{\frac{\sigma-1}{\sigma}}\right)^{\frac{1}{\sigma-1}} \tag{13}$$

Here x is the relative labor ratio in efficiency term of unskilled labor to skilled.

$$x = \frac{A_2N_2}{A_1N_1} \tag{14}$$

Next we proceed to a comparative static analysis of changes in union bargaining power β, intensified market competition m, changes in labor productivities of skilled and unskilled, A_1 and A_2 and finally effective demand, I and c.

4. Effects of bargaining power on employment and wage inequality

Assume the bargaining power of skilled is raised. Other things being equal, a rise in β affects employment of skilled N_1 and unskilled N_2 as follows.

$$\frac{\partial\widehat{N}_1}{\partial\widehat{\beta}} = -\frac{\sigma G_{\beta}}{1+\sigma G_N} < 0 \tag{15}$$

$$\frac{\partial\widehat{N}_2}{\partial\widehat{\beta}} = \frac{\sigma G_{\beta}}{1+\sigma G_N}\, z > 0 \tag{16}$$

Here, $z = x^{\frac{1-\sigma}{\sigma}} > 0$. The employment of skilled labor decreases and that of unskilled labor increases except for the case of zero labor substitution, $\sigma = 0$. Note that only skilled laborers execute bargaining, which causes capitalists to switch skilled laborers to unskilled. Then what happens to the real wage rate? We have

$$\frac{\partial\widehat{\omega}_1}{\partial\widehat{\beta}} = \frac{G_{\beta}}{1+\sigma G_N} > 0 \tag{17}$$

$$\frac{\partial \widehat{\omega_2}}{\partial \widehat{\beta}} = -\frac{G_\beta}{1+\sigma G_N} z < 0 \tag{18}$$

The real wage rate of skilled laborers increases to the contrary and that of unskilled labor is decreased.

[Proposition 1] An increase in the bargaining power of skilled labor raises their real wage rate but deduces their employment. Conversely, the real wage rate of unskilled labor is reduced and the employment is increased.

[Proposition 2] An increase in the bargaining power of skilled labor increases the wage inequality.

It is usually reported that the elasticity of substitution between skilled and unskilled is above unity.[6] It is arguable whether recent technical changes cause σ to rise or to fall; however if it is correct to say that recent IT technologies accelerate the lowering of technological barriers between skilled and unskilled, so that σ becomes smaller, then we have an extended wage inequality due to technological changes.

[Proposition 3] If the elasticity of substitution, σ, is less than one, the degree of employment fluctuation is bigger than that of wages. If σ is decreased due to technological changes, a rise in the bargaining power of skilled labor increases the wage inequality.

As for the total wage income we have

$$\frac{\partial(\widehat{\omega_1 N_1})}{\partial \widehat{\beta}} = \frac{(1-\sigma)G_\beta}{1+\sigma G_N} \tag{19}$$

$$\frac{\partial(\widehat{\omega_2 N_2})}{\partial \widehat{\beta}} = -\frac{(1-\sigma)G_\beta}{1+\sigma G_N} z \tag{20}$$

If $\sigma > 1$, an increase in β results in a reduction in the real income of skilled laborers and conversely in an increase in that of unskilled.

[Proposition 4] In case of $\sigma > 1$, a rise in skilled laborer's bargaining power decreases their real income, although raising unskilled laborer's real income.

What can we say from the results obtained above in relation to the stylized facts stated in the OECD report? First, weakened bargaining power of unions since the 1980s has led to an increase in skilled labor's employment and a decrease in their real wage rate, and as for the unskilled laborers it has raised both the unemployment and real wage rate. As a result, skilled laborer's relative employment ratio is raised and wage inequality is reduced, although real income inequality tends to be increased.

6) Bowles(1970) estimated elasticity of substitution among various education status in twelve countries and reported that those magnitudes are far above unity. Dougherty(1972) obtained almost the same results from the data of states in U.S.A. and Johnson (1997) reported that σ has been approximately 1.5 in almost all investigations until now.

Next, if we can interpret a low union organization rate in Japan as the low β, then we know that in Japan, in contrast to European countries, the unemployment of unskilled laborers is high and wage inequality between skilled and unskilled is small in Japan, where a low β prevails.

Finally, note that a change in bargaining power does not have any effect on output level in this model. This is because skilled and unskilled laborers follow the same consumption behavior. If, as is usually assumed, the consumption propensity of unskilled (so low-income) laborers is higher than that of skilled, then a fall in the bargaining power of skilled leads to a reduction in real income of unskilled laborers, which reduces consumption demand. Therefore a fall in bargaining power not only increases real income inequality, but also may cause a negative demand effect in the commodity market.

5. Effects of intensified competition on employment and wage inequality

In this section we consider the effects of intensified market competition, namely a rise in m which has been accelerated by global economic activities. In particular reverse imports of low-price food or textile commodities from developing countries or deregulation of import and export arrangements have brought about a rise in demand elasticity. A decrease in demand elasticity affects the economy through the following two channels, one is price deflation, which raises the real wage rate and decreases the employment, and another is the Nash bargaining effect where a declining profit tends to depress the real wage rate simultaneously. The aggregate effects of these channels are given as follow.

$$\partial \hat{N}_1 / \partial \hat{m} = \frac{1}{1+\sigma G_N} \{\sigma (1-G_m)+\gamma\} > 0 \tag{21}$$

$$\partial \hat{\omega}_1 / \partial \hat{m} = \frac{G_m+(\sigma+\gamma) G_N}{1+\sigma G_N} \tag{22}$$

$$\partial \hat{N}_2 / \partial \hat{m} = \frac{\sigma}{1+\sigma G_N} \left[\gamma \left\{ G_N (1+ z)+ \frac{1}{\sigma} \right\} + z (G_m-1) \right] \tag{23}$$

$$\partial \hat{\omega}_2 / \partial \hat{m} = 1- \frac{z}{1+\sigma G_N} (G_m+\gamma G_N -1) \tag{24}$$

$$\partial \hat{Y} / \partial \hat{m} = \gamma > 0 \tag{25}$$

Here $\gamma = \frac{D_c}{1-D_c}$, D_c is the consumption demand share to the total demand. Thus we have

[Proposition 5] When competition in commodity markets becomes intensified, the output level Y and the employment of skilled laborers N_1 will increase, but the changes in the employment of unskilled laborers and the real wage rates of both skilled and unskilled are ambiguous.

Let D_c be 0.6, the mark-up ratio $1/m$-1 be 20%, the relative ratio of productivity of skill and

unskilled A_2 / A_1 be 0.7, the employment ratio N_2 / N_1 be 2, the elasticity of substitution σ be 1.5 and with other parameters given in (**) in Appendix we then have the following rough tentative calculations.[7)]

$$D_c = 0.6,\ m = 1/1.2,\ A_2 / A_1 = 0.7,\ N_2 / N_1 = 2,\ \sigma = 1.5. \qquad (*)$$

The elasticity of real wage rate G_β, G_m, G_N in bargaining equilibrium is all expressed by the parameter of skilled laborer's bargaining power β, which is illustrated in Fig. 2. An increase in β raises G_N, however G_m is decreased with a small increase in β but it increases with a further increase of β, as shown in the Figure.

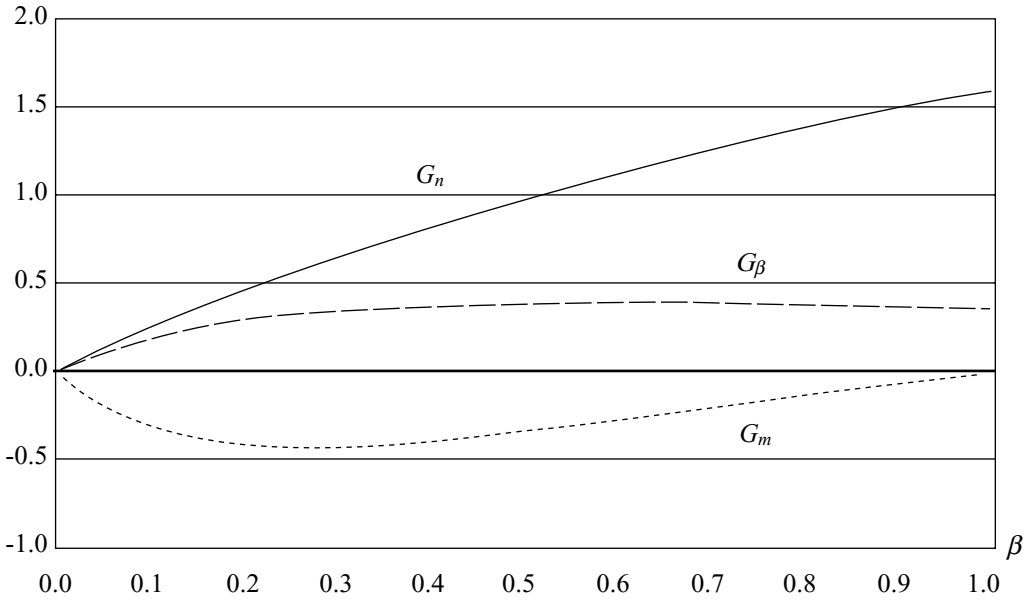

FIGURE 2

Therefore under the assumptions (*) and (**) we have the following.

[Proposition 6] An intensified competition raises the employment of unskilled labor and the wage rates of both skilled and unskilled.

[Proposition 7] When market competition is intensified, employment of both skilled and unskilled tends to increase much more in the economy where the bargaining power is strong.

In summary, the more competitive the commodity market becomes, the more the

7) The sum of junior college and technical college graduates and university and graduate school graduates is 20.88 million in total, so the ratio of this number to the total employed, 63 million, is approximately 2 according to labor force statistics held on February 2000.

employment and real wages of both skilled and unskilled increase.

Next we proceed to wage inequality. We have

$$\frac{\partial \widehat{\omega}_1}{\partial \widehat{m}} - \frac{\partial \widehat{\omega}_2}{\partial \widehat{m}} = - \frac{(1+z)\,\Phi}{1+\sigma G_N} \tag{26}$$

Here

$$\Phi = 1 - G_m - G_N\,\gamma \tag{27}$$

Φ depends on β. Using (*) (**), this is illustrated as Fig 3.

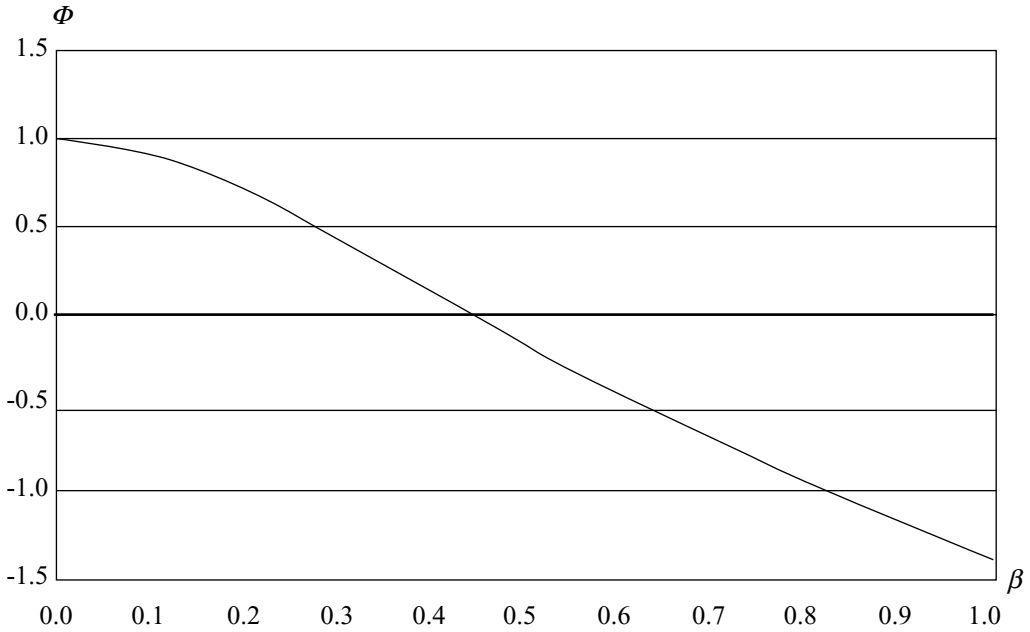

FIGURE 3. Relation between β and Φ

Therefore we have

[Proposition 8] As the bargaining power of skilled becomes weak, the intensified competition in the commodity market brings about a reduction in wage inequality.

Next, as for the effects of competition on real income we have the following.

$$\frac{\partial(\widehat{\omega_1 N_1})}{\partial \widehat{m}} = \frac{(1-\sigma)\,G_m + (\sigma+\gamma)\,G_N + \sigma + \gamma}{1+\sigma\,G_N} \tag{28}$$

$$\frac{\partial(\widehat{\omega_2 N_2})}{\partial \widehat{m}} = \frac{z(1-z)(1-G_m) + \{z\gamma(\sigma-1) + \sigma(1+\gamma)\}\,G_N + 1 + \gamma}{1+\sigma\,G_N} \tag{29}$$

$$\frac{\partial(\widehat{\omega_1 N_1})}{\partial \hat{m}} - \frac{\partial(\widehat{\omega_2 N_2})}{\partial \hat{m}} = -\frac{(1-\sigma)}{1+\sigma}\frac{(1+z)}{G_N}\Phi \tag{30}$$

From $G_m<0$, if $\sigma>1$, the real income of skilled labor unambiguously increases, but the changes for those of unskilled labor are ambiguous. So using (*) (**) we draw the figures as follow (Fig 4).

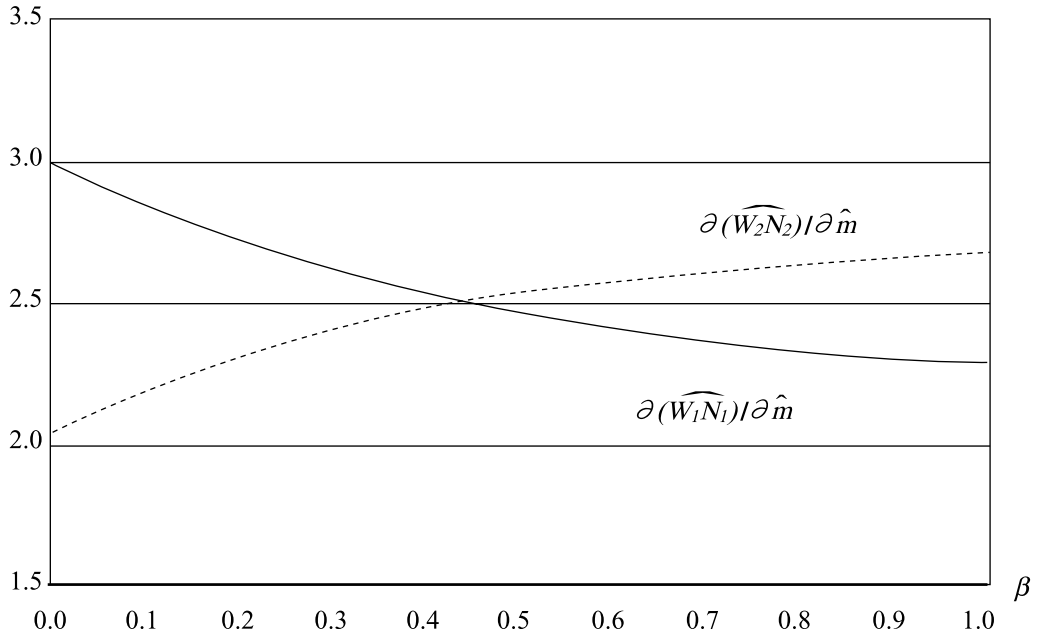

FIGURE 4

Therefore under such plausible parameters, we know the following.

[Proposition 9] The real income of unskilled labor will increase if competition becomes severe, but the income inequality between skilled and unskilled increases.

From the above discussions let us interpret the OECD report. If we are correct to suppose that globalization as well as deregulation since the 1980s has raised demand elasticity, so a decrease in the mark-up ratio and also the elasticity of substitution is greater than one, then we can say as follows.

[A] The intensified competition in the commodity market as well as the weakening of skill laborer's bargaining power has raised both the employment and real wage rates of skilled and unskilled. The relative employment ratio of skilled labor increases, the wage inequality decreases, although the real income inequality increases.

Noting that the union organization rate in Japan is low compared to European countries, we have

[B] Intensified competition in the commodity market of Japan causes the ratio of skilled laborers to be high and the wage inequality to be small.

These results are similar to the effects of a weakening in the union's bargaining power in the previous section, although they differ in the effects of a weakening bargaining power where intensified competition raises the employment of skilled labor and production levels.

6. Demand shocks, supply shocks and employment, wage inequality

Finally in this section we investigate the effects of demand and productivity changes. The demand change is expressed in our model as either a change in consumption propensity c or autonomous demand except consumption I. We take I here.

$$\frac{\partial \hat{N}_1}{\partial \hat{I}} = \frac{1}{1+\sigma G_N}(1+\gamma) D_I > 0 \tag{31}$$

$$\frac{\partial \hat{N}_2}{\partial \hat{I}} = \left(1+\frac{z\sigma G_N}{1+\sigma G_N}\right)(1+\gamma) D_I > 0 \tag{32}$$

$$\frac{\partial \hat{\omega}_1}{\partial \hat{I}} = \frac{G_N}{1+\sigma G_N}(1+\gamma) G_I > 0 \tag{33}$$

$$\frac{\partial \hat{\omega}_2}{\partial \hat{I}} = -z\frac{G_N}{1+\sigma G_N}(1+\gamma) G_I < 0 \tag{34}$$

Suppose negative demand shocks. Then the employment of both skilled and unskilled decreases but the latter change is greater than the former. This denotes a buffer effect of unskilled labor in a sense that unskilled laborers suffer much more than the skilled from stagnant demand. Therefore

[Proposition 10] A negative demand shock acts to reduce employment of both skilled and unskilled and there the effect on unskilled is greater than that of skilled. The employment ratio of skilled is raised.

[Proposition 11] A negative demand shock reduces the real wage rate of skilled, and, in contrast, raises that of unskilled. Thus wage inequality is extended.

Next, as for the real income we have the following from (31) and (33).

$$\frac{\partial(\widehat{\omega_1 N_1})}{\partial \hat{I}} = \frac{1+\{1+(\sigma-1)(1+z)\}G_N}{1+\sigma G_N}(1+\gamma) D_I \tag{35}$$

$$\frac{\partial(\widehat{\omega_1 N_1})}{\partial \hat{I}} - \frac{\partial(\widehat{\omega_2 N_2})}{\partial \hat{I}} = \frac{(1-\sigma)(1+z)G_N}{1+\sigma G_N}(1+\gamma)\, D_I \tag{36}$$

If $\sigma > 1$, we have

[Proposition 12] A negative demand shock will decrease both the real income of skilled and unskilled and the real income inequality will be increased.

Next as for productivity changes, we have

$$\frac{\partial \hat{N}_1}{\partial \hat{A}_1} = -\frac{1-\sigma}{1+\sigma G_N} \tag{37}$$

$$\frac{\partial \hat{\omega}_1}{\partial \hat{A}_1} = -\frac{(1-\sigma)G_N}{1+\sigma G_N} \tag{38}$$

$$\frac{\partial \hat{N}_2}{\partial \hat{A}_1} = -\frac{\sigma z(1+G_N)}{1+\sigma G_N} < 0 \tag{39}$$

$$\frac{\partial \hat{\omega}_2}{\partial \hat{A}_1} = z\,\frac{1+G_N}{1+\sigma G_N} \tag{40}$$

Therefore, under the condition of $\sigma > 1$, we have

[Proposition 13] A rise in productivity of skilled tends to raise the employment of skilled and reduce the real wage rate of unskilled laborers. The employment ratio of skilled is raised.

[Proposition 14] A rise in productivity of skilled raises the real wage rate of both skilled and unskilled, and reduces the wage inequality where (*)(**) are assumed.

[Proposition 15] A rise in productivity of skilled labor raises their real income and reduces that of unskilled. The real income inequality increases.

The effective demand since the 1980s has stagnated and the labor productivity of skilled labor has increased relative to that of unskilled. If this is true, we can say

[C] A negative demand shock raises the relative employment of skilled labor and reduces the wage inequality.

[D] Productivity increase of skilled labor raises their relative employment ratio and, under (*)(**), reduces wage inequality. [8)]

8) A rise in the productivity of unskilled labor raises their real wage rate, and has no effects on skilled laborers.

7. Conclusion

It is a commonly observed fact in Japan that the non-organized laborers have been increasing in number especially since the mid 1980s. On the other hand, the relative wage between skill and unskilled shows no definite changes in Japan, which contrasts with European countries where wage inequality has increased.

In this paper we set up a macro model composed of two kinds of laborers, skilled organized laborers and unskilled non-organized laborers, where organized skilled laborers can attempt to determine their wage rate only through bargaining with capitalists, although the employment decision is left to capitalists. Using this dual labor model we show that the change in employment is consistent with the economic changes of weakened bargaining power of skilled laborers, intensified competition pressure in the commodity market and also stagnant demand conditions. However wage inequality will be reduced from the analysis of this dual economy model, which does not necessarily contradict the facts showing no definite change in Japan.

APPENDIXES

1. Bargaining

According to Layard, Nickell and Jackman(1991), unions and firms maximize the Nash product defined as $\Omega = (V-\bar{V})^{\beta}(\pi-\bar{\pi})^{1-\beta}$, where V is union's utility $V = S\omega + (1-S)\bar{A}$ and π is the profit. Here S is the probability of being employed in the same firm and $\bar{A}$ is the reservation wage when a laborer loses the job at the present firm. If we denote the expected wage in other firms by ω^e and the probability to be employed in other firms by θ, then $\bar{A}$ can be formalized as $\bar{A} = \theta\omega^e + (1-\theta)\omega_0$ where ω_0 is the unemployment compensation. Letting $\bar{V} = \bar{A}, \bar{\pi} = 0$, we have

$$\frac{\partial \log\Omega}{\partial \omega} = \frac{\beta}{\omega - \bar{A}} + \frac{\beta}{S}\frac{dS}{d\omega} + \frac{1-\beta}{\pi}\frac{\partial \pi}{\partial \omega} = 0$$

Noting $\partial\pi/\partial\omega = -N$ from the envelope theorem, we have

$$\frac{\omega - \bar{A}}{\omega} = \frac{\tau\beta}{1-\beta+\tau\beta\xi_{s\omega}} \tag{1-1}$$

where $\xi_{s\omega} = -\frac{dS}{d\omega}\frac{\omega}{S} > 0$, $\tau = \frac{\pi}{\omega N}$. Assuming $\omega^e = \omega$, $\theta = \theta(n)$, n being the employment ratio of skilled, then

$$\frac{\omega - \bar{A}}{\omega} = (1-\theta(n))\frac{\omega - \omega_0}{\omega} \tag{1-2}$$

From (1-1)(1-2) we have

$$\omega = \frac{\omega_0(1-\beta+\tau\beta\xi_{s\omega})}{1-\beta+\tau\beta\xi_{s\omega} - \frac{\tau\beta}{1-\theta(n)}} \tag{1-3}$$

Noting $\tau = \frac{1}{m\xi} - 1$, $\xi = F_1 \frac{A_1 N_1}{F}$, we have that ω is an increasing function of ω_0, β, n and a decreasing function of m, ξ, $\xi_{s\omega}$. If policy parameter ω_0 and the elasticity ξ, $\xi_{s\omega}$ are given as constant and the supply of skilled laborers is assumed as constant, ω becomes an increasing function of β, N_1 and a decreasing function of m, which is (8) in the text.

Equations (7) and (9) are derived from maximizing $\pi = F(A_1 N_1, A_2 N_2) - \omega_1 N_1 - \omega_2 N_2$ with the demand constraint $P = P(Y)$, whose elasticity is assumed constant.

2. Derivation of G_β, G_m, G_N

The probability of a skilled laborer being employed in an outside market is given by

$$\theta = \alpha \frac{N_1}{N_{1S}}.$$

Here N_{1S} is the supply of skilled labor, assumed constant and α (<1) means the subjective discount rate of his or her future employment possibility. The skilled laborers who are leaving are supposed to estimate their future opportunity to get skilled jobs at the discounted rate to the employment rate of skilled laborers N_1/N_{1S}. If $\omega_0 = 1$, $\xi_{s\omega} = 3$, $\alpha = 0.5$, $N_1/N_{1S} = 0.95$ in addition to (*) in the text, we have elasticities G_β, G_m, G_N as the sole function of β as follow.

$$G_\beta = \frac{a_1 \beta}{a_2 \beta^2 + a_3 \beta + a_4} \tag{2-1}$$

$$G_m = \frac{(b_1 \beta + b_2)\beta}{b_3 \beta^2 + b_4 \beta + b_5} \tag{2-2}$$

$$G_N = \frac{c_1 \beta}{c_2 \beta + c_3} \tag{2-3}$$

Here a_i, b_i, c_i are all constant parameters, not dependent on β. The figures illustrated in the graph taking β as the horizontal axis are Fig 2 in the text.

3. Derivation of $\hat{N}_1$, $\hat{\omega}_1$, $\hat{N}_2$, $\hat{\omega}_2$

omitted.

REFERENCES

Acemoglu, D.(1998), "Why Do New Technologies Complement Skills? Directed Technical Change and Wage Inequality," *Quarterly Journal of Economics*, November.

Autor, D., Katz, L., and Krueger, A.(1998), "Computing Inequality: Have Computors Changed the Labor Market?," *Quarterly Journal of Economics*, pp. 1169-213.

Bowles, S.(1970), "Aggregation of Labor Inputs in the Economics of Growth and Planning: Experiments with a Two-Level CES Function," *Journal of Political Economy*, Vol. 78.

Dougherty, C. R. S.(1972), "Estimates of Labor Aggregation Functions," *Journal of Political Economy*, Vol. 80.

Gregg, P. and Manning, A.(1997), "Skill-biassed change, unemployment and wage inequality," *European Economic Review*, 41, pp. 1173-1200

Johnson, G.E.(1997), "Changes in Earnings Inequality: The Roles of Demand Shifts," *Journal of Economic Perspectives*, Vol.11 No.2 pp. 41-54.

Layard, R., and Nickell, S.(1990), "Is Unemployment lower If Unions Bargain over Employment?," *Quarterly Journal of Economics*, vol.105,no.3, pp. 774-787.

Layard, R., Nickell, S. and Jackman, R.(1991), *Unemployment: Macroeconomic Performance and the Labour Market*, Oxford University Press.

Lai, E. L. C.(1995), "The Product Cycle and the World Distribution of Income: a reformulation," *Journal of International Economics*, 39(3-4), pp. 369-82.

McDonald, I. M. and Solow, R. M.(1981), "Wage Bargaining and Employment," *American Economic Review*, Vol.71, pp. 896-903.

McDonald, I. M. and Solow, R. M.(1985), "Wage and Employment in a segmented Labor Market," *Quarterly Journal of Economics*, vol.100, pp. 1115-1141.

Nakatani, T.,(1993), "A Model of Stagflation", Kobe University Economic Review 39

Osumi, Y.,(1998), "Skill Differential and Efficient Bargaining, unskilled labor market," *Economic Review of Oita university*, No.50 Vol.3.

Skott, P. and Auerbach, P.(2000), "Skill Asymmetries, Increasing Wage Inequality and Unemployment," mimeo.

Wood, A.(1994), *North-South Trade, Employment and Inequality: Changing Fortunes in a Skill Driven World*, Oxford: Clarendon Press.