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The Effect of Money on Unemployment under Flexible Money Wages

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I. Introduction

As Keynes himself recognized (*The General Theory* Ch. 19), unemployment in Keynesian models disappears when money wages fall in face of unemployment. Of course, as Keynes emphasized, and as Driskill and Sheffrin (1986) and De Long and Summers (1986) have recently formalized, falls in money wages in face of unemployment could be counterproductive in eliminating unemployment when their effect on expectations is taken into account. Yet, it considerably weakens the force of the Keynesian argument that the ad hoc assumption of money wage stickiness is crucial in the argument. Accordingly, many theories of the labor market have been advanced to vindicate the Keynesian notion of involuntary unemployment without the assumption of money wage stickiness. The efficiency wage hypothesis such as Shapiro and Stiglitz (1984) and the bargaining model such as McDonald and Solow (1981), and the insider-outsider model of Lindbeck and Snower (1984) are notable examples of these theories. A serious criticism against these theories as the vindication is that, though unemployment is shown to exist under flexible money wages, nominal money supply is not demonstrated to affect unemployment. Unless affected by nominal money supply, unemployment in the theories is close to Friedman's natural rate of unemployment, and then one can derive from the theories conclusions similar to those of new classical macroeconomics of Lucas (1972) and Barro (1976).

A recent idea to explain the effect of money on unemployment is the near-rational or menu cost theory of Akerlof and Yellen (1985), Mankiw (1985) and Blanchard and Kiyotaki (1987). This theory demonstrates that a change in money has a first order welfare-improving effect under very small irrationality or menu cost. However, the theory is concerned only with infinitesimally small changes in money supply, but not with large changes in it. Further, Caplin and Spulber (1987) show that menu cost does not imply the macroeconomic stickiness of money wages if the firm's price policy follows the plausible (S, s) rule. Moreover, the near-rational and menu cost theories critically depend on the assumption of differentiability of the revenue function; The theories do not hold when the revenue function is pointed. But, differentiability in economics is not an economic assumption, but merely an assumption to simplify calculation.

The purpose of this paper is to explain the effect of nominal money supply on unemployment without assuming money wage stickiness. The first element in the explanation is dependence of demands and supplies on government bonds through the wealth effect. As Patinkin (1965, ch. 4) already recognized, the dependence implies real effect of money; more rigorously, the neutrality proposition of money does not hold in the presence of other monetary assets, especially, government bonds. This real effect alone is not sufficient to yield the effect of nominal money supply on unemployment under flexible money wages. The second element needed in the explanation is labor market imperfection such as the efficiency wage consideration. The second element directs the real effect to employment, so that an increase in nominal money supply effects an increase in employment under flexible money wages. This paper is thus meant to complete the theory of labor market imperfection as a foundation of Keynesian theory.

The Ricardian equivalence theorem, which Barro (1976) recently revived and extended, contends that government bonds are not net worth, and so that they are irrelevant to the behavior of agents. The theorem then negates the dependence of demands and supplies on government bonds and so, in consequence, the

real effect of money as Patinkin (1965, p. 289) conceded. However, as Tobin (1980) expounds at length and Barro (1976) admits, the Ricardian theorem holds only under the combination of the assumptions of the perfect capital market, the (effectively) infinite time horizon of agents, and the lump sum taxation. Of course, households generally cannot borrow at the same rate as they lend, some families end up with being childless, and the lump sum tax taxation is not the principal tax in modern times. This paper introduces another, though related, simple reason why government debts are net worth.

For the purpose stated above, this paper develops a model, simple yet rigorous enough to be a dynamic general equilibrium model involving intertemporal optimization of agents. The model does not assume, but demonstrates that government debts are net worth, and it adopts the efficiency wage hypothesis as an example of labor market imperfection. One can show the same result in the framework of other labor market imperfections. We will discuss the related literature of Metzler (1951, 1973) and Mundell (1960).

II. A Model with Intertemporal Optimization

The outline of the model is the following. There are two periods in the model. The economy disappears afterwards. The situation of the economy changes between the two periods in two respects. First, workers may shirk in the first period because of the poor state of monitoring technology, but a dramatic improvement in the technology makes shirking impossible in the second period. Accordingly, the efficiency wage hypothesis applies in the first period, while the labor market is perfectly competitive, and cleared in the second. The main significance of the second period lies in providing the future period for intertemporal optimization in the first period. The simple environment of the competitive labor market could make the optimization concise. Second, while workers belonging to the economy in the first period (called original workers) stay there, possibly as descendant families, until the end of the second period, new workers enter into the economy in the beginning of the second period. The new workers are not the newly born, but immigrants to the economy.

Original workers are homogeneous before their fates over the employment status in the first period are determined. In particular, they have the same amounts of money and government bonds in the beginning of the first period, and also have equal rights over the representative firm's profit. To simplify the model by reducing the number of tradable assets, we assume the rights cannot be exchanged.

The product market is competitive in the both periods. We employ the concept of the representative firm that is competitive in the market.

The role of the government is limited to the collection of taxes to finance interest payments to its debts. The amount of the debts is constant over the two periods. This is, of course, merely an assumption for simplification. The tax is lump sum.

II-1. The Second Period Equilibrium

We now begin a formal account of the model. We solve the model backwards.

The Representative Firm The production technology of the representative firm in the second period is given as $y_2=\gamma K_2+L_2$, where y_2, K_2 and L_2 are its level of production, amount of capital, and level of employment in the second period. Since the firm is the representative one, these symbols also designate the corresponding aggregate variables. This applies also to other symbols to be introduced later. The number of original workers is normalized as one, and that of immigrants is β. Let w_2 and p_2 be the money wage rate and product price of the second period. Because the labor market is competitive, and cleared in this period,

(1) $w_2/p_2 = 1$,
(2) $L_2 = 1+\beta$

must hold.

The firm does not newly issue bonds in this period after which the economy disappears. But, it has B_f amount of its bonds outstanding in the period. One unit of bonds yields one unit of money this period as interest. Bonds need not be redeemed. Let $\Pi_2=p_2\gamma K_2$. The

firm's second period dividend is $\prod_2 - B_f$[1].

The Worker There are three types of workers in the second period——original workers employed and unemployed in the first period, and immigrants. Let subscripts e, u, and n indicate variables pertaining to original workers, employed and unemployed in the first period, and new workers (immigrants).

The second period budget constraint of an original worker is:

$$(3) \quad (M_{i1}+q_2B_{i1})+(w_2+\prod_2-B_f+B_{i2}-T_2)=M_{i2}+q_2B_{i2}+p_2c_{i2}, \quad \text{for } i=e,u.$$

The *LHS* means the following. M_{i1} and B_{i1} are the amounts of money and bonds the worker obtained in the first period through market transactions, and hence carried over to the second period. With q_2 being the bond price of the second period, $M_{i1}+q_2B_{i1}$ represents the value of his wealth in the period. All workers are employed in the second period to earn w_2. Original workers receive equal dividends from the representative firm. Their magnitude is $\prod_2-B_f$ because the number of original workers is one. Purchasing B_{i2} bonds in the second period, the worker receives B_{i2} interest from the firm and the government together. T_2 is the lump sum tax. Therefore, the terms in the second bracket in the *LHS* represent the after-tax income of original workers in the second period. The *LHS* is, thus, the sum of the financial wealth and the after tax income. The *RHS* shows that the income and wealth are used to obtain money balance M_{i2}, bonds B_{i2}, and consumption goods c_{i2}.

It is obvious from (3) that, when $q_2>1$, workers do not demand bonds in the second period, and when $q_2<1$, they do so in the infinite amount. In both cases, the bond market cannot be in equilibrium. Hence,

$$(4) \quad q_2=1$$

must hold. When (4) holds, the amount of bonds to purchase in the second period is irrelevant to the worker's behavior. Hence, we can assume without loss of generality, $B_{i2}=B_{i1}$. Hence, (3) reduces to

$$(3') \quad M_{i1}+B_{i1}+w_2+\prod_2-B_f-T_2=M_{i2}+p_2c_{i2} \quad \text{for } i=e,u.$$

Let $m_{i2}=M_{i2}/p_2$ *for* $i=e,u$. Original workers maximize *log* c_{i2} + *log* m_{i2} subject to (3') in the second period. Let Y_{i2} be the *LHS* of (3') divided by p_2. The maximization problem of the original workers yields:

$$(5) \quad c_{i2}=m_{i2}=Y_{i2}/2 \quad \text{for } i=e,u.$$

Let c_n and m_n be the level of consumption and the amount of the real balance of immigrants in the second period. The optimization problem of immigrants is to maximize *log* c_n + *log* m_n subject to the budget constraint, $w_2-T_2=p_2c_n+p_2m_n$. This maximization problem yields:

$$(6) \quad c_n=m_n=(w_2-T_2)/2p_2$$

The Government The government does nothing but collects tax to finance interest payments to its debts. The tax is lump sum. Let B be the amount of government bonds that is constant over the two periods. One unit of the government bond yields one unit of money as interest in the second period. It need not be redeemed. Then, the budget constraint of the government in the second period is simply:

$$(7) \quad (1+\beta)T_2=B.$$

Equilibrium We have already considered the equilibrium conditions of the labor and bond market. The remaining market to be considered is either the product or the money market. We choose the former. Let θ be the number of original workers who were employed in the first period. The equilibrium condition of the second period product market is:

$$(8) \quad y_2=\theta c_{e2}+(1-\theta)c_{u2}+\beta c_n.$$

The amounts of money and bonds the original workers carried over from the first to the second period add up to be equal to their stocks; that is,

$$M=\theta M_{1e}+(1-\theta)M_{1u}$$

and $B+B_f$

$$= \theta B_{e1} + (1-\theta) B_{u1}$$

hold identically, where M is the stock of money. Then, in view of (1) and (7), (8) reduces to :

$$(9) \qquad M = p_2 y_2.$$

That is, the quantity theory of money holds in the second period. By (1), (2), (7) and the second period technology,

$$Y_{i2} = 1 + \gamma K_2 + \{M_{i1} + B_{i1} - B_f - B/(1+\beta)\}/p_2.$$

The second period utilities of the original workers, U_{i2} for $i=e, u$, are given by :

$$(10) \qquad U_{i2} = -2 \log 2 + 2 \log Y_{i2} \quad \text{for } i = e, u.$$

II-2. The First Period Equilibrium

Now, we turn to the first period which is the subject of the interest in this section.

The Firm The production technology of the representative firm in the first period is the same as in the second period, but there is no capital. Accordingly, the firm's investment in the first period is K_2, and the technology of the period is $y_1 = L_1$, where y_1 and L_1 are the firm's levels of production and employment in the first period. Therefore, $\theta = L_1$ identically. Let q_1, p_1 and w_1 be the bond price, the product price and the money wage rate of the first period. Let $\prod_1 = p_1 y_1 - w_1 L_1$. The firm issues B_f amount of bonds in the first period. The firm then obtains $q_1 B_f$ proceeds from the issue. For notational simplicity, we assume the firm does not pay interest for B_f in the first period. It spends $p_1 K_2$ on investment. Then, $\prod_1 + q_1 B_f - p_1 K_2$ represents the first period dividend[2]. Since $\prod_2 - B_f$ gives the second period dividend, the firm maximizes the present value of all dividends, $\prod_1 + \prod_2/(1+i) - p_1 K_2 + (q_1 - 1/(1+i)) B_f$, where i is the interest rate. This maximization implies a positive or negative infinite value of B_f unless $q_1 = 1/(1+i)$ holds. Hence,

$$(11) \qquad q_1 = 1/(1+i)$$

must hold as the equilibrium condition of the first period bond market.

By (11), the firm maximizes $p_1 y_1 - w_1 L_1 - p_1 K_2 + p_2 \gamma K_2/(1+i)$. Then,

$$(12) \qquad 1 - w_1/p_1 \leq 0,$$
$$(13) \qquad -p_1 + p_2 \gamma/(1+i) \leq 0$$

must hold. If the *LHS* of (12) is positive, the firm demands infinite workers. This is impossible. Therefore, (12) holds. When (12) holds in strict inequality, $L_1 = 0$. Accordingly, $\prod_1 = 0$. When (13) does not hold, the firm invests infinitely. This is impossible. Hence, (13) must hold. When (13) holds in strict inequality, $K_2 = 0$.

Let $m = M/p_1$. On account of (9), (13) means $\gamma K_2 + 1 + \beta = y_2 \geq \gamma m x/(1+i)$ Here, $K_2 = 0$ when the inequality holds strictly. Hence,

$$(14) \qquad K_2 = \max\{m/(1+i) - (1+\beta)/\gamma, 0\}.$$

The Worker There are only original workers in the first period. Let c_{i1} and m_{i1} $(i = e, u)$ be the levels of consumption and the real balance of employed and unemployed original workers in the first period. The workers in the first period maximize $a_i + \log c_{i1} + \log m_{i1} + U_{i2} = a_i + \log c_{i1} + \log m_{i1} + 2 \log Y_{i2} - 2 \log 2$ *for* $i = e, u$. Note that the second period utility is considered in this maximization problem. Accordingly, the government budget constraint in the second period is taken account of in the maximization. $a_e = 0$, but $a_u > 0$, so that a_u represents the utility from not working.

The original worker maximizes the above objective function subject to the following budget constraint:

$$(M + q_1 B) + (z_i - p_1 K_2 + q_1 B_f) = q_1 B_{i1} + p_1 c_{i1} + p_1 m_{i1}.$$

As already noted, B_{i1} denotes the bond purchase in the first period. Letting $z_i = w_1$ for $i = e$ and $z_i = 0$ for $i = u$, z_i denotes the wage income of an original worker. The *RHS* is the sum of outlays on the bond purchase, consumption, and the real balance holding. The *LHS* on the other hand represents the sum of the first period income, $z_i - p_1 K_2 + q_1 B_f$, and the value of the initial wealth, $M + q_1 B$. Each original worker is endowed with the same amounts of money and government bonds, M and B. Since the number of original workers is normalized as unity, M and B also

represent individual holdings. $M+q_1B$ is then the value of each original worker's initial financial wealth. In addition to the wage income z_{i1}, each original worker receives the equal first period dividend of $\prod_1-p_1K_2+q_1B_f$ which equals $-p_1K_2+q_1B_f$ on account of $\prod_1=0$. For notational simplicity, we assume the government and the firm pay interest on their debts only in the second period. Accordingly, original workers have no interest income in the first period, and pay no tax since the government need not finance its interest payments in the first period. Thus, the terms in the second bracket of the *LHS* represent the first period income of an original worker.

Substituting Y_{i2} into the above first period budget constraint to delete B_{i1}, one obtains:

$$M+\beta q_1B/(1+\beta)+z_i+q_1p_2 = q_1p_2Y_{i2}+p_ic_{i1}+(1-q_1)p_1m_{i1}$$

because of (11) and (13). Let Y_{i1} denote the *LHS* of the above divided by p_1. Then the first period maximization problem of original workers yields:

$$(15)\qquad c_{i1}=Y_{i1}/4,\ m_{i1}=Y_{i1}/4(1-q_1) \text{ and } Y_{i2}=p_1Y_{i1}/2p_2q_1.$$

Demands for the real balance and consumption depend on the real value of government bonds through Y_{i1}. (15) means that the government debts are net worth in the model. They exist effectively as another monetary asset. This is simply because original workers do not take account of the tax liabilities of immigrants. When $\beta=0$, Y_{i1} and hence c_{i1} and m_{i1} do not depend on B.

Someone argued that the government debts should cease to be net worth even with immigrants if the government spends money for immigrants who burden tax to pay interest of the government debts, for instance, on immigrants' language education. This view is not valid. Government debts remain net worth unless the spending is, and is conceived by the original workers to be, proportional to the amount of government debts.

The Efficiency Wage Because the firm can monitor workers only imperfectly in the first period, the efficiency wage hypothesis applies in the period. We use a simplified version of the Shapiro-Stiglitz model in the following.

Let U_e be the life time utility of an employed original worker who does not shirk, and U_u that of an unemployed original worker; that is,

$$U_e=U_0+4\ log\ Y_{e1},\text{ and } U_u=a_u+U_0+4\ log\ Y_{u1},$$

where $U_0=-8\ log\ 2-\{\log p_2+log\ q_1-log\ p_1\}-log(1-q_1)$. If employed workers shirk undetected, they obtain both the wage income and the utility from not working. If U_s denotes their life time utility, then, $U_s=a_u+U_e$ holds. If employed workers shirk, but are caught, they are fired and unemployed throughout the first period[3]. They must forfeit the wage of the first period. Accordingly, U_u also denotes their life time utility.

The monitoring technology in this paper is the same as in Shapiro and Stiglitz (1984); the firm can detect shirking workers in the exogenously determined probability of a. When $(1-a)U_s+aU_u<U_e$, employed workers shirk, and the firm pays wages to some workers without obtaining output. When $(1-a)U_s+aU_u<U_e$, unemployed workers propose to the firm that they work for wages which are lower than the going level. The firm accepts this proposal, and employs them since the wages provide no incentive for shirking. Therefore, the efficiency wage must satisfy $(1-a)U_s+aU_e$; namely, letting k be defined by $a_u/4a=\log\{(1+k)/k\}$,

$$(k+1)Y_{u1}=kY_{e1}.$$

Because of $a_u/4a>0$, $k>0$. On account of $Y_{e1}=Y_{u1}+w_1/p_1$, one has

$$(17)\qquad w_1/p_1=Y_{u1}/k.$$

as the formula of the efficiency wage.

The First Period Equilibrium Since the firm's investment is K_2, the equilibrium conditions of the product and money markets are:

$$y_1=\theta c_{e1}+(1-\theta)c_{u1}+K_2,$$
$$m=\theta m_{e1}+(1-\theta)m_{u1}.$$

On account of(15),(17), and $\theta=L_1=y_1$, the above two equations become to resemble the simple Keynesian system; that is, they respectively become

$$(18) \qquad y_1 = (w_1/4p_1)(y_1+k)+K_2,$$
$$(19) \qquad m = \{w_1/4p_1(1-q_1)\}(y_1+k).$$

$(w_1/4p_1)(y_1+k)$ gives the aggregate consumption given national income, y_1. This looks like the consumption function in the Keynesian model. Therefore, the multiplier works in this model.

Because of(12), $w_1/p_1 \geq 1$. Further, $k>0$. Then, (18) means y_1 and so L_1 are positive. Hence, by(12), $w_1/p_1=1$. Accordingly, (18) and(19) reduce to;

$$(20) \qquad y_1 = (k+4K_2)/3,$$
$$(21) \qquad m = (k+K_2)/3(1-q_1).$$

By(17), we have

$$(22) \qquad k = Y_{u1} = m+\beta q_1 mB/(1+\beta)M + q_1p_2/p_1.$$

One can solve(14),(20),(21), and(22) for K_2, m, y_1, and q_1 in terms of M, B and other parameters. Consider first the case in which $m/(1+i) \leq (1+\beta)/\gamma$ holds in the first period equilibrium. Then, $K_2=0$ by(14). We also have:

$$m = k\{1+2(1+\beta)/(2+\beta+\beta B/M)\}/3$$
$$y_1 = k/3$$
$$q_1 = 1-k/3m.$$

Furthermore, $m/(1+i) \leq (1-\beta)/\gamma$ means $2k\gamma/3 \leq 2+\beta+\beta B/M$.

On the other hand, if $m/(1+i) > (1+\beta)/\gamma$ holds in the equilibrium, one has:

$$m = k/3-(1+\beta)/3\gamma+(2k\gamma+\beta-2)/3\gamma\{4+3\beta B/(1+\beta)M\},$$
$$y_1 = m-(1+\beta)/\gamma,$$
$$q_1 = 3/4+(1+\beta-\gamma k)/4m\gamma,$$
$$K_2 = (k\gamma+\beta-2)/\gamma\{4+3\beta B/(1+\beta)M\}-(1+\beta)/\gamma.$$

$m/(1+i) > (1+\beta)/\gamma$ means $2k\gamma/3 > 2+\beta+\beta B/M$.

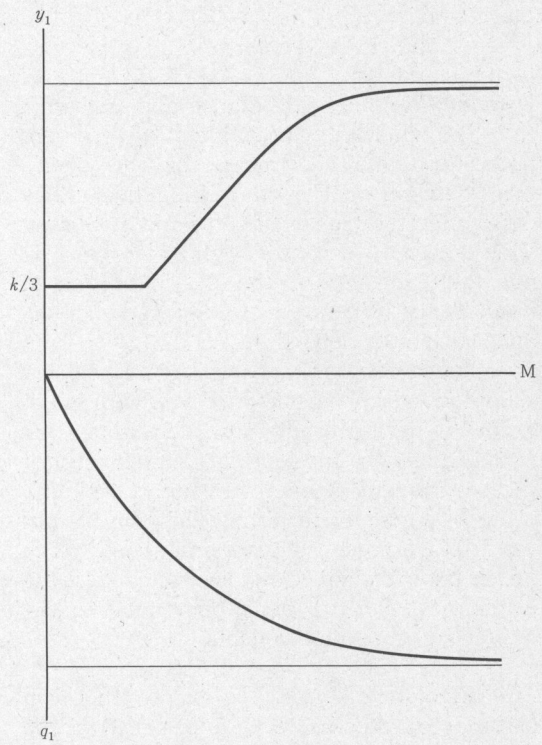
Since B/M is positive, the second case does not occur, but the first case does when $2k\gamma/3 \leq 2+\beta$. When $2k\gamma/3 > 2+\beta$, the second case occurs for sufficiently large M. In both cases, the real stock of money, m, increases and the nominal interest rate, i, falls as the nominal stock of money, M, increases.

Accordingly, we have the following proposition that gives the formal characterization of our model:

Proposition If $2k\gamma > 3(\beta+2)$, $y_1=k/3$ for $M \leq M'$ and y_1 increases with M for $M>M'$ where $M'=3\beta B/\{2k\gamma-3(\beta+2)\}$. When $2k\gamma \leq 3(\beta+2)$, $y_1=k/3$ for any $M \geq 0$. In both cases, the interest rate falls as M increases.

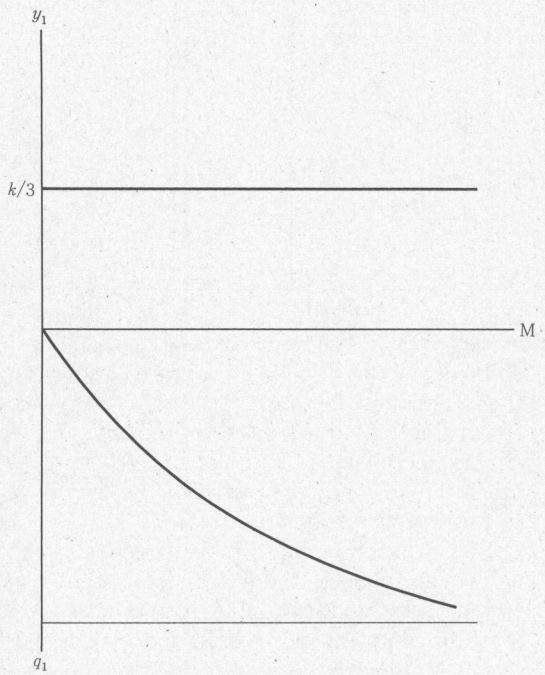
The proposition is graphically depicted in Figure 1 and 2 where the horizontal axis measures the amount of money, and the vertical one the level of the first period output upwards and the interest rate downwards. Figure 1 shows that an increase in money supply lowers the interest rate and increases output for large M when $2k\gamma/3 > \beta+2$. Figure 2 shows it has no effect on output when $2k\gamma/3 \leq \beta+2$.

FIGURE 1



Thus, we have shown that an association of the efficiency wage hypothesis with government bonds as net worth can produce an effect of money on aggregate output and unemployment under flexible nominal wages when the productivity of investment (γ) is sufficiently large, and when money supply is sufficiently large.

FIGURE 2



It must be seen that nominal money supply has no effect on the current aggregate output and unemployment in the absence of either government bonds or the efficiency wage consideration. Suppose $\beta=0$, so that the Ricardian equivalence theorem does hold, and that government bonds are not net worth. In the case, we have:

$y_1 = k-2/\gamma$, $q_1 = 1/2$, $m = k-1/\gamma$, and
$K_2 = k/4-3/2\gamma$ for $k\gamma \geq 3$,
$y_1 = k/3$, $q_1 = 1/2$, $m = 2k/3$, and
$K_2 = 0$ for $k\gamma < 3$.

Thus, increased money supply has no real effect, in particular, on the current aggregate output and unemployment. The efficiency wage hypothesis alone does not account for the effect of money on unemployment under flexible money wages.

When the firm detects worker's shirking perfectly so that the efficiency wage hypothesis does not apply, (17) is not relevant. Instead, the condition of the cleared labor market is. That is, we have $\theta=1$ and $y_1=1$. There is no effect of money on the current aggregate output and unemployment, trivially. With government debts being net worth to original workers, nominal money supply yet has a real effect. In this case, an increase in money supply stimulates investment. But, it has the effect of reducing consumption, so that the level of national income is constant in the first period.

II-3. Interpretation

Let me explain intuitively how the efficiency wage consideration, in combination with government debts as net worth, yields the effect of nominal money supply on unemployment under flexible nominal wages.

As Patinkin (1965, Ch. 4, Sec.4) already pointed out, it is when money is the only monetary asset that the neutrality proposition of money holds. In that condition, demand and supply functions are homogeneous of degree zero with respect to all prices (including, of course, wages) and nominal money. From this property immediately follows the proposition that an increase in money brings about only increases in all prices without real consequence if all prices are flexible. In the presence of monetary assets other than money, by contrast, demand and supply functions typically become homogeneous of degree zero with respect to all prices and **all** monetary assets. Then, one has the extended neutrality proposition that increases in all monetary assets result in increases in all prices without any real effect. The extended proposition implies an increase in money alone generally has some real effects even under flexible prices in the presence of monetary assets other than money, especially when the Ricardian equivalence theorem does not hold so that government bonds are net worth to effectively exist as another monetary asset[4]. (When the Ricardian theorem holds, however, government debts are not present effectively. They are not net worth, and do not affect individual behaviors. Demand and supply functions do not depend on the government debts, and

remain homogeneous of degree zero with respect to money and prices if one ignores income redistribution between private creditors and debtors in the event of inflation.)

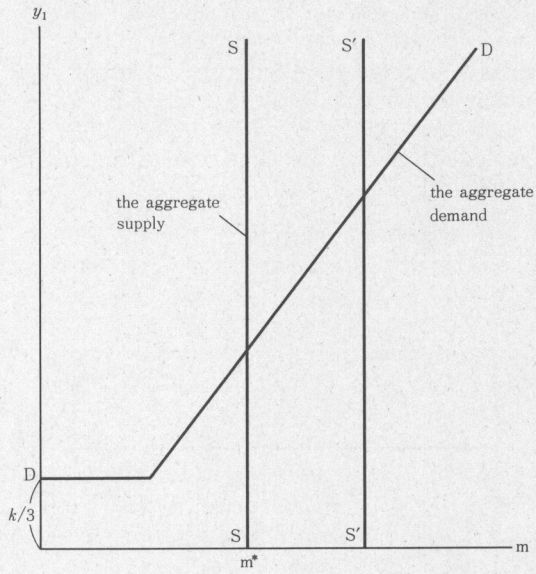
The source by which the Ricardian theorem fails to hold in this paper is immigrants in the second period. They will burden tax in the period. The rational behavior of those living in the first period does not take account of the immigrant's tax liabilities. This means government debts are net worth in the first period. Barro(1986)has already suggested this implication of immigration.

The extended proposition alone is not sufficient to yield the effect of money on unemployment——there is no guarantee that the real effect goes to unemployment. Indeed, as seen in the end of the last subsection, if the labor market is cleared with inelastic labor supply, there is obviously no scope for the effect of money on employment. We now turn to see how the extended proposition together with the efficiency wage translates into the effect of money on employment under flexible money wages.

(18)and(19)respectively correspond to the *IS* and *LM* curve in the standard Keynesian model. Solving(18)and(19)for y_1 and q_1 in terms of m given $w_1/p_1=1$ yields $y_1=f(m)$ and $q_1=g(m)$. $p_1=M/f^{-1}(y_1)$gives the usual aggregate demand function. In this paper, we define $y_1=f(m)$as the aggregate demand function. The function is depicted as the *D-D* curve in Figure 3 where the horizontal axis measures m and the vertical one y_1. The aggregate supply function comes from the efficiency wage consideration. Substituting $q_1=g(m)$into the *RHS* of(22), and in light of (11)and(13), one sees the *RHS* is an increasing function of m when K_2 is positive. Then, there is a unique m, say m^*, that establishes (22). When m is less than m^*, the *RHS* of (22)is less than k. This means the marginal productivity of labor which is assumed unity exceeds the efficiency wage. The firm then wants to employ an infinite amount of labor and to supply infinite output. When m is more than m^*, the opposite occurs. Therefore the aggregate supply function is vertical at m^* as the *S-S* line in Figure 3[5]. The equilibrium output is determined at the intersection of the *D-D* curve and *S-S* line in Figure 3.

m^* depends on the amount of the nominal

FIGURE 3



money stock. When M increases, m^* does. This means the *S-S* line in Figure 3 moves to the right, for instance, to the *S′-S′* line. Accordingly, an increase in money supply effects increases in output and so employment. This is the contention of the first part of the former proposition.

The intuition behind the dependence of m^* on M and hence the effect of money on employment under flexible money wages is the following. An increase in nominal money supply raises the output price. If the rise keeps the real balance constant despite the increase in nominal money supply, the value of the worker's financial wealth decreases because the government debts, which is now net worth and constant nominally, constitutes the wealth partly. Then, the wage income weighs more relatively to the financial wealth in the employed worker's budget. It follows the efficiency wage can be lower, in other words, that an yet lower real wage can now prevent workers form shirking. Given the constant marginal productivity of labor, a lower efficiency wage gives the firm an incentive to expand infinitely. This is impossible. Therefore, when nominal money supply increases, the output price rises, but not proportionally, so that the real balance as well increases. The money wage rate also rises in accordance with the output price to keep the real wage rate constant.

An increase in the real balance stimulates the investment, and hence increases output and employment as in the standard Keynesian model. The labor necessary for the expansion of output is available since the efficiency wage consideration has prevented clearance of the labor market.

The effect of money on aggregate output and employment works through its effect on investment. Therefore, the effect does not exist when investment is zero on account of a smaller money supply (a higher interest rate) and a lower marginal productivity of capital. This is the contention of the second part of the proposition.

When government debts are not net worth, the workers' financial wealth does not include the debts. Then, an increase in nominal money supply raises the output price proportionally to keep the real balance, and so the financial wealth constant. Then, the efficiency wage is in balance with the marginal productivity of labor. In other words, M does not affect m^*. The S-S line in Figure 3 does not move in response to an increase in nominal money supply. There is no effect of nominal money supply on unemployment.

II-4. Metzler and Mundell

Important contributions to the wealth effect and significance of government debts in relation to monetary policy are Metzler (1951, 1973) and Mundell (1965). This paper of course differs from them in the purpose—— the former intends to show the effect of monetary policy on unemployment, while the latters its effect on the real interest rate and capital accumulation given full employment. More important, this paper as well as Patinkin (1965) differs from Metzler and Mundell in the source of the real effect of monetary policy. Let me discuss this difference in some detail in view of the importance of their works.

Government debts in the works of Mundell and Metzler are real bonds as opposed to nominal bonds assumed in this paper. Government debts are, in consequence, a real variable in the formers. It follows that, even if government debts are net worth for whatever reasons, the system is homogeneous of degree zero with respect to money and prices alone in the models of Metzler and Mundell unlike in this paper[6]. As both Metzler and Mundell point out, pure money transfer therefore has no real effect under flexible nominal wages and prices in agreement with the conclusion of the standard neoclassical model. This is contrary to our conclusion.

As Mundell clearly points out, further, the absence of the real effect of pure money transfer implies that the open market operation is nothing but transfer of real bonds. When government debts are somehow conceived as net worth as Metzler assumes, then, the open market operation constitutes a parametrical change in a real exogenous variable, and hence it is no strange that it has real effect. This is the Metzler's result. By contrast, when the debts are not conceived as net worth, the operation does not constitute the parametrical change. The effect of the operation is restricted only to effects from possible tax distortions due to a non-lump sum taxation that is used to finance interest payments of the debts. This is what Mundell (1960) points out.

This paper as well as Patinkin (1965) assumes nominal bonds. The system then becomes homogeneous of degree zero with respect to money, government debts and prices when the debts are net worth for whatever reasons. In that case, pure money transfer, whose consequence is what is analyzed in this paper, has some real effect. When the Ricardian equivalence theorem does not hold, money transfer, causing price increases, decreases the real value of government debts. This decrease does not occur in the Metzler and Mundell models where the debts are assumed real and so their real value is independent of general inflation.

III. Conclusion

Unemployment in Keynesian theory disappears when money wages fall in face of unemployment. Several theories of labor market imperfection are proposed to account for unemployment without the ad hoc assumption of money wage stickiness, and thereby to provide a foundation of Keynesian theory. However, the theories lack demonstration of the effect of money on unemployment. Without the demonstration, unemployment in the theories is, after all, a variant of Friedman's natural rate of unemployment,

contrary to the intention of the theories.

This paper has shown that, when the Ricardian equivalence theorem breaks to make government bonds effectively another monetary asset, increased money supply reduces unemployment of the efficiency wage hypothesis under flexible nominal wages. Thus, this paper completes the efficiency wage hypothesis as a foundation of Keynesian theory. The Ricardian equivalence theorem does not hold in this paper because of the future inflow of immigrants whose tax liabilities are not taken account of in the present optimization of agents presently consisting of an economy.

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Notes

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1) We identify the net cash flow with dividend. The firm does not retain profit in the first period. Generality is not lost by this assumption.

2) We do not assume here the adjustment cost of capital as in Lucas(1967), and Uzawa(1969). This is only because it simplifies subsequent calculations.

3) Since the monitoring is perfect in the second period, the firm employs in the period even workers who shirked in the first period.

4) Sargent(1979, p. 67)also points out this. However, his attribution of this fact to Metzler(1951)is wrong. Assuming real securities, Metzler points out a different property. We discuss this later.

5) The extreme form of the aggregate supply function is due to the assumption of the constant marginal productivity of labor. The decreasing marginal productivity gives a negatively declined aggregate supply curve. The basic understanding of the economic mechanism does not depend on the assumption of the constant marginal productivity. The assumption simplifies the exposition.

6) When government debts are not net worth, they drop off from the system in effect. Hence, whether the debts are real or nominal, the system is homogeneous of degree zero with respect to money and prices alone.

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