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THE EFFICIENCY WAGE HYPOTHESIS: A MESOECONOMIC ANALYSIS

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The Efficiency Wage Hypothesis: A Mesoeconomic Analysis*

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Abstract In this paper, we apply the mesoeconomic approach to examine the efficiency wage hypothesis. With the traditional formulation of the efficiency wage hypothesis, we show that under certain conditions, the economy has a continuum of equilibria and that nominal shocks can have real effects depending on the firms' expectations. With a modified formulation of the efficiency wage hypothesis, we capture the weak positive correlation between real wage and employment and show that nominal shocks may have real effects in an economy without a continuum of equilibria.

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Efficiency Wage Hypothesis: A Mesoeconomic Analysis

1. Introduction

The efficiency wage hypothesis is essentially the proposition that there exists a positive relationship between wage rate and labor productivity. This hypothesis was first proposed by Leibenstein (1963) who argued that in economically backward areas, the effort of a laborer depends on his energy level, and the energy level depends on his nutrition which depends on his income. In developed economies, wage can affect the quality of labor through the adverse selection effect -- when the wage is low, the proportion of high quality workers willing to take the job will also be low -- or the incentive effect -- higher wages induce more work effort (see Weiss, 1991). Solow (1979) first used the wage-productivity relationship to explain wage stickiness by suggesting that wage stickiness is consistent with an employer's profit maximization behaviour. Following Solow (1979), a class of models (dubbed as efficiency wage models) have been developed (see Akerlof and Yellen, 1986 for a survey). The efficiency-wage models are capable of explaining involuntary unemployment and some other stylized facts in the labor market such as dual labor market and discrimination. However, as noted by Benassi, Chirco and Colombo (1994), most of the models are motivated to explain wage stickiness and thus (perhaps rightly) confine themselves to partial equilibrium analysis. Consequently, these models do not capture the interactions between the labor market and other markets, in particular, they are not concerned with the effect of a change in aggregate demand on real variables such as output and the level of employment.

In this paper, we extend the standard efficient wage model beyond the partial equilibrium framework. Specifically, we apply the mesoeconomic analysis to study the effect of aggregate demand shock on equilibrium price, output and employment. In simple words, the mesoeconomic analysis is a microeconomic analysis of the *price-setting* representative firm that takes into account the effects of macroeconomic variables (Ng, 1986, p.4)[1]. By incorporating the efficiency wage hypothesis into the mesoeconomic analysis, we show that there may exist involuntary unemployment at equilibrium, and more importantly that nominal shocks can have real effects. The real effect can be explained by the formation of price expectation associated with nominal shocks if the economy has a continuum of equilibria, in which case there exists an inter-firm macroeconomic externality in the sense that a price reduction of one firm increases the real demand for the output of other firms. If the economy does not have a continuum of equilibria, the real effect can be explained by the time lag in the responding to demand shocks by certain sectors. In the context of the efficiency wage hypothesis, if workers' effort depends on the ratio of wage to unemployment benefit, a nominal shock can change this ratio in the short run as the change in unemployment benefit is likely to lag behind nominal wage changes. This time lag is understandable because under the efficiency wage hypothesis, nominal wage is determined by the firm, whereas unemployment benefit is typically dependent on the budgetary process. We shall also argue that the performance of the economy may also affect workers' effort, in which case the efficiency wage hypothesis can provide an explanation for the observed weak correlation between real wage and employment.

In the following section, we outline a simple mesoeconomic model. Then in section 3, we incorporate the efficiency wage hypothesis to the mesoeconomic model to examine the effect of aggregate demand shocks. We use different formulations of the efficiency wage

[1] This analysis was advanced by Ng (1980, 1982) and was regarded by Marris (1991) as a pioneer of microeconomic foundation of modern Keynesian economics. It is called mesoeconomics because it "focuses on the microeconomics of the representative firm" but is able to capture the essential micro-macro interactions, thus it is "somewhere between microeconomics and macroeconomics and between partial- and general-equilibrium analysis"(Ng, 1986, p.4).

hypothesis including the simplest version as in Solow (1979), and other formulations in line with Akerlof (1982). We conclude the paper in section 4.

2. A Simple Mesoeconomic Model

The model presented here is based on Ng (1980, 1982). Consider an economy with N (N is assumed to be large) representative firms, each producing a distinct good x^i ($i = 1, ..., N$). We present the short-run model such that the number of firms is fixed (for the long-run model, see Ng, 1986, Chapter 4). From a general utility maximisation problem

$$\max U = U(x^1, x^2, ..., x^N)$$
$$s.t. \sum p^i x^i = \alpha,$$

and we can derive the demand function faced by each firm

$$q^i = f^i(p^1, p^2, ..., p^N, \alpha),$$

which can be simplified as (superscripts are dropped for simplicity)[2]

$$q = f(p, P, \alpha) = q(p/P, \alpha/P),$$

where P is the average price of $p^1, p^2, ..., p^N$, α is the nominal aggregate demand. The second equality is due to the fact that demand functions are homogeneous of degree zero in all prices and income.

The cost function of the representative firm is assumed to be

$$C = C(q, Q, P, \varepsilon^c),$$

where C is a twice-differentiable total cost function and ε^c is a set of exogenous factors affecting costs. The average price (P) can affect costs through the price of inputs, aggregate output (Q) can affect costs through affecting wage rate or through external economies or diseconomies.

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[2] This simplification is one of the main features of the mesoeconomic analysis. For a methodological justification, see Ng, 1986, chapter 3 and Appendix 3I.

Note that both micro and macroeconomic variables are included in the model, the impact of external shocks on the whole economy can be investigated. Assume that the representative firm maximizes its profit (π) with respect to the variables under its control, i.e.,

$$\max_{q} \pi = pq(p, P, \alpha) - C(q, Q, P, \varepsilon^{c}).$$

Notice that the representative firm takes the aggregate variables P, Q as given. The first-order conditions is

$$\mu \equiv p(1 + \frac{1}{\eta(p / P, \alpha / P)}) = c(q, Q, P, \varepsilon^{c}), \qquad (1)$$

where μ is the marginal revenue, $\eta \equiv \frac{\partial q}{\partial p}\frac{p}{q}$ is the price elasticity of demand, c is the marginal cost of the representative firm.

The nominal demand is assumed to be a function of the average price, aggregate output, Q, and some exogenous set of (nominal) factors, ε^{d}, such as money supply, fiscal policy variables and other autonomous (independent of P and Q) factors affecting spending

$$\alpha = \alpha(P, Q, \varepsilon^{d}); \qquad (2)$$

with $\eta^{\alpha P} \equiv \frac{\partial \alpha}{\partial P}\frac{P}{\alpha} < 1$, $\eta^{\alpha Q} \equiv \frac{\partial \alpha}{\partial Q}\frac{Q}{\alpha} < 1$.

As we have assumed that firms are representative, at equilibrium we have

$$p = P, \qquad (3)$$

and

$$\frac{\alpha}{P} = Q = Nq. \qquad (4)$$

Totally differentiate equations (1)-(4), we can obtain the following comparative statics results that characterize the responses of average price and aggregate output to a nominal demand shock.

$$\sigma^{P\bar{\alpha}} = \frac{\eta^{cq} + \eta^{cQ} - D}{(1-\eta^{cP})(1-\eta^{\alpha Q}) + (\eta^{cq} + \eta^{cQ} - D)(1-\eta^{\alpha P})} \tag{5}$$

$$\sigma^{Q\bar{\alpha}} = \frac{1-\eta^{cP}}{(1-\eta^{cP})(1-\eta^{\alpha Q}) + (\eta^{cq} + \eta^{cQ} - D)(1-\eta^{\alpha P})}, \tag{6}$$

where $\sigma^{xy} \equiv \frac{dy}{dx}\frac{x}{y}$ is the total elasticity of x with respect to y; and $\eta^{xy} \equiv \frac{\partial y}{\partial x}\frac{x}{y}$ is the partial elasticity of x with respect to y; $D \equiv \frac{\partial \mu}{\partial(\alpha / P)}\frac{(\alpha / P)}{\mu}$ is the effect of real aggregate demand on marginal revenue (μ) through possible changes in demand elasticity at given prices; and $\bar{\alpha}$ is the exogenous change in nominal aggregate demand[3].

As the denominators of equations (5) and (6) are non-negative (otherwise the system is unstable), whether nominal shocks have real effects depends on the signs of the numerators. We consider four cases of interest. Case 1: If $1 - \eta^{cP} = 0$, $\eta^{cq} + \eta^{cQ} - D > 0$, then an increase in aggregate demand will lead to an increase in the price level without affecting the real output. This is a neoclassical result. Case 2: If $1 - \eta^{cP} > 0$, $\eta^{cq} + \eta^{cQ} - D = 0$, then output increases in response to an increase in nominal demand with no change in the average price level. This is a Keynesian result. Case 3: If $1 - \eta^{cP} > 0$, $\eta^{cq} + \eta^{cQ} - D > 0$, then both output and price level increase with positive nominal demand shock. Case 4: If $1 - \eta^{cP} = 0$, $\eta^{cq} + \eta^{cQ} - D = 0$, then output is indeterminate, or in other words, there is a continuum of equilibria. In this case, the outcome depends entirely on price expectation and the expectation will be self-fulfilling -- if firms expect a nominal demand shock to bring a proportionate change in price, then the nominal shock will indeed bring a proportionate change in price with no real effect; otherwise, if firms expect no price change, then price will indeed remain unchanged while output increases in the same proportion as the nominal demand change. Thus, we call this

[3] For more details of the derivation of these results, see Ng (1982).

"the expectation wonderland" case. In the absence of external shocks, the economy may stay in a low-output equilibrium, and there exists an inter-firm macroeconomic externality: an increase in one firm's output and the resulting decrease in its price increases the real demand of other firms (see Ng, 1986, p.42-47). We can illustrate this case in Figure 1.

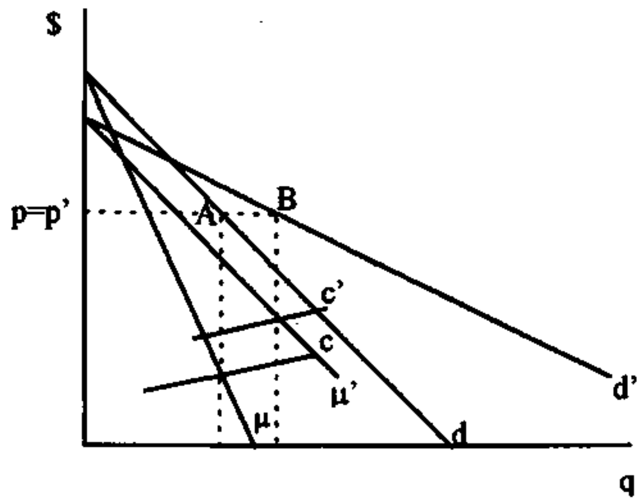

Figure 1

In Figure 1, the representative firm is at point A where marginal revenue (μ) equals to marginal cost (*c*), and the price is *p*. With a nominal demand shock, the demand curve moves to *d'* which is more elastic (D>0). If the firm expects no price change (this, as shown in Figure 1, could happen even if the marginal cost curve is upward sloping, i.e., $\eta^{cq} > 0$, and moves up as output expands, i.e., $\eta^{cQ} > 0$), it moves to a new equilibrium point B with higher output and the same price.

A remarkable feature of the above mesoeconomic model is that it incorporates both the traditional and the Keynesian results in a simple yet convincing way; and it introduces a special case of a continuum of equilibria. In this special case, nominal demand shocks *can* have real effects even if there is no menu cost, asymmetric information, or time lags.

In the next section, we apply the results of the simple mesoeconomic model (equations (5) and (6)) to examine the implications of the efficiency wage hypothesis. For simplicity, we assume $D = 0$, that is, a change in nominal demand is assumed not to appreciably change price elasticity of demand at given prices[4]. If $D > 0$ (or $D < 0$), that is, there is an increase (or decrease) in price elasticity associated with an increase in real aggregate demand, the structure of our analysis does not change, but the parameter range where non-traditional results (cases 2, 3, and 4) occur increases (decreases) because a higher (or lower) price elasticity encourages the representative firm to reduce (increase) price.

3. The Efficiency Wage Hypothesis and the Effects of Nominal Demand Shocks

Assuming $D = 0$, it is clear from equations (5) and (6) that nominal demand shocks may or may not have real effects depending on the representative firm's cost conditions, i.e., the elasticities of the firm's marginal cost to its own output and aggregate output ($\eta^{cq} + \eta^{cQ}$), and to average price (η^{cP}). Ng (1986) outlined several real world factors which can lead to a continuum of equilibrium and thus the possibility of non-neutrality of nominal shocks. These factors include union maximization behaviour, revenue maximization and average-cost pricing. In this section, we show that the efficiency wage hypothesis in its simple formulation can also produce non-neutrality of nominal shocks if the economy has a continuum of equilibria. In addition, we reformulate the hypothesis in line with Akerlof (1982) and show that nominal shocks may be non-neutral even if there does not exist a continuum of equilibria. We also argue that the state of the economy indicated by aggregate output can affect workers effort, which may serve as an explanation for the weak correlation between real wage and employment.

3.1. The simple formulation of the efficiency wage hypothesis

[4] This simplifying assumption is common in related macroeconomic models, see, for instance, Blanchard and Kiyotaki, 1987.

The simple formulation of the efficiency wage hypothesis assumes a positive relationship between work effort (e) and real wage, i.e.,

$$e = e(w / P), \qquad (7)$$

with $\partial e / \partial (w / P) > 0$ and $\partial e^2 / \partial^2 (w / P) < 0$. In this formulation, real wage enters the firm's production function through the efficiency function, for instance, $q = F(e(w / P), l)$, where l is the quantity of labor. Firms are assumed to be wage-setters (firms are also price-setters in our model) -- they choose both the wage rate and the number of workers they hire to maximize profit. Firms will choose an efficiency wage which is higher than the market clearing wage to induce more work effort (higher productivity), thus there is involuntary unemployment at equilibrium.

Assume that the production function of the representative firm takes the simple form

$$q = (e(\frac{w}{P})l)^{\beta},$$

then the firm's decision problem is first to choose a wage rate that minimizes the average cost per unit of efficient labor, then to choose the price (or quantity) of its product to maximize profit. The first stage decision problem is

$$\min_{w} \frac{w}{e(w / P)}.$$

The first-order condition gives us the "Solow condition":

$$\eta^{ew} \equiv \frac{\partial e}{\partial w}\frac{w}{e} = 1, \qquad (8)$$

from which we obtain the efficiency wage $w^* = w^*(P)$ and the representative firm's cost function

$$C = w^* q^{\frac{1}{\beta}} e^{-1}(w^* / P)$$

and the marginal cost is

$$c = \frac{1}{\beta} w^*(P) q^{\frac{1}{\beta}-1} e^{-1}(w^*/P). \tag{9}$$

Once the efficiency wage has been chosen, the firm's price (or output) choice and the comparative statics are the same as the general mesoeconomic model presented in section 2. Thus we can simply use the results of the mesoeconomic model in section 2 (equation (5) and (6)) to examine the effects of nominal shocks. From equation (9), we have

$$\eta^{cP} \equiv \frac{\partial c}{\partial P}\frac{P}{c} = \frac{\partial e}{\partial (w^*/P)}\frac{w^*/P}{e} \equiv \eta^{ew} = 1 \quad ,$$

where the last equality is resulted from the Solow condition. And we have

$$\eta^{cq} \equiv \frac{\partial c}{\partial q}\frac{q}{c} = \frac{1}{\beta} - 1;$$

$$\eta^{cQ} \equiv \frac{\partial c}{\partial Q}\frac{Q}{c} = 0.$$

Clearly, we have the traditional result (case 1) if $\beta < 1$, that is, a nominal shock will only raise prices without affecting real output. However, if $\beta = 1$, or in other words, the representative firm has a horizontal marginal cost curve and the curve does not shift with changes in aggregate output, then we have the expectation wonderland case (case 4), and nominal shocks *can* have real effects depending on firms' expectations. Notably, $\beta = 1$ is not an unreasonable assumption under the efficiency wage hypothesis especially when labor is the only factor of production. This is because with involuntary unemployment, an output expansion in itself does not push up wages (if the output expansion does not negatively affect workers' effort) and hence the firm's marginal cost curve.

3.2. Modified formulations of the efficiency wage hypothesis

An obvious problem of the simple formulation of the efficiency wage hypothesis is, as can be seen from equation (8), that the efficiency wage is independent of some presumably relevant variables such as the state of the economy (aggregate output and employment level), and unemployment benefit. But are these "presumably" relevant variables *really* relevant? How do they affect the level of efficiency wage? Akerlof (1982) provided a plausible answer to these questions. According to Akerlof (1982), a worker's effort is affected by the behavioural norms of the group to which he belongs. This norms determine the level of the "fair wage" and the associated level of "socially accepted" level of effort. The firm is willing to pay an above-market-clearing wage in order to influence the norms. Akerlof further suggested that the "conception of fair treatment" is "(f)or the most part ... not based on absolute standards, but, rather, on comparison of one's own situation with that of other persons".

In the spirit of Akerlof (1982), we assume that a worker's effort is affected by his perception of "fairness" which not only depends on his real wage, but also on his wage relative to that of his reference groups. Two easily identifiable reference groups are other workers including workers in other firms, and those who are unemployed.

We further argue that there may be another reference group which is the residual claimers of the firm. The residuals may be the return to some owner-entrepreneur input[5] or short-run profits (as we assume non-perfect competition). It may well be the case that the workers do not have exact information about the changes in the residual in his own firm, but that they may (rightly) perceive a positive relationship between the changes in the residual and economic growth (approximated by the ratio of current aggregate output to last period's

[5] Strictly speaking, this input should be included in the production function, but if we assume the entrepreneur owns the firm, and his input is separable with the labor input, then excluding it from the production function does not change the results of our model.

aggregate output, i.e, $Q/\overline{Q}$, where $\overline{Q}$ is last period's output)[6]. Given wages and unemployment benefit, workers are likely to work harder when the performance of the economy is not so good because they perceive a "fairer" share of the aggregate output. It is thus understandable that "the economy has enjoyed considerable growth over the years" is often raised as an argument for a wage increase. Validity of the argument aside, the presumption behind it is clear, that is, wage *should* increase with economic growth (or the workers *are entitled to a "fair share"* of the benefit from growth in the form of a pay rise). In addition, the performance of the economy ($Q/\overline{Q}$) can also be used as an indicator of employment prospect: workers are likely to work harder if the it is difficult to find another job.

Based on the above argument, we can reformulate the effort function (7) into

$$e = e(w/P, Q/\overline{Q}, w/W, w/\overline{w}), \tag{10}$$

where Q is this period's aggregate output; $\overline{Q}$ is last period's output; W is the average wage rate used here to approximate the wage rate of other firms; $\overline{w}$ is the level of unemployment benefit. We assume that $\frac{\partial e}{\partial(w/P)} > 0$; $\frac{\partial e}{\partial(Q/\overline{Q})} \leq 0$; $\frac{\partial e}{\partial(w/W)} > 0$; $\frac{\partial e}{\partial(w/\overline{w})} > 0$.

An interesting implication of including aggregate output Q in the effort function is that it can provide an explanation for the weak positive correlation between real wage and employment. Keynes (1939) and many other classical writers believed that real wages would move countercyclical as employers moved along downward sloping demand schedules. However, empirical evidence suggests that if there exists correlation between real wage and employment, it is procyclical. For instance, Sargent (1978) found that, from aggregate US data 1948I - 1982IV, there appears to exist some complicated dynamic interactions between

[6] We argue that it is the change in the residual rather than the level of the residual that affects workers' effort because it is controversial as to what the size of the residual is "fair", but it is usually accepted that it is "fair" that workers' share does not deteriorate with economic growth.

aggregate employment and the real-wage data, and it seems that real wage is not Granger-caused by employment. There have been some "disequilibrium models" that explains the relationship between real wage and employment, among which Barro and Grossman (1971) and Solow and Stiglitz (1968) are probably two of the most well known.

To highlight the stylized fact of slightly positive correlation between real wage and output, we first ignore the effect of relative wages on effort and formulate the effort function as

$$e = e(w / P, Q / \overline{Q}). \tag{11}$$

Using the above formulation, we can solve for the firm's cost minimization problem as in Section 3.1 and obtain the firm's cost function:

$$C = w^* q^{\frac{1}{\beta}} e^{-1}(w^* / P, Q / \overline{Q}),$$

where $w^* = w^*(P, Q / \overline{Q})$.

The firm's marginal cost is

$$c = \frac{1}{\beta} w^* q^{\frac{1}{\beta}-1} e^{-1}(w^* / P, Q / \overline{Q}). \tag{12}$$

From equation (12), we have

$$\eta^{cP} \equiv \frac{\partial c}{\partial P}\frac{P}{c} = \frac{\partial e}{\partial (w^* / P)}\frac{w^* / P}{e} \equiv \eta^{ew} = 1 \quad ;$$

$$\eta^{cq} \equiv \frac{\partial c}{\partial q}\frac{q}{c} = \frac{1}{\beta} - 1;$$

and

$$\eta^{cQ} \equiv \frac{\partial c}{\partial Q}\frac{Q}{c} = \frac{\partial w^*}{\partial Q}\frac{Q}{w^*}\left(1 - \frac{\partial e}{\partial w^*}\frac{w^*}{e}\right) - \frac{\partial e}{\partial Q / \overline{Q}}\frac{Q / \overline{Q}}{e} = -\frac{\partial e}{\partial Q / \overline{Q}}\frac{Q / \overline{Q}}{e} \equiv -\eta^{e(Q/\overline{Q})}.$$

Similar to our result in section 3.1, a nominal shock will have no real effects if $\eta^{eq} + \eta^{eQ} > 0$. However, if $\eta^{eq} + \eta^{eQ} = 0$, i.e., $\eta^{e(Q/\overline{Q})} = \frac{1}{\beta} - 1 < 0$, then the economy has a continuum of equilibria (see case 4 in section 2), and nominal shocks can have real effects if firms expect no (or less than proportional) increase in price. For the real effects to occur, it is necessary, given an unchanged price elasticity of demand, that the firm's production technology exhibits increasing returns ($\beta > 1$). If real effects do occur, the level of efficiency wage changes as well, so does the level of employment. Although the level of involuntary unemployment may rise or decrease with an increase in nominal demand, depending on the demand and supply for labor and the effort function $e(w/P, Q/\overline{Q})$, total unemployment (including voluntary and involuntary unemployment) decreases. It is assumed here that the efficiency wage is no less than the labour market clearing level so that the realized employment is determined by the demand side. Hence, by assuming increasing returns to scale and incorporating a modified formulation of the efficiency wage hypothesis, our mesoeconomic model can explain simultaneously the existence and variation of involuntary unemployment, the weak positive correlation between real wage and employment, and the possible real effects of nominal shocks.

With the traditional effort function (equation (7)) and the reformulated effort function (equation (11)), we have shown that under certain conditions, nominal shocks can have real effects, but whether real effects do occur under relevant conditions depends critically on firms' expectations. In the following we shall show that if we include relative wages in the effort function, that is, if we formulate effort as in equation (10), then nominal shocks will in general have real effects at least in the short run.

Recall equation (10),

$$e = e(w/P, Q/\overline{Q}, w/W, w/\overline{w}). \tag{10}$$

With this formulation of effort, the Solow condition becomes

$$\frac{\partial e}{\partial w}\frac{w}{e} = \frac{\partial e}{\partial(w/P)}\frac{(w/P)}{e} + \frac{\partial e}{\partial(w/W)}\frac{(w/W)}{e} + \frac{\partial e}{\partial(w/\overline{w})}\frac{(w/\overline{w})}{e} = 1, \tag{13}$$

and the resulting efficiency wage can be written as

$$w^* = w^*(P,\ Q/\overline{Q},\ W,\ \overline{w}), \tag{14}$$

where $\partial w^*/\partial P > 0$.

The firm's marginal cost becomes

$$c = \frac{1}{\beta} w^* q^{\frac{1}{\beta}-1} e^{-1}(w^*/P, Q/\overline{Q}, w^*/W, w^*/\overline{w}). \tag{15}$$

From equation (15), we have (see Appendix for the derivation)

$$\eta^{cP} \equiv \frac{\partial c}{\partial P}\frac{P}{c} = 1 - \eta^{e\frac{w}{\overline{w}}}\eta^{wP} < 1\ , \tag{16}$$

where $\eta^{e\frac{w}{\overline{w}}} \equiv \frac{\partial e}{\partial(w^*/\overline{w})}\frac{(w^*/\overline{w})}{e}$, $\eta^{wP} \equiv \frac{\partial w^*}{\partial P}\frac{P}{w^*}$.

From equation (15), we also have

$$\eta^{cq} \equiv \frac{\partial c}{\partial q}\frac{q}{c} = \frac{1}{\beta} - 1;$$

$$\eta^{cQ} \equiv \frac{\partial c}{\partial Q}\frac{Q}{c} = \frac{\partial w^*}{\partial Q}\frac{Q}{w^*}\left(1 - \frac{\partial e}{\partial w^*}\frac{w^*}{e}\right) - \frac{\partial e}{\partial Q/\overline{Q}}\frac{Q/\overline{Q}}{e} = -\frac{\partial e}{\partial Q/\overline{Q}}\frac{Q/\overline{Q}}{e} \equiv -\eta^{e(Q/\overline{Q})}.$$

Refer to equations (5) and (6) in section 2, we have the non-traditional result (case 2 and case 3): a nominal shock has real effects. If nominal demand increases, there will be an increase in aggregate output, but average price may or may not increase depending on whether $\eta^{cq} + \eta^{cQ}$ is positive or zero. The real effects of nominal shocks can be explained by a time lag in the response of the unemployment benefit ($\overline{w}$)[7]. With an increase in nominal demand, the representative firm (rationally) expects that, at equilibrium, its nominal wage w^* will be the same as the average wage W (because the firm is representative), so the ratio w^*/W does not change. However, since the level of unemployment benefit remain unchanged, $w^*/\overline{w}$ increases, thus the firm would optimally decrease the level of real efficiency wage(see equation (14)), and consequently employment increases. Even if the firm cannot decrease the real efficiency wage (say the wage is indexed such that $\eta^{wP} = 1$) and the level of employment remain unchanged, the firm's marginal cost will increase by less than the price increase due to higher effort exerted by workers (see equation (16)), consequently, a nominal shock still has real effects. Therefore we can conclude that with the modified formulation of the efficiency wage hypothesis, nominal shocks will have real effects.

There is an interesting implication that flows from our model concerning the effects of unemployment benefit. Usually unemployment benefit is thought to provide disincentive for people to actively seek jobs, thus increases total unemployment from the supply side. Our model suggests that high levels of unemployment benefit can generate the perception of "unfairness" on the part of employed (especially those with relatively low wages), as a result, the employers have to increase the level of efficiency wage to induce effort, which increases *involuntary* unemployment from the demand side.

4. Conclusion

In this paper, we have briefly outlined the mesoeconomic approach developed by Ng (1980, 1982). We have applied the mesoeconomic approach to examine the efficiency wage

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[7] If unemployment benefit responds to nominal shocks as fast as nominal wage (however this is unlikely in the short run unless unemployment benefit is indexed), then $\eta^{cP} = 1$, and for nominal shocks to have real effect, we need $\eta^{cq} + \eta^{cQ} = 0$ as in our first model in this section.

hypothesis. With the traditional formulation of the efficiency wage hypothesis, we have shown that under certain conditions, the economy have a continuum of equilibria and that nominal shocks can have real effects depending on the firms' expectations. With modified formulation of the efficiency wage hypothesis, we were able to capture the weak positive correlation between real wage and employment and show that nominal shocks will have real effects.

Our results associated with the modified efficiency wage hypothesis suggests that people's perceptions play an important role in determining the economic outcome. This may serve as an example that illustrates the potential fruitfulness to include psychological and sociological factors into economic theorizing.

Appendix Derivation of Equation (16)

From equation (15), we have

$$\eta^{cP} \equiv \frac{\partial c}{\partial P}\frac{P}{c} = \eta^{wP} - \frac{P}{e}(X + Y + Z), \qquad \text{(A1)}$$

where

$$X = \frac{\partial e}{\partial (w^*/P)}\frac{\partial (w^*/P)}{\partial P} = \frac{e}{P}(\eta^{wP} - 1),$$

$$Z = \frac{\partial e}{\partial (w^*/\overline{w})}\frac{\partial (w^*/\overline{w})}{\partial P} = \frac{e}{P}\eta^{e\frac{w}{\overline{w}}}\eta^{wP},$$

and $Y = \frac{\partial e}{\partial (w^*/W)}\frac{\partial (w^*/W)}{\partial P} = 0$ because the representative firm's nominal wage equals average wage, so w^*/W equals 1 and does not change with P and consequently $\frac{\partial (w^*/W)}{\partial P} = 0$ at equilibrium. Substituting X, Y, and Z into equation (A1) we get equation (16) in the text.

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