

MONEY ILLUSION AND ITS IMPLICATION ON UNEMPLOYMENT

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(Word Count: 5251)*

Abstract

The paper discusses the implication of money illusion on persistent unemployment. A particular form of money illusion is assumed and this is modelled into the efficiency wage theory while separating the analysis into nominal and real frames. The model shows that the level of unemployment in the nominal and the real frame are likely to be different and that the government has an incentive to provide a signalling mechanism to the workers to reduce unemployment levels. Additionally, the government is shown to have an incentive to announce unemployment rates.

*Including footnotes.

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1 Introduction

Economists have made many attempts to explain the existence of persistent unemployment. Long term unemployment is usually seen as the result of one or many labour market failures resulting in some stickiness of wages. Generally, the real wage is believed to be approximately procyclical and in addition, in the short run, shifts in labour demand are said to lead to a large shift in employment but only a small movement in the real wage (see, Geary and Kennan, 1982 and Solon, Robert and Parker, 1994). However, in the long run unemployment is said to have no trend (Romer, 2006).

One idea that is lacking in literature is the possibility that money illusion may be a cause of this market failure¹ where money illusion is defined as a "tendency to think in terms of nominal rather than real monetary values" (Shafir, Diamond and Tversky, 1997). This gap in the subject is not surprising since it is widely perceived that the concept of money illusion violates the assumption of rationality;² a somewhat dangerous stand for economists to take. To quote Tobin (1972); "An economic theorist can, of course, commit no greater crime than to assume money illusion." Subsequently, many theories have been constructed to account for the consequences of money illusion while ignoring the very concept.³

Shafir, Diamond and Tversky (1997) highlight the need for theories to account for money illusion in many parts of economics by presenting results from a survey designed to capture the psychology behind the decision making process, specifically looking at framing effects.⁴ Their results show that agents make systematic mistakes and use both real and nominal frames when presented with an economic problem, a view also supported by Blinder and Choi (1990, pp. 1009). They suggest that people choose to work in nominal values "because it is salient, easy to gauge. . . [and it is often a] reasonable estimate of real worth." Moreover, they suggest that by modelling the consequences of money illusion into existing models, its effect can be studied using framework based on rationality amongst agents.⁵ This paper takes a similar approach to Shafir et al. (1997) and extend the efficiency wage theory to account for money illusion and studies the implications.

One school of thought explaining residual unemployment was initially proposed by Solow (1979); the efficiency wage theory in which he argued that productivity of a worker is affected by the amount of effort that he puts in, which, in turn, is determined by the real wage he is paid. Since, many have extended this idea, each with varying reasons behind the relationship between wage and productivity. The two notable models are the shirking model by Shapiro and Stiglitz (1984) and the fair wage effort hypothesis by Akerlof and Yellen (1990).

The former assumes that the workers shirk if there is no possibility of punishment which is the case under perfect labour market as all wages are equal and workers, even when fired, are able to obtain another job immediately. They postulate that firms pay wages above the perfect labour market case in order to deter workers from shirking and these higher wages imply that unemployment will exist in the economy. However, the model is unable to explain the fact that the unemployment rate stays constant even under technological and/or population growth. Additionally, it cannot produce low real wage variation and high em-

¹One of the few studies which looks into the effect of money illusion is by Fehr and Tyran (2001) in which they show that money illusion can be the cause of price rigidity in the economy.

²See Hammond (1997) for a discussion on rationality.

³For example, Lucas (1972) in which he creates a model which allows rational agents to make mistakes similar in cause to money illusion.

⁴Clearly, any economist need to be speculative of the result from a survey but it is hard to argue against their findings in terms of natural human behaviour.

⁵In their paper, as an illustration and extension to their study, they incorporate nominal wage history into Solow (1979)'s model of efficiency wages.

ployment variation seen in empirical data (see Strand, 1992 and Gomme, 1999).⁶ In order to eliminate the long run decreasing trend predicted by the model, Phelps (1994) and Brecher, Chen and Choudhri (2002) introduced the idea that households save optimally which allows the unemployment rate to be constant even when there is technological progress. However, as Alexopoulos (2003) highlights, their models fail to account for the variations in the real wage and employment. Consequently, Burnside, Eichenbaum and Fisher (2000), Alexopoulos (2001) and Felices (2001) complement the model by replacing the consequence of shirking with monetary punishments. It is difficult to criticise the performance of these models in terms of their predictions of unemployment behaviour, however, the idea that wage is determined to deter workers from shirking is not concretely supported by empirical data (see, Blinder and Choi, 1990).

In contrast to the shirking model, Akerlof and Yellen (1990) found motivation for their fair wage effort hypothesis in theories from sociology and psychology and succeed in providing concrete evidence for their idea.⁷ The model assumes that workers have a concept of a “fair wage” and if they are paid less, they provide proportionately less effort to spite their employers. The model segregates the labour force into skilled and unskilled workers and they find that the effect of a productivity increase on unemployment is opposite in each group. An equal increase in productivity for both groups causes no change in unemployment. Hence the model can provide explanation for the lack of a long run trend in the unemployment rate. Furthermore, by assuming non-instantaneous adjustment of workers’ perception of the fair wage, the model can produce cyclical variation in the unemployment rate. However, the exact type of cyclical variation is ambiguous.

The inherent problem with unemployment theories is the fact that they make similar predictions and thus empirical studies can only distinguish different models imperfectly. Consequently, it is extremely difficult to prove that one theory rules over all else. In this way, there is a need for another method of evaluating various models. One way in which this can be done is to look at the foundations of the models; by considering the validity of the models’ assumptions. In this regard, fair wage effort hypothesis can be seen to be a “better” model than the shirking model.

Economic theorists often run the risk of thinking in an overly hypothesised world. Recent literature on experimental and behavioural economics tries to overcome this weakness and can be seen as a natural extension to the conventional method of developing models. By ensuring the robustness of the motivations behind economic models, one can reduce the danger of “over-thinking”.

It is difficult to argue against the existence of money illusion among economic agents as shown by Shafir et al. (1997). Thus, the study of money illusion with respect to unemployment can be seen to have a concrete foundation. In the next section, the current understanding and behaviour of unemployment are discussed and in section 2, money illusion is explained extensively. In section 3, the efficiency model with money illusion is developed. The last section discusses the implications of the model, its weaknesses as well as possible extensions.

⁶Yellen (1984) and Romer (2006) note a problem with using simple wage schemes in the model; using more ingenious contracts such as job selling or bonding can reduce or eliminate involuntary unemployment thus all shirking models suffer from this problem.

⁷Namely: equity theory, relative deprivation theory and social exchange theory.

2 Persistent Unemployment

2.1 What causes Persistent Unemployment?

The existence of persistent unemployment in the labour market is a result of inefficiency in the market. In other words, the labour market may not be perfectly competitive and thus demand for labour and supply of labour cannot be matched. The tendency is that the market is left with excess supply of labour. Clearly, there are demand or supply factors which cause this mismatch.

Recall that the price of the labour is the wage. The traditional view is that workers and firms calculate their supply and demand for labour using the real wage.⁸ This stems from the assumption of rationality where agents are assumed to know everything that they could know about the current market. Following this view, the existence of persistent unemployment implies that the real wage is somehow sticky; it does not adjust fully to match demand and supply. Thus, the explanation for the existence of persistent unemployment is analogous to the explanation of real wage stickiness. In this way, the existence of persistent unemployment contradict the classical dichotomy and thus when analysing, both real as well as nominal economic variables must be considered.

2.2 Stylised Facts about Unemployment

In order to evaluate the accuracy of models for persistent unemployment, it is essential to identify the behaviour of unemployment and the real wage. One observation is that, in the short run, shifts in labour demand lead to large movements in unemployment but only small changes in the real wage; in other words, labour supply is elastic in the short run. However, in the long run, the shifts in labour demand fall almost entirely on the real wage; i.e. labour supply is inelastic in the long run (Romer, 2006). In addition, unemployment level does not seem to follow any trend in the long run.

Geary and Kennan (1982) found that the real wage was approximately acyclical or slightly procyclical using aggregate data. However, when composition bias⁹ is accounted for in the data, Solon, Robert and Parker (1994) find that the real wage (in the US between 1967-87) was more procyclical than previously thought possibly supporting the New Keynesian model of sticky prices for aggregate supply. However, they conclude that their findings do not necessarily support this model, which subsequently implies that non-Walrasian features of the labour market are important to the movement of quantity of labour and real wages.

3 Money Illusion

Money illusion can ultimately be seen as the violation of the assumption of homogeneity of degree zero in utility functions with nominal prices (Leontief, 1936). More generally, it can be seen as an example of framing effect where agents make different decisions depending on whether they are given nominal or real prices/wages.

As argued by Fehr and Tyran (2001); Shafir et al. (1997), the fact that people often take the nominal wage as a proxy for real wage is natural in the sense that people are ordinarily

⁸Obviously, other factors may be included such as benefits, health insurance etc. but for the sake of simplicity, assume that wage is the only concern.

⁹It can be assumed that employment for low-skilled workers is more cyclical and thus they account for a large proportion of employed individuals in booms than in recessions. Consequently, examining aggregate data is likely to understate the extent of procyclical movements (Romer (2006)).

dealing with money and thus are unaccustomed to working under the real price/wage representation. Clearly, problems occur when price level is changing. Agents may be making “rational” decisions in nominal terms but, as rational agents make decision in real terms, strictly speaking, agents may be irrational. At first sight, it might seem difficult to model money illusion into conventional economic theory but this may not be the case. By separating the analysis into real and nominal frames and assuming a particular form of money illusion, it can be incorporated into existing theories.

To demonstrate, assume the following form of money illusion; firms are rational; that is, they base their decision on real wage.¹⁰ However, assume that workers base their decisions on nominal wage alone. A possible rationale behind this is that it is costly to calculate the real wage which may require knowledge of the past, current and future price levels; consequently firms which incur greater losses from making mistakes (as workers make individual decisions) use real wage whereas individuals workers base their decisions on nominal wage alone.¹¹ Recall the ordinary relationship between the real and nominal wage,

$$\frac{W}{P} = \omega$$

where W is nominal wage, P is price level and ω is real wage. If the economy exhibits inflation then this implies $\omega < W$. Consequently, if workers were solely interested in the nominal wage then conventional theory, which uses real wage, would underestimate the labour supply. This should pose a sufficient case for money illusion to be incorporated into unemployment theories.

In order to model the previous situation formally, suppose that there is no direct relationship between real and nominal wages and that they are completely independent of each other for workers only. Then, wage can be defined as,

$$\hat{w} = \theta W + (1 - \theta) \omega \quad (1)$$

where $\theta = \begin{cases} 1 & \text{for workers} \\ 0 & \text{for firms} \end{cases}$. Above is the form of money illusion assumed throughout the paper and implies that workers are unable to convert nominal wage into real wage and vice versa.

In the next section, the efficiency wage model by Solow (1979) is extended using the above concept because of two reasons: its ability to explain the behaviour of persistent unemployment and its simplicity.¹² Solow’s model can be extended to account for wage stickiness and a lack of long run trend in the unemployment.¹³ In addition, the model need not require the use of a game between firms and workers.

The efficiency wage model assumes that individual labour supply is inelastic at unity. Consequently, labour supply is constant regardless of whether workers use nominal or real wage level, however, in order to use the model to account for the effect of money illusion, one needs to assume that labour supply may not be inelastic, at least with respect to nominal wages. Then, given that workers make decisions based on nominal wage, one can

¹⁰Assume that firms can readily transform real terms into nominal terms, and vice versa.

¹¹Shafir et al. (1997) show that both firms and workers may be under money illusion. However, the representative firms were relatively small in size and it is natural to assume that large corporations would use real variables instead of nominal as losses for them from making mistakes are likely to be large.

¹²In this paper, conventional method of maximisation is used for optimising actions of agents. One might consider this as contradictory because of the implication of money illusion on the concept of rationality, however, with the assumption that workers are rational given nominal wages, one can use the conventional maximisation method.

¹³See Appendix 1.

suppose a situation where labour supply is inelastic with respect to real wages but elastic with respect to nominal wages. In such a case, it is possible that labour demand and labour supply match in nominal wages even when there is unemployment given by demand and supply in real wages which is fixed (at the efficiency wage level) as shown in Figure 1. This suggests the idea that persistent unemployment may be an unavoidable result of heterogeneous agents working in nominal or real terms. However, the situation described in Figure 1 is a particular case; it is more likely that there will be unemployment in both nominal and real labour market. In this case, unemployment is caused not only by money illusion and the efficiency wage but by other factors that affect both frames.

4 Efficiency Wage Theory with Money Illusion

In the previous section, the potential for money illusion to help explain persistent unemployment was shown. In this section, a more rigorous model based on Solow (1979)'s efficiency wage model is developed. The traditional efficiency wage model is exposed in Appendix 1.

4.1 Assumptions

In the model, some of the assumptions from the traditional efficiency wage theory still hold, specifically: I number of homogeneous firms with \bar{L} number of homogeneous workers willing to work, and output price at unity.

Money illusion is modelled into the efficiency wage model by implicitly assuming the nominal wage-real wage relationship given by (1); firms know both nominal and real wages, but, workers only know nominal wage and do not have the ability to calculate the real wage.

Assume that the effort function is a logistic function which is convex initially but concave after the point of inflexion. In another words, we expect worker effort to exhibit increasing returns to wages until what the worker considers a fair wage is reached, after which, we expect worker effort to exhibit diminishing returns. This is intuitive; a small increase from zero nominal wage is unlikely to convince a worker to give any effort but as wage converges to the perceived fair wage they expect that higher effort will induce firms to give them a higher wage. After this fair wage is reached, workers are content knowing that any further increase in effort is unlikely to lead to a rise in the wage.¹⁴ Given a logistic effort function, the point of inflexion is the perceived fair wage by workers.

Because the value of nominal wage may vary greatly, normalised nominal wage, \tilde{W} , is used instead, given by,

$$\tilde{W} = \frac{W}{\bar{W} - \underline{W}} \in (0, 1) \quad (2)$$

where $\bar{W} - \underline{W}$ is the range of possible nominal wage. Notice that with strictly monotonic production function, nominal wage transformation given in (2) will not affect the maxima of the profit maximisation problem for the firm.¹⁵

Now, the generalised logistic effort function, $g(\tilde{W})$, is given by,

$$g(\tilde{W}) = A + \frac{K - A}{\left(1 + Qe^{-B(\tilde{W} - M)}\right)^{\frac{1}{\nu}}} \quad (3)$$

¹⁴Notice that this is a generalisation of the effort function given in Akerlof and Yellen (1990) where they assume workers provide no extra effort above the fair wage and provides proportionately less effort below the fair wage to spite their employer.

¹⁵Production function is assumed to be concave and at least twice continuously differentiable.

A = lower asymptote; equals to zero.

K = upper asymptote; determines the productive difference between the amount of effective and ordinary labour.

B = growth rate; adjusted appropriately with the value of K .¹⁶

v = affects near which asymptote the point of inflexion (fair wage effort) lies given positive value.

M = determines where the fair wage lies.

$Q = g(0)$

In order to obtain the result that firms pay nominal wage above the perfect labour market case, the point of inflexion must lie above 1 where amount of effective labour and ordinary labour are equal. For simplicity, we let $v = 1$ and $K > 2$; fair wage is at where $\tilde{W} = 1/2$ and the fair wage effort lies at $K/2 > 1$ implying that the firm has incentive to pay above the perfect market case. Letting g_N denote the effort function with respect to nominal wage, then,

$$g_N(\tilde{W}) = \frac{K}{1 + e^{-B(\tilde{W}-0.5)}} \in (0, K) \quad (4)$$

Additionally, assume g_R , effort function with respect to real wage, is always equal to one; amount of effective labour is equal to amount of ordinary labour whatever the real wage may be.

Let L_N^S and L_R^S be individual labour supply in terms of nominal wage and real wage, respectively. Assume that L_R^S is given by,

$$L_R^S(\omega) = 1$$

that is individual labour supply with respect to real wages is assumed to be inelastic at unity (the same as in the traditional efficiency wage theory). For simplicity¹⁷, assume L_N^S is linear and worker supplies zero units of labour at wage levels below the reservation normalised wage of $\tilde{w} \geq 0$.

$$L_N^S(\tilde{W}) = \tilde{w} + D\tilde{W} \in [0, 1] \quad (5)$$

From above, D is the extent to which a given change in the nominal wage affects labour supply. However, supposed also that D is a signal that the workers receive with the wage, independent of the wage. For now, D is assumed to be a fixed constant. By relaxing this assumption, it is possible to obtain a situation in which there is always an equilibrium in the nominal labour market but disequilibrium in the real labour market.

¹⁶This is so that the effort function reaches sufficiently close to the asymptotes in $\tilde{W} \in (0, 1)$

¹⁷Non-linear labour supply function with respect to nominal wage may be used instead. However, this also means that the signal, D , would also have to be non-linear and thus labour supply is assumed to be linear in this case.

4.2 The Model

Consider the profit maximisation problem of a representative firm¹⁸,

$$\max_{\tilde{W}, L} \pi = \left\{ F \left[g \left(\tilde{W} \right) L \right] - \omega L \right\} \quad (6)$$

where $F(\cdot)$ is a concave, at least twice continuously differential production function, $g(\tilde{W})$ is the effort function given in (4) and L is the amount of labour the firm hires. Recall the assumption that firms can readily convert between nominal wage and real wage thus (6) becomes,

$$\max_{\tilde{W}, L} \pi = F \left[g \left(\tilde{W} \right) L \right] - \frac{\tilde{W}}{P} L$$

Solving above gives,

$$\frac{\tilde{W} g' \left(\tilde{W} \right)}{g \left(\tilde{W} \right)} = 1 \quad (7)$$

The above is simply the Solow condition in terms of the normalised nominal wage and determines the equilibrium nominal wage. Given the effort function in (4), the Solow condition in (7) implies that following must hold,

$$e^{-B(\tilde{W}-0.5)} \left(B\tilde{W} - 1 \right) = 1 \quad (8)$$

The solution to above is the efficiency wage. It can be seen graphically that for reasonable values of B and K , equation (8) has a solution in $(0.5, 1)$ as one expects.¹⁹ The equation also has another solution closer to zero which can be ignored as fair wage is fixed to be $1/2$ in the model.

Note that labour demand, L_N^D at the normalised efficiency nominal wage \tilde{W}^* , is given by,

$$L_N^D \left(\tilde{W}^* \right) = g \left(\tilde{W}^* \right) F' \left[g \left(\tilde{W}^* \right) L \right]$$

in addition, labour demand, L_R^D , at the normalised efficiency real wage, $\tilde{\omega}^*$, is given by,

$$L_R^D \left(\tilde{\omega}^* \right) = g \left(\tilde{\omega}^* \right) F' \left[g \left(\tilde{\omega}^* \right) L \right]$$

and the two are equal in value. Then the level of unemployment in the real labour market²⁰, U_R , is,

$$U_R \left(\tilde{\omega}^* \right) = L_R^S \left(\tilde{\omega}^* \right) \bar{L} - L_R^D \left(\tilde{\omega}^* \right) I = \bar{L} - L_N^D \left(\tilde{W}^* \right) I$$

where $\tilde{\omega}^*$ is the normalised real wage. Alternatively, the level of unemployment in the nominal labour market, U_N , is,

$$U_N \left(\tilde{W}^* \right) = L_N^S \left(\tilde{W}^* \right) \bar{L} - L_N^D \left(\tilde{W}^* \right) I$$

Given that L_N^S has the range $[0, 1]$ then $U_R \geq U_N$.

¹⁸Output price is assumed to be exogenous and at unity for simplicity. This is because the market demand for the product is ignored in this model. Notice that price level is not determined by the unit pricing as this can change over time (again, not modelled here).

¹⁹See Appendix 3 for the graph. Appropriate value of B when K is between 2 and 4 is about 10. A higher value of K requires a higher value of B .

²⁰The model in the real frame is equivalent to the ordinary efficiency wage theory.

4.3 Simple Extension

Previously, it was assumed that the coefficient on the normalised nominal wage in the individual labour supply function was a constant; D was exogenous in (5). However, consider the case when D is determined by a signal sent out to the workers along with the nominal wage offer. Suppose the signal was an indication as to how “fair” the wage offered by the firms were from a third-party who is indifferent between the two types of agents.²¹ The signal thus can alter the preference of the workers such that there is no unemployment in the nominal frame; that is set D such that,

$$L_N^S(\tilde{W}^*)\bar{L} = L_N^D(\tilde{W}^*)I \Leftrightarrow U_N(\tilde{W}^*) = 0$$

This implies that there is an incentive for the government to provide the labour market with a signalling mechanism which could eliminate unemployment, at least in the nominal frame.

5 Evaluation of the Model

5.1 Implications

Because money illusion amongst workers implies that only the nominal wage is relevant for workers, the Solow condition from the ordinary efficiency wage theory becomes (7); firms no longer minimise the real labour cost per efficiency unit but nominal labour cost per efficiency unit²².

Note that the inability of workers to calculate the real wage means that the firms could extract more surplus from the workers. The representative firm employs a certain amount of effective labour at a given nominal wage, however, it only has to pay that nominal wage to the workers; a number smaller than the amount of effective labour. Furthermore, as the firm can readily convert between the nominal and real wage, the cost of employment of a worker is ω . Given $P > 1$, this gives the firm benefits from being able to control effort at an even lower nominal wage than in the case without money illusion.

The efficiency wage solution from (8) does not involve K , which determines the maximum difference between effective labour force and the number of workers. However, recall that the value of B is partially dependent on the value of K thus we get the intuitive result that a higher value of K (i.e. higher potential productivity) leads to a lower efficiency wage;²³ workers who return greater effort given a nominal wage level require lower nominal wage level to achieve the optimal outcome for the firm.

The model in section 3.2 suggests that there will be unemployment in both the real and nominal frame but in most cases, unemployment will be higher in the real frame. This discrepancy in the level of unemployment in the two frames implies that money illusion can indeed cause unemployment in the economy. Furthermore, given that this effect is persistent over time, one can conclude that money illusion is one of the causes of persistent unemployment. In addition, the over-wrapping level of unemployment in the two frames is likely to be caused by factors which affect both the real and the nominal frames.

The simple extension provided in section 3.3 suggests that there is an incentive for a third-party (most likely, the government) to provide workers with a signal to indicate the fairness of the wage offered by the firms. Such a mechanism can eliminate unemployment in the nominal frame, however, the level in the real frame would remain unchanged. The question

²¹Notice that a fairer wage would imply a lower value of D .

²²From the perspective of the firm, the two are equivalent.

²³See Appendix 4 for the graph.

remains whether the government would have the incentive to create such a mechanism as it will not lead to a reduction in the level of unemployment in the real frame. However, if one assumes heterogeneous workers where some have the ability to convert between nominal wages and real wages then such a signalling mechanism will have an effect on the real labour market. In this case, the government has an incentive to create such a signalling mechanism. To see this, suppose a proportion p of workers are able to calculate the real wage. Previous assumption of inelastic labour supply with respect to real wage was based on the fact that workers were unable to calculate the real wage. Hence, it is reasonable to think that for p proportion of workers, labour supply is elastic with respect to real wage²⁴ and denote this function $L_R^S(\tilde{\omega})$. Then the level of unemployment in the real labour market is,

$$U_R(\tilde{\omega}^*) = [pL_R^S(\tilde{\omega})\bar{L} + (1-p)L_R^S(\tilde{\omega})] - L_R^D(\tilde{\omega}^*)I \neq \bar{L} - L_N^D(\tilde{W}^*)I$$

Thus the signal can have an effect in the real labour market as $L_R^S(\tilde{\omega})$ is affected by the value of D .

5.2 Announcements of Unemployment Rates

It is shown in the appendix that the efficiency wage theory can account for the long run behaviour of the unemployment level by including the unemployment rate in the effort function. The intuition is simple; a higher unemployment rate implies higher cost of being out of work and thus it leads to greater effort given a wage level. Applying this approach to the model with money illusion requires consideration of whether one uses the nominal or real unemployment rate; unemployment that exist in nominal and real frames. It is reasonable to assume that the workers, as they work in nominal terms, can only see the nominal unemployment rate. However, firms know both nominal and the real unemployment rates. Following the convention used already, let u_R be the real unemployment rate and u_N be the nominal unemployment rate. Notice that the firm always has the incentive to make workers believe that the unemployment rate is higher as this signifies a costless increase in effective labour for firms. Workers will know this and any suggestion made by the firm about the level of unemployment will not be credible. Now consider the following three cases:

- Case 1:** $u_R > u_N$; workers' perceived level of unemployment is below that of the level in the real frame. The firm will benefit if they could make a credible announcement to the worker.
- Case 2:** $u_R < u_N$; workers' perceived level of unemployment is above that of the level in the real frame. The firm has no incentive to correct workers' belief. It is able to capture even more of worker surplus. Workers, on the other side, have an incentive to deduce the real unemployment rate if only they knew the real wage.
- Case 3:** $u_R = u_N$; workers' perceived level of unemployment is the same as that of the level in the real frame. Optimal.

Hence in cases 1 and 2 (the two most likely cases), either the firm or the worker has an incentive to act to improve the situation. One way to correct the differences is to have a third-party who is indifferent between the firm and the worker making credible announcements about the unemployment rate; for example, the government which is what happens in many countries. Given these credible announcements, nominal unemployment will converge in the

²⁴In fact, by the assumption of transitivity, labour supply function with respect to real wage must be convertible to the function with respect to nominal wage and vice versa.

long-run to the real unemployment, while they may be different in between announcements. Notice that having credible announcements may not lead to a more Pareto efficient outcome, instead, they can be seen to result in a “fairer” outcome; to negate the consequence of money illusion on worker surplus.

5.3 Weaknesses & Extensions

The model developed here has inherent weaknesses arising from the use of the efficiency wage theory. However, these may be negligible as empirical evidence seems to support the existence of efficiency wage (see Krueger and Summers, 1988; Cappelli and Chauvin, 1991; Wadhvani and Wall, 1991). Instead, the weaknesses of the model are likely to arise from the additional assumptions made. Clearly, it is unreasonable to assume homogeneous firms and workers, and the simplified effort function may not reflect the real effort function, however, the simplification is there to make the implications of the model clear. The former problem can be tackled by generalising the relationship defined in (1); by assuming that θ may be distributed on some truncated normal distribution. The latter problem can be solved by further generalisation of the effort function; assuming $v > 1$ in (3). This is likely to have a similar effect to the efficiency wage level as changing the values of K ; that closer the point of inflexion is to the upper asymptote, the lower the efficiency wage level. One important aspect of this model which needs empirical verification is the labour supply function which assumes that workers change their preferences according to a signal sent by a neutral third party.

Other weaknesses of the model arise from two factors: perfect information for the firms and lack of interaction between the two types of agents. The model assumes that the firms know the effort function of the workers. In most cases, the firms will not know the exact effort function of the workers. Even if the firm is uncertain about the effort function of the workers, it is unlikely that this will lead to any significant changes in the implication of the model discussed here except that the possibility to eliminate unemployment in the nominal frame disappears after this assumption breaks down. The lack of interaction between the firms and workers essentially means that the model does not make use of incomplete information games. It is possible to model the behaviour of the workers by separating them into two groups. For example, consider one group as the leaders of a union and the other, its members. In this case, one could make use of principal-agent games where union members are the principal and the agents are the union leaders with the assumption of costly calculation of real wages. Furthermore, the paper did not consider the possibility of “learning” by the workers after announcements of unemployment rates by a neutral third party. A richer model would consider the effect that the announcements may have on the ability for workers to deduce the real wage at a lower cost.

6 Conclusion

The paper first showed that money illusion should not be feared but, instead, embraced into general economics; money illusion need not lead to an abandonment of traditional economic approach. By using the relation given by (1) (a particular form of money illusion), one can systematically study the effect of money illusion by considering both the nominal frame and real frame separately.

The paper also argued that the efficiency wage model is a good candidate to explain persistent unemployment and extended this model to incorporate money illusion. By considering the labour market with respect to nominal wages and real wages separately, it

was shown that the economy can be in a situation where there is unemployment in the real market but exhibit market clearing in the nominal market with the aid of a neutral third party. However, realistically, unemployment is likely to exist in both frames at different levels. The difference between the two is the direct consequence of money illusion but the similarity is due to factors that affect the labour market in both nominal and real frames. Furthermore, the paper proved the case for why the unemployment rate is usually announced by the government with the suggested outcome of converging values of real and nominal unemployment rates in the long run.

Money illusion has, in the past, been largely ignored and there is a definite lack of study into the topic. The paper supports the view held by Shafir et al. (1997) that money illusion can be systematically studied and introduced a different way in which it may be incorporated into existing models.

A Appendices

A.1 Traditional Efficiency Wage Theory

A.1.1 The Model

Assume a large number, I , of homogeneous competitive firms who are wage-setters in the labour market. They believe that higher wage induces higher average productivity and thus they are willing to offer wage above the market clearing level. Additionally, assume that effort is driven by real wage and the output price is unity. Then the representative firm's maximisation problem is,

$$\max_{\omega, L} F[g(\omega)L] - \omega L$$

where $F(\bullet)$ = production function, g = average effort/productivity of workers, L = number of workers²⁵, ω = real wage. First order conditions lead to the Solow condition; i.e. elasticity of effort with respect to wage is unity,

$$\frac{\omega g'(\omega)}{g(\omega)} = 1 \tag{9}$$

and the real wage satisfying above is known as the efficiency wage. Let ω^*, L^* denote the values of wage and labour that satisfy (9). Given the assumption of identical firms, the total labour demanded is simply IL^* and if labour supply (\bar{L}) exceeds this amount then there will be unemployment of amount $\bar{L} - IL^*$.

The model is clearly able to predict the existence of unemployment. Furthermore, because wage is fixed at the efficiency wage level, it is unresponsive to demand shifts. Consequently, this can explain why shifts in labour demand lead to large movements in employment but only small changes in the real wage. Consider the long run implication of the model; as economy grows, demand for labour increases, however real wage remains constant and therefore unemployment trends downward until it reaches zero. Thus this model is unable to explain the behaviour of unemployment in the long run.

A.1.2 The Extended Model

Generalise the effort function to the following²⁶,

$$g = g(\omega, u), e_1(\bullet), e_2(\bullet) > 0$$

where u = unemployment rate. Provided that labour supply is above IL^* , there is unemployment of amount $\bar{L} - IL^*$. Now, consider the long run implication of this model. As before, with economic growth, unemployment level trends downward. However, because lower unemployment level has a negative effect on the level of effort, the model can account for the absence of trends in unemployment in the long run.

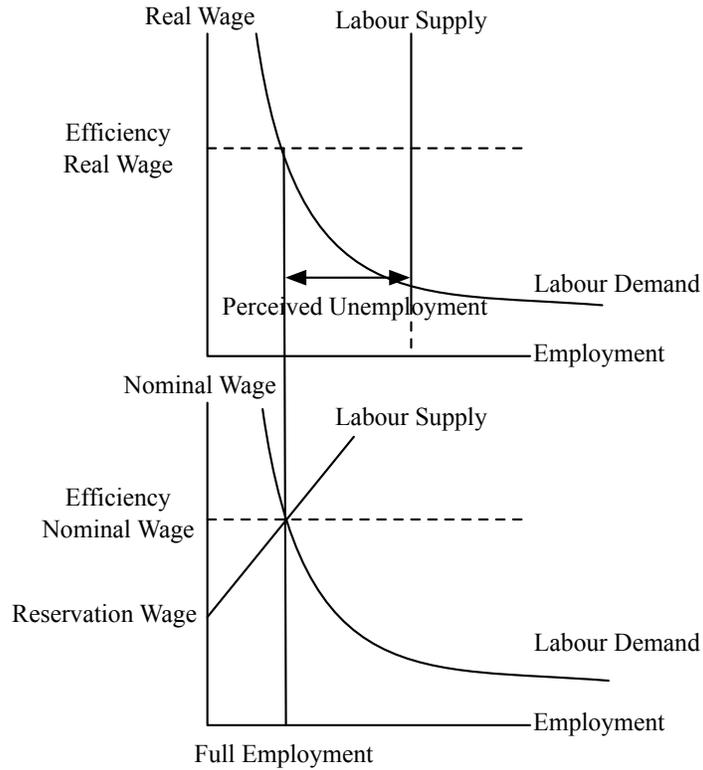
The extended model is able to explain the behaviour of unemployment described in the main text and thus constitutes as a possible candidate for the explanation of the existence of persistent unemployment.

²⁵ $e(\omega)L$ is the amount of effective labour.

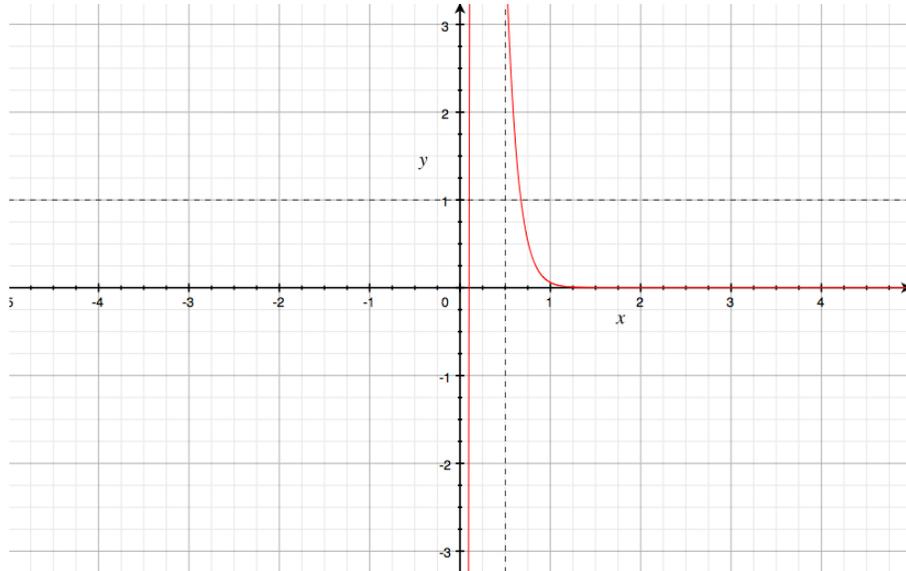
²⁶Based on Romer (2006).

A.2 Figures

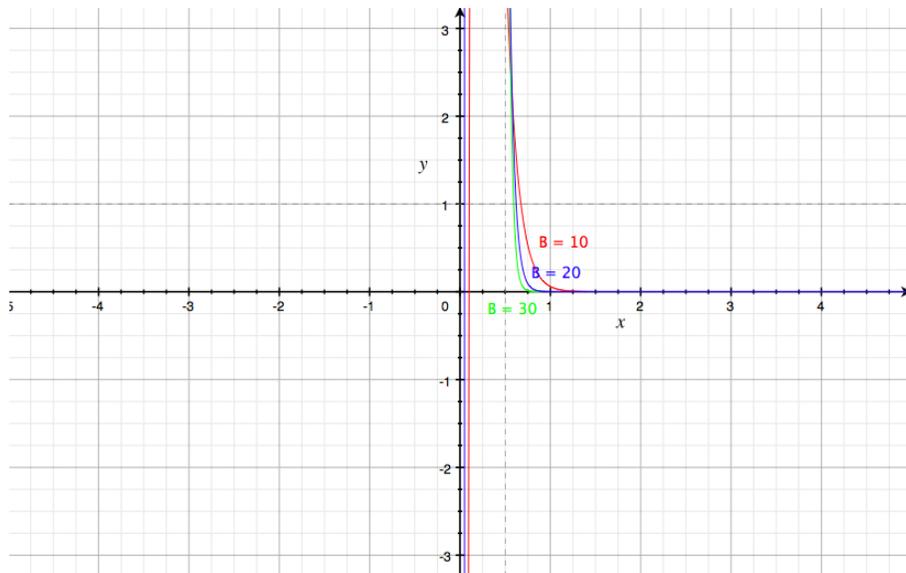
Figure 1: Implication of Money Illusion on Traditional Efficiency Wage Theory



A.3 Graphical Solution to Efficiency Wage



A.4 Analysis of Solution to Efficiency Wage



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