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Money Illusion and its Implication on Unemployment

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Abstract

The paper discusses the implication of money illusion on persistent unemployment. A particular form of money illusion is assumed and this is modeled 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 signaling mechanism to the workers to reduce unemployment levels. Additionally, the government is shown to have an incentive to announce unemployment rates.

Keywords

money illusion, unemployment, efficiency wage

Cover Page Footnote

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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, shifts in the labour demand are said to lead to a large shift in employment in the short run, but only a small movement in real wage (see: Geary and Kennan, 1982; Solon, Robert and Parker, 1994). In the long run, however, 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 failure. I define money illusion as the "tendency to think in terms of nominal rather than real monetary values," following Shafir, Diamond and Tversky (1997).[1] This gap in the subject is not surprising since it is widely perceived that the concept of money illusion violates the assumption of rationality; a somewhat dangerous stand for economists to take.[2] 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 rational 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 to explain the existence of residual unemployment was initially proposed by Solow (1979); the efficiency wage theory in which he argued that the 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).

Shapiro and Stiglitz (1984) proposed that workers may shirk if there is no possibility of punishment, which is the case under perfect labour market (as all wages are equal and workers are able to obtain another job immediately even when fired). They postulate that firms pay wages above the market clearing level in order to deter workers from shirking

[1] One of the few studies which look into the effect of money illusion (though not specifically on unemployment) is by Fehr and Tyran (2001) in which they show that money illusion may be the cause of price rigidity in the economy.

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

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

[4] Clearly, an economist need to be speculative of results from a survey, but it is hard to argue against their findings in terms of natural human behaviour.

[5] As an illustration and extension to their empirical study, they incorporate nominal wage history into the efficiency wage model by Solow (1979).

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 or population growth. Additionally, it cannot produce low real wage variation and high employment variation seen in empirical data (see: Strand, 1992; Gomme, 1999).[6] In order to eliminate the long run decreasing trend predicted by the model, Phelps (1994) and Brecher et al. (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. Alternatively, Burnside et al. (2000), Alexopoulos (2001) and Felices (2001) complemented the shirking model by introducing monetary punishments for workers who shirk to account for the aforementioned variations. 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 succeeded 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. Thus, an equal increase in productivity for both groups causes no change in unemployment providing an explanation for the lack of long run trends 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 cyclicality 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; for example, by considering the validity of the assumptions of the model. In this regard, the 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 may be able to 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, I discuss the current understanding and behaviour of unemployment. In section 2, I explain the concept of money illusion and in section 3, I develop the efficiency wage model with money illusion. Finally, in the last section, I discuss the implications of the model, its weaknesses as well as possible extensions.

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

[7]Namely: 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 other words, the labour market may not be perfectly competitive and thus the demand for labour and the supply of labour cannot be matched by itself. The tendency is that the market is left with excess supply of labour; that is, unemployment. 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 the workers and the 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 contradicts 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; that is, 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 bias is accounted for in the data, Solon, Robert and Parker (1994) found 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.[9] However, in the end, they concluded that their findings do not necessarily support the New Keynesian model, which subsequently implies that non-Walrasian features of the labour market may be important in explaining 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.

[8] Other factors may be included in the decision making process such as benefits and health insurance, but for the sake of simplicity I assume that wage is the only concern.

[9] It 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; this is the composition bias.

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 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 strictly speaking, agents may be irrational as they should base their decision on real variables. At first sight, it might seem difficult to model money illusion into conventional economic theory as it seems to require a new notion of rationality, but it can be done by separating the analysis into real and nominal frames then assuming a particular form of money illusion.

To demonstrate, assume the following form of money illusion. Firms are rational; that is, they base their decision on the real wage.[10] However, assume that workers base their decisions on the nominal wage alone. A possible rationale behind this is that it is costly to calculate the real wage, which require the 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 only on nominal wage.[11] Recall the ordinary relationship between the real and nominal wage,

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

where W is the nominal wage, P is the price level and ω is the 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 the 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 the real and the nominal wage and that they are completely independent of each other, at least for workers. Wage can then be defined as

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

where

$$\theta = \begin{cases} 1 & \text{for workers} \\ 0 & \text{for firms.} \end{cases}$$

(1) 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 relation in (1) 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

[10] I assume that firms can readily transform real terms into nominal terms and vice versa.

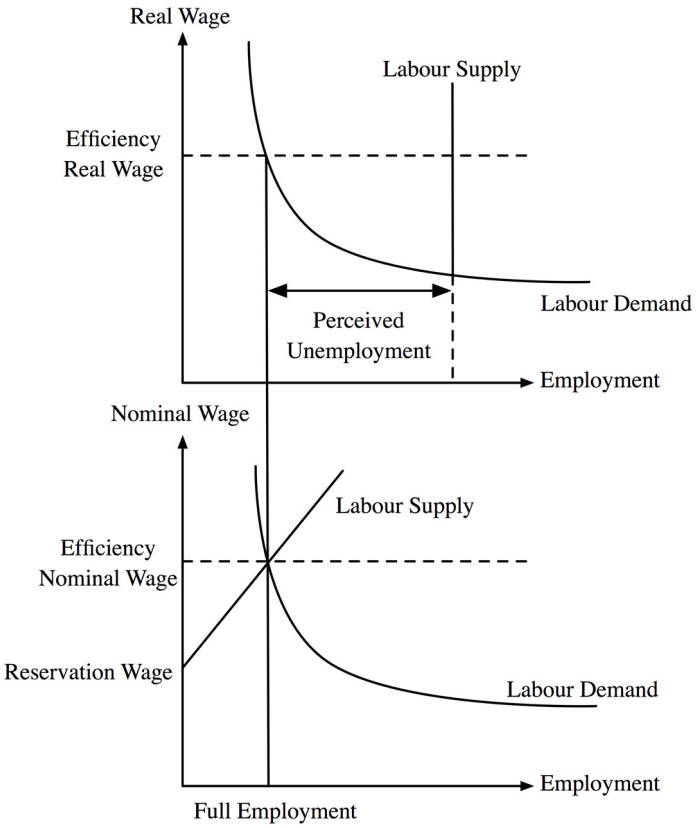
[11] Shafir et al. (1997) show that both firms and workers may be under money illusion. However, the representative firms were relatively small in size and it is natural to assume that large corporations would use real variables instead of nominal as losses for them from making mistakes are likely to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

[12] I use the conventional method of maximisation for optimising actions of agents. One might consider this contradictory because of the implication of money illusion on the concept of rationality. However, I postulate that workers are rational given the information available to them. In other words, I assume that they do not have the information to be able to calculate the real wage thus justifying my use of conventional maximisation method.

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, I assume that the labour supply may not be inelastic, at least with respect to nominal wages. Given that workers make decisions solely based on the nominal wage, I can then 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 the demand and the 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.

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



[13] See Appendix 1.

4 Efficiency Wage Theory with Money Illusion

In the previous section, I discussed the potential for money illusion to help explain persistent unemployment. In this section, I develop a more rigorous model based on the efficiency wage model by Solow (1979). For reference, The traditional efficiency wage model is exposed in Appendix 1.[14]

4.1 Assumptions

In the model, some of the assumptions from the traditional efficiency wage theory still hold. Specifically: I is the number of homogeneous firms with $\overline{L}$ 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). In words, firms know both the nominal and the real wage, but workers only know the 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 other words, I suppose worker effort to exhibit increasing returns to wages until what the worker considers a fair wage is reached, after which I 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.[15] Given a logistic effort function, the point of inflexion is the perceived fair wage by workers.

The value of nominal wage may vary greatly thus I will use the normalised nominal wage $\tilde{W}$ defined as

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

where $\overline{W} - \underline{W}$ 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.[16]

The generalised logistic effort function $g\left(\tilde{W}\right)$ is given by

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

where

A	Lower asymptote; equals to zero.
K	Upper asymptote; determines the productive difference between the amount of effective and ordinary labour.

[14] The reference is taken from Romer (2006).

[15] Notice 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.

[16] Production function is assumed to be concave and at least twice continuously differentiable.

B	Growth rate; adjusted appropriately with the value of K.[17]
v	Affects near which asymptote the point of inflexion (fair wage effort) lies given positive value.
M	Determines where the fair wage lies.
Q	Equals $g(0)$.

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

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

Additionally, assume that the effort function with respect to real wage $g_R(\cdot)$ is always equal to one; that is, the amount of effective labour is equal to the amount of ordinary labour whatever the real wage may be (following the standard efficiency wage model).

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

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

In words, the 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 simplicity, assume L_N^S is linear and worker supplies zero units of labour at wage levels below the reservation normalised wage $\underline{\tilde{w}} \geq 0$:[18]

$$L_N^S\left(\tilde{W}\right) = \underline{\tilde{w}} + D\tilde{W} \in [0, 1]. \tag{5}$$

From equation (5), D is the extent to which a given change in the nominal wage affects labour supply. However, it is possible to let D be 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.

4.2 The Model

Consider the profit maximisation problem of a representative firm:

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

where $F(\cdot)$ is a concave, at least twice continuously differential production function, $g\left(\tilde{W}\right)$ is the effort function given in (4) and L is the amount of labour the firm hires.[19] Recall

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

[18] Non-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.

[19] Output 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 the price level is not determined by the unit pricing as this can change over time (again, not modelled here).

the assumption that firms can readily convert between nominal wage and real wage thus (6) becomes

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

Solving gives

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

(7) 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 the following must hold

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

The solution to (8) 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.[20] The equation also has another solution closer to zero which can be ignored as the fair wage is fixed to be $1/2$ in the model.

Note that the 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, the 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. The level of unemployment in the real labour market U_R is

$$\begin{aligned} U_R\left(\tilde{\omega}^*\right) &= L_R^S\left(\tilde{\omega}^*\right)\overline{L} - L_R^D\left(\tilde{\omega}^*\right)I \\ &= \overline{L} - L_N^D\left(\tilde{W}^*\right)I. \end{aligned}$$

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

Alternatively, the level of unemployment in the nominal labour market U_N is

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

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

4.3 A Simple Extension

Previously, it was assumed that the coefficient on the normalised nominal wage in the individual labour supply function was a constant; that is, 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]

[20] See 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.

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

The signal can then alter the preference of the workers such that there is no unemployment in the nominal frame; by setting D such that

$$\begin{aligned} L_N^S\left(\tilde{W}^*\right)\overline{L} &= L_N^D\left(\tilde{W}^*\right)I \\ \Leftrightarrow U_N\left(\tilde{W}^*\right) &= 0. \end{aligned}$$

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

The similarity between the Solow condition from the ordinary efficiency wage theory and (7) is unsurprising given that money illusion amongst workers implies that only the nominal wage is relevant for workers. In words, firms no longer minimise the real labour cost per efficiency unit but nominal labour cost per efficiency unit.[22]

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 (that is, higher potential productivity) leads to a lower efficiency wage; workers who return greater effort given a nominal wage level require lower nominal wage level to achieve the optimal outcome for the firm.[23]

The model in section 4.2 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, I conclude that money illusion is one of the causes of persistent unemployment. In addition, the overlapping 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 4.3 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 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. It can be shown, however, that the government indeed has the incentive to provide the signalling mechanism.

[22] From the perspective of the firm, the two are equivalent.
[23] See Appendix 3 for the graph.

Assume heterogeneous workers where some have the ability to convert between the nominal wages and the real wages. In addition, 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 wage and denote this function $L^S_{R'}(\tilde{\omega})$.[24] The level of unemployment in the real labour market is then

$$\begin{aligned} U_R(\tilde{\omega}^*) &= \left[pL^S_{R'}(\tilde{\omega})\overline{L} + (1-p)L^S_R(\tilde{\omega})\right] - L^D_R(\tilde{\omega}^*)I \\ &\neq \overline{L} - L^D_N\left(\tilde{W}^*\right)I. \end{aligned}$$

Thus, the signal can have an effect in the real labour market as $L^S_{R'}(\tilde{\omega})$ 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 firms 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 firms have no incentive to correct workers' belief. It is able to capture even more of worker surplus. Workers, on the other hand, 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.

In cases 1 and 2 (the two most likely cases), either the firms or the workers have 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

[24] In 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.

unemployment rate; for example, the government which is what happens in many countries. Given these credible announcements, nominal unemployment will converge in the 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; that is, 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; Wadhwani 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); for example, 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; for example, by 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 neural 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. Note that even if the firm is uncertain about the effort function, 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. The lack of interaction between the firms and the 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, considering one group as the leaders of a union and the others as 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

I 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. I showed that by using the relation given in (1) (that is, 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.

I 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, I showed 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. Furthermore, I proposed a reason 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.

In the past, money illusion has been largely ignored and there is a lack of study into the field. I support the view held by Shafir et al. (1997), that money illusion can be systematically studied and introduced an alternative way in which it may be incorporated into existing models.

A Appendices

A.1 Traditional Efficiency Wage Theory

Based on Romer (2006), chapter 9.

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

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

where $F\left(\cdot\right)$ is the production function, $g\left(\cdot\right)$ is the average effort/productivity of workers, L is the number of workers, and ω is the real wage.[25] First order conditions lead to the Solow condition:

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

In words, elasticity of effort with respect to wage is unity. The real wage satisfying (9) is known as the efficiency wage. Let ω^* and 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, the 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 following

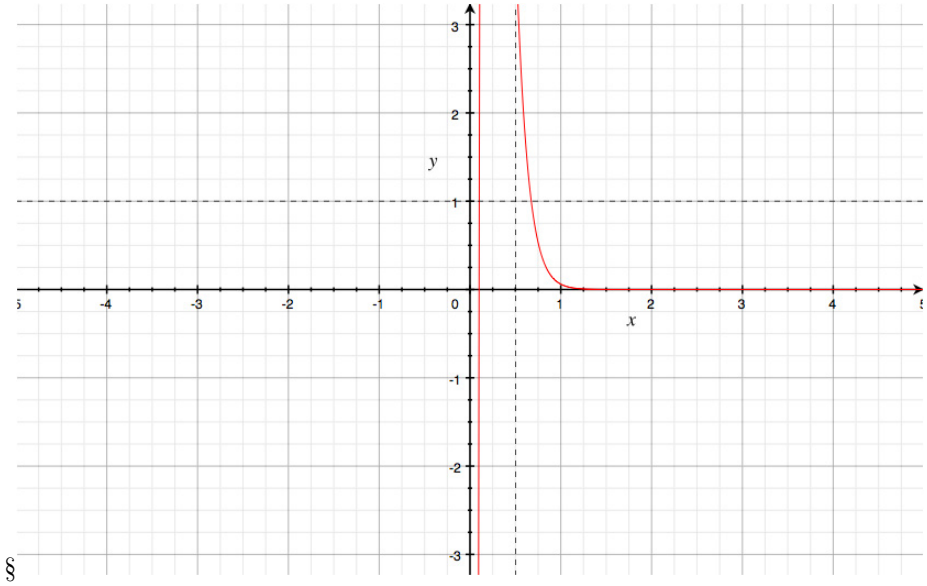
$$g = g\left(\omega, u\right),\ e_1\left(\cdot\right), e_2\left(\cdot\right) > 0,$$

where u is the 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] $e\left(w\right)L$ is the amount of effective labour.

A.2 Graphical Solution to Efficiency Wage



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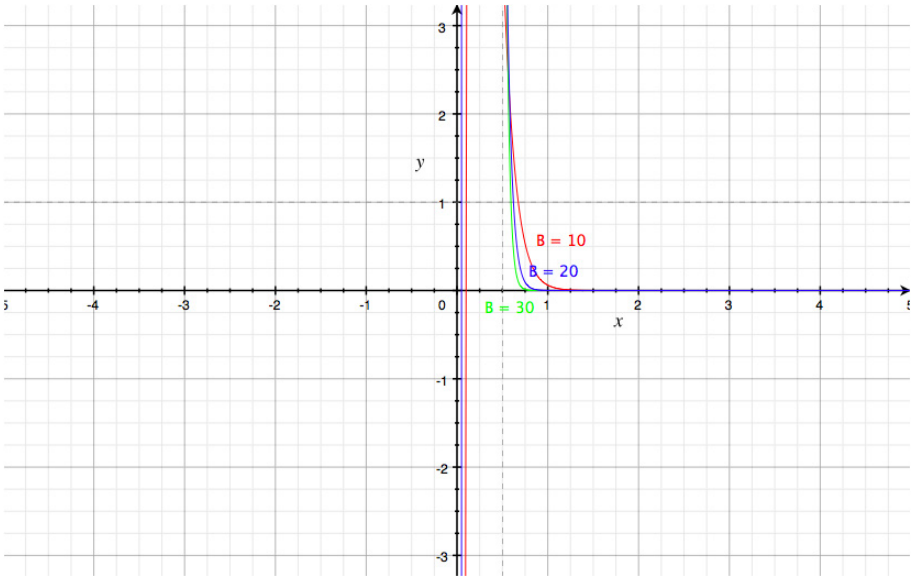
A.3 Analysis of Efficiency Wage



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