Sticky wages, labor demand elasticity and rational unemployment

Chen, Siyan and Desiderio, Saul

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Sticky wages, labor demand elasticity and rational unemployment

Siyan Chen[a] Saul Desiderio[a, b]

Abstract

In this paper we give a clear-cut explanation to the sluggish wage adjustments which are commonly experienced also in face of involuntary unemployment. We prove that unemployment may be the physiological outcome of rational decisions by competing workers who may find it optimal to ask higher wages than the full-employment ones. The key element driving the result is the slope (or elasticity) of labor demand schedule: in case of rigid labor demand, in fact, workers' wage requests are kept high because of reduced unemployment opportunity costs. This contrasts with other approaches to the analysis of unemployment, where only the level of labor demand is considered. Impatience of working and effort required by the job are also showed to influence the degree of wage stickiness.

Keywords : Sticky wages, involuntary unemployment, labor demand elasticity, game theory

JEL classification : C72, E24, J23, J64

1 Introduction

Sticky wage theories are currently the most popular approach to the analysis of unemployment. If on one hand such models appear as sophisticated and formally elegant explanations of unemployment, on the other hand they often rest on rather *ad hoc* and implausible assumptions. The goal we pursue in

[a]Business School, Shantou University, Daxue Road 243, Shantou, Guangdong, P. R. China. Tel.:+86 754 82903386; fax:+86 754 82903442

[b]Corresponding author. E-mails: saul@stu.edu.cn, saul1979@libero.it

this paper, therefore, is to provide a simple and general explanation to wage stickiness and persistent involuntary unemployment[1].

The benchmark for the sticky wage models is represented by the Classical marginalist theory of unemployment, which holds the Walrasian presumption that wage adjustments always settle imbalances between demand and supply of labor. In this view unemployment is largely voluntary and therefore needs not to be explained (and cared of)[2]. However, in reality the observed wage adjustments are not as prompt as they are supposed to be by Classical theory, and unemployment is acknowledged to be an involuntary and persistent phenomenon.

In the view of sticky wage theories the labor market is still intrinsically Walrasian and prone to attain the balance of demand and supply, but wages are prevented from adjusting to full employment levels by frictions of one sort or another. These theories can be therefore classified according to how they explain the nature of the rigidities causing market-clearing to fail. Since the literature is very huge, in what follows we just recall the principal strands of research that make it up.

Among the principal examples we find *contracting* models (e.g. Taylor, 1979) and *search* models (e.g. Diamond, 1982). Unfortunately, these approaches do not provide true economic explanations and basically border on tautology, the former stating that wages do not adjust because predetermined job contracts prevent them from adjusting, the latter claiming that individuals cannot find a job because the search for a firm willing to hire is costly. Also, even though legal commitments and search costs may partly explain the presence of persistent equilibrium unemployment, these frictions could hardly be satisfactory explanations of its cyclical variations. In fact, if frictions cause a given level of unemployment, then in principle their variations should cause variations in unemployment. But cyclical movements in frictions preceding those of the unemployment rate are hardly observed. The explanation to unemployment variations should be therefore sought elsewhere.

Another popular way to explain sluggish wage adjustments is represented by the *efficiency-wage* theories (e.g. Shapiro and Stiglitz, 1984), which prove that firms, in presence of imperfect monitoring, might find it convenient to

[1]We shall be loose on whether wages are nominal or real since this is not crucial for the analysis.

[2]Classical attitude toward the unemployed is not dissimilar from that held by Queen Marie Antoinette toward the Parisians asking for bread during the French Revolution.

pay higher wages than the full-employment ones in order to prevent workers from shirking. Efficiency-wage models provide economic explanations to sticky wages but, perhaps, for the wrong reasons. Crucial to the analysis, in fact, is the naive, unproven and unnecessary assumption that workers shirk in full-employment conditions. Moreover, real firms need not to pay "high" wages to reduce the temptation of shirking because they dispose of many other incentives such as wages linked to individual productivity. Efficiency-wage theories can be also questioned as far as their predictions are concerned. As a matter of fact, these models hold that wages are fully flexible outside equilibrium, but fixed at equilibrium. Hence, they do not explain why wages are sticky even in face of excess of labor supply, but tell why equilibrium wages *must* always lie above the market-clearing level and why full employment can never be attained, regardless of labor demand. Clearly, these predictions are unnecessary. Last but not least, there is one more aspect that to our knowledge has so far never been recognized. In these models equilibrium unemployment occurs at the intersection between labor demand and the no-shirking condition curve. The no-shirking condition curve represents the wage to be paid in order to induce a given amount of employees to exert effort, that is to induce them to provide their labor, and basically matches a canonical forward-leaning labor supply schedule. In fact, both functions are mappings from offered wages to labor supply. Thus, the efficiency-wage approach, apart from the formal complicacies and the rather *ad hoc* assumptions that characterize it, is essentially identical to the Classical theory[3].

As a conclusion to our brief review, we point out that while maintaining the involuntary nature of unemployment, the sticky wage approach reduces it to a peculiar equilibrium of the labor market. This is the starting point of the present paper, where we are going to assume an alternative perspective. In our opinion, in fact, what can be observed in labor markets at the usual time frequencies is neither an equilibrium nor a permanent situation of disequilibrium, but a slow process of adaptation possibly converging to some equilibrium. Consequently, wages should be regarded neither as fixed nor as fully flexible. The correct research question, therefore, is not to explain why a smooth adjustment process eventually sticks into a situation charac-

[3]Efficiency wages supporters may point out that at equilibrium unemployment is involuntary. However, in our opinion semantic tricks are being played here. In fact, if the unemployed were hired at an infinitesimally lower wage, they would shirk, and shirking workers are ones who do not want to supply labor. Therefore, they are not different from voluntarily unemployed workers (aside from an economically small epsilon, of course!).

terized by involuntary unemployment, but is to explain why this process can be more or less sluggish. To understand that the difference is substantial, let us consider Fig. (1), where two different labor markets are depicted: both share the same rigid labor supply S, same current wages w_0 and same levels of unemployment, but one is characterized by a steep (inelastic) labor demand D, while the other is characterized by an elastic labor demand D'. Full-employment wages are respectively equal to 0 and 12. Paradoxically, ac-

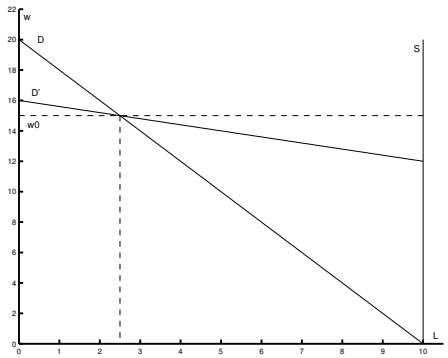

Figure 1: Two alternative labor markets: with rigid (D) and elastic demand (D')

cording to economic theory the two scenarios are identical. On the one hand Classical theory holds that both markets will quickly converge to full employment, even though in the case of inelastic demand workers are supposed to accept a null wage, on the other hand the sticky wage approach predicts that unemployment will persist in both scenarios, although in the case of elastic demand the wage reduction necessary to reach full employment is small. But simply calling upon common sense, we believe that anyone would agree on the fact that a relatively prompt adjustment to full employment is more likely to occur in the elastic labor demand case, while more resistance should be experienced in the rigid demand case. The essence of this paper is exactly to prove that to rational workers the two scenarios are indeed different.

To formalize the above intuition, we set up a stylized game-theoretic framework where rational unemployed workers compete for a job by bidding

wage offers. While they are ready to work at any wage level (including full-employment wages), they would also like to earn as much as possible. But because of competition, high bids may drive them out of the market. Workers, therefore, face a trade-off between the certainty of finding a job at a low wage and the risk of experiencing a long spell of unemployment caused by too exorbitant wage bids. In solving this dilemma, workers may actually find it optimal asking at first high wages, and reducing their requests only later if necessary. Thus, sluggish wage adjustments and the consequent persistent unemployment may be the natural outcome of competition among rational workers and not of macroeconomic disequilibrium or microeconomic frictions impeding firms from hiring. We point out that, in spite of marked formal differences, our approach might be seen as an instance of *competitive search* modeling (Moen, 1997; Shimer, 1996), where wage posting by firms is combined to directed job search by workers (see Rogerson *et al.*, 2005).

The key factor driving our result is the slope (or the elasticity) of labor demand schedule, which normally is not given much consideration in the analysis of unemployment: when demand is inelastic sticky wages and persistent unemployment are more likely to show up, while full employment can be restored more easily when labor demand is elastic. This finding contrasts with other approaches, such as Keynesian economics, where the *level* of labor demand is regarded as the cause of unemployment. Moreover, we find that other two factors of secondary importance can also play a role in increasing wage stickiness: the degree of patience characterizing the workers and the effort required by the job. In particular, we can deduce that ill-paid and hard jobs are generally made only by the poor.

Besides the traditional dichotomy of voluntary and involuntary unemployment, we propose here a third concept that we take the liberty to call "*rational unemployment*". It is not involuntary as no rigidity prevents workers from immediately finding a job by bidding the full-employment wage, and it is not even voluntary in the Classical sense because workers are in principle available to work at any wage level. In a sense, we can think of rational unemployment as a lost bet.

The remainder of the paper is organized as follows. In section 2 we describe the model and discuss the main result. In the third section we extend the model by introducing the working effort and analyze the relationship between impatience of working and the effort required by the job. Section 4 concludes.

2 The model

Consider a labor market made up of one monopsonistic firm and two competing unemployed workers[4]. At the current wage w_0 the firm has no vacancies, but it is willing to open one vacancy at wage rate w_1 and two vacancies at w_2, with $w_0 > w_1 > w_2$. The workers are available to accept any wage level in order to get the job. As a consequence, w_2 is the full-employment wage rate. The workers compete for the two jobs bidding a wage offer. The game lasts two periods and everything is common knowledge. Even though considering an infinitely repeated game would seem more appropriate to explain persistent unemployment, we stick to the simpler two-stage game because results qualitatively coincide.

To determine the payoff functions we have to consider three possible cases. In the first case both workers bid w_2 and the firm opens two vacancies, so that they get the job at the proposed wage. This is the Classical solution, with wages immediately set at full employment level.

In the second case one worker bids w_1 and the other bids w_2. Hence, the one bidding less immediately gets the job at wage w_2, while the other stays unemployed since she is asking for a job at a higher wage. In the second period the firm's labor demand is decreased by one at any wage rate as one worker has been employed in the previous period. Consequently, at w_1 the firm has no more vacancies, and has only one at w_2. Thus, the unemployed is forced to bid w_2 in order to work. We suppose that the second-period wage is discounted by a non-negative factor $\beta \leq 1$. In this case unemployment is persistent as it takes two periods to disappear, even though the wage at which both workers find the job is the full-employment one w_2.

In the last case both workers bid w_1 and the firm opens one vacancy only. We assume that each worker has $1/2$ of probability to get the job at w_1. Who stays unemployed will face in the second period a reduced labor demand as above explained. However, the firm has one more worker employed at wage w_1, and it is likely that she is not willing anymore to open another vacancy at wage w_2. So, in order to keep the firm's behavior consistent we should assume that the worker can get the job only at the wage $w_3 \leq w_2$[5]. Thus,

[4]From a formal viewpoint, our model resembles that of Montgomery (1991), where two firms post wages and two workers apply for a job. However, similarities stop here.

[5]Notice that this assumption is the most unfavorable to our argument, as we will show in a while.

assuming risk-neutrality each worker has an overall expected payoff of

$$\pi_i(w_1, w_1) = \frac{2w_1 + \beta w_3}{2}. \tag{1}$$

Also in this case unemployment is persistent. In addition, wages adjust slowly, from w_0 to w_1, and then from w_1 to w_3.

The game is summarized by the payoff matrix given in Fig. (2). As we

	w_1	w_2
w_1	$\frac{2w_1+\beta w_3}{2}, \frac{2w_1+\beta w_3}{2}$	$\beta w_2, 2w_2$
w_2	$2w_2, \beta w_2$	$2w_2, 2w_2$

Figure 2: Workers' payoffs

can see, the Classical outcome '(w_2, w_2)' is indeed a Nash Equilibrium of the game. However, the crucial point is to assess its plausibility.

For the time being, let's consider the extreme case of $w_3 \leq 0$: if both workers choose the pair of strategies '(w_1, w_1)', then in the second period the unemployed cannot find a job at a positive wage. Though, the pair '(w_1, w_1)' can still be an equilibrium if $w_1 \geq 2w_2$, that is when the labor demand schedule is very steep, or inelastic. If this is the case this solution Pareto-dominates the Classical equilibrium and proposes itself as the focal point of the game. Its meaning is straightforward: when the wage reduction necessary to immediately find a job is excessive, the workers find optimal to risk a longer spell of unemployment in order to gain a high wage or, better, not to end up with too low a wage. Thus, when labor demand is rather inelastic wages adjust slowly and unemployment takes time to disappear simply as a result of rational choices, whereby our definition of rational unemployment.

More in general, we can define the Rational Unemployment Region (RUR) as all the possible combinations of values for the vector (β, w_1, w_2, w_3) such that rational unemployment and sluggish wages show up as equilibrium phenomena. The RUR is given by the set of non-negative values satisfying

$$\frac{2w_1 + \beta w_3}{2} > 2w_2,$$

that is

$$w_1 - w_2 > w_2 - \frac{\beta}{2} w_3. \tag{2}$$

Inequality (2) helps to show the importance of the elasticity of labor demand: the larger the difference between w_1 and w_2 or the smaller the one between w_2 and w_3, the higher the possibility of having persistent unemployment.

The RUR also shows how the degree of "patience" β influences wage stickiness and unemployment. If the workers are patient (β close to 1), as in the case of individuals endowed with enough savings to live without working, or supported by their family, or again benefiting from unemployment subsidies, then the RHS of inequality (2) is smaller and the pair of strategies '(w_1, w_1)' is more likely to be an equilibrium. The interpretation of the role of β is clearcut: if workers are not compelled to bid down the wage by some contingency (i.e. if their budget constraint is not binding), they actually could find it optimal trying to get the job at a high wage (w_1) at the risk of remaining unemployed for a longer period. Conversely, when β is close to 0, that is when unemployed workers are impatient to find a job because their budget constraint binds, the Classical outcome '(w_2, w_2)' is more likely to be the unique solution of the game. This finding is consistent with the fact that poor people are more inclined to accept low wages.

In the next section we extend the model to include the effort of working, and we will see that also in this case our framework forecasts reasonable results.

3 Effort and unemployment

In this section the working effort is introduced. We will see that when the effort required by the work is higher, the workers are more reluctant to bid down the wage (the strategies '(w_1, w_1)' become the Pareto-dominant equilibrium). In addition, we find a convincing relationship between effort and patience.

Now, working costs an effort e to workers, whereby their payoff from working reduces to $w - e$. The new payoff matrix is shown in Fig. (3), where we set $w_3 = w_2$ to make algebra simpler.

Again, the RUR is given by

$$\frac{2w_1 + \beta w_2 - (2+\beta)e}{2} > 2(w_2 - e),$$

that is

$$2w_1 - 4w_2 > \beta e - 2e - \beta w_2. \tag{3}$$

	w_1	w_2
w_1	$\frac{2w_1+\beta w_2-(2+\beta)e}{2}, \frac{2w_1+\beta w_2-(2+\beta)e}{2}$	$\beta(w_2-e), 2(w_2-e)$
w_2	$2(w_2-e), \beta(w_2-e)$	$2(w_2-e), 2(w_2-e)$

Figure 3: Workers' payoffs

For given w_1 and w_2, the occurrence of rational unemployment depends on β and e. Since the derivative of RHS of inequality (3) with respect to both β and e is negative, these two parameters increase the likelihood of persistent unemployment. In fact, effort reduces the value of a job and therefore the incentive to work, and it is logical for workers to ask for higher wages. Said in passing, we frankly believe that the way effort works in our model is much more realistic than how is supposed to work in efficiency wage theories. However, it is even more interesting to study how the parameters β and e interact with each other, as shown below.

First, suppose that $e \leq w_2$ (otherwise in the second period there is no incentive whatsoever to work). For a given e, we define $\hat{\beta}(e)$ as the maximum degree of patience that workers may possess such that the LHS in (3) is not greater than the RHS, making the Classical solution '(w_2, w_2)' the unique equilibrium of the game. So, $\hat{\beta}(e)$ is such that

$$2w_1 - 4w_2 = \hat{\beta}e - 2e - \hat{\beta}w_2,$$

from which

$$\hat{\beta}(e) = \frac{a-2e}{w_2-e}, \tag{4}$$

where we have set $2w_1 - 4w_2 = -a$.

If the degree of patience characterizing the workers is lower than the threshold $\hat{\beta}(e)$, then the full-employment equilibrium is the only outcome, while if it exceeds $\hat{\beta}(e)$ then the sticky wages/persistent unemployment solution '(w_1, w_1)' becomes the focal point of the game. Eq. (4) shows that threshold $\hat{\beta}(e)$ is clearly decreasing in e, which implies that higher effort levels are compatible with the Classical outcome only for smaller degree of patience. In other words, more patient workers (say 'richer' workers) can only tolerate low effort levels before the focal point of the game becomes '(w_1, w_1)'. On the contrary, less patient workers (say 'poorer' workers) can

still have an incentive to bid a low wage w_2 even though the job becomes harder. This finding is consistent with the fact that in general hard and ill-paid jobs are performed by the poor.

4 Conclusion

The goal of this paper was to give a clearcut rationale for the sluggish wage adjustment which is commonly experienced also in face of involuntary unemployment. We have proved that unemployment needs not to be necessarily the fruit of macroeconomic disequilibrium or frictions impeding the right working of labor market mechanisms, but that it may simply be the natural consequence of workers' rational decisions. We did so by working with a theoretical apparatus characterized by extreme formal simplicity, which is always a value added when explaining real phenomena.

We assumed that unemployed workers compete for a job by bidding wage offers. While they are ready to work at any wage rate, at the same time they would like to earn as much as possible. Workers, therefore, face a trade-off between the certainty of finding a job at a low wage and the risk of experiencing a long spell of unemployment caused by too exorbitant wage bids. We have showed that workers may indeed be reluctant to immediately bid low wage offers and want to assume the risk of remaining unemployed for a long period. We have therefore referred to this kind of unemployment as *rational unemployment* to stress that it is neither voluntary in the Classical sense, because workers do want to have a job, nor involuntary, as no rigidity prevents workers from bidding the full-employment wage level.

The major factor driving the result is the *elasticity* of labor demand, which is in general neglected in the analysis of unemployment. Labor demand rigidity, in fact, lowers the convenience of finding a job since it requires the bidding of a low wage level. As a consequence, it decreases the opportunity cost of being unemployed. This marks a sharp difference with other approaches, where only the level of labor demand is considered.

The model also predicts that poor people are more inclined to accept low wages and hard jobs. This finding, which is largely consistent with common sense and everyday experience, helps to increase our confidence that the proposed approach to unemployment is viable and potentially fruitful.

Extensions might include that of making the degree of impatience endogenous or of explicitly considering opportunity costs in the workers' decisions.

As an example, it is often wondered why the unemployed do not move to other cities to find a job. A likely explanation is that workers might face opportunity costs in moving, for instance because in their city they already own a house and the wage they might earn in another city could not be high enough to buy a new house. Again, workers could have fixed costs to pay every month, or minimum consumption levels to attain; if labor demand is inelastic and the wage they could earn is not sufficient to meet their needs, then they may keep on asking high wages. Moreover, this can also provide a rationale for why individuals may eventually exit the labor force.

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