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THREE UNEMPLOYMENT MEASURES RELEVANT TO MONETARY POLICY

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Abstract

The paper describes a Neo-Keynesian model, with a standard specification for the utility function and nominal rigidities, in which monopolistic firms have norms and the bargaining power in the wage setting process is variable. Due to the norms, the firms hire workers in excess of the number of employees required by technology. They are efficiency reserves of the firms. We present the implications for the inflation-unemployment trade-off.

We proceed in two steps. First, we leave aside the nominal rigidities. The model implies a negative relation between the real wage and the unemployment rate. Besides the natural rate of unemployment, two other unemployment rates are relevant for the decisions. We show that, in the presence of norms, in certain conditions, the bargaining power determines the temporary shift to an alternative wage setting mechanism (AWSM), which eliminates the efficiency reserves. This consists in the simultaneous increase of the real wage and the unemployment rate. The paper presents these conditions.

Finally, we introduce nominal rigidities in the form of sticky prices and we derive a negative relation between inflation and unemployment rate. We show that, in the presence of norms, the response of unemployment rate to a change in the monetary policy stance is relatively large. In the case of AWSM, unemployment rate increases without a fall in inflation rate. The monetary policy can only temporarily realign the unemployment rate to the level seen before the use of efficiency reserves at the cost of higher inflation rate.

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1. Introduction

The conduct of monetary policy is guided by several fundamental principles, two of which refer to money neutrality. One of the two principles, which is attributed to Friedman (1968) and Phelps (1968), shows that, in the long run, there is no trade-off between inflation and unemployment, as money is neutral. The second principle states that monetary policy can exploit the negative relation between inflation and unemployment in the short term. The standard Neo-Keynesian model (NK), which plays an essential role in the conduct of monetary policy, incorporates these principles but does not include adjustments in the unemployment rate (Blanchard, 2008). Recently, Blanchard and Gali (2008) have expanded the model by introducing the labor market with frictions and sticky wages. This change allows for characterizing the effects of productivity shocks on inflation and employment and the manner in which they depend on monetary policy and the nature of frictions.

This paper extends the NK model by introducing the labor market in which: (i) part of the employees has key qualifications for the branch in which the firm operates, and the other part performs auxiliary activities; (ii) only the workers with key qualifications have wage bargaining power; (iii) the wage bargaining power of employees and firms is variable; and (iv) the firms have norms regarding the adequate number of auxiliary workers. Due to these norms, there are persons performing auxiliary activities in excess of the number required by technology. They are efficiency reserves of the firms. By adding nominal rigidities, we derive a negative relation between inflation and unemployment. The establishment or removal of norms influences this relation through the shocks in employment and labor productivity. In certain conditions and only temporarily, the relation does not work, and unemployment rate increases without a fall in inflation rate. Moreover, we discuss what monetary policy should do in this case.

The paper is organized as follows:

Section 2 presents the model, leaving aside the nominal rigidities in price and wage setting. The firms establish the norms when aggregate demand is high enough for the unemployment rate, u_t, to drop below a relevant level, u_{nor}. Norms and efficiency reserves can be removed by the fall in aggregate demand so that $u_t \geq u_{nor}$ or by a supply shock. The presence or the absence of norms induces an unemployment rate which is lower or higher for the same level of production. Consequently, the response of unemployment rate to a certain change in production is larger if the norms are present as compared to the situation in which they are not. The magnitude of the response changes cyclically, whenever demand fluctuations lead to a decline or an increase in the unemployment rate below or above the level u_{nor}.

Bargaining power depends on the aggregate demand and can be expressed in terms of the unemployment rate. In the presence of norms the employees have maximum bargaining power at low unemployment rate, u_{min}. If there were no norms, the unemployment rate would be u_{min}^1, which is higher than u_{min} with the efficiency reserves. The firm has maximum bargaining power

at an unemployment rate that is sufficiently high, $u_{max} \geq u_{nor}$ [1]. Thus, the demand change determines the transfer of the bargaining power between workers and firms within the interval $[u_{min}, u_{max}]$ if the norms are present, or within the interval $[u^1_{min}, u_{max}]$ otherwise. The natural rate of unemployment (u^*) lies within these intervals.

The equation for the labor force demand results from the price setting process in an economy with monopolistic competition. The labor supply equation results from a Nash wage bargaining process. The resulting wage is the notional wage. Both processes depend on the real wage. The supply equation shows that the real notional wage increases when unemployment rate falls[2]. The equilibrium wage is established when unemployment is at its natural level and ensures the concurrent maximization of unitary surpluses of both firms and employees.

Section 3 shows that, in the presence of norms, if $u_t \leq u^*$ and u^* is sufficiently close to u_{min}, one can switch to a temporary alternative wage setting mechanism. This occurs if workers decide to use their bargaining power in order to increase the real wage beyond the notional level and the firm responds by dismissing excess workers in order to preserve its unit labor surplus. The information asymmetry and inflation expectations could favor this decision. Thus, the real wage, labor productivity and unemployment rate rise simultaneously, leaving the marginal cost gap and the unemployment gap unchanged. This is equivalent to the increase in the natural unemployment rate.

Section 4 introduces sticky prices in the model. On this basis we derive the Neo-Keynesian relation between current inflation, anticipated inflation and the anticipated real marginal cost gap, which, in this model, depends on the unemployment rate. We show that the norms influence the effects of monetary policy on this relation. Moreover, we show that the temporary alternative wage setting mechanism leads to an increase in unemployment rate without a fall in inflation. According to the two fundamental principles, monetary policy can realign the unemployment rate to the level seen before dismissing excess workers only temporarily and at the cost of higher inflation. Section 5 presents the conclusions.

[1] The cyclical movement of the unemployment rate response to a given change in production is no longer valid if $u_{max} = u_{nor}$.

[2] The results of empirical studies dealing with the relation between wages and unemployment rate are mixed. Blanchflower and Oswald (1994) have shown that there is a strong correlation between wages and unemployment in the USA. By contrast, Blanchard and Katz (1997) have shown, by analyzing regressions for the states of the USA, that there is a correlation between nominal wages and unemployment, but that the unemployment dependency is low and wages are more dependent on their previous levels.

2. The model

2.1. Assumptions

Preferences

The representative household is made up of a continuum of members normalized to 1. The proportion of the representative household members which are employed by firms is L , whereas leisure or unemployment is $u = 1 - L$. The preferences of the representative household are defined over a composite consumption good C_t and leisure. Each member of the household maximizes the expected present value of utility:

$$E_t \sum_{i=0}^{\infty} \delta^i \left[\frac{C_{t+i}^{1-\sigma}}{1-\sigma} - \chi \frac{L_{t+i}^{1+\phi}}{1+\phi} \right] \quad (1),$$

where σ is the coefficient of relative risk aversion of households and ϕ is the inverse of the wage elasticity of labor supply.

The composite consumption good C_t is defined as:

$$C_t = \left[\int_0^1 c_{jt}^{\frac{\beta-1}{\beta}} dj \right]^{\frac{\beta}{\beta-1}},$$

where β is the price elasticity of demand and satisfies the condition $\beta > 1$.

The representative household decides to purchase that combination of individual goods that minimizes the cost of the chosen quantity of the composite good. The cost minimization problem is

$$\min_{c_{jt}} \int_0^1 p_{jt} c_{jt} dj$$

provided that

$$\left[\int_0^1 c_{jt}^{\frac{\beta-1}{\beta}} dj \right]^{\frac{\beta}{\beta-1}} \geq C_t ,$$

where p_{jt} is the price of the good j . Solving this problem, one can obtain the demand (c_j) for each consumption good j .

$$c_{j_t} = C_t \left(p_t / \overline{p}_t \right)^{-\beta} \quad (2).$$

In equation (2), $\overline{p}$ stands for the economy-wide average price level, whereas p is the average production price of a firm. The ratio $\left(p_t / \overline{p}_t \right)^{-\beta}$ gives the negative slope of the demand for the firm's products.

The aggregated budgetary constraint of the consumer is:

$$C_t + B_t / \overline{p}_t = \left(\overline{W}_t / \overline{p}_t \right) L_t + \left(1 - r_{t-1} \right) \left(B_{t-1} / \overline{p}_t \right) \quad (3),$$

where $\overline{W}_t$ is the economy-wide average nominal wage, B_t is the nominal value of the bonds owned by consumers and r_t is the interest rate. Relations (1) and (3) give the inter-temporal optimality condition which establishes the marginal rate of substitution between leisure and consumption:

$$\chi L_t^{\phi} / C_t^{-\sigma} = \overline{W}_t / \overline{p}_t \quad (4).$$

Technology

Each monopolistically competitive firm produces a differentiated final good j. All firms have access to an identical technology, which is assumed to vary exogenously over time. Given this technology, each firm requires a number of employees with key qualifications for its own market niche (L^{np}) and a number of workers who are auxiliary to the production process (L^{sb}). The unemployment rates u^{np} and u^{sb} match these two categories of workers. The total number of employees is given by $L^P_t = L^{np}_t + L^{sb}_t$. Accordingly, the unemployment rate is $u^P_t = u^{np}_t + u^{sb}_t$. Due to technology, the ratio between the auxiliary workers and the ones with key qualifications (c_p) is constant:

$$L^{sb}_t = c_p L^{np}_t \quad (5).$$

Thus, L^P_t can be written as:

$$L^P_t = 1 - u^P_t = \left(1 + c_p \right) L^{np}_t, \text{ with } c_p > 0 \quad (6),$$

and the production (Y_t), equal to consumption C_t, is directly proportional to the number of employees L^{np}_t:

$$Y_t = \eta_{xef} \left(1 + c_p \right) L^{np}_t \quad (7),$$

where η_{xef} is labor productivity, which we assume to be constant.

Norms

When the economic perspectives are favorable, during the upturn of the business cycle, the firms establish norms (as described by Akerlof, 2007) regarding the adequate number of auxiliary workers[3]. The norms regarding the auxiliary workers are established when aggregate demand is high enough to trigger a decrease in the unemployment rate below the relevant u_{nor}. It is worth mentioning that $u_{nor} = u_{nor}^{np} + u_{nor}^{sb}$.

Due to the norms, the actual number of auxiliary workers is systematically larger than L^{sb}_{t}. This causes the unemployment rate in the presence of norms, u^{R}_{t}, to be lower than u^{P}_{t} with excess workers, u^{xef}:

$$u^{R} = u^{P} - u^{xef} \qquad (8).$$

Equation (8) shows that the adoption or elimination of norms induces a shock in the unemployment rate equal to u^{xef}. Being in excess, the workers u^{xef} do not influence the level of production, but only the labor productivity, representing efficiency reserves of the firms. Moreover, u^{xef} can be interpreted as the "comfort rate" enjoyed by both employees and government[4].

Because of the norms, firms and workers perceive the total number of employees $L^{R}_{t} = 1 - u^{R}_{t}$ as being normal. Being rational agents, the firms seek to avoid having employees in excess of L^{R}_{t}[5]. Firms regard the excess workers u^{xef} as efficiency reserves in two cases: (i) when demand falls sufficiently so that $u_t \geq u_{nor}$ or (ii) if they face a supply shock (z) that forces them to dismiss excess workers, or, in other words, to use the efficiency reserves. A supply shock can change the

[3] Norms are established in relation with workers performing routine activities and not with those with key qualifications for the branch in which the firm operates because the relation between the former and technology is less strict. For example, a software firm can function with 50 programmers, each using a computer. Technology requires two hardware engineers to solve the problems that arise when using the computers. Yet, the firm and workers can agree that it is safer to hire four hardware engineers. Obviously, the effort is greater when using only two engineers.

[4] If the firm did not hire excess workers, they would receive unemployment benefits smaller than their wages, thus increasing government expenditures. Because $L + u = 1$, the ratio $u^{xef} / (L + u) = u^{xef}$.

[5] In addition to the result induced by norms, the firm can also hire excess workers if it anticipates a significant increase in demand. Hiring personnel is difficult when demand increases at relatively high rates. Firms build up personnel "reserves" from both categories in order to be prepared to respond to the increase in demand. But these reserves are temporary. They run out as demand increases and firms use the personnel reserves to produce more. Thus, they are not efficiency reserves of firms. It is reasonable to assume that at the natural rate of unemployment or at a smaller rate, the firm has used up these personnel reserves. We agree with John Vickers (1995), who found a trade-off between the costs of having slacks and the cost of risk. If the future payment is related to a performance ratio, it would be best for a manager to act inefficiently now in order to maintain the potential for achieving future gains with average efforts. In our view, there is no contradiction between this approach and the neoclassical theory.

way in which a firm perceives the number of employees if it has the power to 'disclose' the efficiency reserves. In our view, a shock has this power if it reduces the remaining unit labor surplus. Such a shock forces the firm to use the efficiency reserves in order to preserve the surplus or to minimize its reduction.

In order to provide a formal description and keep it simple, we concede that u^{xef} is a constant fraction (c_{xef}) of the minimum number of auxiliary workers hired after establishing the norms ($u^{xef}{}_t = -c_{xef}(1-z_t)\Delta u^{sb}_{nor\,t}$, where $\Delta u^{sb}_{nor\,t} = u^{sb}{}_t - u^{sb}_{nor}$). Thus, if $u^{np}{}_t < u^{np}_{nor}$ and $z = 0$, then $c_{xef} > 0$. If $z = 1$ or $u^{np}{}_t \geq u^{np}_{nor}$, then there are no norms and $c_{xef} = 0$. Considering equation (5), we can write

$$u^{xef}{}_t = -c_p c_{xef}(1-z_t)\Delta u^{np}_{nor\,t} \quad \text{if } u^{np}{}_t < u^{np}_{nor} \qquad (9),$$

where $\Delta u^{np}_{nor\,t} = u^{np}{}_t - u^{np}_{nor}$, and z is equal to 1 if there is a negative supply shock that forces the firm to use its efficiency reserves and is equal to 0 otherwise.

Equations (8) and (9) show that the unemployment rate depends not only on $L^{np}{}_t$ (which in turn depends on demand), as also shown by equation (6), but also on z and c_{xef}, which reflects the presence or absence of norms and efficiency reserves. If $z = 1$ or $u_t \geq u_{nor}$ (namely, in the absence of norms), given the level of production, the number of workers is set by technology. If $z = 0$ and $u_t < u_{nor}$ (namely, in the presence of norms), the number of workers with key qualifications is set by technology and the number of the effective auxiliary workers is the combined result of both technology and norms.

Using the previous notations, the general form of the production function is

$$Y_t = \begin{cases} \eta L_t = \eta(1-u_t) = \eta\left[(1+c_p)L^{np}{}_t + u^{xef}{}_t\right] & \text{if } z = 0,\ u^{np}{}_t < u^{np}_{nor} \text{ and } \Delta u^{np}{}_t \neq 0 \quad (10) \\ \eta_{xef} L_t = \eta_{xef}(1-u_t) = \eta_{xef}(1+c_p)L^{np}{}_t & \text{if } z = 1 \text{ and } u^{np}{}_t \geq u^{np}_{nor} \text{ and } \Delta u^{np}{}_t \neq 0 \quad (11) \\ Y_{t-1} & \text{if } u_t = u_{t-1} + u^{xef}{}_{t-1} \text{ and } \Delta u^{np}{}_t = 0 \quad (12), \end{cases}$$

where the constant η is labor productivity in the presence of norms.

Equation (10) specifies the firms' production function when there are efficiency reserves and equation (11) specifies the production function of the firm when there are no efficiency reserves[6]. Both equations show that the production of the firm is directly proportional with the

[6] This definition is compatible with the idea that labor productivity is constant as long as the firm does not change its technology, but it can grow by using efficiency reserves.

number of employees. Equation (12) shows that using the efficiency reserves leaves production unchanged.

The alternation between equations (10) and (11) is determined by the cyclical evolution of demand and by supply shocks which require the use of efficiency reserves. Once adopted, the norms operate as long as $u^{np}{}_t < u^{np}_{nor}$ and are not eliminated by a shock ($z = 0$). If $z = 0$ and demand increases or decreases within limits that preserve the validity of the inequality $u^{np}{}_t < u^{np}_{nor}$, the production function is given by equation (10). We assume that this occurs for i consecutive periods ($i \geq 1$ is an integer), after which demand decreases sufficiently for $u^{np}{}_t \geq u^{np}_{nor}$ and norms are eliminated. If for l periods ($l \geq 1$ is an integer) demand increases or decreases so that $u^{np}{}_t \geq u^{np}_{nor}$, the production function is given by equation (11). Norms are reestablished after l periods, when demand increases again high enough so that $u^{np}{}_t < u^{np}_{nor}$ and the cycle repeats itself.

A supply shock that eliminates norms and the efficiency reserves at moment t, when $u^{np}{}_t < u^{np}_{nor}$, remains in the memory of firms for i consecutive periods (here $i \geq 1$ shows the number of consecutive periods in which $u^{np}{}_t < u^{np}_{nor}$ after the shock). Thus, if $z = 1$ and demand increases or falls within limits that preserve the validity of the inequality $u^{np}{}_t < u^{np}_{nor}$ for i consecutive periods, production is given by equation (11). If after i consecutive periods, employment falls for l consecutive periods, so that $u^{np}{}_t \geq u^{np}_{nor}$, production is also given by equation (11). Norms are reestablished once demand increases enough for $u^{np}{}_t < u^{np}_{nor}$, so that the production function is again given by equation (10).

The cyclical evolution of demand combined with the norms, along with the supply shocks that reduce the firm's employee surpluses, produce shocks in the unemployment rate and labor productivity. A change in demand that determines the increase in unemployment rate from the level $u_{t-1} > u_{nor}$ to the level $u_t < u_{nor}$ or the other way around, from $u_{t-1} < u_{nor}$ to $u_t > u_{nor}$, is reflected by the relation

$$u_t - u_{t-1} = (1 + c_p)\Delta u^{np}{}_t + u^{xef}{}_t \qquad (13),$$

where $u^{xef}{}_t$ is the size of the shock determined by the adoption or elimination of norms.

The change in the unemployment rate in response to a change in demand (captured by $\Delta u^{np}{}_t$) after the adoption of norms is[7]

[7] This is obtained by adding to the differential of equation (6) with respect to $L^{np}{}_t$ the efficiency reserves in equation (9) and taking into consideration that $\Delta L_t = -\Delta u_t$ and $\Delta L^{np}{}_t = -\Delta u^{np}{}_t$.

$$u_t - u_{t-1} = \left(1 + c_p + c_p c_{xef}\right)\Delta u^{np}{}_t \quad \text{if } z = 0 \text{ and } u^{np}{}_t < u^{np}_{nor} \qquad (14),$$

where $\Delta u^{np}{}_t = u^{np}{}_t - u^{np}{}_{t-1}$, and after eliminating (or before adopting) them is

$$u_t - u_{t-1} = \left(1 + c_p\right)\Delta u^{np}{}_t \quad \text{if } u^{np}{}_t \geq u^{np}_{nor} \qquad (15).$$

Equations (14) and (15) show that the decrease (increase) in demand triggers relatively large increases (decreases) in unemployment rate if employment is above the level for which norms are adopted as compared to the situation in which employment is equal to or falls below this level.

In the case of a supply shock that leads to an instantaneous elimination of efficiency reserves, but leaves the level of production unchanged, the unemployment rate after the shock (when there are no efficiency reserves left, $u_t = u^P{}_t$) and the unemployment rate at the moment of the shock (when efficiency reserves still existed, $u_{t-1} = u^R{}_t$) satisfy the equation:

$$u_t - u_{t-1} = u^{xef}{}_{t-1} \qquad (16).$$

Equation (16) shows the increase in unemployment rate due exclusively to using efficiency reserves.

At the moment t when norms are removed (including due to shocks), labor productivity increases up to the constant level η_{xef} in order to satisfy the relation:

$$I_\eta = \eta_t / \eta_{t-1} = \eta_{xef} / \eta = \left(1 - u_{t-1}\right)/\left(1 - u_t\right), \quad \text{if} \quad u_t = u_{t-1} + u^{xef}{}_{t-1} \qquad (17).$$

Given the efficiency reserves and the wage level, the firms set prices to get a maximum profit. Once the prices are set by each firm, the demand for the products of a firm is given by equation (2). Knowing that, at equilibrium, demand is equal to production, then the level of production is implicitly determined.

2.2. Wage setting

The wage is set through a Nash-type bilateral bargaining between each firm and its workers, in the absence of any rigidity concerning the decrease in nominal wage. This is the notional wage. The notional wage is the generalized Nash solution when firms and workers bargain over wages, but not employment.

The real notional wage is set at that level that maximizes both the remaining unit labor surplus of the firm (S_f^{1-a}) and the remaining surplus of the employee (S_e^a). Thus, the level of the real notional wage in a Nash bargaining is obtained from the condition

$$\text{Max } S_f^{1-a} S_e^a \quad (18),$$

where a stands for the employees' bargaining power, which can range between 0 and 1.

Accordingly, $1-a$ is the firms' bargaining power. In condition (18), the remaining surpluses of firms and employees, respectively, as well as the bargaining power, need to be defined. We begin by defining the bargaining power as a function of unemployment rate.

2.2.1. Bargaining power and unemployment rate

Usually, in macroeconomic models, all employees have a constant bargaining power. In this model we assume that only workers with key qualifications for the branch in which the firm operates have bargaining power, while the auxiliary workers do not have bargaining power[8].

If only the workers with key qualifications have bargaining power, we can admit that the variation in the bargaining power depends on $\Delta L^{np}{}_t = -\Delta u^{np}{}_t$, similarly to production. Since $\Delta u^{np}{}_t$ appears as a response to the change in the aggregate demand, then, the variation in the bargaining power depends on the fluctuations in aggregate demand, similarly to production.

The higher the aggregate demand given the labor productivity, the stronger the labor force demand and the bargaining power of employees. The latter is at a maximum ($a=1$) if $u^{np}{}_t$ is equal to or below a critical value $u_{a=1}^{np}$ ($u^{np}{}_t \le u_{a=1}^{np}$, where $u_{a=1}^{np} > 0$). Conversely, the bargaining power of the employees is at a minimum ($a=0$) if aggregate demand is low enough for the unemployment rate of the workers with key qualifications to be equal to or higher than the critical value $u_{a=0}^{np} \ge u_{nor}^{np}$ ($0 < u^{np}{}_t \le u_{nor}^{np} \le u_{a=0}^{np}$ and $0 < u_{a=1}^{np} < u_{a=0}^{np}$). Wage bargaining occurs within the interval $\left[u_{a=1}^{np}, u_{a=0}^{np}\right]$.

Within this interval, the distance at moment t of the workers' bargaining power from the maximum ($1-a_t$) is a function of the distance of $u^{np}{}_t$ from $u_{a=1}^{np}$, so that

$$1-a_t = \varphi\left(u^{np}{}_t - u_{a=1_t}^{np}\right) = \varphi \Delta u_{a=1_t}^{np} \quad (19),$$

where $\Delta u_{a=1_t}^{np} = u^{np}{}_t - u_{a=1}^{np}$, and φ is a positive coefficient showing the intensity of the relation between a and $\Delta u_{a=1_t}^{np}$. The restriction $a \in [0,1]$ yields that $\Delta u_{a=1_t}^{np} \in [0, 1/\varphi]$, namely the length of the bargaining interval is $u_{a=0}^{np} - u_{a=1}^{np} = 1/\varphi$.

[8] The assumption is backed by the "competitive approach" of wage setting in the labor market. According to this approach, some of the unemployment is simply a consequence of the diminished opportunities in the labor market for some workers relative to their reservation wage. "Especially in the lower part of the qualification distribution, the employees have an extremely small bargaining power or even null due to the fact that they can be easily replaced." (Blanchard, 1997, p. 54).

This interval matches a range expressed in terms of the current unemployment rate. If $z = 0$, this interval is $[u^1_{min}, u_{max}]$, and if $z = 1$ the interval is $[u_{min}, u_{max}]$. u_{min} and u^1_{min} are the unemployment rates for which $a = 1$ and u_{max} is the unemployment rate for which $a = 0$[9]. They satisfy the relation $u^1_{min} = u_{min} + u^{xef}$, where, according to equation (9), $u^{xef} = c_p c_{xef}\left(u^{np}_{nor} - u^{np}_{a=1}\right)$ is the maximum volume of efficiency reserves accumulated in the bargaining interval. Thus, the bargaining power equation is as follows[10]

$$a_t = \begin{cases} 1 & \text{if } u_t \le u_{min} \text{ and } \Delta u^{np}{}_t \le 0 & (20) \\ 1 - \lambda(u_t - u_{min}) & \text{if } u_t \in (u_{min}, u_{max}) \text{ and } \Delta u^{np}{}_t \ne 0 & (21) \\ 0 & \text{if } u_t \ge u_{min} + 1/\lambda \text{ and } \Delta u^{np}{}_t \ge 0 & (22) \\ a_{t-1} & \text{if } u_t = u_{t-1} + u^{xef}{}_{t-1} \text{ and } \Delta u^{np}{}_t = 0 & (23), \end{cases}$$

where λ is a constant that simultaneously satisfies the restrictions $\lambda = \varphi/\left(1 + c_p + hc_p c_{xef}\right)$ and $\lambda \ge 1/(1 - u_{min})$, while $h = \left(u^{np}_{nor} - u^{np}_{a=1}\right)/(1/\varphi)$.

Equation (21) shows that, within the interval $[u_{min}, u_{max}]$, the closer the current unemployment rate is to u_{min}, the stronger the bargaining power of the employees and vice versa. Equation (23) shows that during a shock that triggers the use of efficiency reserves, the bargaining power stays put.

The upper limit of the interval in which the bargaining power is transferred between employees and the firm depends on λ (equation (21)). The higher λ, the smaller the interval $[u_{min}, u_{max}]$ in

[9] By definition, when the workers' bargaining power is zero, the coefficient $c_{xef} = 0$, which explains why the upper limit of the interval is unique.

[10] In order to express the bargaining power in terms of the unemployment rate (u_t), $\Delta u^{np}_{a=1t}$ is rewritten depending on Δu_t. The size of the bargaining interval in terms of u_t is obtained by using the maximum values of $\Delta u^{np}{}_t$ and $u^{xef}{}_t$ in equations (13) and (14). Replacing $\Delta u^{np}{}_t$ by $1/\varphi$ and $u^{xef}{}_t$ by u^{xef}, we have $u_{max} - u_{min} = (1 + c_p)(1/\varphi) + u^{xef}$ if $z = 0$ or $u_{max} - u^1_{min} = (1 + c_p)(1/\varphi)$, if $z = 1$. The distance of u_t to u_{min} or u^1_{min} is obtained through replacing $\Delta u^{np}{}_t$ in equations (13) and (15) with $\Delta u^{np}_{a=1t}$ and solving the latter case. The value obtained for $\Delta u^{np}_{a=1t}$ is replaced in equation (19) and the workers' bargaining power is obtained in terms of the deviation $u_t - u^1_{min}$. The bargaining power for the definition interval is $a_t = 1 - \lambda_1\left(u_t - u^1_{min}\right) = 1 - \lambda_1\left(u_t - u_{min} - u^{xef}\right)$, where $\lambda_1 = \varphi/(1 + c_p)$. In order to write this expression exclusively in terms of $u_t - u_{min}$, we must make sure that $a_t = 1 - \lambda_1\left(u_{max} - u^1_{min}\right) = 1 - \lambda(u_{max} - u_{min})$, where λ is a constant. This equality is valid if $\lambda = \varphi/\left(1 + c_p + hc_p c_{xef}\right)$.

which the bargaining power influences the wage setting[11]. The employees and the firm have equal bargaining power when $u_t = (u_{min} + u_{max})/2$.

The equation of the bargaining power is consistent with the idea that on a depressed labor market, the bargaining power of employees is small, because finding a job can prove difficult. This is reflected in the setting of a relatively low negotiated wage. Conversely, in a very strong labor market, the bargaining power of employees is high and the negotiated wage exceeds significantly the reservation wage.

2.2.2. The workers' and employers' surplus

Assuming that $z = 0$, $u^{np}{}_t \in [u^{np}_{a=1}, u^{np}_{nor})$ and that the firm's core business does not allow for alternative uses of the capital, the remaining nominal unit labor surplus is [12]

$$S_{f_t} = p_t D_t / L_t - \overline{p}_t \left(f (1 - u_{min}) \eta / L_t \right) - W_{st} \qquad (24),$$

where W_{st} is the nominal wage received by the worker, f is a constant that represents the weight of the fixed costs of production[13] in the total production corresponding to the unemployment rate u_{min}.

[11] In turn, the lower λ, the higher c_p and c_{xef}. Thus, the larger the efficiency reserves, the wider the interval of the unemployment rates for which a and $u_t - u_{min}$ are determined.

[12] A similar definition is presented by Akerlof, Dickens and Perry (1996), in which S_{f_t} is defined in terms of u^*. To keep the equations simple, we decided to define S_{f_t} in relation to u_{min}.

[13] We could exclude f from the definition of the firm's surplus, but we considered necessary to keep it, as in the case of certain products like software, medicines, etc., the fixed costs hold a larger share in total costs than the marginal ones, so that the price reflects more the mark-up rather than the marginal costs.

The worker's surplus is given by the difference between wage W_{st} paid by the firm and the expected wage. The latter is equal to the arithmetical mean of the economy-wide average nominal wage, $\overline{W}_t$, weighted by the likelihood $(1-u_t)$ he or she will be employed and the reservation wage, S_t, which approximates the value of leisure, weighted by the likelihood (u_t) he or she will be unemployed. Considering that s is the constant ratio of the reservation wage to the nominal value of production per unit of labor ($s = S_t/(\overline{p}_t Y/L)$, then the reservation wage can be written as $S_t = s\eta\overline{p}_t$, where $s\eta$ is the reservation wage in real terms. Thus, the worker's surplus is given by:

$$S_{et} = W_{st} - \left(\overline{W}_t(1-u_t) + u_t s\eta\overline{p}_t\right) \qquad (25).$$

According to the intra-temporal optimality condition setting the marginal rate of substitution between leisure and consumption, the expected wage should fulfill the condition $\chi L_t^{\phi} / C_t^{-\sigma} = \left(\overline{W}_t / \overline{p}_t\right)(1-u_t) + u_t s\eta$. This means that the worker's surplus will be positive only if $\left(\overline{W}_t / \overline{p}_t\right) > s\eta$.

With values of S_f and S_e given by equations (24) and (25), condition (18) becomes

$$\text{Max}\left(p_t D_t/L_t - \overline{p}_t\left(f(1-u_{min})\eta/L_t\right) - W_{st}\right)^{1-a_t} \times \left[W_{st} - \left(\overline{W}_t(1-u_t) + u_t s\eta\overline{p}_t\right)\right]^{a_t} \qquad (26),$$

with the bargained real notional wage ($w_{st} = W_{st}/p_t$) for which this condition is fulfilled given by:

$$w_{st} = a_t\left[\left(p_t D_t - \overline{p}_t f(1-u_{\min})\eta\right)/\overline{p}_t L_t\right] + (1-a_t)\left[\overline{W}_t/\overline{p}_t\,(1-u_t) + u_t s\eta\right] \qquad (27).$$

In equation (27) $\overline{W}/\overline{p}$ represents the economy-wide average real wage. The real notional wage (w_{st}) is a weighted arithmetical mean of the firm's real variable cost per worker and the real opportunity cost of the worker. According to equation (21), the weights of these costs in real wage formation depend on the difference $u_t - u_{min}$ for as long as the difference ranges within the interval $(0,1/\lambda)$. In accordance with equations (21), (24), (25) and (27), when the difference $u_t - u_{min}$ is zero, the firm's surplus equals zero as well. Conversely, if $u_t - u_{min} = 1/\lambda$, the worker's surplus is zero. Obviously, if $z = 1$ or $u_t \geq u_{nor}$, there are no longer any norms or efficiency reserves, so that equations (24), (25), (26) and (27) should be rewritten to substitute η, u_{min} and λ by η_{xef}, u_{min}^1 and λ_1 respectively. This outlines that when norms are in place the negative relation between the real wage and the unemployment rate takes place at lower levels of real wages, as compared to the case the norm are missing.

2.3. Equilibrium with flexible prices

For a representative firm, the labor market equilibrium is reached at the intersection point of supply and demand equations. The demand equation derives from the firm's behavior in setting prices, while the supply equation is determined by the wage-setting mechanism. Both processes depend on real wages. Further in this section we will write the demand and supply equations and will introduce the concept of natural rate of unemployment.

2.3.1. Aggregate demand and supply equations on the labor market

Assuming further that $z = 0$ and $u^{np}{}_t \in \left[u^{np}_{a=1}, u^{np}_{nor}\right)$, a firm that produces final goods will set the price p in order to maximize the difference

$$\text{Max } p_t C_t \left(p_t / \overline{p}_t\right)^{-\beta} - W_t(1/\eta) C_t \left(p_t / \overline{p}_t\right)^{-\beta} \qquad (28),$$

where $W_t(1/\eta)$ is the nominal marginal cost of the firm. If prices are flexible, all the firms will choose the same price, so that the difference in equation (28) is at its highest level for a constant value of the real wage $W_t / p_t = w_{d_t}$[14] equal to

$$w_{d_t} = \eta(\beta - 1)/\beta = \eta/\mu \qquad (29),$$

where $\beta/(\beta - 1) = \mu$ represents the best gross margin that a firm could add to the nominal marginal cost.

Equation (29) represents the labor demand equation and it shows how the prices response to changes in wages. The equation describes the wage that is consistent with the willingness of the firm to hire, given the general conditions regarding commodity prices, the tax system, the interest rates, etc. Equation (29) is consistent with the fact that real wages are neutral to the business cycle. The constant value of the real wage results from both the constant elasticity of the demand equation (2) and the assumption that labor productivity is constant. An increase in labor productivity or demand elasticity relative to prices triggers the rise in w_{d_t}. From the definition of nominal marginal cost it results that $w_{d_t}/\eta = 1/\mu$ is the real marginal cost of the firm.

[14] Equation (29) can be derived by making the distinction between the firms producing final goods, facing monopolistic competition, and the firms producing intermediary goods, facing perfect competition. Profit maximization by the firms producing intermediary goods is conditional on the equality between real marginal labor income and real marginal cost: $\eta P^I / P = w$, where P^I is the price of the intermediary good and P is the price index associated with C. Profit maximization by the firms producing final goods requires that $P = \mu P^I$. By replacing the value of μ in the previous equation, we obtain equation (29).

As real wage equation that results from the price setting mechanism reflects labor demand, the real wage equation resulting from the wage setting process provides the labor supply equation. Noting that, at equilibrium, $D = Y$, $p = \overline{p}$, $\overline{W}/\overline{p} = \eta(\beta - 1)/\beta$ and taking into account equations (20)-(22), then equation (27) of the real wage will read as follows:

$$w_{s_t} = [1 - \lambda(u_t - u_{min})]\eta[1 - f(1 - u_{min})/(1 - u_t)] + \lambda(u_t - u_{min})\eta[(1 - u_t)(\beta - 1)/\beta + u_t s] \qquad (30).$$

Equation (30) shows the negative non-linear dependence of the real wage on the unemployment rate for $u_t \in (u_{min}, u_{max} = u_{min} + 1/\lambda)$ and if $\Delta u^{np}_t \neq 0$. The real wage curve on supply side, w_{s_t}, reflects the market forces and the power of the workers and the firms. Outside the interval $[u_{min}, u_{max}]$, the firms' and workers' surplus cannot be simultaneously positive and the work relations are privately inefficiently. Lest either of the two surpluses should be negative, the real wage must satisfy the condition[15]: $\eta[(1 - u_{min} - 1/\lambda)(\beta - 1)/\beta + (u_{min} + 1/\lambda)s] \leq w_{s_t} \leq \eta(1 - f)$. If $z = 1$ or $u_t \geq u_{nor}$, this condition and equations (29) and (30) can be rewritten with η being replaced by η_{xef}.

Given perfectly flexible prices and wages, the equilibrium between w_{d_t} and w_{s_t} is reached at the natural rate of unemployment. Our model shows that this rate is influenced by the economic business cycle or by the supply-side shocks which determine the reduction of the surplus per unit of labor. When adopting norms ($u^{np}_t < u^{np}_{nor}$), labor productivity falls from η_{xef} to η, while the wages given by equations (29) and (30) become equal at a relatively low natural rate of unemployment, u^*. When the firms remove the norms (at $u_t \geq u_{nor}$), labor productivity returns to the η_{xef} level, while wages grow to the levels indicated by equations (29) and (30) adjusted for the productivity[16]. In this case, the natural rate of unemployment will rise. The increase in the natural rate of unemployment will occur also when, given a supply-side shock, the firms resort to efficiency reserves. The changes in the natural rate of unemployment take place without any modification in the unemployment rate gap[17].

A change in demand that triggers a rise in the unemployment rate from $u_{t-1} > u_{nor}$ to $u_t < u_{nor}$ or vice versa, from $u_{t-1} < u_{nor}$ to $u_t > u_{nor}$, according to equation (13), can determine a disruption of the negative relation between wages and unemployment. This occurs if $w_t(u_{t-1}) > w_t(u_t)$ or $w_t(u_{t-1}) < w_t(u_t)$, respectively. Further on, we will show the relation between u^* and u_{min}.

[15] The real wage on the supply side in equation (30) equals the real wage on the demand side in equation (29), only if the reservation wage is equal to the real wage on the demand side.

[16] The decrease/increase in wages while establishing/eliminating norms is explained by the increase/decrease in the weight of auxiliary workers that are paid lower wages than the workers with key qualifications.

[17] This could explain partially some uncorrelated moves between the (natural) rate of unemployment and inflation rate, as shown by Tobin (1993), Eisner (1996), Galbraith (1997), Gordon (1997), Stiglitz (1997), Fair (1999), Bernanke and Mihov (1998), Coen, Eisner, Marlin, Shah (1999), Ball and Mankiw (2002).

2.3.2. The natural rate of unemployment and u_{min}

In accordance with equation (21), the difference $u_t - u_{min}$ has an impact on wage bargaining if it ranges within the interval $[0, 1/\lambda]$. This condition is fulfilled if demand elasticity relative to prices ranges within the interval $[1/(1-s), 1/f]$[18]. If $\beta = 1/f$, then $u_t = u_{min}$. This situation is little likely to occur because the unit labor surplus of the firm would be zero. If $\beta = 1/(1-s)$, then $u_t = u_{max}$. This case is also little likely to materialize, as the surplus of each worker would be zero. If $\beta \in (1/(1-s), 1/f)$, then u_t ranges between u_{min} and u_{max}. In this case, the firm's and workers' surpluses are positive.

Taking into consideration that the natural rate of unemployment is consistent with positive or null surpluses, then $u^* \in [u_{min}, u_{max}]$. Thus, the workers' bargaining power reaches its highest level at an unemployment rate lower than or equal to its natural rate. The lower the difference $u^* - u_{min}$, the higher the workers' bargaining power at the natural rate of unemployment.

Given the parameters η, f, s, λ, the natural rate of unemployment depends on the margin μ which is added to the marginal cost, depending in turn on β ($\mu = \beta/(1-\beta)$). *Ceteris paribus*, the lower the margin, the lower the natural rate of unemployment and closer to u_{min}. However, according to Blanchard (2008, p. 18), how markups move, in response to what, and why, is almost like *terra incognita.* The rationale set forth in this section are valid also if the norms are no longer present. In this case, the natural rate of unemployment ranges within the interval $[u^1_{min}, u_{max}]$.

[18] $u^* - u_{min} = 0$ if the difference between the wage on the supply side according to equation (30) calculated for $u_t = u_{min}$ and the wage on the demand side according to equation (29) equals zero. This means that $\eta[1 - f - (\beta - 1)/\beta] = 0$ if $\beta = 1/f$. Also, $u^* - u_{min} = 1/\lambda$ if the difference between equation (30), calculated for $u_t = u_{max}$ and equation (29) equals zero. This means that $\eta[(1 - u_{min} - 1/\lambda)(\beta - 1)/\beta + (u_{min} + 1/\lambda)s] - \eta(\beta - 1)/\beta = 0$ if $\beta = 1/(1-s)$. In this case, the workers' bargaining power at the natural rate of unemployment is zero. The two combined restrictions support the assertion in the text. It can be shown that $1/(1-s) > 1/f$ if $s < 1 - f$.

3. The power of bargaining and the temporary alternative wage setting mechanism

The presence of a surplus associated with the existing work relations means that any path of the real wage that allows for $S_{e_t} \geq 0$ and $S_{f_t} \geq 0$ for any t is compatible with the equilibrium (Hall, 2005 and Blanchard and Gali, 2008). Nash negotiation generates one of these trajectories.

In this section we show that if the workers' bargaining power is significantly higher than that of the firm, Nash negotiation can be temporarily replaced by an alternative wage setting mechanism (AWSM). This temporary mechanism leads to the simultaneous growth of real wage and unemployment rate. We first show under what conditions workers can use their bargaining power in order to increase the real wage above its notional level. Afterwards, we continue by analyzing what is the wage growth rate acceptable for a firm in order to preserve its surplus.

3.1. The bargaining power and the unemployment gap

One reason for which workers would want to use the bargaining power to increase real wage above its notional level could be the information asymmetry (Acemoglu, 1995). If workers have imperfect information regarding the total surplus associated with the employment relation, they could demand excessive increases of their wages. Another reason could be the inflation expectations following a loosening of monetary policy or fiscal policy stance to alter the proportion of surplus reallocation.

There are two conditions to be simultaneously satisfied in order for the workers to use their bargaining power for demanding a real wage above the notional value. The first condition is that the effective unemployment rate must be equal to or lower than the natural rate of unemployment ($u_t \leq u^*$). If this condition is not fulfilled, there is available labor force willing to work for a wage equal to the notional level. If $u_t \leq u^*$, then there is no more available labor force willing to work for the notional wage. Thus, workers gain the power to demand wage increases above the notional level, being able to give up Nash negotiation.

The other condition is that the workers' bargaining power must be higher than that of the firm ($u_t < (u_{min} + u_{max})/2$) and the effective rate of unemployment must be sufficiently close to u_{min}. This condition is fulfilled if, given the parameters u_{min}, f, s and λ (the latter depending on φ, c_p and c_{xef}), the markup μ is sufficiently low, reflecting the firms' small market power. Formalizing, this condition would mean that $u_t \leq u_x$, where $u_x \in (u_{min}, (u_{min} + u_{max})/2)$ is the maximum value of u_t at which workers can impose wages above the notional level.

The previous condition means also that u^* must be close enough to $u_{\min}$. The two unemployment rates are sufficiently close if the markup μ is sufficiently low, reflecting the firms' small market power. If $u^* < (u_{min} + u_{max})/2$, u^* could be higher than, lower than or equal to u_x. By combining

the two conditions, it results that the workers' bargaining power can be used for wage increases above the notional level if $u_t \leq u_x$ and $u^* \geq u_x$ or if $u_t \leq u^*$ and $u^* \leq u_x$.

The case where $u_t = u^* \leq u_x$ shows clearly that the real wage could rise above the notional level due to the workers' high bargaining power, although there is no excess demand. Obviously, in the case of an inflationary gap of unemployment rate ($u_t < u^* \leq u_x$ or $u_t \leq u_x < u^*$), the probability of the high bargaining power to be used for increasing real wages above the notional level is even higher.

The cases described above are essential as far as this paper is concerned. They allow us to show the microeconomic rationale of shifting to AWSM, which leads to the simultaneous increase of the real wage and unemployment rate. Further on, we show this rationale.

3.2. The positive correlation between the real wage and unemployment rate

The AWSM consists of real wage growth above the notional level while dismissing the workers in excess. The rationale behind shifting to a new mechanism is the fallowing: if workers use their high bargaining power for asking an increase in the real wage above the notional level, the firm will decide to pay the increased wages in order to prevent shirking (as defined by Shapiro and Stiglitz, 1984) which would lead to reduced labor productivity. *Ceteris paribus*, the remaining labor unit surplus of the firm decreases, which is equivalent to a shock that 'discloses' the firm's efficiency reserves. To accommodate higher wage costs, the firm decides to use these reserves. Since efficiency reserves are limited, the alternative wage setting mechanism is temporary. Unemployment rate rises according to equation (16) and the production and bargaining power remain unchanged consistent with equations (12) and (23).

The real wage that a firm can pay to a worker without altering its unit surplus or the workers' surplus, when the unemployment rate increases according to equation (16), should satisfy the condition (18) on surplus maximization. In the absence of norms (z = 1) and taking into account the level of the bargaining power defined by equations (20)-(22) and that, at equilibrium, $D = Y$, $p = \overline{p}$, $L = 1 - u$, and $\overline{W}/\overline{p} = \eta(\beta - 1)/\beta$, the real wage that satisfies condition (18) is given by equation (30) adjusted with η being replaced by η_{xef}.

The real wage given by the adjusted equation (30) in the absence of the norms is $I_\eta = \eta_{xef}/\eta$ times higher than the real wage indicated by equation (30), in the presence of the norms. This means that when unemployment rate increases exclusively on account of dismissing the workers in excess, the real wage should grow by an index ($I_s = w_{s\,t}/w_{s\,t-1}$) equal to I_η in order for the surpluses of the firm and workers to remain maximum.

If $I_s = I_\eta$, the demand-related unemployment rate gap and the real marginal cost are preserved. This means that at the time of the AWSM adoption, the following changes occur at the level of the wage and the actual unemployment rate: $w_{st} = w_{st-1}\left[(1-u_{t-1})/(1-u_t)\right]$ (according to equation (17)), and $u_t = u_{t-1} + u^{xef}{}_{t-1}$ (according to equation (16)). Shifting to the AWSM is possible anywhere in the range $\left[u_{min}, u^* - u^{xef^*}\right]$ if $u_t \le u_x \le u^* - u^{xef^*}$ or if $u_t \le u^* - u^{xef^*} \le u_x$.

4. The unemployment rate and inflation

In this section we introduce sticky prices in our model and investigate the implications of norms and of the AWSM on the relation between inflation and unemployment rate. In line with much of the recent literature on monetary business cycle models, we consider the sticky price á la Calvo (1983). Thus, in each period, only part of final producers $(1-\theta)$, selected randomly, change their prices, while the remaining final producers (θ) keep prices unchanged.

$$\overline{p}^{1-\beta}{}_t = (1-\theta)\left(p_t^*\right)^{1-\beta} + \theta\left(\overline{p}_{t-1}\right)^{1-\beta} \qquad (34),$$

where p_t^* is the new price set by the firm at time t. The optimal rule of price setting for a firm that re-sets prices at time t is

$$E_t \sum_{i=0}^{\infty} \theta^i A_{t,t+i} (1-\beta)\left(\overline{p}_{t+i} p^*\right)^{-1} \left(p_t^* / \overline{p}_{t+i}\right)^{-\beta} C_{t+i}\left[p_t^* - \overline{p}_{t+i}\mu MC_{t+i}\right] = 0 \qquad (35),$$

where $A_{t,t+i} = \delta^i \left(C_{t+i}/C_t\right)^{-\sigma}$ is the discount factor, and MC is the real marginal cost.

From equations (34) and (35), after log-linearization around the steady state level of inflation rate equal to zero, we obtain the inflation rate (π)[19], which in view of equation (31) takes the form:

$$\pi_t = \delta E_t \pi_{t+1} - \kappa\gamma\hat{u}_t \qquad (36),$$

where $\gamma\hat{u}_t$ is the deviation of the real marginal cost from its trend, $\hat{u} = u_t - u^*$ is the demand-related unemployment rate gap, $\kappa = (1-\delta\theta)(1-\theta)/\theta$, $E_t\{\pi_{t+1}\}$ is the inflation expected at t for $t+1$, and $\gamma = f\left(1-u^1_{min}\right)\left[\lambda_1\left(1-u^1_{min}\right)-1\right]/\left(1-u^*\right)^2 - \lambda_1\left[(1/\beta)+(1-s)\left(2u^* - u^1_{min}\right)\right]$.

Equation (36) represents the supply side of the economy. In the form presented herein, it relates the demand-related unemployment rate gap to inflation. In order for it to close, our model needs a demand equation. Following the steps indicated in Walsh (2003), it can be proved that the demand equation takes the form

[19] A demonstration is provided by Carl E. Walsh (2003).

adjustment of inflation is relatively large and has an opposite sign if employment is relatively high when $u_t < u_{nor} < u_{max}$. The response of the unemployment rate is lower for low levels of employment, when $u_t \geq u_{nor}$ (equation (15)). Depending on the size of the response, adjustments in unemployment gap in equation (34) are larger or lower respectively. This can be an explanation for the counterintuitive fact that, sometimes (Fair, 1999), for relatively high levels of employment the Philips curve is relatively flatter.

To show the implications of AWSM on the correlation between inflation rate and unemployment, rate we assume the economy is functioning at the natural rate of unemployment. Adopting AWSM means that the effective rate of unemployment and the natural rate of unemployment grow at the same time by the same amount as described in equation (16). Equation (34) allows us to show that the evolution of the inflation rate depends on the causes behind AWSM adoption.

If the cause is represented by the information asymmetry, inflation rate will remain unchanged. However, an easing of the monetary policy stance in order to bring the unemployment rate back to the level prior to AWSM adoption generates a negative gap which in turn determines the increase in inflation. As it is unsustainable at the new level, the unemployment rate returns to its natural level in the medium term. Finally, the economy is functioning at relatively high wages, inflation and unemployment rates. The wage and the unemployment rate remain relatively high until the conditions for adopting the norms are satisfied again.

However, if the cause is the anticipation of an easing of the monetary policy stance, inflation expectations emerge and the inflation rate increases due to the component $E_t\{\pi_{t+1}\}$ in equation (34). Thus, the anticipation of an easing of the monetary policy stance which leads to AWSM adoption triggers the simultaneous growth of unemployment and inflation. The real interest rate falls, causing aggregate demand to increase and unemployment rate to decrease.

If the easing of the monetary policy stance offsets completely the growth of the unemployment rate implied by AWSM, then the combined effect is a higher inflation. This result is in line with the results presented in the papers by Kidland and Prescott (1977), Baro and Gordon (1983) and others. If the easing of the monetary policy stance is not completely reversing the increase in the unemployment rate implied by AWSM, then both inflation and unemployment will grow.
In other words, a looser monetary policy stance may result in the simultaneous growth of the inflation rate and the unemployment rate if AWSM is adopted following the expectations of an easing of the monetary policy stance.

It is reasonable to assume that the firms that change prices $(1-\theta)$ choose to pass the wage growth on prices. In this case, the use of efficiency reserves is a gradual process. In a first stage, only the firms that do not change prices (θ) will adopt AWSM. Thus, inflation and unemployment will rise simultaneously. In the following stages, the firms that did not use the

efficiency reserves will want to use them insofar as their competitors that had already done that are going to increase prices. This pushes unemployment rate higher. However, because the firms that change prices are selected at random, it remains uncertain if inflation and unemployment increase simultaneously in the following adjustment stages.

5. Conclusions

The model presented in this paper shows that if the firms set norms that entail hiring auxiliary workers in excess and the workers' bargaining power depends on the unemployment rate, then the negative relation between inflation and the unemployment rate can be temporarily interrupted. In the presence of norms, labor productivity, the unemployment rate and the real wage are relatively low. Besides the natural rate of unemployment, there are also other levels of the unemployment rate that are relevant to monetary policy decisions.

The unemployment rate u_{nor} below which the norms are set is relevant to the changes in labor productivity and to the effects of a shift in the monetary policy stance on the unemployment rate. When the unemployment rate falls below u_{nor}, firms establish norms that entail excess workers, which causes a shock that reduces the unemployment rate irrespective of the changes in aggregate demand. Thus, there is a negative shock on labor productivity. Conversely, when the unemployment rate becomes equal to (or higher than) u_{nor}, the firms remove the norms no longer entailing workers in excess, while the unemployment rate becomes exclusively reliant on the changes in aggregate demand. Thus, there is a positive shock on labor productivity. Monetary policy aiming to achieve a certain inflation adjustment causes higher changes in the unemployment rate in the presence of the norms ($u_t < u_{nor}$) as compared to the opposite situation.

The unemployment rate at which the bargaining power of workers is maximum, u_{min}, may be relevant to the relation between inflation and unemployment and to the monetary policy. Thus, it is relevant when the effective rate of unemployment is equal to (or lower than) the natural rate of unemployment and sufficiently close to u_{min}. *Ceteris paribus*, the lower the natural rate of unemployment, and thus closer to u_{min}, the lower the markup that monopolistic firms add to the marginal cost.

When these conditions are fulfilled, the workers, using their high bargaining power, can force the firm to shift from Nash negotiation of wages to a temporary alternative wage setting mechanism (AWSM). This mechanism consist in wage increases above the notional level (the workers have the power to impose this), while removing the norms and dismissing the workers in excess. AWSM preserves the proportion to which the surplus associated with work relation is shared between the firm and the workers and leads to a temporary interruption of the negative relation between the inflation rate and the unemployment rate. Compared to the situation seen before the firms' using the efficiency reserves, the wage, the inflation rate, unemployment rate and labor productivity are relatively high until the condition for adopting the norms is satisfied again.

The reason behind the AWSM adoption is relevant to the relation between inflation and unemployment. In order to show this, we assume the economy is functioning at the natural rate of unemployment. If the adoption of AWSM is caused by the fact that workers have imperfect information regarding the level of the surplus associated with work relations, the unemployment rate will increase without any change in inflation or the unemployment rate gap. However, if AWSM adoption is determined by the workers' expectation of the monetary policy stance loosening, inflation and unemployment will increase simultaneously, while the unemployment gap will remain unchanged.

After dismissing the workers in excess, the relation between inflation and unemployment turns negative again. In the short term, an easing of the monetary policy stance focusing on lowering the unemployment rate to the level seen before resorting to the efficiency reserves increases the unemployment gap and, thus, the inflation rate. As the unemployment rate is unsustainable at this level, it returns in the medium term to its natural level.

The monetary policy should not seek to counterbalance the increase in unemployment implied by giving up norms due to the fall in demand or to AWSM adoption. However, in practice, it is difficult to identify those changes in the unemployment rate and the labor productivity that reflect the above mentioned causes.

The norms and the AWSM can explain in part why the relation between inflation and the unemployment rate is mysterious, as defined by Mankiw (2000). They support the idea that the relation between inflation and unemployment is influenced by the interaction between monetary policy and the labor market. On the one hand, the labor market influences the monetary policy effects on the relation between inflation rate and unemployment rate. In our model this fact is due to norms. On the other hand, the expectations regarding the changes to the monetary policy stance influence the labor market. In our model, this aspect determines the adoption of AWSM, which leads to the simultaneous growth of inflation and unemployment.

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