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THE DEGREE OF CENTRALIZATION OF
COLLECTIVE BARGAINING, THE INFLATION
UNEMPLOYMENT TRADE-OFF AND
MICROECONOMIC EFFICIENCY REVISITED*

por

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1.- Introduction

In most European countries, the wage determination process takes the form of collective bargaining between employers and workers. Recent research has paid attention to this process focusing on the macroeconomic effects of the characteristics of collective bargaining procedures.¹ In particular, the relationship between the degree of centralization of collective bargaining and macroeconomic performance is an issue of increasing interest.² With regards to this relationship, the stylized facts are roughly as follows. The more centralized the wage setting process is, the best macroeconomic performance in terms of unemployment, inflation and output growth and the lower (aggregate) real wage rigidity are. Decentralized wage bargaining leads to higher inflation, higher unemployment, a worse inflation-unemployment trade-off and lower flexibility of real wages. More recently, Calmfors and Driffill (1988) have claimed that the relationship between centralization and macroeconomic performance is "hump-shaped", as countries with highly decentralized wage setting processes have performed better than centralized countries during the 80s (see also Dell'Aringa and Samek (1989)).

The usual arguments to explain the different economic effects of centralization and decentralization of the wage setting process rely on externalities. There is a pecuniary externality not internalized in decentralized bargaining (because wage setters at this level do not take into account the price increases caused by higher wages, as these will be supported by someone else but the own wage setters), and a fiscal externality, as the possibility of reducing the wage wedge without reducing total government intakes that could be accomplished by the employment creation caused by wage moderation, disappears under decentralization.³ Differences in alternative wages and in the "insider weight" also favours centralization in the sense of providing a bias towards full employment. Moreover, Calmfors and Driffill (1988) have shown how the elasticity of the labour demand curve and, consequently, the employment-wage trade-off that wage setters face, change depending on the level at which collective bargaining takes place. In this case, though, there is a "hump-shaped" relationship since such elasticity is higher at the national and the firm levels than at the industry level. Hence, extreme centralization

¹The classical references are Bruno and Sachs (1985), chapter 11 and Crouch (1985). For a description of collective bargaining institutions of different OECD countries, see Hartog and Theeuwes (1992).

²At this early stage, it is convenient to remark that we will define the degree of centralization of collective bargaining in terms of the level at which wage bargaining takes place (the whole economy, industries, firms) and the extent of coordination and synchronization among bargaining units. In fact, our results will stress the importance of coordination and synchronization when assessing the plausible macroeconomic implications of a given wage bargaining structure.

³The catch-word is "fiscal increasing returns". See Blanchard and Summers (1987).

and extreme decentralization yield more wage moderation and, therefore, lower inflation and unemployment.

Although these arguments are widely accepted, there are reasons to believe that there are other factors at work which need to be emphasized. In particular, the precedent explanations, based on standard theoretical bargaining models, predict some effects of centralization in the levels of wages and unemployment while empirical studies find the predicted relationship between centralization and rates of growth of wages. It is also true that centralized economies seem to have performed better after the negative supply shocks of the mid-seventies and early eighties and during disinflationary processes. These facts are difficult to account for with the traditional approach to the macroeconomic effects of centralization of the wage setting process described above.

The motivation of this paper is, thus, to explain the latter observations by providing another reasons why centralized collective bargaining is preferable to decentralized collective bargaining as a wage setting process. These reasons are related to the implications of the information structure under which wage setting takes place. As a starting point, we take that this information structure is likely to be different depending on the degree of centralization of collective bargaining.⁴ We will show that, not only unexpected shocks are different because of the difference in the information structure, but the responses to unexpected shocks are different as well, depending on whether the wage setting process is decentralized or centralized. As a result, the difference between actual and equilibrium unemployment rates are also different depending on the collective bargaining structure. Additionally, the same difference in information structures make some equilibria more likely than others, as the degree of cooperation between price-setters, wage-setters and the government is higher under centralization. When cooperative equilibria arise, the inflation-unemployment trade-off is more favourable and cooperative equilibria are more likely to arise under centralization than under decentralization.

The main intuition behind our results is the following: Decentralized wage setters have incentives to acquire information about the economic conditions of the production unit whose wages they bargain over, but they have less incentives to spend resources on acquiring information about the aggregate state of the economy. Thus, decentralization imposes, on each wage setter, the need of predicting the

⁴We will take as given the existence of these different information structure without modelling it, though. However, if pooling information has some costs, it is not obvious that decentralized wage setters would replicate the information structure to prevail under centralized collective bargaining, even if there are some gains from doing it.

behaviour of other wage setters, (and monetary policy, and the expectations of other wage setters on monetary policy, altogether) as their utility depends on aggregate variables. This introduces uncertainties in the wage setting process that might have negative effects on unemployment and inflation. Conversely, centralized wage setters need better information on the aggregate state of the economy and they have incentives to acquire it. Given the predominance of microeconomic shocks in actual economies at the microeconomic level, the information structures resulting under these two alternative regimes are very different. Moreover, the scope for strategic behaviour (including cooperation with the government) is greater under centralization, as decentralization imposes cooperation and coordination problems among a large number of wage setters (a fact well-known in both the industrial relations literature, where the concept of corporatism includes centralization of wage setting as a determinant, and in models of monetary policy based on reputation effects (see Tabellini (1988)). This improves the inflation-unemployment trade-off under centralization.

A complete discussion of the macroeconomic effects of centralization of collective bargaining must tackle the issue of the effects on microeconomic efficiency. In this regards, we distinguish two interpretations of the latter concept. The first interpretation is related to the response of sectoral wages to sectoral shocks. Since decentralized wage setters have some knowledge about sectoral shocks, there is likely to be some relationship between them and sectoral wages. Consequently, by aggregation, there will be some relationship between aggregate wages and aggregate shocks (that is, microeconomic efficiency as a source of macroeconomic flexibility). Conversely, centralized wage setters act on the basis of information on aggregate shocks and affect wages economy-wide, so that missperceptions are spread through the whole economy and the extent to which sectoral wages are related to sectoral shocks depends on the relative importance of aggregate and sector-specific shocks. A second interpretation of microeconomic efficiency has to do with the existence of an optimal wage structure which maximizes aggregate employment. Since the degree of centralization of wage setting obviously determines the actual wage structure, it also affects aggregate employment through this channel. Freeman (1988) argues that decentralization is more likely to yield a wage structure closer to the optimal one than centralization and, therefore, aggregate employment, other things equal, is lower in economies with centralized wage setting processes. We will discuss the interrelations between these two interpretations and the macroeconomic implications of microeconomic efficiency. In this regards, we conclude that it is not always the case that decentralization yields the optimal distribution of wages and, consequently, that centralization does not always reduce microeconomic efficiency.

The structure of the paper is as follows. Section 2 presents the basic setup of the model. In section

3, we obtain the reduced form of unemployment and inflation assuming decentralized wage bargaining. Section 4 derives similar results for economies with centralized wage bargaining in two different cases, depending on whether or not economy-wide agreements are compulsory for further levels of negotiation, so that a wage drift might or might not arise. This is important because it is often argued that a decentralized collective bargaining process yields equivalent results to a centralized wage bargaining process in which there is scope for further levels of negotiation. We will show that this assesment is wrong. Section 5 presents a simple example aimed at quantifying the losses caused by decentralization. Section 6 comments on the effects of centralization on microeconomic efficiency. Finally, section 7 concludes.

2.- The Model: Basic Setup

This model is a simplified version of the models in Layard and Nickell (1987) and Blanchard (1991) with explicit introduction of stochastic labour productivity shocks and monetary policy. Thus, we consider a monopolistically competitive economy with three agents: wage setters, price setters and the government, whose role is to decide on monetary policy. The timing is as follows: wage bargaining takes place between workers and employers after some shock to the productive unit that they represent has been revealed exclusively to them. There are n productive units. The government, after observing wages, sets monetary policy. Finally, firms set prices. Obviously, monetary policy has real effects as long as there are monetary "surprises" to wage setters. It is worth pointing out that the qualitative results of our analysis do not depend on this timing.

We will represent wage bargaining by the following wage equation⁵

$$w_i = a_1 p_i^{e,i} + (1 - a_1) w^{e,i} - a_2 u^{e,i} + a_3 \theta_i + z_i \quad 0 < a_1 < 1, \quad i=1,2,\dots,N \quad (1)$$

where, w is wages, p is prices, i stands for the productive unit where wage bargaining takes place (n "firms" if collective bargaining is decentralized, and the whole economy if bargaining is centralized), θ_i is a labour productivity shock and z is a variable that represents "wage pressure". With respect to the labour productivity shock, we will assume that it is the sum of an aggregate component, $\underline{\theta}$ (which affects all productive units of the economy) and a firm-specific (or sector-specific) component, that we denote by θ'_i . The superscript e indicates expectations. More precisely

⁵This equation can be derived from standard wage bargaining models with insider effects. It basically says that the wage is a weighted average of the (expected) outside wage given by $w^{e,i} - \alpha_1 u^{e,i}$ and the insider wage given by $p^{e,i} + \alpha_2 \theta_i + \alpha_3 z_i$. See Jackman, Layard and Nickell (1991), chapter 2, for a derivation of this type of equation from "first principles" and Nickell and Wadwhani (1990) for an estimation of the "insider weight".

$$\begin{aligned}\theta_i &= \theta + \theta_i \\ x^{e,i} &= E[x \mid \theta_i]\end{aligned}\tag{2}$$

Thus, aggregate expectations are given by

$$\bar{x}^e = \frac{1}{n} \sum_{i=1}^n E[x \mid \theta_i]\tag{3}$$

On the other hand, we will assume that consumers have preferences of the Dixit-Stiglitz type, so that the optimal pricing rule of the firm is given by:⁶

$$\begin{aligned}p_i - p &= b_1(m - p) + b_2(w_i - p) - b_3\theta_i, \\ b_1, b_2, b_3 &< 1, \quad b_1 + b_2 + b_3 = 0\end{aligned}\tag{4}$$

Finally, we model the government as minimizing the following loss function:

$$L(\pi, u) = \pi^2 + \rho u^2\tag{5}$$

where π is the inflation rate and ρ is a parameter describing the government's preferences between inflation and unemployment. The government observes the aggregate productivity shock before setting monetary policy.

The equilibrium rate of unemployment (which in this model is a natural rate and also the non-accelerating rate of inflation, see Jackman, Layard and Nickell (1991) chapter 8) is given by equations (1) and (4), after imposing correct expectations.⁷ Hence, and assuming inexistence of long-run effects of productivity shocks on unemployment, that is, $a_3 b_2 = a_1 b_3$, we find that this equilibrium rate is given

⁶Additionally, we assume that the product demand function faced by each firm has a constant price-elasticity, $\sigma > 1$, and that the degree of returns to scale to labour is $\theta \leq 1$. Then,

$$b_1 = (1-\theta)[1-\sigma(\theta-1)]^{-1}, \quad b_2 = \theta[1-\sigma(\theta-1)]^{-1} \text{ and } b_3 = [1-\sigma(\theta-1)]^{-1}$$

(see Blanchard and Kiyotaki (1987)).

⁷The unemployment rate adjusts to achieve that the real wage in (1) is compatible with the mark-up of prices over wages implied by equation (4).

by⁸

$$u^* = \frac{b_2 \bar{z}}{a_1 b_1 + a_2 b_2} \quad (6)$$

$$\bar{z} = \frac{1}{n} \sum_{i=1}^n z_i$$

As it is clear from the discussion in the introduction, this equilibrium rate of unemployment is different under decentralization than under centralization, since we should expect that the parameters in the wage equation, mainly a_2 , will change with the degree of centralization of collective bargaining.

Finally, we close the model by assuming that aggregate demand, y , real balances, $m-p$, and unemployment are related in a simple fashion:

$$y = m - p = -u \quad (7)$$

In the following sections, we will present different solutions of this model under different degrees of centralization of wage bargaining and cooperation among wage-setters, price-setters and the government.

3.- Inflation and Unemployment under Decentralized Wage Bargaining

In a system of decentralized wage setting, each bargaining unit has information about the labour productivity shock received by its corresponding productive unit, Θ_i , but it lacks information about the aggregate component of that shock and about the extent of wage pressure in the rest of the economy. In other words, the evolution of aggregate wages is uncertain, even if, as we assume, the decision rule followed by other wage setters (the wage equation in (1)) is common knowledge. Another source of uncertainty is introduced by government behaviour about monetary policy.⁹

⁸See Layard and Bean (1988) for a justification of this condition and Manning (1990) for an alternative view.

⁹Although the interrelations between the expectations of private agents and monetary policy in decentralized economies has been widely investigated (starting from Barro and Gordon (1983)), the private sector of the economy is usually modeled as a representative agent. In our model of decentralized wage setting, it matters, not only what agents expect, but also what they expect that other agents expect.

3.1.- The non-cooperative solution

We will now derive the reduced form of inflation and unemployment in the model presented in section 2, assuming that there is no scope for cooperation among the agents of this economy nor for any type of commitments. Calculations are a little bit tedious but straightforward. Substituting equation (7) into equation (1), aggregating and taking expectations yields

$$w^{e,i} = p^{e,i} + \frac{a_2}{a_1}(m^{e,i} - p^{e,i}) + \frac{a_3}{a_1}\bar{\theta}^{e,i} + \frac{1}{a_4}\bar{z}^{e,i} \quad (8)$$

Equation (8) and the aggregated expected version of equation (4) imply that

$$p^{e,i} = m^{e,i} + \frac{b_2\bar{z}^{e,i}}{a_1b_1 + a_2b_2} \quad (9)$$

and, thus

$$w^{e,i} = m^{e,i} + \frac{a_3}{a_1}\bar{\theta}^{e,i} + \frac{b_3\bar{z}^{e,i}}{a_1b_1 + a_2b_2} \quad (10)$$

Since

$$p_i^{e,i} = p^e + b_2(w_i - w^{e,i}) - b_3(\theta_i - \bar{\theta}^e) \quad (11)$$

we can find that

$$w^i = m^{e,i} + \frac{a_3}{a_1}\bar{\theta}^{e,i} + \frac{(1-b_2)(\theta_i - \bar{\theta}^{e,i})}{1-a_1b_2} + \frac{b_3\bar{z}^{e,i}}{a_1b_1 + a_2b_2} + \frac{z_i - \bar{z}^{e,i}}{1-a_1b_2} \quad (12)$$

which implies wages increasing in the expectations of aggregate wage pressure and aggregate labour productivity shocks. Thus, we can derive the following equations:

$$p = \frac{b_1}{b_3}m + \frac{b_1}{b_3}m^e - \frac{1-a_1}{1-a_1b_2}(\bar{\theta} - \bar{\theta}^e) + \frac{b_2}{b_3(1-a_1b_2)}(\bar{z} - \bar{z}^e) + \frac{b_2}{a_1b_1+a_2b_2}\bar{z}^e \quad (13)$$

$$u - ((u^*)^e) = \frac{b_2}{b_3}(m^e - m) - \frac{1-a_1}{1-a_1b_2}(\bar{\theta} - \bar{\theta}^e) + \frac{b_2}{b_3(1-a_1b_2)}(\bar{z} - \bar{z}^e) \quad (14)$$

The optimal policy rule is given by $b_1\pi = \rho b_2u$, that is

$$\begin{aligned} b_1^2m + b_1b_2m^e - \frac{b_1b_3(1-a_1)}{1-a_1b_2}(\bar{\theta} - \bar{\theta}^e) + \frac{b_1b_2}{1-a_1b_2}(\bar{z} - \bar{z}^e) + b_1b_3(u^*)^e - b_1b_3p_{-1} &= \\ = \rho b_2^2(m^e - m) - \frac{\rho b_2b_3(1-a_1)}{1-a_1b_2}(\bar{\theta} - \bar{\theta}^e) + \frac{\rho b_2^2}{1-a_1b_2}(\bar{z} - \bar{z}^e) + \rho b_2b_3(u^*)^e \end{aligned} \quad (15)$$

which implies that

$$\begin{aligned} m^e &= p_{-1} + \frac{\rho b_2 - b_1}{b_1}(u^*)^e \\ m &= p_{-1} + \frac{\rho b_2 - b_1}{b_1}(u^*)^e - \frac{b_3(\rho b_2 - b_1)(1-a_1)}{(b_1^2 + \rho b_2^2)(1-a_1b_2)}(\bar{\theta} - \bar{\theta}^e) + \frac{b_2(\rho b_2 - b_1)}{(b_1^2 + \rho b_2^2)(1-a_1b_2)}(\bar{z} - \bar{z}^e) \end{aligned} \quad (16)$$

and, after substituting equation (16) into equations (13) and (14), we obtain

$$u - (u^*)^e = \frac{b_1b_2}{(b_1^2 + \rho b_2^2)(1-a_1b_2)}(\bar{z} - \bar{z}^e) - \frac{b_1b_3(1-a_1)}{(b_1^2 + \rho b_2^2)(1-a_1b_2)}(\bar{\theta} - \bar{\theta}^e) \quad (17)$$

$$\pi = \frac{\rho b_2}{b_1}(u^*)^e + \frac{\rho b_2^2}{(b_1^2 + \rho b_2^2)(1-a_1b_2)}(\bar{z} - \bar{z}^e) - \frac{\rho b_2b_3(1-a_1)}{(b_1^2 + \rho b_2^2)(1-a_1b_2)}(\bar{\theta} - \bar{\theta}^e) \quad (18)$$

These two equations represent the responses unemployment and inflation to labour productivity shocks and wage pressure. For obvious reasons, unexpected negative productivity shocks and unexpected

wage pressure increase both unemployment and inflation.¹⁰ When we say that decentralization introduces uncertainties, we refer to these last two terms in the reduced form of both unemployment and inflation. Note that, under this non-cooperative solution, the inflation unemployment trade-off is given by $\pi = \rho b_2 u / b_1$.

3.2.- Other Equilibria

A) Commitment on monetary policy

We emphasize that equations (17) and (18) corresponds to a non-cooperative solution without commitments. But other types of situations are possible. Consider, first, the possibility of the government committing on a certain path of money supply ($m = p_{-1}$, for instance). In this case, after substituting in equations (13) and (14)

$$u = \pi = (u^*)^e + \frac{b_2}{b_3(1-a_1b_2)}(\bar{z} - \bar{z}^e) - \frac{1-a_1}{1-a_1b_2}(\bar{\theta} - \bar{\theta}^e) \quad (19)$$

Comparing this equation to equations (17) and (18) we observe that, when expectations are fulfilled, commitment dominates non-commitment as long as $\rho b_2 > b_1$ (it yields the same unemployment rate - the equilibrium rates - and lower inflation).

B) Cooperative solutions

Another possibility is that of cooperative behaviour among the three agents. By this, we mean information pooling among wage setters or announcement by the government of the aggregate productivity shock and aggregate wage pressure so that uncertainty is revealed. In this case, it is trivial to show that unemployment takes always its equilibrium value and inflation is given by

$$\pi = \frac{\rho b_2}{b_1} (u^*)^e \quad (20)$$

As we shall show, this is also the outcome under centralized wage bargaining. We will comment further on this equivalence in section 4.

¹⁰ It is also obvious that expected wage pressure increase the equilibrium unemployment rate (see equation 6) and therefore, actual unemployment and inflation. On the other hand, expected productivity shocks have no effects on these variables because of the assumption regarding their long-term neutrality.

Finally, notice that if the government commits on certain monetary path (as in A) **and** truthfully announces aggregate productivity shocks and wage pressure (as in B), both inflation and unemployment will always be equal to the equilibrium rate of unemployment. It is convenient to remark that the government providing information on the aggregate productivity shocks and wage pressure is equivalent (in this simple economy) to it announcing future inflation (a widespread practice in the real world). To the extent that these announcements are believed by each wage setters **and** they expect them to be believed by the rest, decentralization yields a rate of inflation as in equation (21) and the equilibrium rate of unemployment as actual unemployment.

The previous discussion highlights how, not only the values of inflation and unemployment, but also the inflation-unemployment trade-off, change with the type of equilibria. This result should not be surprising for those readers familiar with the literature on standard monetary policy models and the debate on policy rules versus discretionary monetary policies. More interestingly, the response of inflation and unemployment to unexpected shocks is also different depending on the existence of the scope for cooperation among wage-setters, prices-setters and the government. In any case, decentralization reduces the scope for cooperation among these three agents to its minimum degree and, for this reason, the non-cooperative equilibrium is most likely in economies with this type of wage determination process. Anecdotal evidence supports this latter assesment.

4.- Unemployment and Inflation under Centralized Wage Bargaining

We will analyze first the case of extreme centralization, that is, wages are determined for all workers of the economy by an unique negotiation ($i=n=1$) with no further negotiations at other levels. Afterwards, we shall consider a wage setting process under which a national agreement sets the wages of a certain fraction of the workers in the economy and posterior negotiations at each productive unit yields wages for the rest of the workers. This second case is closer to the reality of countries with institutional wage bargaining at the national level (e.g., Nordic countries).

4.1.- Extreme Centralization

In this case, the wage equation, equation (1), becomes

$$w = p^e - a_2^C u^e + \frac{a_3}{a_1} \theta + \frac{1}{a_1} z \quad (21)$$

where a_2^C measures the response of wages to unemployment when wage bargaining takes place at the national level. For all the reasons discussed in the introduction, it is likely that

$$a_2^C > \frac{a_2}{a_1}$$

and, therefore, the corresponding equilibrium unemployment rate is likely to be lower than under decentralization. If we assume, as in section 2, that wage setters observe productivity shocks, actual unemployment will be given by the corresponding equilibrium rate of unemployment and inflation by the expression in equation (20). In order to find the responses of inflation and unemployment to unexpected labour productivity shocks under centralization, we still allow for them in what follows. It should be emphasized that these unexpected shocks are not equal to those in section 3.1.

To find the reduced form of unemployment and inflation in this case, substitute equation (21) into equation (4). Thus,

$$p^e = m^e + u^* \quad (23)$$

$$w = m^e + u^* + \frac{a_3}{a_1} \theta^e \quad (24)$$

$$p = u^* + \frac{b_1}{b_3} m + \frac{b_2}{b_3} m^e - (\theta - \theta^e) \quad (25)$$

$$u = u^* + \frac{b_2}{b_3} (m^e - m) - (\theta - \theta^e) \quad (26)$$

and, substituting the optimal monetary policy rule

$$\pi = \frac{\rho b_2}{b_1} u^* - \frac{\rho b_2 b_3}{b_1^2 + \rho b_2^2} (\theta - \theta^e) \quad (27)$$

$$u = u^* - \frac{b_1 b_3}{b_1^2 + \rho b_2^2} (\theta - \theta^e) \quad (28)$$

We can now compare the reduced forms of inflation and employment under different regimes (extreme centralization, equations (27) and (28), and extreme decentralization equations (17) and (18)) when unexpected aggregate productivity shocks are present and non-cooperative equilibria arise. We can see that the responses of inflation and actual unemployment to unexpected labour productivity shocks is higher under centralization since

$$0 < \frac{1-a_1}{1-a_1 b_2} < 1$$

The reason for this different response to unexpected labour productivity shocks is simple. Under centralization, unobserved aggregate shocks have full effects on wages, contrary to what happens in the decentralized economy in section 2, where, since sectoral shocks are observed, they affect wages, and by aggregation, there is some relationship between the realization of the aggregate shocks and aggregate wages. However, this does not imply that the difference between actual unemployment and equilibrium unemployment shocks is larger under centralization because there are reasons to believe that unexpected aggregate productivity shocks are likely to be lower under this regime. Furthermore, under decentralization "expected wage pressure" is not necessarily equal to actual wage pressure and this constitutes another source of divergence between actual unemployment rate and the corresponding equilibrium rate.

As in the case of the decentralized economy, the non-cooperative equilibrium is not the only possible. When commitment on monetary policy is possible and announcements of aggregate productivity shocks are credible, then the rates of inflation and unemployment are equal to the equilibrium rate of unemployment.¹¹ To the extent that these cooperative equilibria are more likely under centralization

¹¹ Notice that another different between centralization and decentralization is that expectations of what other wage setters expect only matter under decentralization, for obvious reasons and as we have already pointed out.

than under decentralization, the inflation-unemployment trade-off will also be more favourable in the first case than in the second.

4.2.- Centralized Wage Bargaining with Wage Drift

There is no real world economy that fits the extreme description of the centralized economy presented in the previous subsection. It is well-known that, even in most centralized economies like those of the Scandinavian countries, wage setting takes place at more than one level. In fact, the existence of a wage drift is always mentioned as an important feature of economies with a highly centralized collective bargaining process. This section discusses how the existence of several levels of wage setting affects the results in section 4.1. The main motivation for this discussion is to show that, in general, the existence of a wage drift does not eliminate the macroeconomic effects of centralization, as it is often argued.

To represent more accurately the wage setting process in centralized economies, we suppose now that, previous to wage setting in each production unit, there is wage bargaining at the aggregate level and the fraction λ of workers have their wages set by the centralized wage agreement.¹² Let w_1 be the wage set by the centralized agreement and w_2 the resulting aggregate wage after wage negotiations at further levels (so that the wage drift is $w_2 - w_1$). Then,

$$\begin{aligned}
 w^e &= \lambda w_1^e + (1 - \lambda) w_2^e \\
 w_1 &= p^e + a_2^c (m^e - p^e) + \frac{a_3 \bar{\theta}^e}{a_1} + \frac{1}{a_1} \bar{z}^e \\
 w_2^e &= p^e + \frac{a_2}{a_1} (m^e - p^e) + \frac{a_3 \bar{\theta}^e}{a_1} + \frac{1}{a_1} \bar{z}^e \\
 p^e &= \frac{b_1}{b_1 + b_2} m^e + \frac{b_2}{b_1 + b_2} w^e - \bar{\theta}^e
 \end{aligned} \tag{30}$$

In this case, the equilibrium rate of unemployment is

¹²We can also think of λ as the "proportion of workers who coordinate" in the wage setting process.

$$u^* = \frac{b_2 \bar{z}}{a_1 b_1 + b_2 [\lambda a_2^C a_1 + (1-\lambda) a_2]} \quad (31)$$

which is larger than the equilibrium rate of unemployment under centralization but smaller than that under decentralization, as long as $a_2^C > a_2/a_1$. After straightforward algebra, it can be shown that

$$\begin{aligned} p &= (u^*)^e + \frac{b_1}{b_3} m + \frac{b_2}{b_3} m^e - \frac{1-a_1+\lambda a_1(1-b_2)}{1-a_1 b_2} (\bar{\theta} - \bar{\theta}^e) + \frac{b_2(1-\lambda)}{b_3(1-a_1 b_2)} (\bar{z} - \bar{z}^e) \\ u - (u^*)^e &= \frac{b_2}{b_3} (m - m^e) - \frac{1-a_1\lambda + a_1\lambda(1-b_2)}{1-a_1 b_2} (\bar{\theta} - \bar{\theta}^e) + \frac{b_2(1-\lambda)}{b_3(1-a_1 b_2)} (\bar{z} - \bar{z}^e) \end{aligned} \quad (32)$$

and, substituting the optimal monetary policy rule:

$$\begin{aligned} \pi &= \frac{\rho b_2}{b_1} (u^*)^e - \frac{\rho b_2 b_3}{b_1^2 + \rho b_2^2} \frac{1-a_1+\lambda a_1(1-b_2)}{1-a_1 b_2} (\bar{\theta} - \bar{\theta}^e) + \frac{\rho b_2^2(1-\lambda)}{(1-a_1 b_2)(b_1^2 + \rho b_2^2)} (\bar{z} - \bar{z}^e) \\ u &= (u^*)^e - \frac{b_1 b_3}{b_1^2 + \rho b_2^2} \frac{1-a_1\lambda + a_1\lambda(1-b_2)}{1-a_1 b_2} (\bar{\theta} - \bar{\theta}^e) + \frac{b_1 b_2(1-\lambda)}{(1-a_1 b_2)(b_1^2 + \rho b_2^2)} (\bar{z} - \bar{z}^e) \end{aligned} \quad (33)$$

Thus, the responses to unexpected shocks are also smaller than under centralization with no wage drift but still higher than under decentralization, as only a fraction $(1-\lambda)$ of wage setters take into account information of sectoral shocks to determine wages, and, consequently, only a fraction $(1-\lambda)$ of wages contain information on the unexpected component of the aggregate shock. On the other hand, unexpected productivity shocks and unexpected wage pressure are also going to differ respect to both centralization and decentralization.

In any case, the important point made by this result is that it is not true that the existence of a wage drift makes centralized economies and decentralized economies equivalent, in the sense of delivering a similar evolution and distribution of wages, and, therefore, similar levels of unemployment, inflation and real wage rigidity. It is important to realize that the different information structures under which wages are determined and the coordination problem existing in decentralized economies have important implications which are reduced in centralized economies even after allowing for successive levels of negotiation.

5.- An Approximation to the Costs of Decentralization

In this section we present a simple example to elaborate further on the costs of decentralization arising from the uncertainties prevalent under this wage determination process. To make our point more clear, we will assume that the equilibrium unemployment rate is the same under centralization and decentralization (or, what is the same, that $a_2^C = a_2/a_1$) and that unexpected wage pressure is zero under both regimes. Thus, the difference between centralization and decentralization is only due to the fact that unexpected labour productivity shocks are likely to differ under both regimes.

We will approximate the welfare costs of decentralization by the variance of actual unemployment minus equilibrium unemployment relative to that variance under centralization. Alternatively, we could evaluate the government's objective function at the values of inflation and unemployment under both regimes to obtain similar qualitative results.

In this example, aggregate productivity shocks are white noise with variance equal to σ^2 , while the variance of sector-specific productivity shocks, which are also assumed to be white noise, is σ_i^2 . For ease in notation, we assume that all sector-specific shocks have the same variance (so that σ_i^2 is different to σ^2 but does not depend on i), and that sector-specific shocks are uncorrelated among themselves and to aggregate shocks. Hence, under decentralization

$$E(\theta \mid \theta_i) = h \cdot \theta_i, \quad h = \frac{\sigma^2}{\sigma_i^2 + \sigma^2}, \quad (34)$$

$$\bar{\theta} - \bar{\theta}^c = (1-h) \cdot \bar{\theta}$$

and the variance of the difference between actual and equilibrium unemployment is:

$$\text{var}(u - u^*) = (1-h)^2 \cdot \left(\frac{b_1 b_3}{b_1^2 + \rho b_2^2} \right)^2 \left(\frac{1-a_1}{1-a_1 b_2} \right)^2 \sigma^2 \quad (35)$$

On the other hand, under centralization and assuming that aggregate productivity shocks are observed before setting wages (in the same spirit of assuming that sectoral productivity shocks are observed under decentralization), this variance would be zero. Thus, and taking into account that h is a number close to zero, since typically the variance of sector-specific shocks is much larger than the variance of aggregate shocks, the costs of decentralization are proportional to the variance of aggregate productivity shocks, which indicates that the relative macroeconomic performance of centralized

economies respect to decentralized economies improved during periods of high volatility in this type of shocks. This is consistent with the anecdotal evidence available.

6.- Wage Dispersion and Microeconomic Efficiency

The issue of the effects of the degree of centralization on microeconomic efficiency deserves some clarification. As already mentioned in the introduction, microeconomic efficiency can be understood in two ways: i) the extent to which wages at the sectoral levels respond to economic changing conditions in those sectors, and ii) if an optimal wage structure exists, the extent to which the actual wage structure differ from it. These two definitions might share some implications. For instance, if an optimal wage structure exists and is related to the sectoral distribution of shocks, then microeconomic efficiency, understood in any of the two ways describe above, is desirable and reduced by centralization.¹³

However, it is not clearcut that such optimal wage structure is unique or is related to the sectoral distribution of shocks. The usual argument in favour of such relationship is that aggregate employment can be maximized by lowering wages in those sectors with low productivity growth (so that job losses are minimized). But, alternatively, a less disperse wage structure would create more jobs in high productivity growth sectors (although at the cost of reducing employment in low productivity growth sectors) without implying aggregate employment losses respect to the former scenario. The following example clarifies this point. Suppose that labour demand functions are given by:

$$\begin{aligned}
 l &= -\beta(w-p) + \gamma\theta \\
 l_i &= -\beta_i(w_i-p) + \gamma_i\theta_i \\
 \beta &= \frac{1}{n} \sum_{i=1}^n \beta_i \\
 \gamma &= \frac{1}{n} \sum_{i=1}^n \gamma_i \\
 \frac{1}{n} \sum_{i=1}^n \beta_i \gamma_i &= 0
 \end{aligned} \tag{36}$$

Under centralized bargaining (with no wage bargaining at further levels of negotiation and no

¹³See Freeman (1988) for a case against centralization along this line.

uncertainty on aggregate productivity shocks), real wages are equal across production units. Assume, for simplicity, that they are proportional to aggregate shocks, for instance

$$w-p=\eta \theta, \quad \eta > 0 \quad (37)$$

and, hence

$$l=(\gamma-\eta \beta) \theta \quad (38)$$

Alternatively, under similar assumptions, decentralized bargaining yields:

$$w_i-p=\eta_i \theta_i, \quad \eta_i > 0, \quad i=1, \dots, n \quad (39)$$

which implies:

$$\begin{aligned} l_i &= (\gamma_i - \eta_i \beta_i) \theta_i \\ l &= \gamma \theta - \beta \sum_{i=1}^n \eta_i \theta_i \end{aligned} \quad (40)$$

We are now in conditions of assessing to which extent decentralization maximizes employment. Whether aggregate employment under decentralization is higher than under centralization would depend upon¹⁴

$$\sum_{i=1}^n \eta_i \theta_i \begin{matrix} > \\ < \end{matrix} \eta \theta \quad (41)$$

In other words, when sectoral shocks and the response of wages to them are uncorrelated across sectors, aggregate employment is not affected by the dispersion of wages. Only the sectoral dispersion of employment is affected by the sectoral dispersion of wages. If the response of wages to productivity shocks is asymmetric, for instance, wages are rigid downwards (upwards), then decentralization (centralization) yields a higher level of aggregate employment.

In any case, there are other reasons to believe that the wage structure matters for aggregate employment. These reasons have to do with the duration of the shocks and the existence of factor mobility costs and of dynamic effects of the sectoral distribution of employment. For instance, if

¹⁴We are measuring aggregate employment in logs and abstracting from the differences in aggregate employment that implies the fact that the sum of logs is not equal to the log of the sum.

shocks are transitory and there are factor mobility costs, centralization imposes some burdens since it would imply inefficient job losses that could be avoided under decentralization. On the other hand, the existing employment structure might have some implications for future employment creation (through some kind of dynamic effects). For instance, if there are learning-by-doing effects, which might imply that creation of employment in high productivity growth sectors is a condition for a more rapid expansion of these sectors, centralization would be preferable to decentralization also on the grounds of microeconomic efficiency.

The previous discussion is somehow sketchy but it aims at emphasizing that the effects of the degree of centralization of the wage setting process on microeconomic efficiency can go both ways. Further research on this issue is on the agenda.

7.- Concluding Remarks

This paper has considered the effects of centralization of the wage setting process in inflation and unemployment determination from a different perspective that it is available in the existing literature on this issue, that focus on the effects of centralization on the equilibrium unemployment rate. In our approach, the different degree of uncertainty implied by different wage determination regimes is stressed and its effects on the difference between actual and equilibrium unemployment analyzed. Regarding microeconomic efficiency, we have distinguished two different definitions: i) the relationship between sectoral wages and sectoral economic conditions as a source of macroeconomic flexibility, and ii) the degree to which the economy achieves an optimal sectoral wage dispersion. In this regards, we have argued that the effects of centralization on microeconomic efficiency are ambiguous. Our main conclusion is, then, that centralization is preferable to decentralization since the difference between actual and equilibrium unemployment is likely to be more volatile under decentralization and the costs of centralization in terms of microeconomic efficiency are ambiguous. The reason for the larger difference between actual and equilibrium unemployment rate under decentralization is that under this wage determination regime, unexpected aggregate labour productivity shocks and unexpected wage pressure are higher. The costs of decentralization are, therefore, higher during periods of volatile supply shocks and during disinflations.