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Lilia Cavallari, *University of Rome III*



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## Optimal contracts and the role of the government in wage bargaining

Lilia Cavallari\*

University of Rome III, Italy

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## ABSTRACT

This paper introduces a contract between the government and trade unions in a model of strategic wage bargaining à la Lippi (2003). It shows that an optimal contract can be implemented through an appropriately defined inflation target.

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## 1. Introduction

It is well-known that the typical solutions to the problem of time-inconsistency in monetary policy-making, as appointing a conservative central banker, may not work properly in the presence of large unions.<sup>1</sup> In a scenario of low inflation, in fact, unions perceive their wage claims to have smaller inflationary consequences and may therefore be induced to behave more aggressively. A key finding in the literature on strategic wage bargaining suggests that any solution to this type of problem is not independent of endogenous distortions in labour markets and hence on the system of wage bargaining in place. In most contributions in this area the government plays no role in the policy game, with fiscal policy eventually being considered as exogenous.<sup>2</sup> Yet fiscal policy contributes to shape the strategic environment that unions face when bargaining wages. A given rise in nominal wages, for instance, might affect unions' utility in a different manner depending on labour income taxes or on the amount of transfers accruing to wage-setters. The focus of this

paper is exactly on exploring the role of the government in the wage bargaining game.

This paper extends the model of wage and monetary policy interaction in Lippi (2003) by introducing a contract between the government and trade unions akin to the one proposed by Walsh (1995) for a central bank. The contract consists of a monetary transfer from the government which can be viewed as direct income for the trade union or a contribute to its budget. It can also be interpreted more broadly as reflecting legislative objectives of interest for unions, as reforms of the pension system or of employment protection. The contract is a means for relocating the commitment problem at the root of the inflationary bias in the economy: it is assumed that the government is unable to commit to a specific inflation policy, either directly or by means of the central bank, while he can commit to offer trade unions a specific contract. The assumption is plausible in that relocation is generally considered an efficient means for solving commitment problems (Walsh, 1998). Moreover, a climate of accord between the government and trade unions, exemplified by a formal contract in this paper, is typical of corporatist policies and "social pacts" as those experienced in many European countries in the run-up to the European Monetary Unification.

I show that a transfer inversely related with the real wage of each union can restore the perfectly competitive level of employment. When such a contract is in place, unions realize that any attempt to increase the real wage of their members by negotiating an increase in their nominal wage will lead to a corresponding reduction in the amount of the public transfer.

\* Correspondence to: Dipartimento di Istituzioni Pubbliche, Economia e Società, Università Roma Tre, Via C. Chiabrera, 199, 00145 Roma, Italy. Tel.: +39 0657335327.  
E-mail address: [cavallar@uniroma3.it](mailto:cavallar@uniroma3.it).

<sup>1</sup> See Lippi (2003), Guzzo and Velasco (1999, 2002), Jerger (2002) and Cavallari (2004) among others.

<sup>2</sup> Acocella et al. (2007) and Cavallari (2010) provide notable exceptions.

The best thing to do, therefore, is to set nominal wages at the competitive level and stand ready to supply any amount of labour that the market demands at that wage. Once employment and output are at the competitive standard, in turn, the central bank will have no reason to unleash a surprise monetary expansion and the inflationary bias in the economy will vanish.

The paper is organized as follows. Section 2 presents the model. Section 3 solves the game and analyses its macroeconomic consequences. Section 4 discusses the main policy implications and Section 5 concludes.

## 2. The model with fiscal transfers

The structure of the economy draws on Lippi (2003). The private sector is populated by a representative competitive firm and a continuum of workers of unit mass. The firm produces a single consumption good using all labour types. Workers supply labour, receive dividends from the firm and consume. They are organized in  $n \geq 1$  trade unions, each of size  $1/n$ , who bargain nominal wages on behalf of their members. The public sector comprises a benevolent government and a central bank. The government commits to make a transfer to each union before the wage bargain starts.

### 2.1. The firm

The representative firm produces output,  $Y$ , according to the CES technology:

$$Y = \left[ \int_0^1 L_j^{\frac{\phi-1}{\phi}} dj \right]^{\frac{\alpha\phi}{\phi-1}} \quad (1)$$

where  $L_j$  is labour supplied by worker  $j$ ,  $\phi > 1$  the elasticity of substitution among different types of labour and  $\alpha \in (0, 1)$  is a return to scale parameter. Cost minimization implies the following demand for each labour type  $j$ :

$$L_j = \left( \frac{W_j}{W} \right)^{-\phi} Y^{\frac{1}{\alpha}} \quad (2)$$

where  $W_j$  is the nominal wage of worker  $j$  and  $W$  the nominal aggregate wage. In a symmetric equilibrium the above expression can be written as

$$L_j = \left( \frac{W_j}{W} \right)^{-\phi} \left( \frac{W}{\alpha P} \right)^{\frac{-1}{1-\alpha}} \quad (3)$$

where  $P$  is the price level.

### 2.2. Workers and unions

Workers derive utility from consumption,  $C$ , and dislike work effort,  $L$ :

$$U_j = \log C_j - \frac{\kappa}{2} (\log L_j)^2. \quad (4)$$

They earn wage income, firms' profits,  $D_j$ , a transfer from the government,  $TR_j$  and pay lump-sum taxes  $T_j$ . The budget constraint of a representative worker in real terms is therefore<sup>3</sup>:

$$\begin{aligned} C_j &= \frac{W_j}{P} L_j + D_j + TR_j - T_j \\ &= \alpha^{\frac{1}{1-\alpha}} \left( \frac{W_j}{W} \right)^{1-\phi} \left( \frac{W}{P} \right)^{\frac{-\alpha}{1-\alpha}} + D_j + TR_j - T_j. \end{aligned} \quad (5)$$

<sup>3</sup> It is convenient to express the real wage of a generic worker belonging to union  $i$  as  $\frac{W_i}{P} = \frac{1+w_i}{1+\pi}$  where  $w_i$  is the growth rate in the nominal wage of union  $i$  and  $\pi$  is the inflation rate. In the remainder, I use the approximation  $\log \frac{W_i}{P} \cong w_i - \pi$  and similarly for the real aggregate wage  $\log \frac{W}{P} \cong w - \pi$ .

Workers are organized in  $n$  trade unions where each union  $i$  represents the workers that lie contiguously in the interval between any couple of unions  $(i - 1/n, i)$ . As in Lippi (2003), unions are interested in the utility of their members:

$$V_i^U = n \int_{i-1/n}^i U_j dj. \quad (6)$$

### 2.3. The public sector

The central bank directly controls the inflation rate,  $\pi$ . As in Lippi (2003), her objective function is given by

$$V^M = \int_0^1 U_j dj - \frac{\beta}{2} \pi^2 \quad (7)$$

where the parameter  $\beta > 0$  captures the degree of inflation aversion.<sup>4</sup>

I assume that a benevolent government is able to commit to a contract with trade unions. The contract entitles each trade union to receive a monetary transfer  $TR_i$  whose amount is inversely related with the real (consumption) wage of his members:

$$TR_i = T_0 \left( \frac{W_i}{P} \right)^{-\tau} \quad (8)$$

where  $T_0$  is set so as to satisfy the unions' participation constraint and  $\tau > 0$ .

The transfer can be interpreted as a public contribute to the budget of unions or it can be viewed more broadly as reflecting legislative objectives of interest to unions, regarding for instance the pension system or employment protection. The contract can also be interpreted as capturing a climate of accord among social parties in the tradition of the so-called "social pact".<sup>5</sup> The social pact is generally finalized at restraining wages in exchange for non-wage benefits. This type of accord has been frequent in many European countries in the early 90s as part of the disinflation strategy in the run-up to the European Monetary Unification. In the European experience, the role of the government has varied considerably, from a formal engagement in the wage contract, as in the Netherlands, to an external endorsement.

The government budget constraint is as follows:

$$T \equiv \int_{j=0}^1 T_j dj = \sum_{i=1}^n TR_i \quad (9)$$

where  $T$  are aggregate lump-sum taxes.

## 3. The wage bargain

The wage bargain involves a two-stage game. Before the game starts, the government commits to make the transfer to each union according to (8). In the first stage, unions simultaneously and independently choose the nominal wage of their members, considering as given the behaviour of other unions. In the second stage, once wages are set, the central bank picks inflation. The game is solved by backward induction.

### 3.1. The central bank reaction function

The central bank chooses inflation so as to maximize its objective function (7) taking as given the behaviour of wage-setters,

<sup>4</sup> Without loss of generality, the central bank's target for inflation is normalized to zero.

<sup>5</sup> Visser (2002) provides a comprehensive overview of social pacts in Europe. See Cavallari (2008) and Acoella et al. (2009) for formal models of wage bargaining under a social pact.

implying the first order condition:

$$\alpha - \kappa \int_0^1 \log L_j dj - \beta (1 - \alpha) \pi = 0. \quad (10)$$

The expression above, together with labour demand (3) provides the reaction function that unions face when they set nominal wages. A typical union perceives that an increase in the wage of his members,  $w_i$ , will have the following consequences for inflation:

$$\frac{\partial \pi}{\partial w_i} \equiv s = \frac{\kappa}{n[\kappa + \beta(1 - \alpha)^2]}. \quad (11)$$

### 3.2. The strategy of unions

The problem of a typical trade union amounts to choosing the rate of wage growth  $w_i$  so as to maximize the utility of its members (6) taking into account the monetary reaction function (10) and the contract with the government (8) and considering as given the wages set by all other unions. This yields the first order condition:

$$\alpha [1 - s - \varepsilon] + \kappa \log L_i \varepsilon - \alpha \tau (1 - s) = 0 \quad (12)$$

where  $\varepsilon \equiv -\frac{\partial \log L_i}{\partial w_i} = \phi \frac{n-1}{n} + \frac{1}{1-\alpha} (\frac{1}{n} - s) > 0$ .

The condition above says that a typical union has an incentive to demand a higher wage up to the point where the costs of reducing consumption (the first addend in (12) is negative) and the costs of reducing the monetary transfer from the government (the third addend) exactly balance the benefits of increasing leisure (the second addend). With respect to the wage strategy in Lippi (2003), where there is no contract with the government ( $\tau = 0$ ), unions clearly appear to have a greater incentive to moderate their wage claims so as to benefit from the transfer.

### 3.3. The macroeconomic outcome

In a symmetric equilibrium where  $\log L_i = \log L$  for all unions, the strategy (12) yields:

$$\log L = \frac{\alpha}{\kappa} \left(1 - \frac{1}{\eta}\right) + \frac{\alpha \tau}{\kappa \eta} \quad (13)$$

with  $\eta \equiv \frac{\varepsilon}{1-s} > 1$ .<sup>6</sup>

Note that employment is increasing (decreasing) in the elasticity of labour demand  $\eta$  whenever  $\tau < 1$  ( $\tau > 1$ ). It coincides with the perfectly competitive level,  $\log L = \alpha/\kappa$ , when the elasticity is infinite. It is immediate to verify that employment is at the competitive level despite monopoly distortions (i.e., in spite of a finite elasticity of labour demand) whenever  $\tau = 1$ . The transfer (8) with  $\tau = 1$  therefore constitutes an optimal contract: it provides a marginal benefit in terms of higher consumption that exactly balances the marginal cost of increasing work effort up to the competitive level.

Finally, using equilibrium employment into the central bank's reaction function gives the equilibrium level of inflation:

$$\pi = \frac{\alpha(1 - \tau)}{\beta(1 - \alpha)\eta} \quad (14)$$

where it appears that the inflationary bias vanishes when the optimal contract is in place. For  $\tau < 1$ , equilibrium inflation is higher than optimal for the well-known reasons of time-inconsistency in monetary policy-making stressed by Barro and Gordon (1983) and Kydland and Prescott (1977). The transfer

<sup>6</sup> It is worth stressing that the variable  $\eta$  represents the elasticity of labour demand with respect to a change in the real wage, i.e.  $\eta \equiv -\frac{\partial \log L_i}{\partial \log(W_i/P)} = \frac{\frac{\partial \log L_i}{\partial w_i}}{\frac{\partial \log(W_i/P)}{\partial w_i}}$ .

effectively moderates wage claims, thereby reducing monopoly distortions in the economy, although not as much as necessary. Employment will still be too low, inducing the central bank to reduce real wages by means of a burst in inflation. For  $\tau > 1$ , on the contrary, wage moderation is excessive and a deflationary bias occurs. This is a consequence of the incentive on the part of wage-setters to reduce the wage of their members below the competitive standard whenever the welfare loss associated with the increase in work effort is more than compensated by the transfer from the government.

## 4. Policy implications

Up until now, I have shown that a contract between the government and trade unions linking the public transfer to the real wage of each union can eliminate the inflationary bias in the economy. The transfer induces unions to negotiate wages at the competitive level, thereby eliminating the incentive on the part of the central bank to increase inflation. A transfer based on the real wage of unions' members may, however, be difficult to implement in practice. Informational asymmetries, for instance, may hinder the assessment of real labour costs at the core of the transfer. A pragmatic approach suggests to look at the experience of wage contracts at work in mostly centralized systems of wage bargain, as the one in place in Italy since the late 90s. In the Italian system, unions negotiate the growth in the nominal wage of all workers in a given sector through a "national contract". Wage growth over the whole contract period must be below a benchmark inflation rate, the so-called "programmed rate of inflation", which is announced by the government at the beginning of each bargaining round.<sup>7</sup> If at the end of the contract period, realized inflation is higher than programmed inflation, nominal wages are adjusted so as to compensate workers for the loss in the purchasing power of labour incomes.<sup>8</sup>

In this system, the national contract implies a negative transfer for workers whenever actual inflation is above a given programmed rate (as it has effectively been the case in Italy). In my model, this is equivalent to modifying the government's transfer as follows:

$$TR_i = T_0 \exp(\pi^* - \pi) \quad (15)$$

where  $\pi^*$  is the (exogenously given) programmed rate of inflation. Note that the elasticity of the transfer is equal to unity, implying that a one per cent deviation of inflation from the benchmark leads to a corresponding reduction in real wages until the next bargaining round.

Under (15), the first order condition for union  $i$  becomes<sup>9</sup>:

$$\log L_i = \frac{\alpha}{\kappa} \left(1 - \frac{1}{\eta}\right) + \frac{s\alpha}{\kappa(1-s)\eta}. \quad (16)$$

As before, the wage strategy may lead to a sub-optimal outcome and essentially for the motives already discussed. In the symmetric equilibrium, employment and inflation are now given by

$$\log L = \frac{\alpha}{\kappa} \left(1 - \frac{1}{\eta} + \frac{s}{(1-s)\eta}\right) \quad (17)$$

$$\pi = \frac{\alpha(1-2s)}{\beta(1-\alpha)\eta(1-s)}$$

<sup>7</sup> The programmed rate of inflation is the inflation rate that the government expects for the whole duration of the wage contract. In principle it depends on expected changes in both wage and non-wage (core) inflation. In the Italian experience, it has been interpreted as an ideal inflation target. Programmed inflation has systematically been below both expected (ex ante) and realized (ex post) inflation.

<sup>8</sup> Originally, national contracts had a validity of 2 years. From February 2009, the contract horizon is 3 years.

<sup>9</sup> An Appendix with details of derivations is available upon request.

where it appears that a deflationary (inflationary) bias materializes whenever  $s$  is larger (smaller) than  $1/2$ .<sup>10</sup> The equation above indicates that reaching the competitive level of employment with zero inflation requires two conditions. First, unions must be large enough in order to internalize the effect of their wage claims on the public transfer. In a completely decentralized system of wage bargain, namely when  $n \rightarrow \infty$ , each union will perceive his moves to have only a negligible effect on inflation ( $s = 0$ ) and will therefore take the transfer (15) as given. No matter how the transfer is conceived, employment will be below the competitive benchmark and inflation will be positive in this case. Second, the marginal benefit of the transfer must equalize the marginal cost of increasing labour effort up to the competitive level. For a given level of programmed inflation, this is not generally the case, unless  $s$  happens to be equal to  $1/2$ . Programmed inflation, however, may well be made dependent on the (expected) dynamics of wages along the contract horizon, i.e.  $\pi^*(w)$ . It is easy to show that a transfer like (15) restores the efficient equilibrium whenever

$$\pi^* = \lambda w \quad (18)$$

$$\text{where } \lambda \equiv \frac{\kappa(2-n) - n\beta(1-\alpha)^2}{(\kappa + \beta(1-\alpha)^2)}.$$

Interpreting the expression above, it says that the programmed rate of inflation should be linked (linearly) to nominal wage growth. Moreover, a change in the aggregate wage  $w$  may have a positive or a negative effect on  $\pi^*$  depending on parameter values.

I stress that programmed inflation is negatively associated with wage inflation in systems (like the Italian one) characterized by an intermediate degree of wage centralization, i.e.  $\lambda < 0$  whenever  $\infty > n > 2\kappa / (\kappa + \beta(1-\alpha)^2)$ . The reason draws on the limited capability of such systems to internalize the adverse macroeconomic consequences of excessive wage hikes and therefore on the need to use the public transfer as a discipline device. In order to see how, consider the moves of the players at each bargaining round. Under (18), the government announces that programmed inflation will be revised downwards by  $\lambda$  percent for each percentage point of wage inflation that will eventually realize over the contract period. As a consequence, unions realize that the amount of the transfer (15) will be correspondingly reduced for any given level of realized inflation. This in turn induces wage moderation up to the point where there is effectively no wage inflation and the economy converges to the competitive standard. Note that the sole announcement of eventually reducing programmed inflation below the ideal inflation target (here normalized to zero) can discipline wage behaviour.

In mostly centralized systems of wage bargaining ( $n < 2\kappa / (\kappa + \beta(1-\alpha)^2)$ ), on the contrary, the risk of a public transfer like (15) is that large unions excessively moderate the wage claims of their members in the attempt to increase the amount of the transfer (recall from (17) that a deflationary bias may realize in this case). Programmed inflation should therefore react positively to wage inflation, i.e.  $\lambda > 0$ . The announcement of a loose inflation target can effectively hedge against deflationary risks in this case.

## 5. Concluding remarks

Drawing on a model of strategic wage bargaining à la Lippi (2003), this paper has investigated the macroeconomic consequences of a contract between the government and trade unions analogous to the one proposed by Walsh (1995) for central bankers as a solution to the problems of time-inconsistency in monetary policy. The contract involves a monetary transfer to

unions, which can be viewed as a public contribution to the unions' budget or more broadly as reflecting policies of interest to their members. The contract can also be interpreted as capturing a climate of accord among social parties in the tradition of "social pacts" and corporatism.

The paper provides two main results. First, it shows that a public transfer inversely related with the real wage of each union can restore the perfectly competitive level of employment and eliminate the inflationary bias in the economy. The finding extends to trade unions the idea of an optimal contract proposed by Walsh (1995) for central bankers. Second, it finds that the optimal contract can be effectively implemented through an appropriate inflation target in a system of wage bargaining akin to the one in place in Italy since the 90s. In the Italian system, nominal wage growth cannot exceed the "programmed" rate of inflation announced by the government at the beginning of each bargaining round. I stress that programmed inflation need not coincide with an ideal inflation target, as it has effectively been the case in Italy. In systems characterized by an intermediate degree of wage centralization, it should be negatively associated with wage inflation, eventually amounting to an over-restrictive inflation target. The reason is the need to induce wage moderation in an environment in which wage-setters would otherwise be largely unaware of the adverse consequences of wage aggressiveness. In highly centralized systems, on the contrary, programmed inflation should be positively related with wage inflation so as to refrain unions from excessively moderating their claims. A high awareness of the inflationary consequences of wage hikes typical of these systems may in fact induce very large unions to reduce the growth in the nominal wage of their members (and therefore generate a deflationary bias in the economy) in the attempt to increase the amount of the public transfer. A loose inflation target hedges against the risk of deflation in this case.

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<sup>10</sup> Employment is at the competitive level and inflation is zero only in the case  $s = 1/2$ .