

Macroeconomic Determinants of Equilibrium Unemployment Insurance

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Abstract. This paper proposes a new modeling strategy as regards the definition of an optimal level of unemployment benefits. While the traditional methodology privileges labor market equilibrium to derive optimal employment, wage and unemployment benefit levels, we present a model in which the optimal level of unemployment benefits is a function of the government's macroeconomic objectives in terms of inflation and output fluctuations. In a second stage, the model allows for the investigation of unemployment insurance effects on labor market equilibrium.

1. Introduction

Over the last 25 years or so, economists have worried about sticky prices, rigidities in the labor market, and the effects of the design of unemployment insurance schemes on unemployment rates (see Holmlund (1998) for a survey). The modeling strategy most commonly used has been based on the construction of a microeconomic framework in which some optimal levels of wages, employment and unemployment benefits determine the equilibrium in the labor market. As microeconomics naturally precedes macroeconomics, inference on the macroeconomic effects of unemployment insurance schemes usually follows the determination of the optimal level of unemployment benefits, wages and

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employment. The most common result is that replacement ratios and the duration of unemployment benefits are positively correlated with the duration of unemployment; the corollary being a change in unemployment insurance schemes in order to tackle unemployment.

In this paper we propose a different modeling strategy. As the government budget constraint is a crucial determinant of unemployment insurance schemes, together with the structure of collective bargaining and the degree of risk aversion of workers and firms, we develop a model in which unemployment benefits are determined first, as a function of fiscal constraints. Having established the macroeconomic determinants of unemployment benefits, the optimal levels of wages and employment which are compatible with labor market equilibrium are then examined.

Our model is general enough to consider different (a) collective bargaining structures (c.f. Calmfors and Driffill, 1988) (b) degrees of risk aversion by firms and workers, and (c) wage determination arrangements (e.g., as in the cases of monopoly union or efficient bargaining models; c.f. Oswald (1985)). The theoretical framework put forward in this paper allows the investigation of different policy options as regards the design and implementation of unemployment insurance schemes and severance payment systems.

The paper is structured as follows. Section 2 presents the main features of the traditional modeling strategy of unemployment insurance (job search theory, implicit contract models, and labor market equilibrium under collective bargaining). Section 3 presents our model in which macroeconomic factors come first in the determination of unemployment benefits and subsequently the determination of optimal levels of wages and employment. Section 4 discusses some broad policy implications and Section 5 concludes.

2. Traditional modeling of unemployment insurance

2.1 Job search theory

Job search theory has provided economists with an important analytical tool for exploring rational individual behavior during unemployment. Mortensen (1977) offered the first rigorous analysis of the impact of unemployment benefits on individual job-search behavior with a model of sequential search where

institutional factors of the labor market (such as duration of benefits and eligibility criteria) were incorporated. He also allowed for the choice of reservation wage, layoff risks associated with accepted jobs and endogenous choice of search effort.

The most important implications of Mortensen's model were that: (i) the reservation wage declines as the individual approaches the date at which the benefit terminates, implying that exit rates increase over the spell of insured unemployment; (ii) higher benefits will make it more attractive for currently non-eligible workers to accept jobs and become eligible for benefits in the future — the so-called 'entitlement effect'; and (iii) a rise in the benefit level will lead to an increase in the reservation wage of a newly unemployed worker, but will induce an insured worker close to benefit termination to reduce his reservation wage, implying that exit rates for newly unemployed workers will increase with the opposite effect for those workers whose unemployment benefit is close to exhaustion.

Other authors have tried to link job search with labor supply (Yaniv, 1982; Hamermesh, 1980). The argument is that since unemployment benefits are typically tied to previous earnings, employed workers can influence their future benefit level by their choice of work hours. Therefore, unemployment benefits may increase labor supply amongst employed workers and encourage labor force participation.¹

Empirical support for job search theories does not seem to be robust. Lancaster and Nickell (1980) and Layard *et al.* (1991) have found a positive effect of unemployment benefits on the duration of unemployment, but this result does not appear to be robust in the empirical survey undertaken by Pedersen and Nielsen (1993). Holmlund (1998), on the other hand, argues that 'the effects of benefits on unemployment duration is far from a firmly established parameter that is comparable in robustness to, say, estimates of the returns to schooling' (p. 118). In the same vein, empirical research on the impact of benefits on search behavior has not yielded conclusive results. For example, Jones (1989) finds that higher benefits increase search effort, whereas Burgess and Low (1998) find a negative impact.

2.2 *Implicit contracts*

A significant piece of evidence suggests that a large number of unemployed workers can be rehired by their most recent

employer, a feature of the labor market that is not captured by job search models. Implicit contract models are appropriate to take account of temporary layoffs and were developed to investigate the implications of unemployment benefits with respect to the level and financing of benefits. Feldstein (1976), who proposed a model featuring a firm with a pool of attached workers facing uncertain product demand, made the seminal contribution in this field.

In the basic implicit contract model, the firm and the worker have to agree on a contract that specifies wages, employment and work hours in periods of boom and recession. The number of workers laid-off will be given by the difference between the number of workers attached to the firm and the number of workers employed by the firm. An assumption of the model is that the firm has to finance part of the unemployment benefit due to the worker who is laid off. The relevant implication of the model is that a rise in the unemployment insurance subsidy causes a reduction in employment. Recent empirical work, however, has not confirmed that prediction basically because rehiring are found to increase labor costs thus making layoffs more costly to the firm (see Mortensen and Pissarides, 1994).

2.3 Labor market equilibrium and unemployment benefits

A large amount of theoretical and empirical work has been devoted to the analysis of the role of trade unions in the determination of optimal levels of wages, employment and unemployment benefits (see Oswald (1985) and Nickell (1990) for surveys). Considering a situation in which wages are bargained for between a single trade union and a single firm and employment is determined unilaterally by the firm, a typical outcome is that increases in unemployment benefits will increase negotiated wages and lead to higher unemployment.² Under this framework, it is easy to imagine that a rise in the replacement ratio will impact positively unemployment rates.

Search-matching models have also investigated labor market equilibrium outcomes. These models have incorporated different degrees of risk aversion by workers who are either employed or unemployed and care about the expected present value of lifetime utility. Vacancies are opened as long as they yield positive expected profits. The behavior of recruiting firms generates a relationship between the real wage cost and the state of the labor market.³

Wages are determined in decentralized bargains where higher labor market tightness increases the bargained wage. Unemployment benefits are assumed to be financed by a payroll tax and hiring costs are taken to be proportional to the after-tax wage costs, thus making equilibrium tightness independent of the payroll-tax rate. The same general implication arrived at in the bargaining models remains valid — unemployment rates are positively related to replacement ratios and the level of unemployment benefits (see Layard *et al.*, 1991).

As bargaining is pervasive in most industrialized countries and firms are not free to set wages at their own discretion, models of the bargaining variety seem more relevant than search-matching models which consider wage-setting firms. Nevertheless, the empirical results from studies on both cross-country and time series data confirm the theoretical outcomes commented above. For example, Manning (1993) estimated unemployment equations for Britain and found significantly positive replacement ratio effects. Layard *et al.* (1991) used cross-country data to explain average unemployment in 20 OECD countries and found a significant and positive coefficient of 0.17 for the replacement ratio. Budd and McCall (1997), investigating the effect of unions on the receipt of unemployment benefits, have found that workers laid off from union jobs in the USA are more likely to receive unemployment benefits than comparable nonunion workers.

3. An encompassing model

The different modeling strategies reviewed in the preceding section were fundamentally based on the microeconomics of labor market equilibrium. Under the traditional modeling framework, macroeconomic implications of unemployment insurance policies can only be assessed following the determination of optimal levels of wages and employment. In what follows we reverse this line of causality. By considering that the level and design of unemployment insurance benefits is strongly influenced by the government's targets, we present a model that derives the optimal level of unemployment benefits from the macroeconomic objectives of the government, such as price stabilization and output fluctuation. After defining the optimal level of unemployment benefits, the model allows for the investigation of unemployment insurance effects on labor market

equilibrium. Only then the effects in the bargained levels of wages and employment are considered. An attractive feature of the model is that it is cast on different degrees of bargaining centralization and wage determination arrangements.⁴

The model presents the following timing. The government minimizes a loss function in order to define unemployment benefits. Then, bargaining between trade unions and firms takes place and equilibrium wages and employment are derived. Trade unions are supposed to care only about nominal wages (W) and their opportunity cost is captured by the unemployment benefit (B). Trade unions are assumed to represent the interests of insiders and therefore do not care about employment (N) (see Carruth and Oswald, 1987). Firms care about wages and employment. The preferences of trade unions and firms are given by their utility functions (U) and (V), respectively.

The recursive solution to the model starts at the second stage, when firms and trade unions bargain over nominal wages and employment taking unemployment benefits as given:

$$\text{Max}_{N, W} \{a \log U(W, B) + b \log V(W, N)\} \quad [1]$$

The first order conditions for W and N are, respectively:

$$\frac{a}{U(W, B)} U_W(W, B) + \frac{b}{V(W, N)} V_W(W, N) = 0 \quad [2]$$

$$\frac{b}{V(W, N)} V_N(W, N) = 0 \quad [3]$$

From [2] and [3] we find the optimal solutions for nominal wages and employment as a function of unemployment benefits (B) and the degrees of bargaining power of unions and firms, a and b :

$$N = N(a, b, B) \quad [4]$$

$$W = W(a, b, B) \quad [5]$$

The comparative static analysis shows that, as expected, wages increase with trade unions bargaining power $W_a > 0$, and with unemployment benefits $W_B > 0$, and decrease with the bargaining power of firms $W_b < 0$. Conversely, employment grows with the bargaining power of firms, $N_b > 0$, and decreases with unemploy-

ment benefits and the bargaining power of unions, $N_B < 0$, $N_a < 0$ (see Appendix 1).

In the first stage, the government minimizes the value of the loss function (L), à la Barro and Gordon (1983), that depends on output (y) fluctuations and on the rate of inflation (p):

$$L = \frac{1}{2}[p^2 + \delta(y - y^*)^2] \quad [6]$$

The government wishes to stabilize inflation around zero and output around equilibrium output y^* . Aggregate output is given by a Lucas supply curve of the following form:

$$y = y^* + a(p - p^e) \quad [7]$$

where effective output can be different from equilibrium output in the case in which agents have imperfect information relatively to their prices and the general price level. The informational problem is captured by the difference between effective inflation p and expected inflation p^e .

It is also assumed that there is a positive relationship between inflation and nominal wages, capturing the effect of a wage increase in the costs of the firms and (given the firm's monopoly degree in the product market) its prices:

$$p = p(W), p_w > 0 \quad [8]$$

Substituting [5] into [8] yields:

$$p = p(W(a, b, B)) \quad [8']$$

and by substituting [7] and [8'] into [6], one can see that the control variable available to the government for the minimization of its loss function is the unemployment benefit:

$$\text{Min}_b L = \frac{1}{2} \{ [p(W(a, b, B))]^2 + \delta[\alpha(p(W(a, b, B)) - p^e)]^2 \} \quad [9]$$

The first order condition for this problem is:

$$[p_w W_B p(W(a, b, B))] + \delta[\alpha(p(W(a, b, B)) - p^e)] p_w W_B = 0 \quad [10]$$

By solving equation [10], we obtain the optimal unemployment benefit as a function of the bargaining power of trade unions and firms, a and b , the relative weight the government attributes to output stabilization δ , and the effect of unanticipated inflation on

the fluctuations of output, given by α :⁵

$$B = B(a, b, \alpha, \delta)$$

The comparative static analysis shows that unemployment benefit increases with the bargaining power of firms, $B_b > 0$, and decreases with the bargaining power of unions, $B_a < 0$ with the relative weight the government attributes to output stabilization $B_\delta < 0$, and with the effect of unanticipated inflation on the fluctuations of output, given by $B_\alpha < 0$ (see Appendix 2).

The rationale for these results is quite simple, the government decreases unemployment benefits in order to minimize output fluctuations and inflation. In addition, the government knows that a rise in unemployment benefits increases wages, which increases prices and inflation. Therefore in order to keep inflation low the government offsets the increase in the bargaining power of unions by lowering unemployment benefits. In the same vein, the government tries to smooth out business cycle and minimize unemployment, by counterbalancing an increase in the bargaining power of firms with higher unemployment benefits.

4. Policy implications

The optimal equilibrium arrived at in the previous section can be contrasted to an alternative equilibrium where the government does not care about the labor market. The alternative equilibrium can be visualized if we consider equations [6] and [7], and also if we assume that the government is concerned with a direct relationship between the monetary policy and the rate of inflation, instead of assuming equation [8]:

$$p = \Delta M \tag{11}$$

where the money supply is determined by the government's budget constraint:

$$\Delta M = G + B - T \tag{12}$$

By equation [12] we see that the money supply depends on the government's public deficit. Government expenditures are formed by ordinary spendings G and unemployment benefits B , and government revenues are formed by taxes T .

Using [12] and [11] in the problem of the government given by [6] and [7] we can see that labor market equilibrium is not taken into

account and, therefore, that the unemployment insurance policy is totally constrained by the government's fiscal budget. In this alternative scenario, such policy is sub-optimal relatively to labor market equilibrium since the government does not take into account the impact of B over the levels of employment and nominal wages. This scenario is consistent with several disequilibrium situations such as in the cases of high unemployment and high nominal wages.

A natural question that arises is whether there is any country for which the model can be applied to. Clearly, the model is better suited to countries where wages are set by means of collective bargaining agreements and unemployment insurance benefits are determined at a national level.⁶ In this sense, countries like the USA would be out of the reach of the implications of the model. In this vein, countries where collective bargaining is defined as intermediate-centralized in the sense of Calmfors and Driffill (1988) and job protection rules are set by the government could benefit from the predictions of the model.

Intermediate-centralized bargaining is believed to be conducive to bad macroeconomic management, rent-sharing, union power, high inflation and high unemployment. Under such scenario, unemployment spells tend to be long creating an extra burden on the fiscal situation of the country.⁷ If job protection rules are constrained by the fiscal budget, the alternative available for the government is to reduce unemployment benefits. Thus, in line with our model, by reducing unemployment benefits, the government will be smoothing output fluctuation, reducing inflation, and minimizing unemployment. In addition, measures aimed at introducing more flexibility in the labor market could be applied in order to improve macroeconomic management. This could be achieved by means of a move towards further decentralization of collective bargaining.

5. Conclusion

In this paper, we have proposed a new methodology for defining the optimal level of unemployment benefits. While the traditional modeling strategy followed the path of determining the level of unemployment benefits based only in the optimal labor market outcome, our model takes into consideration the macroeconomic constraints faced by the government. It is assumed that the

government's loss function, representing the objectives of price and output stabilization, will affect the bargaining process through which the optimal levels of employment, wages and unemployment benefits will be defined. We have shown that the optimal unemployment benefit is a function of the bargaining power of trade unions and firms, the relative weight the government attributes to output stabilization, and the effect of unanticipated inflation on the fluctuations of output.

Appendix 1

Comparative statics analysis of employment and wages from equations [2] and [3]. Notice first that we are assuming: $U_W > 0$, $U_{WW} < 0$, $U_B > 0$, $U_{BB} = 0$, $U_{WB} > 0$, and, $V_W < 0$, $V_{WW} = 0$, $V_N \geq 0$, $V_{NN} < 0$, $V_{WN} < 0$. By totally differentiating equations [2] and [3] and using the Cramer rule we obtain the following:

$$\frac{dW}{da} = -b \frac{U_W}{U} \left(\frac{V_{NN}}{V} - \frac{V_N^2}{V^2} \right) J^{-1} > 0$$

$$\frac{dW}{db} = \left\{ -b \frac{V_W}{V} \left(\frac{V_{NN}}{V} - \frac{V_N^2}{V^2} \right) + b \frac{V_N}{V} \left(\frac{V_{WN}}{V} - \frac{V_N V_N}{V^2} \right) \right\} J^{-1} < 0$$

$$\frac{dW}{dB} = \left\{ a \left(\frac{U_N U_B}{U^2} - \frac{U_{WB}}{U} \right) b \left(\frac{V_{NN}}{V} - \frac{V_N^2}{V^2} \right) \right\} J^{-1} > 0$$

$$\frac{dN}{da} = b \frac{U_W}{U} \left(\frac{V_{NW}}{V} - \frac{V_N V_W}{V^2} \right) J^{-1} < 0$$

$$\frac{dN}{db} = \left\{ -b \frac{V_W^2}{V^2} + a \left(\frac{U_{WW}}{U} - \frac{U_W^2}{U^2} \right) \right\} \left(\frac{-V_N}{V} \right) J^{-1} > 0$$

$$\frac{dN}{dB} = \left\{ -a \left(\frac{U_N U_B}{U^2} - \frac{U_{WB}}{U^2} \right) B \left(\frac{V_{NW}}{V} - \frac{V_N V_W}{V^2} \right) \right\} J^{-1} > 0$$

where

$$J = \left[-b \frac{V_W^2}{V^2} + a \left(\frac{U_{WW}}{U} - \frac{U_W^2}{U^2} \right) \right] b \left(\frac{V_{NN}}{V} - \frac{V_N^2}{U^2} \right) - b^2 \left(\frac{V_{NW}}{V} - \frac{V_N V_W}{V^2} \right)^2 > 0$$

Appendix 2

By totally differentiating equation [10], we obtain the following:

$$\frac{dB}{da} = \frac{-W_a}{W_B} < 0$$

$$\frac{dB}{db} = \frac{-W_b}{W_B} > 0$$

$$\frac{dB}{d\delta} = \frac{-\alpha(p - p^e)}{(1 + \alpha\delta)p_W} < 0$$

$$\frac{dB}{d\alpha} = \frac{-\delta}{(1 + \alpha\delta)p_W} < 0$$

Notes

¹ Labor force participation may increase if relative rewards from participation are increased see (Hamermesh, 1980).

² This situation represents the so-called right-to-manage model as the firm retains the right to determine employment following negotiations with the trade union over wages.

³ A tight labor market is usually defined by a high ratio between the number of vacancies and the number of unemployed workers.

⁴ We have opted to present the model in its most general form. However, the appendix to Carneiro *et al.* (1999) brings a sample of different functional forms in line with the traditional models of the labor market (monopoly union, right-to-manage, and efficient bargain) that could be used to replace the general utility functions for unions and firms.

⁵There are basically three ways in which B can be financed: (i) the government can fund unemployment insurance entirely, and in this case the cost of such option should appear as an additional argument in the government's loss function; (ii) employers and employees can share the costs of unemployment insurance, and in this case B should be introduced in the utility functions U and V with a negative coefficient; and (iii) firms could bear the costs alone, and in this case B should enter as an argument that reduces the value of V in the bargaining.

⁶Guasch (1999) revises collective bargaining and unemployment insurance arrangements in a number of Latin American countries. Countries like Argentina and Brazil, for example, have nation-wide collective bargaining arrangements and unemployment insurance schemes defined by the government, and could be taken as examples of countries for which our model could be of any use.

⁷Carneiro (1999) analyses the wage determination process in Brazil and shows that the intermediate-centralized bargaining structure prevailing in the country is rather conducive to rent-sharing and bad macroeconomic management.

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