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A Dynamic Modelling of Unemployment Insurance

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ABSTRACT

The paper analysis the level of unemployment insurance beneficiaries. The model is allow for the simultaneous determination of wages with feedback from excess supply. The analysis concentrates on the flow of workers in and out of unemployment rather than on the net result, the level of unemployment. It focuses on the sub-set of the labor force covered by the unemployment insurance (UI) scheme. The estimation result show that the entry and exit rates exhibit some degree of persistence. Structural change effect both flow equations adversely. Real wages appear to be determined by a mix of efficiency wage and market clearing factors.

1. INTRODUCTION

The analysis of labor market flows offers the opportunity to develop more disaggregated macro analysis and it has benefitted from increasing attention since the pioneer article by Nickell (1982), Blanchard and Diamond (1992), and Pissarides (1985). When applied to study unemployment, the flow approach offers several appealing features compared to the stock analysis. First, through a more precise identification of the supply and demand factors, it is possible to distinguish between the behavior of agents in declining sectors (or periods) and in expanding sectors (or periods). In particular, the job allocation process can be better identified, and so can the sources of persistence or hysteresis. Secondly, the flows are variable and large compared to the stock and the unemployment level may fail to reflect the true underlying changes on the labor market. Thus it is essential to identify separately how the entry rate (incidence) and the exit rate have evolved through time.

2. THE MODEL

The model consists of two flow equations and a wage equation. The wage equation is explicitly introduced to allow for feedback from excess labor supply to the determination of wages. In most empirical studies of the flows, the real wage is simply instrumental as real wages do not adjust according to the market-clearing model (see for example Branson and Rotemberg, 1980). Simultaneous equation models have been developed mostly within the stock framework (see for example Bean, Layard and Nickell, 1986).
Abstracting for the time being from particular institutional features, workers can become eligible for unemployment benefits for three reasons: First, because they have laid off from their job (L). Secondly, because they have quit their job and the beginning of the new job does not coincide with the termination of the old one (Q). Finally, there are new entrants in the labor force who are looking for a job (E). People lose their eligibility for unemployment benefits when they find a job (H) or when they reach the end of the collecting period (R). The inflow and the outflow are thus defined as,

$$I \equiv L + Q + E, \qquad O \equiv H + R. \tag{1}$$

Using an aggregate search model as in Nickell (1982) it is assumed that the flows of workers and jobs are generated by random shocks hitting firms in every period. In equilibrium, shocks are taken as permanent by all agents and are distributed randomly around a zero mean and constant variance. When hit by a positive shock, a firm starts searching for suitable workers. When hit by a negative shock, it lays off workers. Unemployed workers in every period search for a suitable job. Wages are set at the beginning of the period (through negotiation, for example) and agents take them as given for the coming period. Furthermore, it is assumed that layoffs and quits are proportionate to employment. Hiring from unemployment is the product of the number of contacts made by the unemployed (cU), the proportion which receives an offer (f) and the proportion which accepts the offer (p). The two flow definitions in (1) can thus be written,

$$I = k.N + q.N + e.LF = k\left[X\right].N + q\left[Z\right].N + e\left[T\right].LF,$$

$$O = c.U.p.f + r.LF = c.U.p\left[Y\right].f\left[S\right] + r\left[T\right].LF.$$

where the rates, k, q, p, f. e, r are each a function of a vector of exogenous variables (X, Z, Y, S, T).

In the hiring function, the contact rate by the unemployed (c) is assumed to be constant in equilibrium. The job offer rate (f) and the layoff rate (k) depend on the cost of labor (i.e. real wage relative to productivity, LABC), supply shocks (SSHOCK), and the cost of idle capital when opening a vacancy or laying off a worker (CK). The quit rate (q) depends on the future job prospect and the distribution of wages as represented by f, the job-offer rate to the unemployed, and on their acceptance rate (p). the acceptance rate by the unemployed (p) depends on the cost of searching while unemployed, or the characteristics of the UI scheme (UI) and the state of the labor market (f,c).

The rates of new entry (e) and exit (r) depend on the labor force composition (LFCOMP) and on the features of the unemployment scheme (UI).

In equilibrium, the shocks generating the labor flows are distributed with a constant variance. Structural shifts (STRUCT), Lilien (1982), are introduced through mean-preserving shifts in the distribution of shocks. As some firms are hit by larger positive and others by larger negative shocks both, the layoff rate (k) and the job offer rate (f) increase. As the two flows increase no persistent effect is expected on the level of unemployment. However, this holds only if hiring firms are looking for the type of workers freed by declining firms. In a world with technical changes and with widely different sectors, it is unlikely that workers are perfect substitutes. Then mismatch will occur (MMATCH) as growing firms cannot find among the unemployed the type of workers they are looking for. The outflow from unemployment may not respond as fast as the inflow to shifts in the distribution of shocks and unemployment may increase temporarily until adjustment takes place.

The chosen wage-equation is consistent with the earlier assumption that wages are set by some form of bargaining at the beginning of the period and agents take them as given for the period (Nickell, 1990). It also allows for a feedback from excess supply to wage setting. It is defined as,

$$RWAGE = \left[U, \Delta U, PTY, V\right],$$

where RWAGE is the real wage, U is the level of unemployment and PTY is productivity. The variable ΔU takes into account any insider-outsider effect: If there is such an effect, the coefficient on the first difference in unemployment is expected to be positive and there is a larger sensitivity of wages to unemployment in the short-run than in the long-run. This is a very simple way to account for the insider-outsider effect. However, since we use administrative data, nobody is unemployed for more than one year and any impact from the long-term unemployed is expected to be weak. V is a vector which contains other factors affecting the equilibrium wage, namely, supply-shocks (SSHOCK), the characteristics of the supply of labor (LFCOMP), the opportunity cost of being unemployed (UI), the cost of idle capital (CK). Mismatch (MMATCH) is expected to affect real wages positively. An increasing gap between the characteristics of the jobs and those of the unemployed, may induce firms to bid for already employed workers and new entrants.

The three-equation model can thus be written as follows,

$$\frac{I}{N}=k\left[LABC,SSHOCK,STRUCT,CK\right]+q\left[\bar{c},UI,f\right]+e\left[LFCOMP,UI\right].\left(\frac{LF}{N}\right),$$

$$\frac{O}{U}=\bar{c}.p\left[UI,f\right].f\left[LABC,SSHOCK,STRUCT,MMATCH,CK\right]+r\left[LFCOMP,UI\right].\left(\frac{LF}{N}\right), \qquad (2)$$

$$RWAGE=w\left[U,\Delta U,PTY,SSHOCK,MMATCH,CK,UI,LFCOMP\right].$$

where LABC is the $\frac{RWAGE}{PTY}$ ratio. The results of the comparative statics for the equilibrium model can be summarized into the following sign matrix:

$$\begin{array}{c} \\ UI \\ CK \\ RWAGE \\ SSHOCK \\ STRUCT \\ MMATCH \\ LFCOMP \\ U \\ PTY \end{array} \begin{array}{cccccc} w & k & p & f & q & r(e) \\ \left\{\begin{array}{cccccc} + & na & + & na & + & -(+) \\ - & - & - & + & + & na \\ na & + & + & - & - & na \\ - & + & + & - & - & na \\ na & + & - & + & + & na \\ - & na & + & - & - & na \\ ? & na & na & na & na & ? \\ - & na & na & na & na & na \\ + & - & na & + & na & na \end{array}\right\} \end{array}$$

Finally, the model should allow for out of equilibrium situations when aggregate demand is not constant. In the wage equation, errors in inflation expectations are introduced (UEINFL) and aggregate demand variations are accounted for by unemployment (U). A business cycle measure (AD) is introduced in each flow equation. Thus, the reduced forms for (2) can be written as,

$$\frac{I}{N}=A\left[AD,LABC,SSHOCK,STRUCT,CK,UI,LFCOMP\right],$$

- +/- +/- + +/- + +

$$\frac{\mathrm{O}}{\mathrm{U}}=B\left[AD,LABC,SSHOCK,STRUCT,MMATCH,CK,UI,LFCOMP\right], \qquad (3)$$

+ - - - - + - -

$$LABC=W\left[UEINFL,U,NPROD,SSHOCK,MMATCH,CK,UI,LFCOMP\right].$$

- - + +/- + +/- + -

The three equations in (3) are specified in log-linear dynamic form such that,

$$Y_t=a_0+\sum_{i=1}^{4}a_iY_{t-i}+\sum_{j=1}^{n}\sum_{i=0}^{4}b_{j,i}X_{j,t-i}+u_t.$$

The introduction of the auto-regressive terms follows from the results of a Durbin-Watson test for stationarity run on each dependent variable. They indicate that the presence of unit root is likely in the wage series and unlikely (but not with certainty) in the flow series. Using the “general-to-specific” approach, initially four lags are introduced to take into account any yearly effect in the auto-regressive as well as in the distributed lag portion (see Davidson, et. all, 1978). The basic theoretical argument behind Lilien’s (1982) dispersion measure is particularly important in a flow model. Thus, using a dynamic setting, the dispersion index has been corrected for cyclical effects. The procedure is as follows: First, employment in each sub-category has been purged from aggregate demand variations, such that,

$$N_{i,t} = a_0 + \sum_{j=1}^{6} a_j N_{i,t-j} + \sum_{k=1}^{6} b_k AD_{t-k} + \varepsilon_t,$$

where $N_{i,t}$ is the log of the employment level in the *ith* category at time *t* and AD is the detrended RGDP. Then the 'purged' employment level is computed from the following dynamic simulation:

$$\hat{N}_{i,t} = a_0 + \sum a_j \hat{N}_{i,t-j} + \hat{\varepsilon}_t. \quad (4)$$

This procedure allows for stochastic trends and therefore avoids the arbitrary imposition of a deterministic trend. It also corrects for any persistence in aggregate demand shocks. The resulting estimated employment levels from (4) are then used to compute Lilien's dispersion index. The index is defined in the following way,

$$\sigma_t = \left[\sum_{i=1}^{k} s_{i,t} \left(\Delta \log \hat{N}_{i,t} - \Delta \log \hat{N}_t \right)^2 \right]^{\frac{1}{2}}$$

where s_i is the share of category *i* in total employment. Two kinds of structural changes have been measured: industrial shifts within manufacturing (ISHIFT) and sectoral shifts (SSHIFT) across the economy.

3. SIMULATIONS

In order to identify the responsibility of each factor in explaining unemployment, dynamic simulations have been run for the beneficiary level such that,

$$U_{t+1}^s = U_t^s \left[1 - B_t^s \right] + A_t^s \left(W_{t-2}^s \right) N_t^s \,,$$

where s stand for simulated and,

$$B_t^s = \left[\frac{O}{U} \right]_t^s, A_t^s = \left[\frac{I}{N} \right]_t^s, W_{t-2}^s = LABC_{t-2}^s, N_t^s = LF_t - U_t^s.$$

with LF the labor force. Initially, the estimated coefficients have been used to assess the performance of the flow model in fitting actual level data. Thus, simulations are run to evaluate the responsibility of each factor in explaining unemployment.

4. CONCLUSION

The main characteristic of this paper is that it concentrates on the unemployed who collect unemployment insurance (UI) benefits. For policy purpose it is important to uncover the interaction between supply, demand and unemployment benefits. More precisely, to identify the reasons why people end up on unemployment insurance, it is informative to design more targeted policies.

In equilibrium, the shocks generating the labor flows are distributed with a constant variance. Structural shifts, are introduced through mean-preserving shifts in the distribution of shocks. When structural shifts are accompanied by technological changes, hiring firms may be looking for workers with characteristics different from those offered by laid off workers. Thus firms may compete for employed workers rather than hire from the unemployment pool. Larger inflow and smaller outflow increase unemployment temporarily as mismatch between labor demanded and supplied by the unemployed occurs. The discrepancy between the characteristics of labor demanded and supplied by the unemployed is approximated by the ratio of the proportion of people with no more than a high school degree in unemployment and in employment (MATCH). A larger ratio reflects an increase in mismatch.

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