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On the cyclicality of unemployment: Resurrecting the participation margin

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ABSTRACT

This paper considers a real business cycle model with search frictions in the labor market and labor supply which is elastic along the participation margin. Previous authors have found that such models generate counterfactually procyclical unemployment and a positively sloped Beveridge curve. This paper presents a calibrated model which succeeds at generating countercyclical unemployment and a negatively sloped Beveridge curve, despite the presence of a participation margin.

1. Introduction

Recently, there has been renewed interest in the business cycle properties of models with search frictions and wage bargaining. Beginning with the seminal papers of Shimer (2005) and Hall (2005), a growing body of literature examines the ability of business cycle models with Diamond–Mortensen–Pissarides (DMP) search frictions to account for the cyclical variation of labor market variables. One striking feature of this literature is that all models assume that labor supply is inelastic.

Several attempts have been made to calibrate Real Business Cycle models with labor search frictions and labor supply which are elastic along the participation margin. However, previous authors have been unable to match key qualitative facts on the cyclical behavior of unemployment. Ravn (2008), Tripier (2003) and Veracierto (2008) all find that their models contradict the data by generating procyclical unemployment and a positively-sloped Beveridge curve (a positive correlation between unemployment and vacancies).

The difficulty is simple but vexing: in response to a positive shock, some agents may wish to enter the labor market by commencing search, swelling the ranks of the unemployed. If the flow of workers from non-participation into search is large enough — and if the flow of workers from search into employment is small enough — then unemployment becomes procyclical and is positively correlated with the procyclical vacancies.

How to solve this conundrum? First, participation rates in the data are indeed procyclical, but only about 1/5 as volatile as GDP. This indicates that flows into participation in response to a productivity shock are relatively modest. Hence, it is important that the model mimics the data by also generating modest responses of participation.

Second, job-finding rates in the data are procyclical and nearly six times as volatile as labor productivity (cf. Shimer, 2005), indicating that job-finding rates increase strongly upon impact of a positive productivity shock. This strong increase in job-finding rates ensures that the increased flows into unemployment are counterbalanced by sufficiently increased flows out of unemployment and into employment, so that unemployment begins to drop soon after impact. Hence, it is also important that the model-generated job-finding rates of unemployed workers mimic the data by increasing sufficiently in response to a positive shock to productivity.

In a DMP search framework, job-finding rates depend positively on labor market tightness, the ratio of vacancies to unemployed workers. Hence, in order to generate an increase in job-finding rates on impact, vacancies must increase more strongly on impact to the positive shock than unemployment. The challenge for the calibrated model is to generate labor market tightness and vacancies that are sufficiently responsive to productivity shocks (again as in the data).

The key role for the elasticity of tightness with respect to productivity is reminiscent of the challenge posed by the Shimer

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puzzle. As noted by Shimer (2005) and others, generating enough responsiveness in labor market tightness on impact of a productivity shock is also important for generating sufficient volatility in vacancies, unemployment and tightness. In this sense, the quantitative Shimer puzzle and the qualitative procyclical unemployment puzzle are linked. In the body of the paper, I will make this link explicit by showing that it is precisely the same set of parameters which is responsible both for generating a sufficiently large tightness elasticity of productivity and for generating countercyclical unemployment and a negatively sloped Beveridge curve.

The main contribution of this paper is to show that a calibrated RBC model with search frictions and a participation margin is indeed able to generate both highly countercyclical unemployment rates and a negative correlation between unemployment and vacancies (a negatively sloped Beveridge curve). The key to success is a new calibration strategy with two main elements: ensuring that participation rates display as little volatility as in the data and wage rigidity. It will also turn out to be useful to implement the model at a weekly, rather than monthly or quarterly frequency.

As to the first element, I calibrate the Frisch elasticity of labor supply (which will be defined carefully in the paper) to match the relative volatility of participation to GDP.[1] In contrast, Ravn (2008), Tripier (2003) and Veracierto (2008) all choose the elasticity of labor supply to be either infinite or to match the relative volatility of employment to GDP.

This subtle but important difference in calibration strategies turns out to be crucial. In the data, the participation rate is only about 1/5 as volatile as GDP. The low volatility of the participation rate implies that the flows of workers into and out of the labor force in reaction to shocks are relatively modest. An attractive feature of this calibration is that the labor supply elasticity along the participation margin corresponds to the low values typically found in microeconometric studies.

The second key element of the calibration strategy involves ensuring that the degree of wage rigidity in the model matches that in the data. Introducing wage rigidity into the DMP framework generates more responsiveness in vacancies to productivity shocks, a feature which has been noted by many authors. Here, I choose parameters so that the share of vacancy costs in national income and the degree of wage rigidity (measured as the wage elasticity of productivity) correspond to the data. This is similar to the approach of Hagedorn and Manovskii (2008), although my calibration targets will impose less wage rigidity. Nonetheless, my baseline calibration shares their Achilles heel, namely that the value of worker's surplus is rather low. However, my main qualitative results do not rely on extremely low values of worker's surpluses (or equivalently on extremely high replacement rates). In particular, the share of the wage from surplus can rise to more than 60%, while still ensuring that unemployment rates remain countercyclical. Similarly, the Beveridge curve remains negatively sloped, even if the surplus share of the wage is 20%.

It is important to emphasize that imposing wage rigidity is important only as a means to ensure that the incentives to create vacancies remain strong. Any other means of generating vacancies which respond sufficiently to shocks should also suffice for the purposes of this paper. Possible alternatives include on the job search as in Nagypal (2007) or downward-sloping labor demand as in Elsby and Michaels (2008).

A further important element of the calibration strategy involves time aggregation. GDP and productivity are measured at a quarterly frequency, while the BLS measures unemployment by considering one reference week each month. Quarterly unemployment data is obtained by averaging these monthly observations. Hence, it is possible that a technology shock raises unemployment in the impact week or month, but that this is subsequently reversed. As a result, the procyclical impact reaction of unemployment would be washed out by subsequent countercyclical movements, so that unemployment is countercyclical in the quarterly average. To address this concern, I calibrate the model at a weekly frequency, and aggregate up to obtain quarterly data.

One model assuming heterogeneous agents(Haefke and Reiter,2006) has also succeeded at generating countercyclical unemployment and a negatively sloped Beveridge curve. They allow for heterogeneous productivity in home production, combined with idiosyncratic productivity shocks. These two model elements also serve to restrict the flow of workers into unemployment due to a positive technology shock, much in the same way that the low Frisch labor supply elasticity works in my setting. The two other key ingredients in their model are similar as well, namely time aggregation and wage rigidity. However, the heterogeneity increases the complexity of their analysis considerably. In contrast, the model presented in the present paper is a standard RBC model with search frictions. Its advantages are that it is relatively simple, highly tractable and the role of the parameters is quite clear. In addition, to my knowledge, no other paper with homogeneous agents has been able to generate countercyclical unemployment and/or a negatively sloped Beveridge curve in RBC models with search frictions and a participation margin.

This paper also relates to an earlier literature which integrated search frictions into business cycle models. Merz (1995) and Andolfatto (1996) showed that business cycle models with search frictions could be quite successful at accounting for the cyclical properties of macro variables, as well as for the subset of the labor variables they considered. However, neither of these models allows for a participation margin. Merz (1995) also encounters the difficulty of a positively-sloped Beveridge curve when allowing for endogenous search intensity.

The paper is organized as follows: Section 2 presents the model, whose equilibrium is described in Section 3. Some analytical results are derived in Section 4. The calibration strategy is described in Section 5, while quantitative results are presented in Section 6 and 7. Section 8 concludes.

2. Model

This section presents the model. It is a standard real business cycle model, augmented by Mortensen–Pissarides labor market frictions and wage bargaining. Labor supply is elastic along the participation margin. The bargaining setup involves firms bargaining individually with each worker. Agents are risk averse and are organized into large households which provide full insurance against idiosyncratic consumption fluctuations. The production technology is Cobb–Douglas with labor and capital as inputs. This model can be seen as the natural extension of the RBC literature to allow for search frictions and decentralized wage bargaining. It is very similar to the model studied in Ravn (2008), differing only in the specification of the utility function.

2.1. Household's problem

The household chooses consumption c_t, investment in physical capital i_t and the fraction of household members engaged in search u_t to maximize its discounted expected utility, represented by the Bellman equation:

$$V(n_{t-1}, k_{t-1}) = \ max_{c_t, i_t, u_t}\{u(c_t, l_t, u_t) + \beta E_t V(n_t, k_t)\} \tag{1}$$

subject to the large-family budget, transition and time constraints

$$w_t n_{t-1} + r_t k_{t-1} + \pi_t \geq c_t + i_t \tag{2}$$
$$k_t = (1-\delta)k_{t-1} + i_t \tag{3}$$

[1] In the body of the paper, I will carefully justify the low labor supply elasticity, and address concerns about aggregation arising from the results of Rogerson (1988).