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Endogenous separation, wage rigidity and the dynamics of unemployment

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ABSTRACT

Previous attempts to evaluate the Mortensen–Pissarides model rely on *either* endogenous separation or wage rigidity. In this paper I simulate a version of the Mortensen–Pissarides (MP) model with wage rigidity *and* endogenous separation. The model is then able to answer a key question in the literature: can wage rigidity and endogenous separation explain the joint dynamics of unemployment, vacancies and wages? I find that it can. The model generates sufficient volatility in unemployment, the separation rate and the finding rate, 75% of the observed volatility in vacancies, and 70% of the Beveridge curve (the negative correlation between unemployment and vacancies). More substantially, the model matches the volatility of the average wage and generates a response of new hires' wages to productivity and unemployment consistent with key estimates in the literature. I then simulate the model while restricting the separation rate to be constant and show that the model predicts only 70% of the variance of unemployment. I conclude that finding rate fluctuations explain 70% of unemployment fluctuations halfway in between the most prominent estimates in the literature.

1. Introduction

The Mortensen and Pissarides (1994) (MP) search and matching model is the dominant paradigm for studying unemployment fluctuations. Shimer (2005) argues that the model is unable to explain the volatility of unemployment, job-finding and vacancies. Subsequently a key question in the literature is: how can one modify the MP model to be consistent with the observed behavior of unemployment, vacancies and wages?

One strand of the literature (e.g. Hall, 2005a; Gertler and Trigari, 2009) attempts to rectify the model's shortcomings by allowing for wage rigidity. However this work assumes a constant separation rate. While earlier work (e.g. Shimer, 2012; Hall, 2005b) has argued that the separation rate is relatively acyclical and contributes little to unemployment fluctuations, much recent work has demonstrated a role for variation in the separation rate in explaining unemployment fluctuations. For example, Elsby et al. (2009) which concludes, "A complete understanding of cyclical unemployment requires an explanation of countercyclical inflow rates". Models with a constant separation rate, then, can only give an incomplete explanation for unemployment fluctuations. Additionally, these models cannot evaluate the required degree of wage rigidity since they must overstate finding rate volatility, and hence wage rigidity, in order to explain unemployment volatility.

Noting that the separation rate appears to be endogenous, another strand of the literature (e.g. Bils et al., 2011; Fujita and Ramey, 2012; Menzio and Shi, 2011) focuses on modeling endogenous separation. However these models suffer from the

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Shimer puzzle (Shimer, 2005) i.e. they generate too little variance in the job finding rate. For a thorough analysis of these two approaches and their implication for unemployment volatility see Mortensen and Nagypal (2007).

Both strands of the literature are important contributions to our understanding of unemployment fluctuations. However, since both approaches underestimate the importance of one channel in generating unemployment fluctuations (either job-finding or job-separation) neither can fully explain the volatility in unemployment fluctuations or evaluate the required degree of wage rigidity. I solve a version of the MP model with endogenous separation and wage rigidity. The model is able to explain the volatility of unemployment, the separation rate, and the finding rate. The model explains 74% the volatility of vacancies and 70% of the Beveridge Curve (the strong negative correlation between unemployment and vacancies). The model is consistent with the volatility of the average wage and more significantly, the model predicts a response of the wages of new hires to unemployment and productivity consistent with the main estimates in the literature.

I also show that restricting the separation rate to be constant allows the model to better explain the Beveridge curve and the volatility of vacancies, but the model cannot explain the observed volatility of unemployment. The constant separation rate model explains only 70% of the observed volatility of unemployment. This estimate is halfway between the two most prominent estimates of the contribution of the finding rate to unemployment fluctuations.

The paper makes several contributions to the literature. It is the first paper, to the best of my knowledge, to examine if endogenous separation and wage rigidity simultaneously can explain unemployment volatility. More significantly, it is the first to fully examine if the required degree of wage rigidity is counterfactual since models with a constant separation rate must necessarily overestimate the degree of wage rigidity needed to explain unemployment fluctuations. I find that the required degree of wage rigidity is in line with the key estimates in the literature (see Section 3.3 for more details). Finally, the paper uses a simple framework, with only one modification (wage rigidity) to the original MP model, in order to explain unemployment fluctuations.

The rest of the paper proceeds as follows. Section 2 describes the baseline model with endogenous separation and wage rigidity. Section 3 explains the model solution, calibration and gives the results from simulating the model. In Section 4, I demonstrate that once the separation rate is restricted to be constant, the model predicts too little variance in unemployment. In Section 5 I compare the model to other attempts to quantify the importance of the separation rate in explaining unemployment fluctuations. Section 6 examines the robustness of the results to alternate choices for model parameters and the idiosyncratic productivity distribution. Section 7 concludes.

2. Model

2.1. Theoretical model

2.1.1. Informal description

In this Section I describe a version of the Mortensen and Pissarides (1994) model with wage rigidity. The model is a discrete time version of the Mortensen–Pissarides model. The model has large, persistent idiosyncratic productivity shocks to allow for endogenous separation. Some matches will receive a large enough negative productivity shock that the value of unemployment exceeds the value of production. These matches separate and the worker becomes unemployed.

My main departure from the standard MP model is the inclusion of wage rigidity. Shimer (2005) demonstrates that the Mortensen–Pissarides model does not generate sufficient unemployment volatility when workers' outside options are low. Finding this also to be the case for my model as well, I add wage stickiness via a wage norm, as in Hall (2005a), to increase the model's ability to generate unemployment volatility.

Because wages are rigid, and there are large idiosyncratic productivity shocks, wages may be, at times outside the bargaining set of the worker and firm. If this is the case, I assume that the outside option binds and that the wage adjusts to avoid an inefficient separation. Therefore, if the match receives a shock such that the wage is too high and the firm will want to sever the match, the wage adjusts so the firm's share of the surplus is zero. This makes the firm indifferent between keeping and firing the worker. Similarly if the wage is too low such that the worker would want to quit the match, I assume that the wage rises so that the worker gets a zero share of the surplus. I now proceed to a formal description of the model.

2.1.2. Match productivity

At the beginning of the period there is a mass of worker-firm matches. Workers maximize expected discounted lifetime income. Firms maximize expected discounted profits. A fraction ρ^x of matches exogenously separates into unemployment.[1] Remaining firms produce according to the following production function $x_{i,t}y_t$ where $x_{i,t}$ is the idiosyncratic productivity level. $x_{i,t} = x_{i,t-1}$ with probability $1-\phi$ and with probability ϕ, $x_{i,t}$ is drawn from the discrete distribution $H(x)$ with maximum value x^h. y_t represents aggregate productivity, which follows the $AR(1)$ process $\ln y_t = \rho^z \ln y_{t-1} + \varepsilon_t$ where ε_t is an i.i.d normal random variable with mean 0 and standard deviation σ^ε.

[1] Exogenous separation can be thought of as needing to leave a job for personal reasons or as receiving a permanent shock that destroys the value of the job.