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Productivity growth, on-the-job search, and unemployment ☆

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ABSTRACT

The impact of long-run productivity growth on unemployment is studied. We incorporate disembodied technological progress and on-the-job search into the endogenous job separation model of Mortensen and Pissarides (1994). Because we include on-the-job search, faster growth reduces unemployment by decreasing job separation and inducing job creation. The incorporation of on-the-job search substantially improves the ability of the Mortensen and Pissarides model to explain the effect of growth on labor market variables. Specifically, our model generates not only an empirically consistent sign of the effect, but also a larger impact of growth on unemployment than the standard matching model.

1. Introduction

The relationship between productivity growth and unemployment has been investigated in both theoretical and empirical studies. Recent empirical studies find a negative relationship between the two, both in time series and cross-country data.[1] The search and matching model, which has been often used for studying aggregate labor markets, faces several challenges generating this negative relationship. Pissarides and Vallanti (2007) demonstrate that the matching model with disembodied technological progress (henceforth DTP) predicts a negative relationship between productivity growth and unemployment, but cannot replicate a large enough magnitude. Furthermore, Prat (2007) demonstrates that once endogenous separation is incorporated, faster productivity growth increases job separation due to the so-called outside option effect; consequently, the model can generate a positive relationship between productivity growth and unemployment.

This paper re-visits the effect of long-run productivity growth on unemployment, focusing on worker flows. We first document the fact that productivity growth increases the job finding rate and reduces the separation rate, lowering unemployment at low frequencies in the US. Then, we develop an endogenous job separation model with on-the-job

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[1] Although early research found non-significant or even weakly positive correlations between growth and unemployment (Bean and Pissarides, 1993; Caballero, 1993), recent studies find a strong negative relationship between them (Bruno and Sachs, 1985; Ball and Moffitt, 2001; Muscatelli and Tirelli, 2001; Staiger et al., 2001; Tripier, 2006; Pissarides and Vallanti, 2007).

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search and DTP to account for the empirical findings. Our analysis yields two main results. First, in our model, the effect of productivity growth on the unemployment rate is negative and larger than in the search and matching model with DTP and exogenous separation. Second, our model predicts that growth reduces the separation rate, while the model without on-the-job search generates a positive relationship between growth and the separation rate. These differences are the results of incorporating on-the-job search into the model.

Incorporating on-the-job search is motivated by the fact that a large fraction of workers who leave their jobs move immediately to new jobs without entering unemployment (Fallick and Fleischman, 2004; Nagypál, 2005a). This gives rise to two channels through which faster productivity growth may reduce unemployment: an increased job finding rate and a reduced separation rate. First, on-the-job search adds another pool of workers for any new firm to recruit from. When productivity growth is high, increasing search activity by employed workers expands the pool of potential hires for firms. This induces more job creation and lowers unemployment. Second, the incorporation of the on-the-job search makes it more likely for the separation rate to fall when productivity growth increases. Faster productivity growth can reduce separation by increasing option value of the existing job match, but it can also increase separation by increasing the workers' outside option. The presence of on-the-job search weakens the second effect. In the model, workers in firms with low productivity jobs search for a better job. Some of the benefit from on-the-job search is shared with the firm through the wage. This allows otherwise unproductive jobs to survive, leading to lower job separation when productivity growth increases.

Incorporating endogenous job separation and on-the-job search substantially improves the ability of the standard matching model with DTP to account for the size of the impact of growth on unemployment. Using the standard matching model with DTP, Pissarides and Vallanti (2007) show that a 1% decrease in the growth rate increases unemployment by about 0.01%, assuming Nash bargaining over wages. This is far from the estimated magnitude in the empirical literature. Blanchard and Wolfers (2000) estimate that a 1% decline in the growth rate leads to a 0.25%–0.7% increase in the unemployment rate. Pissarides and Vallanti (2007) find the effect to be 1.3%–1.5%. In our model, a one percentage point decline in productivity growth increases the unemployment rate by 0.23%. This result is in contrast with earlier studies by Pissarides and Vallanti (2007) and Prat (2007) both of which fail to find such a strong negative relationship between productivity growth and unemployment.[2]

The remainder of the paper is organized as follows. Section 2 presents salient features of the US aggregate labor market in the long-run, and discusses the relationship between productivity growth and the labor market. Section 3 develops a generalized Mortensen and Pissarides model with on-the-job search. In Section 4, we calibrate the model parameters and present the results of quantitative comparative statics exercises. We also discuss the sensitivity of the numerical results to our choice of parameter values. Section 5 concludes.

2. US labor market facts

In this section, we present some of the salient features of the US aggregate labor market in the long-run. We use this to discuss the relationship between productivity growth and the labor market. We focus on productivity growth, g, and three labor market variables: the unemployment rate u, the job finding rate f, and the separation rate s.

Labor productivity growth is measured by the first difference of logged labor productivity. We use real output per person in the non-farm business sector as labor productivity.[3] The unemployment rate is the quarterly average of seasonally adjusted monthly data constructed by the BLS using the Current Population Survey (CPS) data.

Dynamics of the unemployment rate are determined by the underlying flows in and out of unemployment, particularly the rates at which workers match with and separate from jobs. In this paper, we define the job finding rate as the rate of transition from unemployment to employment, and the separation rate as the rate of transition from employment to unemployment. Shimer (2007) uses short-term unemployment data and total unemployment data to pin down these rates. Following Shimer's (2007) time aggregation correction, we measure job finding and separation rates from the CPS over the 1948Q1–2005Q1 period.

Since our focus is the long-run relationship between productivity growth, the unemployment rate, and rates of worker flows, we use band-pass filtering to isolate the long-term components of productivity growth and labor market variables. Let y_t be a quarterly time series, and let y_t^* denote its trend. Following Staiger et al. (2001), y_t^* is estimated by passing y_t through a two-sided low pass filter, with a cutoff frequency of 15 years.[4] Essentially, this estimates y_t^* as a long two-sided weighted moving average of y_t with weights that sum to one. Estimates of the trend at the beginning and end of the

[2] The search and matching theory predicts that the impact of productivity growth on unemployment depends on the extent to which new technology is embodied in new jobs (Mortensen and Pissarides, 1998; Pissarides and Vallanti, 2007). The standard search and matching model with disembodied technological progress predicts that a faster rate of productivity growth reduces unemployment through the so called capitalization effect (Pissarides, 2000; chapter 3). On the other hand, in the model with embodied technological progress, faster productivity growth increases unemployment through creative destruction (Aghion and Howitt, 1994, 1998; Postel-Vinay, 2002).

[3] The Bureau of Labor Statistics (BLS) constructs this quarterly time series as part of its Major Sector Productivity and Costs program. Using output per hour or total factor productivity as a measure of labor productivity yields similar results, but we use this series because it is a natural way to consider productivity in the standard search and matching model.

[4] We also adopt the definition of the business cycle as the cyclical components between 1.5 years and 8 years, following Baxter and King (1999) and Stock and Watson (1999). When we use these limits as the definition of the business cycle, we obtain similar results.