



Labor-market volatility in the search-and-matching model: The role of investment-specific technology shocks

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ABSTRACT

Shocks to investment-specific technology have been identified as a main source of U.S. aggregate output volatility. In this paper, we present a model with frictions in the labor market and explore the contribution of these shocks to the volatility of labor market variables, namely, unemployment, vacancies, tightness and the job-finding rate. Thus, our paper contributes to a recent body of literature assessing the ability of the search-and-matching model to account for the large volatility observed in labor market variables. To this aim, we solve a neoclassical economy with search and matching, where neutral and investment-specific technologies are subject to shocks. The three key features of our model economy are: (i) Firms are large, in the sense that they employ many workers. (ii) Adjusting capital and labor is costly. (iii) Wages are the outcome of an intra-firm Nash-bargaining problem between the firm and its workers. In our calibrated economy, we find that shocks to investment-specific technology explain 40% of the observed volatility in U.S. labor productivity. Moreover, these shocks generate relative volatilities in vacancies and the workers' job finding rate which match those observed in U.S. data. Relative volatilities in unemployment and labor market tightness are 55% and 75% of their empirical values, respectively.

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1. Introduction

In the last few years, a large and active literature has emerged around the unemployment volatility puzzle. More precisely, this literature assesses the extent to which the search-and-matching model with Nash wage bargaining can account for the following three observations: (1) large fluctuations in labor market variables relative to the fluctuations of labor productivity; (2) low sensitivity of unemployment with respect to unemployment benefits, and (3) a high sensitivity of wages to productivity in new matches. (Admittedly, the extent of this latter sensitivity is still a subject of debate and more contributions will surely follow.)

Shimer (2005) and Costain and Reiter (2008) have shown that the textbook version of the Mortensen–Pissarides model is unable to generate the observed relative fluctuations in labor market variables in response to shocks to labor productivity. The failure of the model is to be found in the surplus' sharing rule implied by Nash bargaining. That is, under standard parameter values, wages absorb most of the increases in labor productivity, thus reducing the procyclicality of the firm's share of the surplus and so the incentive for vacancy creation. Costain and Reiter (2008) and Hagedorn and

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Manovskii (2008) note that a different calibration of the model can generate large fluctuations in labor market variables. Indeed, with high, acyclical non-market returns to workers, the firm's share of surplus can be made small but highly sensitive to labor productivity so that incentives to create vacancies are restored. However, as pointed out by Costain and Reiter (2008) and by Pissarides (2009), this calibration strategy implies a counterfactually high sensitivity of unemployment to non-market returns. A different line of research has advocated for the replacement of continuous Nash wage bargaining by some stickier sharing rule. Gertler and Trigari (2009) propose wage stickiness à la Calvo. Hall (2005) argues in favor of efficient wage stickiness where wages do not react, or only partially, to high-frequency changes in labor productivity.¹ Objections to models with sticky wages have been raised by Pissarides (2009) and Haefke et al. (2008) by arguing that they fail to generate the high correlation between wages and productivity observed in new matches.

In this paper, we retain the assumption of continuous Nash renegotiation of wages and contribute to this literature by endogenizing labor productivity to the firm's investment and hiring policy. The mechanism we explore in this paper relies on the firm's adjustment of capital and labor in response to exogenous changes in technology. With this aim, we remove the assumption of employer–worker pairs producing without capital and assume instead the standard neoclassical firm that employs many workers and owns capital.² We then explore the ability of the model to amplify the volatility of labor market variables after shocks to both neutral and investment-specific technology. We model this latter type of technology as in Greenwood et al. (1997, 2000), which allows us to calibrate investment-specific technology shocks using the cyclical component of the relative price of new capital goods. In our model economy, job separations within the firm occur exogenously and capital depreciates at a constant rate. To hire workers the firm must open vacancies and then negotiate wages for new and continuing workers. Adjusting the level of capital and employment is costly and these costs are jointly determined by investment and hiring rates. An important consequence of the large firm assumption is the so-called intra-firm bargaining, that is, the fact that the firm anticipates the wage effects of its hiring and investment policy.³ By virtue of intra-firm bargaining, the wage function in our model becomes, ceteris paribus, increasing in the level of neutral technology and decreasing in investment-specific technology.

In our calibrated economy, shocks to investment-specific technology account for 40% of the observed volatility in U.S. labor productivity. Moreover, these shocks generate relative volatilities in vacancies and the workers' job finding rate which match those observed in U.S. data. Relative volatilities in unemployment and labor market tightness are 55% and 75% of their empirical values, respectively. In other words, from this quantitative exercise we conclude that 40% of the volatility in labor productivity explains 22% of the observed volatility in unemployment, 40% of the volatility in vacancies, 30% of the volatility in tightness and 40% of the volatility in the job finding rate. When the two technology shocks—neutral and investment-specific—are taken together, our model accounts for the estimated contribution of technology shocks to labor market volatility.

The mechanism for amplification works through the costly adjustment of capital and labor and its effect on the intra-firm bargained wage. There are two main forces shaping the response of vacancies to investment-specific technology shocks in our model economy. First, a positive shock to investment-specific technology increases investment by making capital relatively cheap. Hence, convex adjustment costs create a tension between investment and hiring, leading to an initial contraction in hiring. This initial freeze in hiring is compensated by an increase in hours of work per employee when the intensive margin in labor is operative. The second force comes from the increased productivity of labor caused by investment and from the compressing effect of investment-specific technology shocks on wages, which increases the procyclicality of the firm's share of the surplus with respect to these shocks. This second force leads to a delayed increase in hiring after the positive shock to technology. The dynamics of factor adjustment just described matches recent empirical findings on the short-run response of labor market variables to investment-specific shocks. We will elaborate further on this in the main text of this paper.

The increased volatility in labor market variables in our model economy is not at the cost of a counterfactually high sensitivity of unemployment to unemployment benefits. Since we calibrate the model to match a replacement rate of 45%, non-market returns are low compared to returns from employment. In our benchmark economy, the semi-elasticity of unemployment with respect to benefits is slightly above one, which is in the lower bound of estimated values. On the other hand, the elasticity of wages with respect to labor productivity in our baseline economy is about one, a value which is in line with the estimated elasticity in new matches.

The way we introduce investment-specific technological change in our model economy closely follows the original idea of technology embedded in new investment goods, which the firm can acquire by devoting resources to investment. As in Greenwood et al. (1997, 2000), we allow the firm to continuously invest in new capital, in contrast to the Schumpeterian view where only newly created firms have access to new technologies, with all its implications in terms of employment reallocation. In this regard, the mechanism we explore in this paper to generate volatility in labor market variables after shocks to investment-specific technology is different from the ones put forward recently by Reiter (2008), Hornstein et al. (2007) and Michelacci and Lopez-Salido (2007). Reiter (2008) abstracts from capital and retains the assumption of

¹ Different sources of wage rigidity in the search-and-matching model have been studied, e.g., by Hall and Milgrom (2008), Kennan (2010), Menzies (2005), Moen and Rosen (2006) and Rudanko (2009).

² For early work on the search-and-matching model with large firms see Andolfato (1996) and Merz (1995).

³ See Stole and Zwiebel (1996a, 1996b) for a general discussion of intra-firm bargaining. For studies of intra-firm bargaining within the search-and-matching model see, e.g., Cahuc and Wasmer (2001), Krause and Lubik (2007) and Rotemberg (2006).

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