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## On-the-job search, sticky prices, and persistence

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## ABSTRACT

Models of the monetary transmission mechanism often generate empirically implausible business fluctuations. This paper analyzes the role of on-the-job search in the propagation of monetary shocks in a sticky price model with labor market search frictions. Such frictions induce long-term employment relationships, such that the real marginal cost is determined by real wages and the cost of an employment relationship. On-the-job search opens up an extra channel of employment growth that dampens the response of these two components. Because real marginal cost rigidity induces small price adjustments, on-the-job search gives rise to a strong propagation of monetary shocks that increases output persistence.

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## 1. Introduction

There is a widespread view in the monetary business cycle literature that optimizing sticky price models need to be augmented with a source of real marginal cost rigidity in order to generate empirically plausible dynamics.<sup>1</sup> The marginal cost of production connects the labor market and inflation. If the structure of the labor market renders firms' marginal cost unresponsive to a change in production, the ensuing inflation adjustment can be sluggish. In that case, monetary shocks can be propagated to yield persistent effects on real economic activity.

A recent literature has studied the dynamics of real marginal cost, inflation and output in sticky price models with labor market search and matching frictions along the lines of Mortensen and Pissarides (1994).<sup>2</sup> The labor market frictions make employment adjustment costly, thus increasing the sensitivity of marginal cost to a demand-induced increase in real activity. In particular, such frictions give rise to a surplus from a match between a worker and a firm, which induces a long-term employment relationship. Consequently, the marginal cost is determined by the cost of an employment relationship, i.e. the cost of hiring a worker net of the expected saving of future hiring costs, in addition to the real wage. To expand

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E-mail address: [willem.vanzandweghe@kc.frb.org](mailto:willem.vanzandweghe@kc.frb.org)<sup>1</sup> Empirical responses to monetary shocks are documented in an extensive vector autoregression literature; see e.g. Christiano et al. (1999). There is a large literature that studies the so-called persistence problem of models with staggered price setting; see e.g. Chari et al. (2000).<sup>2</sup> Examples include Christoffel and Linzert (2005) and Krause and Lubik (2007), who study the role of real wage rigidity. The latter authors find that search frictions per se do not improve the ability of a sticky price model to explain the persistent effects of monetary shocks. Walsh (2005) shows that search frictions affect the dynamics of real marginal cost to the effect of augmenting the persistence in output and inflation in a model with habit persistence in consumption preferences and price indexing to past inflation. Krause et al. (2008) and Ravenna and Walsh (2008) focus on estimation of a New Keynesian Phillips curve, whereas Sveen and Weinke (2007) and Trigari (2009) analyze the role of the intensive and extensive margin. An early exploration is conducted by Walsh (2003).

production, firms must increase their hiring by posting vacancies, and as vacancies rise and unemployment declines the labor market tightens. If real wages are set so as to split the surplus of the match, then the tighter labor market leads to higher wages. But it also raises the cost of an employment relationship, since hiring is relatively expensive when the labor market is tight. Therefore, both components contribute to a rise in marginal cost.

This paper revisits the question of whether search frictions are a source of real marginal cost rigidity by studying the role of on-the-job search for marginal cost dynamics. Employer-to-employer transitions are an important part of U.S. labor market flows. Fallick and Fleischman (2004) use the Current Population Survey to construct a measure of employer-to-employer flows. They find that 2.6 percent of employed workers change employers in an average month. That is about as large as the flow of workers leaving employment out of the labor force and twice as large as the flow of workers moving from employment to unemployment, so that employer-to-employer transitions make up 39 percent of separations. Nagypál (2008) studies employer-to-employer transitions in the Survey of Income and Program Participation and calculates that they account for 49 percent of separations. Moreover, these transitions are highly procyclical, as also emphasized by Shimer (2005b).

The magnitude and procyclicality of this job-to-job flow of workers suggests that accounting for it may substantially diminish the sensitivity of the components of marginal cost to monetary shocks. The reason is that if workers can search on-the-job for more productive and valuable jobs, they become a source of employment growth in addition to unemployed workers. If this pool of employed searchers expands during periods of booming economic activity, it moderates the tightening of the labor market that occurs as firms post vacancies aiming to expand employment. By dampening the labor market tightening, such positive comovement between vacancy creation and on-the-job search can induce sluggishness in the rise of wages and the cost of an employment relationship. As a result, a monetary expansion leads to a mitigated increase in marginal cost and hence in inflation. That amplifies the effect of the shock on aggregate demand and thus strengthens firms' incentive to post vacancies. The increased vacancy posting fuels the boom and thus further stimulates on-the-job search. This complementarity turns on-the-job search into a propagation mechanism that can generate large fluctuations in the vacancy–unemployment ratio, which translates into strong employment and output growth.

This reasoning is borne out by the quantitative analysis of a sticky price model with search frictions. The analysis shows that when workers can search on-the-job, a monetary shock induces a dampened response of the components of marginal cost, and thus of marginal cost and inflation. Under a baseline calibration, the impact response of inflation is reduced by about half. The resulting effect on aggregate demand almost doubles the impact response of output and the output response displays a hump-shaped pattern. Model simulations correspondingly show a substantial reduction of fluctuations in inflation, marginal cost and its components relative to output. Thus, on-the-job search constitutes a powerful propagation mechanism of monetary shocks. This finding is in stark contrast with the result of Krause and Lubik (2007) that introducing an exogenous source of real wage rigidity into a labor market with search frictions has only minor effects on the dynamics of marginal cost. If wage rigidity is imposed, the change in surplus of a match generated by a monetary shock accrues largely to the firm and increases the incentive to adjust vacancies. That amplifies the tightening of the labor market and hence amplifies the fluctuations in the cost of an employment relationship.

Allowing workers to search on-the-job also leads the model to more accurately reproduce cyclical properties of the U.S. labor market. Simulation of the model economy with on-the-job search shows that the size of fluctuations in unemployment, vacancies and the vacancy–unemployment ratio comes close to the large fluctuations observed in the U.S. data. In addition, the complementarity of on-the-job search and vacancy creation produces a more persistent response of the labor market variables and generates a negative correlation between vacancies and unemployment (i.e. the Beveridge curve).

New matches become productive instantaneously in the model, but the above conclusions based on model simulations are robust to the more conventional timing where such matches become productive in the subsequent period.<sup>3</sup> In contrast, when workers cannot search on-the-job the timing assumption affects the labor market dynamics substantially. With instantaneous productivity of new matches, a shock provokes a large but short-lived adjustment in vacancy creation on impact. This response produces a large volatility of vacancies and labor market tightness, even when generated by productivity shocks, but it also yields a negative autocorrelation of vacancies and fails to produce a Beveridge curve.<sup>4</sup> If instead new matches become productive with a lag, productivity shocks generate larger autocorrelation in labor market variables and a Beveridge curve, but fail to amplify fluctuations in the labor market, reflecting the lack of propagation that is emphasized by Shimer (2005a). Thus, each timing assumption introduces a distinct deficiency in the standard labor market with search frictions, which is overcome when workers can search on-the-job. With on-the-job search the timing assumption is crucial for determining the effect of price stickiness on the transmission of productivity shocks to the labor

<sup>3</sup> If new matches become productive with a lag, and without another margin of instantaneous production adjustment, a shift in aggregate demand produces an implausibly large impact on marginal cost, its components, and inflation.

<sup>4</sup> The strong impact response of vacancies in the absence of on-the-job search arises because firms adjust employment in the face of a predetermined stock of unemployed workers, so an initial change in matches results from a change in vacancies only. The timing assumption is also adopted in models with wage bargaining by e.g. Blanchard and Galí (2010), Krause et al. (2008), Ravenna and Walsh (2008), Sveen and Weinke (2007), and Kurozumi and Van Zandweghe (2008), but none of these papers evaluates the model in terms of labor market fluctuations. Rotemberg (2008) studies a model with wage posting.

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