Real price and wage rigidities with matching frictions ☆

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Frictional unemployment means that workers, for some time, are a firm-specific factor of production. This paper models the resulting interaction of wage bargaining and price setting at the firm level in a New Keynesian model with labor market matching frictions. Real rigidities arise and the labor share ceases to be a good proxy for marginal costs. The model replicates the impulse responses of an SVAR for U.S. data better than alternatives in which the real rigidities arising at the firm level are absent. In addition, it implies reasonably low degrees of nominal rigidity whereas the alternatives do not. The interaction of wage and price setting at the firm level is important for the macroeconomic dynamics.

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1. Introduction

At least since Keynes (1936), a tradition in monetary economics assigns the labor market a central role in inflation dynamics. Empirically, inflation does not respond much to shocks. Labor market frictions are considered a natural source of real rigidities that help explain this attenuated response (for instance, Ball and Romer, 1990). In this line, the New Keynesian literature has recently analyzed the role of frictional unemployment for inflation dynamics. The literature finds that explicitly modeling unemployment either has only a limited effect on inflation dynamics, or may even render other sources of real rigidity ineffective.

This paper introduces the idea that frictional unemployment shapes the interaction of wage and price setting behavior at the firm level, implying firm-level real rigidities. In contrast, the previous literature has focused on how equilibrium unemployment affects real rigidities that arise at the aggregate level. This paper assumes that firms and workers bargain

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over prices (which determine hours worked) and wages. Apart from this, the environment is a standard New Keynesian model with Mortensen and Pissarides (1994) search and matching frictions in the labor market ("labor market frictions" henceforth), an intensive (hours worked) margin, one-worker firms, and exogenous separation.

The mechanism underlying the firm-level real rigidities is as follows. Frictional unemployment means that, for some time, workers constitute a firm-specific factor of production. In the model, the marginal cost of producing is given by the cost that a firm pays for the marginal hour worked. The previous literature has assumed that this cost is independent of the firm's price setting decision. Here, instead, wage bargaining is conducted at the level of the individual price-setting firm, which means that wage and price setting interact. Under these circumstances, a higher relative price of a firm, for instance, means less demand and fewer hours worked by the firm's worker. As a result, if the worker has an increasing marginal disutility of work, the wage at the firm falls, which reduces the incentive to have a higher price in the first place. This mechanism thus leads to a weaker response of inflation to shocks than absent the interaction of wage and price setting. Similarly, wages are also smoother.[1]

Firm-level determination of wages and prices has important implications for estimates of the New Keynesian Phillips curve (NKPC, henceforth). First, since the labor market exhibits frictions, the marginal wage does not coincide with the wage for inframarginal hours worked. The latter is the basis for the labor share, which is a widely used proxy for marginal costs (for instance, Galí and Gertler, 1999; Sbordone, 2002). Thus, the labor share does not adequately reflect marginal costs. In this paper's New Keynesian model, rather, marginal costs depend on the labor share *and* the gap between marginal and average wages. Marginal costs can alternatively be expressed in terms of an output gap and an employment gap. Second, the real rigidity arises at the firm level, which alters the mapping from the slope of the estimated NKPC to the degree of nominal rigidity. Estimates and simulations show that neglecting the firm-specificity of labor likely biases estimates of the NKPC toward too much price rigidity (Eichenbaum and Fisher, 2007, present an assessment of other approaches that introduce firm-level real rigidities).

The paper estimates the model's parameters by matching the impulse responses to monetary shocks in the current setup to those from a structural vector autoregression (SVAR) on post Volcker-disinflation U.S. data. In order to examine the importance of the firm-level real rigidity channel, the paper also estimates alternative models that abstract from the firm-specific real rigidity. These alternatives fit the SVAR's impulse responses worse. In addition, the current setup implies reasonably low degrees of nominal rigidity, whereas the alternatives do not. These results point toward the importance of accounting for the interaction of wage and price setting at the firm level.

This paper studies a New Keynesian model that is close to that in Trigari (2006). She abstracts, however, from the interaction of wage and price setting at the firm level by assuming that these activities are conducted in different sectors (compare also Walsh, 2005). Krause and Lubik (2007) emphasize that labor market frictions give rise to longer-term relationships that mute one of the conventional channels for aggregate real rigidity, namely, the link from wage rigidity to smooth inflation. They abstract from the hours worked margin of labor adjustment that is key for this paper's finding that the longer-term relationships give rise to quantitatively important real rigidity, at the firm level. Sveen and Weinke (2007) and Thomas (2009) have also recently observed that frictional unemployment generates firm-specific real rigidities. They do not, however, present an estimation that identifies the parameters driving these rigidities. Nason and Slotsve (2005) study trend-cycle decompositions of the price level. As in this paper, they find that labor market frictions help reconcile the New Keynesian model with the data at low nominal rigidities. They do not, however, emphasize the firm-level real rigidities that are the focus of this paper, nor do they estimate their model.

Section 2 lays out the model. Section 3 discusses the resulting New Keynesian Phillips curve and its implications for existing estimates of the NKPC. Section 4 estimates the parameters and evaluates the current setup against impulse responses to monetary policy shocks taken from an SVAR for post Volcker-disinflation U.S. data. The section also compares the fit to models that abstract from firm-level real rigidities. A final section concludes.[2]

2. The model

The economy has one-worker firms. Each firm produces a different variety of a differentiated good. The amount of production is determined by hours worked. The main difference from the existing literature is that the same set of firms that post vacancies and engage in wage setting also set prices. This, combined with a marginal disutility of work that is increasing in hours worked, is responsible for the real rigidities that this paper focuses on. Apart from joining the labor market and the price-setting sector, and from the details of the bargaining, the environment is close to that in Trigari (2006). In addition, there is variable product variety, which is a convenient assumption.[3]

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[1] In a model without equilibrium unemployment, Woodford (2003, Chapter 3) has explored the consequences of permanently firm-specific labor. In the current model, in contrast, the search and matching frictions provide a mechanism that generates the firm-specificity. Workers are *ex-ante* homogeneous and differ only insofar as they may be *currently* matched to a specific firm or not.

[2] The appendix, available online on Science Direct, provides sensitivity analysis with regard to the estimation and corroborates the importance of firm-specific real rigidities, as opposed to real rigidities arising at the aggregate level.

[3] Appendix B presents an alternative setup with multi-worker firms and constant product variety that leads to the same conclusions.