



Macroeconomic dynamics in a model of goods, labor, and credit market frictions



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ABSTRACT

Goods market frictions drastically change the dynamics of the labor market, both in terms of persistence and volatility. In a model with three imperfect markets – goods, labor, and credit – we find that credit and goods market imperfections are substitutable in raising volatility. Goods market frictions are unique in generating persistence. Two key mechanisms in the goods market generate large hump-shaped responses to productivity shocks: countercyclical goods market tightness and prices alter future profit flows and raise persistence; procyclical search effort of consumers and firms raises amplification. Goods market frictions are thus key in understanding labor market dynamics.

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1. Introduction

The propagation of productivity shocks has been at the core of the real business cycle (RBC) research agenda since its inception. The need for large innovations to obtain realistic business cycle fluctuations, and the lack of any quantitatively significant endogenous persistence mechanism in the RBC model, has been emphasized in, respectively, King and Rebelo (1999) and Cogley and Nason (1995). The subsequent literature has focused on finding mechanisms that endogenously generate large and persistent responses to shocks.

The same issues and controversies arise when studying the cyclical dynamics of aggregate labor markets in the Mortensen–Pissarides search-and-matching model. The central variable in search models of the labor market, the ratio of job vacancies to unemployment, is very volatile in the data, and its response to a productivity shock peaks several quarters after the innovation. In a standard labor search model, however, this ratio reacts very little to productivity shocks and the peak response of the $v-u$ ratio is contemporaneous to the innovation. In response, a large body of research has developed amplifying mechanisms with some works focusing on the role of frictions in labor and credit markets.¹ However, few of these papers have addressed the issue of persistence. Our approach – which integrates and evaluates frictions in three markets, labor, credit, and goods – aims precisely to address this issue. The paper studies how these frictions interact to

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¹ For research on focusing on amplification in the labor market, see Shimer (2005) and Hall (2005), while Fujita and Ramey (2007) raise the issue of persistence. For financial frictions, we refer to the large literature on financial multipliers surveyed in Gertler and Kiyotaki (2013). Section 5 offers a detailed discussion of the relevant literature.

propagate exogenous shocks to productivity and decompose the role of each friction in generating amplification and persistence.

The paper develops a model with three imperfect markets – goods, labor, and credit – building on the general equilibrium model with credit and labor market frictions in Wasmer and Weil (2004) and Petrosky-Nadeau and Wasmer (2013), and identify which market frictions are needed to match the cyclical properties of labor market variables in the data. The modeling strategy represents each friction as a process matching two sides of the three markets, respectively, jobs, lending relationships, and goods. Although this assumption is now well accepted in the labor and financial markets (e.g., Duffie et al., 2005), it is quite novel in modeling goods market frictions, and indeed, it is only recently that this approach has proven useful in the macro-labor literature.² The goods market was, however, the prototypical market in the early search literature (e.g., Diamond, 1982). Moreover, Diamond's (2011) Nobel lecture emphasizes developments in modeling search frictions in the goods market, and in particular their implications for unemployment.

The bilateral matching process leads to several appealing properties which are absent in a frictionless view of markets. As put forward in the macro-search literature (Mortensen and Pissarides, 1999; Rogerson and Shimer, 2011), the relative measure of supply and demand in each market captures the degree of market tightness: the familiar vacancy–unemployment ratio in the labor market, the ratio of prospecting consumers and products in the goods market, and the ratio of investment projects to creditors in the credit market. Further, it introduces endogenous mark ups, turnover in each market, and search effort. In addition, a matching model of the goods market has interesting implications. In the goods market, for instance, consumer search effort is procyclical in the model, searching more when they have higher income and when more firms supply goods, as is the case in the data.³ As Table 1 from the American Time Use Survey over the 2003–2011 period reports, the average time spent in a day on shopping activities declined during the last recession, with the exception of grocery shopping which remained stable.⁴

Our main insight is a surprising one: *goods market frictions* drastically change the qualitative and quantitative dynamics of the labor market. They amplify shocks just as credit market frictions do. They are unique, however, in being able to generate endogenous persistence and are thus better at bridging the gap with the data in terms of both persistence and volatility. The principal measure of persistence, the impulse response of labor market tightness to a productivity shock as identified in Fujita and Ramey (2007), peaks five quarters after this innovation. The model matches the amplitude and the shape of this hump-shaped response in the data. In previous work (Petrosky-Nadeau and Wasmer, 2013) in which goods market frictions were absent, and in line with a vast literature on financial market imperfections, it was only possible to significantly raise volatility by the presence of a financial multiplier arising from search frictions in the credit market. It was not able to address the challenge of persistence.

The dynamics in the goods market, and their effects on the incentives to hire workers, explain the persistent, hump shaped response of the $v-u$ ratio to a productivity shock. During the first stages of an economic expansion, more firms enter the goods market relative to the change in the effective demand from consumers. This higher competition between firms makes it more difficult for a given product to find a consumer and be sold. Prices, which are bargained, thus decline. This moderates the incentives to create a vacancy at the beginning of an expansion. As consumers see rising incomes and falling prices, they raise their search effort in the goods market to reach their desired consumption level. This, along with a slowdown in the entry of new products, leads to a further easing of the matching rate in the goods markets from the perspective of the firms in the periods after the technology shock. As such, firms are more likely to find a consumer, and sell at a higher price. The incentives to recruit workers increase even as productivity is returning to trend. These mechanisms in the goods market combine to generate both amplification and persistence in the labor market. Propagation arises from the fact that the economic value of hiring a worker is tied to the dynamics of prices and congestion in the goods market. These mechanisms are absent from environments using the standard labor search model. The right mix in the model of amplification and persistence depends on the combination of intensive and extensive search margins in the goods market. Intensive search margins (consumer's effort or advertisement by firms) are by definition less persistent than extensive search margins (the number of firms willing to sell, or number of prospecting consumers and their disposable income).

These properties of goods market frictions are robust to several alternative modeling strategies of the goods market. In particular, the results are robust to introducing endogenous search effort on both sides of the goods market, consumers and firms, separately and simultaneously, as well as to constant search effort. Furthermore, this additional amplification and persistence does not hinge on a particular wage determination schedule, and in particular does not arise from wage rigidity.⁵

² Recent papers include Bai et al. (2011), who model frictions in the goods market with a matching process between buyers and sellers, den Haan (2013), who models the friction on the seller's side of the goods market with a focus on the dynamics of inventories, and Gourio and Rudanko (2014) and Michailat and Saez (2014). This research is discussed below and in Section 5.

³ This observation is true in the aggregate (see Table 1), even if there may also exist incentives for consumers to search more for lower price in recessions – a mechanism absent from our model with no price dispersion across identical goods. See Shi (2011) as well as the early contribution in Shi (1998) discussed in Section 5 for the cyclical implications of search in the goods market. In a more recent note, Petrosky-Nadeau et al. (2014) show, based on the American Time Use Survey, that average time spent searching declined in the aggregate over the period 2008–2010 compared to 2005–2007, and the decline was largest for the unemployed who went from spending more to less time searching for goods than the employed. Cross-state regressions point towards a pro-cyclicality of consumer search in the goods market.

⁴ In our model, essential goods such as food and utility will be frictionless goods and reflect this cyclical pattern. See Appendix section 1 for a description of the series.

⁵ This is shown in a variety of ways. First, by implementing a reduced-form wage rule, proposed by Blanchard and Galí (2010), in which the wage elasticity can be controlled directly. Second, by allowing for Nash bargained wages.

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