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# The high sensitivity of employment to agency costs: The relevance of wage rigidity

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## ABSTRACT

The paper studies the interaction between financing constraints and labor market imperfections and the role of this interaction on labor market dynamics. In the model economy, a positive productivity shock is amplified through endogenous fluctuations in the financial market. The paper shows that if wages are set via Nash bargaining, the productivity shock substantially increases wage volatility and, as a result, the shock has very little effect on firm profitability and hiring workers over the business cycle. When the model includes wage rigidities, however, firms' profitability becomes highly responsive to productivity changes: the financial accelerator mechanism induces additional fluctuations in labor market quantities, as observed in the data.

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## 1. Introduction

What role do financing constraints play in the cyclical behavior of employment? That financing constraints might be relevant not only for corporate finance but also for macroeconomics has become a pervasive topic of macroeconomic research.<sup>2</sup> Both the theoretical and empirical literature on financing constraints focuses on fixed capital investment decisions. However, there are very few studies on how financing constraints affect firms' employment decisions and the work that there is on this topic deals mainly with the influence of financing constraints on the level of employment, not its dynamics.<sup>3</sup> Wage payment makes hiring sensitive to the financial market imperfections that firms face. Failing to account for the effect of financial constraints on wages means failing to account for a powerful effect on hiring and on economic activity in general. Moreover, the forward-looking nature of employment also makes firms sensitive to expected future financing constraints.

In this paper, I study how the interaction between financing constraints and labor market imperfections in the business cycle context influences labor markets. It is well known that wage rigidities or small-surplus "bounds" on the wage bargaining are sufficient to overcome the Hall/Shimer critique of labor markets with matching. The issue explored in this paper is

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<sup>2</sup> Examples of papers making significant contributions to this strand of the literature include [Bernanke and Gertler \(1989\)](#), [Greenwald and Stiglitz \(1990\)](#), [Carlstrom and Fuerst \(1997\)](#), [Kiyotaki and Moore \(1997\)](#) and [Bernanke et al. \(1999\)](#). More recent work includes [Cúrdia and Woodford \(2009\)](#), [Gertler and Karadi \(2011\)](#), [Gertler and Kiyotaki \(2010\)](#) and [Gilchrist et al. \(2009\)](#).

<sup>3</sup> See, e.g., [Acemoglu \(2001\)](#) and [Wasmer and Weil \(2004\)](#).

whether that effect is sensitive to the financing regime conditional on total factor productivity (TFP) shocks.<sup>4</sup> I confirm the standard result in the literature that financing constraints can amplify the effects of shocks on real economic activity. However, under the assumption that the worker and firm bargain over the gains from trade, splitting the surplus according to the Nash bargaining solution (Nash, 1953), financing constraints substantially increase wage volatility. In turn, amplification of the labor variables falls short of the observed volatilities in the data. Moreover, the co-movement between output and labor share is counterfactual. Making wages rigid, however, induces more realistic labor market volatilities and quantities.

I model financing constraints based on the agency cost framework of Carlstrom and Fuerst (1998) (CF). I assume that informational problems may arise in the production of aggregate output (hereafter, the output model), rather than only in the production of investment. The main insight from the CF model is that asymmetric information between an entrepreneur (the borrower) and a financial intermediary (the lender) together with costly state verification (CSV) leads to a premium on the external finance. I depart from CF in two respects. First, to study employment, in contrast to total hours worked, I introduce labor search imperfections. Following Faia and Monacelli (2007), my second variation on CF is my assumption that the mean of the distribution of risky project outcomes across entrepreneurs is positively linked to the aggregate TFP, an assumption made so that the output model better matches empirical evidence on the cyclical behavior of the external finance premium.<sup>5</sup> As a consequence, in my model economy, financing constraints are able to amplify fluctuations in economic activity in response to the TFP shocks.<sup>6</sup>

I discipline the quantitative analysis based on the requirement that the output model with labor search frictions matches U.S. data on the behavior of the finance premium and the dynamics of other macroeconomic aggregates. I then quantify the model's ability to explain important labor market outcomes.

The broad message of the study is that even if changes in financial condition cannot, per se, explain labor market outcomes, the extent to which financial factors affect labor variables increases substantially under alternative wage determination settings. Why? Labor search frictions give rise to match-specific rents (see, e.g., Hall, 2005; Rogerson and Shimer, 2011). At a crude level, the marginal revenue product of labor is larger than the marginal rate of substitution between consumption and leisure, where the difference constitutes the match-specific rent that a worker and a firm can share. Conditional on a positive TFP shock, the difference—the match-specific rent—in a model economy with financing constraints increases by more than the difference in an economy without financing constraints. That is, changes in the finance premium over the business cycle lead to larger fluctuations in the range of bilateral gain possibilities between the worker and the firm.

Hall (2005) and Shimer (2005) argue that real wage rigidity is key to explaining the cyclical behavior of unemployment and vacancies. Essentially, it is wage rigidity that is responsible for giving financing constraints a leading role in the output model in terms of accounting for the behavior of labor market aggregates. The reasoning behind this is that under any type of rigid wage, loosening of financing constraints is channeled into hiring (and not into increasing wages). Wage rigidity in turn implies that the average worker shares a larger portion of the match-specific rent in the economy with financing constraints. That is, financing constraints and wage rigidity reinforce each other, amplifying firms' hiring intensity by distributing a larger share of the rent to the firm.<sup>7</sup>

Two studies are closely related to mine, both in terms of the question addressed and the methodology employed: Chugh (2013) and Petrosky-Nadeau (2009). Although the conclusions I reach are in contrast to those drawn by these authors, I believe that my analysis complements their work. These two papers state that, conditional on a countercyclical external financing premium, a financial accelerator mechanism amplifies labor market fluctuations. I agree with the conclusion, albeit find it to be conditional on the degree of wage rigidity. Chugh (2013) conducts his analysis in a framework in which some model features induce rigidity in the wage, similar to Hagedorn and Manovskii (2008).<sup>8</sup> For example, similar to the current study, Chugh (2013) uses the CF framework but calibrates the model with labor search frictions and labor supply, which is elastic along the participation margin. In this environment, then, in response to a positive TFP shock, some agents, formerly content to be out of the market, may decide to enter the labor market and start looking for a job, thus increasing the ranks of the unemployed. This, in turn, puts a downward pressure on the wage. Petrosky-Nadeau (2009) indirectly includes wage rigidity in his model by assuming that only hiring costs are subject to working capital requirements, an assumption that changes the relative volatilities of the firms' total input production costs. That is, it makes hiring costs more volatile relative to wage bill costs.

This paper is organized as follows. In the next section, Section 2, I present the theoretical framework. Section 3 discusses calibration issues. The amplification mechanism in labor dynamics is discussed in Section 4. Section 5 discusses the quantitative results. Section 6 concludes. Various technical details can be found in the appendices.

<sup>4</sup> I focus on TFP shocks as the driving force behind business cycles mainly for purposes of comparability, as much of the extant business cycle literature also takes this perspective. My treatment here broadly follows Pissarides (1985) and Mortensen and Pissarides (1994), early work that integrates the labor search model into the real business cycle framework (Andolfatto, 1996; Merz, 1995), and recent analysis by Shimer (2010).

<sup>5</sup> That is, the empirically observed finance premium is countercyclical, whereas the CF model predicts a counterfactual (procyclical) finance premium.

<sup>6</sup> This is in contrast to CF, where there is a tradeoff between amplification and propagation.

<sup>7</sup> Moreover, the output model can generate a wide range of co-movements between output and labor share dependent on the wage rigidity. In contrast, the model without agency costs has implications for the labor share that seem implausibly extreme: the labor share under rigid wages becomes almost perfectly negatively correlated with output.

<sup>8</sup> Note that neither Hagedorn and Manovskii (2008) nor Chugh (2013) view their work as dealing with wage rigidities. Hagedorn and Manovskii (2008) introduce an unemployment benefit term in the wage rule—the worker's outside option—that is basically a constant. Also, they calibrate the Nash bargaining parameter based on the assumption that wages move less than one-for-one with productivity, which gives them a small value for workers' bargaining power.

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