## The Cyclicality of Wages and Match Quality

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How do real wages behave over the business cycle? This old question has motivated a large body of research and is still not fully settled. The answer is crucial for explaining the cyclical behavior of employment, since the cyclical behavior of wages is determined by the nature of wage-setting, which in turn determine the incentives for job creation. The difficulties of the canonical search and matching model in reconciling the volatile behavior of unemployment with the relatively smoother behavior of real wages, discussed in Pissarides (2009), renewed interest in the cyclicality of wages of new hires.

In this paper, I provide new evidence on the cyclical behavior of real wages. I argue that the countercyclical cyclical selection with respect to the quality of match between a worker and a firm biases our estimates of the real wage cyclicality, making them appear less procyclical. This view is supported by the findings from German administrative microdata. I show that the cyclical selection on match quality arises naturally in a standard Diamond-Mortensen-Pissarides search and matching model with added match-specific productivity.

To investigate the cyclicality of wages, I estimate the relationship between wages and the unemployment rate using a matched employer-employee administrative dataset from Germany. The dataset allows me both to differentiate between two types of hires <sup>1</sup> and to address the potential composition bias due to worker heterogeneity, as discussed in Bils (1985) or Solon, Barsky and Parker (1994), occupational down- or upgrading, and differences

<sup>&</sup>lt;sup>1</sup> The differentiation between hires from employment and unemployment <sup>2</sup> was neglected in the wage cyclicality literature until recently Notable recent exceptions are Getler, Huckfeldt and Trigari (2016) who find that the wages of hires from employment are more procyclical and the wages of hires from unemployment are no more cyclical than those of job stayers, and Haefke, Sonntag, and van Rens (2013) who find that the changes in the wages of hires from unemployment closely follow aggregate labor productivity.

between cyclicality of employment at high- and low-paying firms.<sup>3</sup>

Contrary to expectations, the wages of new hires are less procyclical than the wages of continuing workers. This effect is stronger for hires from employment than for hires from unemployment. This counterintuitive result call for an explanation.

I propose an explanation based on cyclical changes in the quality of firm-worker matches: in bad times, worker-firm pairs have to be unusually productive to warrant job creation. Suppose that output and wages in a firm-worker match depend, positively, on both aggregate and match-specific productivity. A firm-worker contact leads to job creation only if its output is high enough, that is if its idiosyncratic productivity is above a threshold that depends negatively on aggregate productivity. In bad times, only the matches with high idiosyncratic productivity are profitable, in good times, even the matches with low productivity are acceptable. Lower aggregate productivity affects wages directly, pushing them down. At the same time, its compositional effect on match productivity increases observed wages.

The proposed mechanism is empirically validated. As observed in Bowlus (1995), matches of better quality, which I conceptualize as match-specific productivity, should last longer. I investigate the relationship between risk of separation to unemployment, a proxy for match quality, and the unemployment rate at the start of an employment relationship. If the initial unemployment rate is negatively associated with subsequent risk of separation, especially separation into unemployment, then it can be concluded that matches started when the unemployment rate is higher are of better quality. I estimate a proportional hazard model controlling for firm heterogeneity with the use of the stratified version of the Cox model. The estimated negative relationship between the initial unemployment rate and risk of separation into unemployment supports the hypothesis of countercyclical match quality.

Finally, I build a stochastic Diamond-Mortensen-Pissarides type model. The key features of the model are match-specific productivity and a cost incurred after a worker is hired.<sup>4</sup>

<sup>&</sup>lt;sup>3</sup> Recently, Moscarini and Postel-Vinay (2012), Kahn and McEntarfer (2014), Haltiwanger, Hyatt and McEntarfer (2015) investigated the cyclical properties of employment growth at different categories of firms. Their findings raise the possibility that lower-paying firms are responsible for a higher share of employment and hiring during downturns, which would introduce procyclical bias.

<sup>&</sup>lt;sup>4</sup>Hiring costs were added to the search and matching model in Braun (2006), Nagypal (2007), Silva and

To be consistent with the results on job duration, I assume endogenous separations. With endogenous separations, there are matches that are created and maintained when aggregate productivity is high, but destroy once it drops. Match-specific productivities of job stayers are lower, on average, in bad times, which introduces countercyclical bias into their wages. The presence of a hiring cost allows the threshold for job creation to be more cyclically sensitive than for job survival. Consequently, composition bias generated by changes in match quality can outweigh direct affect of changes in aggregate productivity for new hires but not for job stayers.

To account for the stronger countercyclical selection for new hires from employment than from unemployment, I add on-the-job search. A contact between a firm and an employed worker leads to a job-to-job transition if the difference between match-specific productivity in the proposed match and match-specific productivity in the current match is high enough to cover the hiring cost. When aggregate productivity is low, matches created by job-to-job transitions have to be not only good enough to cover a hiring cost but also better than previous matches, which are already positively selected. Consequently, countercyclicality of match quality is pronounced for new hires from employment.

I compare the cyclical properties of the model-generated wages and the observed wages. I easily match the cyclicality of model-generated wages to the observed cyclicality of wages.

Toledo (2009) and Yashiv (2006), see also a discussion in Mortensen and Nagypal (2007).