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The response of employment and wages to aggregate shocks: On-the-job search effect

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ABSTRACT

The purpose of the paper is to study and quantify the possible importance of on-the-job for the fluctuations in the job finding rate within an alternative market equilibrium framework to that of the Diamond–Mortensen–Pissarides model recently introduced by Coles and Mortensen (2013). In the process we show that the Coles–Mortensen model can easily explain the magnitudes of worker flow fluctuation reported by Shimer (2005) for the 50 year post WWII period in the U.S. as well as the observed real wage rigidity.

1. Introduction

Although the Diamond–Mortensen–Pissarides (DMP below) model has become the "working horse" of macro-labor analysis in recent years and is indeed being incorporated into more general dynamic stochastic equilibrium models of the aggregate economy,[1] it suffers from several shortcomings. An important one is the lack of job-to-job flows in spite of the fact that these are large and highly procyclical in the data. Another is the concept of a firm. For example, there is a little role for firm entry, growth, and reallocation, also highly procyclical processes of known importance in recession recoveries. Our purpose is to study and quantify the possible consequences of these processes within a new market equilibrium framework recently introduced by Coles and Mortensen (2013) (CM hereafter) which is based on the original work of Burdett and Mortensen (1998) (referred to as BM below).

The theoretical framework is one of the labor market equilibria in which workers and employers interact in a game to determine both the terms and volume of trade. The structure allows firm entry and firm size dynamics. Innovative start-up companies are born small as in the data, can either grow quickly over time or disappear. Firm′s set wages and workers respond sequentially to existing offers. As a firm productivity is a persistent process, firm size is correlated with productivity and thus with wages, but firm size has no direct (causal) impact on productivity or wages. With endogenous aggregate job creation rates and job-to-job transitions, this model provides a coherent framework of equilibrium wage formation and labor force adjustment outside of steady state.

In the model, workers do not observe firm productivity and firms cannot commit to future wages. Employees may obtain outside job offers through on-the-job search and do so in order to ascend the job ladder. Assume that the firm has all the bargaining power, as in Burdett and Mortensen (1998), but in contrast to their assumption of commitment, firms post

[1] For example, see Christiano et al. (2012) and Sala et al. (2012).

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current wages but do not guarantee future wages. At every point of time, the firm's wage is the outcome of an optimal trade-off between paying more and reducing its quit rate. As the loss in future profit through a quit is greater for more productive firms, a fully revealing signaling equilibrium exists in which the more productive firms pay strictly higher wages and enjoy strictly lower quit rates. This wage structure remains tractable outside of steady state where workers anticipate future wages given current information and the state of the market.

An investment margin is also incorporated into the model reflecting the fact that acquiring and training new employees is a costly process. The market equilibrium is not efficient as firms choose their wage and hiring strategies to maximize own profit, not taking into account that a worker who quits reduces the profit of his/her original employer. Thus, in contrast to the recent non-steady state search literature, equilibrium turnover outcomes cannot be identified by solving the Planner's Problem. Equilibrium, however, is more interesting for, with incomplete markets, wage formation, and has a direct impact on unemployment, turnover and investment.

In this paper, we abstract from idiosyncratic firm productivity shocks and focus instead on aggregate shocks to the value of marginal revenue product. These shocks can be interpreted as either general cost saving innovations or as demand shocks reflected in the price of output. To focus on the effects of the shock, we study a limiting case in which the firm specific component of productivity is permanent and differences are small across firms. This approximation yields a surprising simple characterization of the dynamic market equilibrium, much of it in close form mathematics, which is particularly straightforward to analyze.

The quantitative purpose of the paper is to provide some sense of the size of the aggregate impact and responses in the job finding rate to aggregate productivity shocks implied by the model. As the job finding rate is the principal determinant of employment in both the DPM and CM models, the paper is directly related to the literature on this topic initiated in the highly influential paper reported by Shimer (2005).

The quantitative results are based on structural parameter estimates of a more general formal model of the firm behavior than ours, but one that reduces to ours in a rather natural special case. The estimation, based on U.S. panel data for industries, is performed and reported in Merz and Yashiv (2003). In addition, we use the Shimer (2005) observations on U.S. worker flow data over the past 50 years both to inform our choice of some of the baseline worker flow parameters and to evaluate the degree to which the model succeeds in explaining historical data. Finally, we draw from another source based on U.S. panel data on individual labor market histories by Jolivet et al. (2006), for an empirical estimate of the extent of search on-the-job.

The task at hand is accomplished by studying two scenarios, one in which employed worker seek better employment with the same vigor as do their unemployed selves while the second repeats the exercise based on a more realistic measure of the extent of employed worker search in U.S. data. In the first scenario, we show that its volatility is lower than that reported in Shimer's data, but still almost three times as volatile as that implied by his calibration of the DMP model. In addition, wages are highly procyclical. In the second scenario, the Jolivet et al. (2006) estimate of the on-the-job search parameter is used. In this case, the job finding rate and the level of employment are more volatile than in the data and the response of the real wage is very "sticky." In sum, we find that the CM model can easily match observations on the magnitude of both wage and employment fluctuations with some but not too much on-the-job search.

A vast literature on our topic for the DMP model was initiated by Shimer (2005). For a review of early papers in this literature which takes a similar approach to the analysis as this paper, see Mortensen and Nagypál (2007). However, because the CM model is new, none of it is otherwise related to results found in this paper.

2. The model

The economic environment is one in which a single good is produced with labor using a linear technology. The economy is populated by a unit measure of workers who are identical, risk neutral, and discount the future at rate $r \geq 0$. At any point in time, each agent is employed or not; while employed her/his value of marginal product is p and the wage earned is w. When not employed, an agent produces at the home production rate b.

A new firm is born when an entrepreneur develops a viable business idea. At start-up, ITS productivity is drawn from a given distribution characterized by the c.d.f. $\Gamma(p)$, the entrepreneur immediately sells the firms for its value, and becomes its first employee while the vacated position as an entrepreneur is immediately taken by an existing unemployed worker. For the purpose of characterizing a particular firm, we use its rank in the distribution of firm productivity, denoted as x. The aggregate (fixed) flow of new firms is μ. To capture the fact that business ideas become obsolete, we assume that existing firms die at exogenous rate δ. Note that the mass of firm is μ/δ. Hence, there are multiple worker firms in general only if $\mu < \delta$, which is we assume.

Hiring is costly because employee time is required to screen new applicants and to assimilate new hires into firm practice. If a firm with n employees decides to recruit an additional worker at rate H, then the cost of hiring is $nc(h)$ where $h = H/n$ is the effort required per employee. $c(\cdot)$ is continuously differentiable and strictly convex with Inada conditions $c(0) = c'(0) = 0$.

Firm productivity is not observed by workers and firms cannot commit to future wage rates. In a Markov (Bayesian) equilibrium an employer signals the firm's productivity with an optimal wage strategy that is continuous and strictly increasing in p. As the wage offered reflects the employer's rank $x = \Gamma(p(x))$ in the productivity distribution, a firm's current