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Stock–flow matching ☆

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Abstract

We develop the implications of the stock–flow matching model for unemployment, vacancies, and worker flows. Workers and jobs are heterogeneous, so most worker–job pairs cannot profitably match, leading to the coexistence of unemployment and vacancies. Productivity shocks cause fluctuations in the number of jobs, which in turn cause fluctuations in other labor market variables. We derive exact expressions for employment and for worker transition rates in a finite economy and analyze their limiting behavior in a large economy. A calibrated version of the model is consistent with the observed co-movement and volatility of labor market variables.

JEL classification: E24; E32; J63; J64

Keywords: Unemployment; Vacancies; Worker flows; Aggregation; Business cycles; Labor market; Beveridge curve; Matching function

1. Introduction

This paper develops and quantifies the implications of the stock–flow matching model [3,5,29] for labor market outcomes. Workers and jobs are heterogeneous, so most worker–job pairs cannot profitably match, leading to the coexistence of unemployment and job vacancies. Ag-

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gregate productivity shocks affect the number of jobs that firms create, which in turn cause fluctuations in unemployment, job vacancies, and worker flows. We derive exact expressions for these variables in an economy with finitely-many workers and jobs; prove convergence to a well-behaved limit when the number of workers and jobs is large and the probability that any particular worker–job pair can match is small; and quantitatively analyze the behavior of unemployment, vacancies, and worker flows in the large economy limit.

We consider an economy where at any point in time, there are L workers and M jobs, with L constant and exogenous and M time-varying and dependent on firms' job creation decision. Each worker–job pair can either match productively or cannot match. The probability that any particular match is unproductive is independent across workers and jobs and denoted by x. Moreover, it is costly for a firm to learn whether its job has a productive match with a particular worker, so match quality is an inspection good. We argue that if the inspection cost C is neither too large nor too small, it is optimal for firms with vacant jobs to inspect unemployed workers until they find a productive match, but it is not optimal for a vacant job to inspect an employed worker. If inspection costs are too high, firms with vacant jobs will not inspect unemployed workers; if costs are too low, they will inspect employed workers. Idiosyncratic productivity heterogeneity and moderate inspection costs are the key frictions in our economy.

To understand how matching works, suppose that at some point in time, E workers are productively employed in a job, while each of the $V = M - E$ vacant jobs knows that it cannot productively match with any of the $U = L - E$ unemployed workers. Now consider a firm that creates a new job. It then proceeds to inspect each of the unemployed workers until it finds a productive match. If it fails to find one, the job becomes vacant. Similarly, when an idiosyncratic shock causes a filled job to exit the labor market, vacant jobs that have not yet inspected the newly-unemployed worker pay the inspection cost to see if they can productively match with her. If none can, she joins the stock of unemployed workers. Thus the inflow of newly unemployed workers matches with the stock of vacant jobs and symmetrically the stock of unemployed workers matches with the inflow of new jobs, the essence of the stock–flow matching model.

Because of the idiosyncracies in matching, the number of employed workers is a random variable, even conditional on the total number of workers and jobs. We derive an exact formula for the distribution of the number of employed workers as a function of the current number of workers and jobs and the probability that any worker–job match is productive. We also derive an exact formula for the probability that the entry of a new job leads to an unemployed worker finding a job and for the probability that the exit of a job leads to an employed worker becoming unemployed.

We then consider a sequence of economies in which the expected number of workers who can productively match with a job, $\alpha \equiv L(1 - x)$, and the expected cost of finding a good match, $c \equiv C/(1 - x)$, are constant, but each of the components varies. More precisely, we take the limit of our finite-agent economy as the number of workers L converges to infinity, the matching probability $1 - x$ converges to 0, and the inspection cost C converges to 0, all at appropriate rates. We prove that in a large economy the employment rate is deterministic and depends only on the contemporaneous ratio of the number of jobs to workers, $m \equiv M/L$, and the parameter α. Similarly, the probability that a job exiting causes an employed worker to become unemployed and the probability that a job entering causes an unemployed worker to become employed are functions of m and α. We also argue that there is a range of values for the inspection cost c such that it is optimal for a vacant job to inspect a worker if and only if she is unemployed.

Finally, we quantitatively examine how the economy responds to aggregate productivity shocks. The calibrated model generates two robust features of the U.S. labor market: the negative