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Labor Markets and Business Cycles

Robert Shimer*

Why are workers unemployed sometimes? Why do unemployed workers coexist with job vacancies? How much does the incidence and the duration of unemployment rise during economic downturns, and why? Much of my research during the last five years has tried to answer these questions by developing quantitative models of labor market dynamics and comparing the models' predictions with data, especially from the United States.

Lucas and Rapping's theory of intertemporal substitution in labor supply is the starting point for any modern analysis of employment fluctuations,¹ including the real business cycle model² and the New Keynesian model.³ The key assumption is that workers decide how much to work at each point in time, taking the prevailing wage as given. To the extent that labor supply is elastic, hours of work fluctuate with movements in the wage.

While models based on intertemporal substitution are qualitatively consistent with the movement of hours of work over the business cycle, they run into at least two problems. First, a number of authors have argued that, from the perspective of a labor-market-clearing model, hours of work fluctuate too much at business cycle frequencies. Recessions look like times when the disutility of work increases. Equivalently, they look like times when labor income taxes rise, discouraging workers from supplying labor.⁴ Neither possibility is empirically tenable. Second, models where workers

can decide how much to work at each point in time can generate movements in hours worked but do not generate unemployment, that is, non-employed workers who would like to work at the prevailing wage. This omission may have important implications for welfare, because workers who cannot find jobs at the prevailing wage but would like to have them are, by revealed preference, worse off than if they simply chose not to work at that wage. It also may have important consequences for the positive analysis of business cycles, because most cyclical movements in aggregate hours of work are explained by movements between employment and unemployment, not by movements in hours worked by employed workers.

Equilibrium search and matching models provide an ideal laboratory for understanding unemployment.⁵ These models build on the idea that it takes workers time to find a job. Thus a worker entering the labor market, or a worker who loses her job, necessarily experiences a spell of unemployment. Moreover, unemployed workers are worse off than employed workers because they cannot work until they find a job. In this sense, this is a theory of unemployment, not just of non-employment.

Search and matching models also assume that firms must create job vacancies in order to find a suitable worker. A matching function determines the number of workers and firms that meet as a function of the unemployment and vacancy rates. Because of the frictions embodied in the matching function—the number of matches is smaller than either the number of unemployed workers or the number of vacancies—unemployed workers and vacant jobs necessarily coexist.

Fluctuations in the profitability of hiring a worker, possibly because of fluctuations in aggregate productivity, induce fluctuations in the number of job vacancies. When firms create more job vacancies, unemployed workers find jobs faster, pulling down the unemployment rate. Thus search and matching models naturally generate a negative correlation between the unemployment and vacancy rates, a robust feature of U.S. data.⁶ The extent of the movement in unemployment and vacancies is limited by the behavior of wages, which many authors assume are bargained bilaterally between workers and firms. As firms create more jobs, workers grow less concerned with the risk of unemployment. This improves their threat point in bargaining, allowing them to obtain a higher wage. This, together with the reduced availability of labor, limits firms' willingness to create jobs and restores the economy to equilibrium.

My first paper in this area examined whether a search and matching model can quantitatively, not just qualitatively, match the cyclical behavior of unemployment and job vacancies.⁷ I found that it could not. At business cycle frequencies, a standard calibration of the search and matching model generates about 10 percent of the observed movement in the vacancy-unemployment ratio in the United States in response to aggregate productivity shocks.

This failure of the baseline search model makes sense when viewed from the perspective of previous research on business cycles in competitive labor market models. Recall that such models are unable to explain why hours worked fluctuate so much over the business cycle, so recessions look like periods when the labor income tax rate rises. Relative to

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this frictionless benchmark, search frictions make it more costly for firms to adjust employment and hence tend to reduce the amplitude of fluctuations in employment. To phrase this differently, suppose that labor market data really were generated by a search and matching model, but an economist ignored the existence of search frictions and viewed the world through the lens of a frictionless model. He would be surprised that employment fluctuates so little at business cycle frequencies and might interpret this as evidence of a subsidy to labor supply during recessions. This is the opposite of what we observe in the data.⁸ I conclude that, while search frictions may be important for understanding why unemployment and vacancies coexist, they do not provide a direct explanation for the volatility of hours worked.

One possible way to reconcile the baseline search and matching model with the data is to look at other shocks. The baseline model focuses on how adverse aggregate productivity shocks reduce firms' incentives to create jobs. Perhaps unemployment increases when there are more idiosyncratic shocks that induce firms to lay off workers, say "job destruction" shocks.⁹ I find that while idiosyncratic shocks may create more unemployment, they have little effect on the vacancy-unemployment ratio. More precisely, an increase in the incidence of idiosyncratic shocks causes a direct increase in unemployment but also an increase in vacancies as firms create more jobs to absorb the newly unemployed workers. In reality, unemployment and vacancies are almost perfectly negatively correlated at business cycle frequencies, so this prediction is counterfactual. To the extent that recessions are characterized by an increased incidence of idiosyncratic shocks, this is an additional shortcoming of the basic model.

Motivated by this theoretical finding, I have reexamined evidence on the extent to which periods of high unemployment are in fact characterized by a high incidence of unemployment rather than a long duration of unemployment.¹⁰

Using unemployment duration data, I conclude that fluctuations in the probability of finding a job — unemployment duration — account for three-quarters of the overall movement in unemployment in the United States since 1948, while fluctuations in the exit rate from employment to unemployment — unemployment incidence — account for the remaining quarter. Evidence from the gross flow of workers between employment, unemployment, and out-of-the-labor-force suggest a similar conclusion. Although some details of this finding remain controversial, there is broad agreement that fluctuations in the job-finding rate explain the majority of changes in unemployment.¹¹

Another possible explanation for the behavior of the unemployment rate and the job finding rates is that wages are more rigid in reality than in the baseline search model.¹² Recall that in response to a positive productivity shock, the baseline search model predicts that firms will create vacancies to take advantage of the resulting rise in revenue. The process stops when firms' profits return to the normal level, which happens for two reasons. First, as firms create more job vacancies, unemployment falls, making it harder to find a worker. Second, as unemployment duration falls, workers are able to bargain to a higher wage. If one mechanically shuts down the second equilibrating mechanism by making wages rigid, then the model generates large fluctuations in unemployment, potentially larger than those we observe in the data. The critical assumption is that wages in new employment relationships do not change, or at least do not change too much, in response to movements in aggregate productivity.¹³ R.E. Hall has observed that this type of wage rigidity does not run afoul of the "Barro critique," that a matched worker and firm should not forego any of the potential gains from trade simply because they are bound to a rigid wage.¹⁴ Unmatched workers might wish that wages were lower so as to increase firms' incentive to create jobs, but the nature of search frictions makes it impossible for them to

commit to receive a lower wage.

A third approach to reconciling theory with data is to move away from the assumption that a matching function explains why unemployment and job vacancies coexist. The starting point for such an analysis is R. Lagos's work on the matching process between taxicabs and riders.¹⁵ He assumes that taxis and riders meet in spatially distinct locations, with each location clearing in the sense that vacant taxis and waiting riders do not coexist within a location. Nevertheless, there may be vacant taxis in one location and waiting riders in another; that is, they may coexist in the aggregate economy.

I have extended this idea to the labor market and evaluated the theory quantitatively.¹⁶ There are many distinct labor markets, characterized by geography and human capital requirements. Within each market, there are typically many workers and many jobs. If there are more workers than jobs in a particular market, then some workers are unemployed, while the wage is driven down to the reservation wage of the marginal worker. If there are more jobs than workers, then some jobs are vacant and the wage is equal to the marginal product of labor. Thus labor allocations within each market are competitive. The key assumption is that it is costly for workers and jobs to move between markets, that is, to go to another city or to acquire a different type of human capital. This means that unemployment and low wages may prevail in one local labor market, while job vacancies and high wages exist in another.

In the simplest version of the model, the mobility of workers and jobs between markets is exogenous and idiosyncratic. Fluctuations in productivity induce fluctuations in the total number of jobs in the economy. When firms create new jobs, some are created in markets with unemployed workers, reducing the aggregate unemployment rate, while others are created in markets that already have vacant jobs, raising the aggregate vacancy rate. I find that this generates a negative correlation between aggregate unemployment and aggregate vacancies that almost per-

fectly matches the one we observe in the data. Moreover, when there are many jobs, so that the vacancy-unemployment ratio is high, unemployed workers are more likely to find a new job quickly because there is less competition from other workers. Thus the model is also quantitatively consistent with the relationship between these variables, which I call the “reduced-form matching function.” Finally, the model produces a flow of workers who move directly from one job to another. When a job ends but the worker is located in a market with available vacancies, she accepts one immediately. The theory predicts that employer-to-employer flows should be procyclical and offset movements in the exit rate from employment to unemployment. Again, this is quantitatively consistent with the data.

A related paper with Ehsan Ebrahimi analyzes a version of the model where the ability of workers and jobs to match is idiosyncratic, as might be the case within occupational and geographic cells.¹⁷ The results are quantitatively similar. In response to a positive productivity shock, firms create more jobs, only some of which are suitable for unemployed workers. Thus unemployment falls and vacancies rise, in line with the data. Moreover, unemployed workers find jobs faster and employed workers are more often able to move directly to another job, again consistent with the data. In both papers, I find that the explicit model of the matching process also helps to amplify fluctuations in unemployment and job vacancies.

Finally, Fernando Alvarez and I¹⁸ build on the Lucas-Prescott search model¹⁹ and relax the assumption that mobility is exogenous. A large number of distinct labor markets produce heterogeneous goods. Idiosyncratic productivity shocks induce the reallocation of workers across labor markets. However, it is time-consuming for workers to switch markets. We argue that two distinct types of unemployment may arise in this framework. First, as in Lucas and Prescott’s original article, workers are unemployed while they switch between

markets. Second, under some conditions workers may be willing to wait in a labor market for conditions to improve, rather than switching to a new market. This type of “rest unemployment” is voluntary, in the sense that individuals choose not to work rather than taking a job at the prevailing wage. Nevertheless, they are worse off than their peers in labor markets that have experienced a more favorable sequence of shocks. Using data on the behavior of wages at the industry level, we argue that the rest unemployment (or low-search-intensity unemployment) may be an important component of the overall unemployment rate.

This paper does not speak directly to the cyclicity of unemployment and vacancies; however, the paper, and my recent research more generally, suggests that we should not necessarily think of unemployed workers as engaged in a search-intensive activity. Unemployment may instead be a consequence of adverse shocks to the value of human capital. Symmetrically, job vacancies need not be a sign of firms’ effort to recruit new workers, but rather of their inability to do so. I am continuing to pursue the broader implications of these preliminary findings.

¹ R.E. Lucas, Jr. and L. Rapping, “Real Wages, Employment, and Inflation,” *Journal of Political Economy*, 77(5), 1969, pp. 721–54.

² F.E. Kydland and E.C. Prescott, “Time to Build and Aggregate Fluctuations,” *Econometrica*, 50(6) 1982, pp. 1345–70.

³ See, for example, M. Woodford, *Interest and Prices: Foundations of a Theory of Monetary Policy*, Princeton University Press, 2003.

⁴ See M. Parkin, “A Method for Determining Whether Parameters in Aggregative Models Are Structural,” Carnegie-Rochester Conference Series on Public Policy, 29, 1988, pp.215–52; J.J. Rotemberg and M. Woodford, “Markups and the Business Cycle,” NBER Macroeconomics Annual, 1991, pp. 63–121; R.E. Hall, “Macroeconomic Fluctuations and the Allocation of Time,”

NBER Working Paper No. 5933, March 1998, and *Journal of Labor Economics*, 15(1), 1997, pp. 223–50; C.B. Mulligan, “A Century of Labor-Leisure Distortions,” NBER Working Paper No. 8774, February 2002; and V.V. Chari, P.J. Kehoe, and E.R. McGrattan, “Business Cycle Accounting,” NBER Working Paper No. 10351, March 2004, and *Econometrica*, 75(3), 2007, pp.781–836.

⁵ Important equilibrium search models include: C.A. Pissarides, “Short-Run Equilibrium Dynamics of Unemployment, Vacancies, and Real Wages,” *American Economic Review*, 75(4), 1985, pp.676–90; and D.T. Mortensen and C.A. Pissarides, “Job Creation and Job Destruction in the Theory of Unemployment,” *Review of Economic Studies*, 61(3), 1994, pp.397–415.

⁶ The correlation between unemployment and job vacancies was first noted by K.G. Abraham and L.F. Katz in “Cyclical Unemployment: Sectoral Shifts or Aggregate Disturbances?” NBER Working Paper No. 1410, 1987, and *Journal of Political Economy*, 94(3), 1986, pp. 507–22.

⁷ R. Shimer, “The Cyclical Behavior of Equilibrium Unemployment and Vacancies,” NBER Working Paper No. 9536, March 2003, and *American Economic Review*, 95(1), 2005, pp.25–49.

⁸ I develop this argument much further in a book manuscript entitled *Labor Markets and Business Cycles*.

⁹ In a series of papers culminating in a book — *Job Creation And Destruction*, MIT Press, 1996 — S.J. Davis, J.C. Haltiwanger, and S. Schuh argue that job destruction is more volatile than job creation at business cycle frequencies, consistent with an increase in idiosyncratic shocks during downturns.

¹⁰ R. Shimer, “Reassessing the Ins and Outs of Unemployment,” NBER Working Paper No. 13421, September 2007.

¹¹ M.W. Elsby, R. Michaels, and G. Solon reach a broadly similar conclusion in “The Ins and Outs of Cyclical Unemployment,” NBER Working Paper

No. 12853, January 2007. G. Ramey and S. Fujita find a roughly equal role for the two margins, but conclude that an increase in job loss Granger-causes a decline in the job finding rate in "The Cyclical Behavior of Equilibrium Unemployment and Vacancies," UCSD working paper 2008-08.

¹² I suggested this idea in the conclusion of "The Cyclical Behavior of Equilibrium Unemployment and Vacancies," and this point is made forcefully in R.E. Hall, "Employment Fluctuations with Equilibrium Wage Stickiness," NBER Working Paper No. 9967, September 2003, and American Economic Review, 95(1), 2005, pp. 50-65. A number of

subsequent papers by Hall and others have built on these ideas.

¹³ For a discussion of the distinction between rigid wages in new and existing employment relationships, see R. Shimer, "The Consequences of Rigid Wages in Search Models," NBER Working Paper No. 10326, February 2004, and Journal of the European Economic Association, 2(2-3), 2004, pp. 469-79.

¹⁴ R.J. Barro, "Long-Term Contracting, Sticky Prices, And Monetary Policy," Journal of Monetary Economics, 3(3), 1977, pp. 305-16.

¹⁵ R. Lagos, "An Alternative Approach to Search Frictions," Journal of Political

Economy, 108(5), 2000, pp. 851-73.

¹⁶ R. Shimer, "Mismatch," NBER Working Paper No. 11888, December 2005, and American Economic Review, 97(4), 2007, pp. 1074-1101.

¹⁷ E. Ebrahimi and R. Shimer, "Stock-Flow Matching," 2008.

¹⁸ F. Alvarez and R. Shimer, "Search and Rest Unemployment," NBER Working Paper No. 13772, February 2008.

¹⁹ R.E. Lucas and E.C. Prescott, "Equilibrium Search and Unemployment," Journal of Economic Theory, 7(2), 1974, pp. 188-209.

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Jay Bhattacharya is a Faculty Research Fellow in the NBER's Programs on Health Care and Health Economics and an assistant professor in the Centers for Health Policy and for Primary Care and Outcomes Research (CHP/PCOR) at Stanford University's Medical School. Bhattacharya earned his bachelor's and master's degree in economics, his M.D. in 1997, and his Ph.D. in Economics in 2000, all from Stanford University. He worked for three years as an economist at the RAND Corporation in Santa Monica, CA, where he also taught health economics as a visiting assistant professor at the University of California-Los Angeles.

Bhattacharya's research focuses on how

insurance markets and government programs affect the health and well-being of a wide variety of vulnerable populations, including the elderly, obese populations, HIV patients, cancer patients, and disabled individuals. His work is widely published in economics, statistics, medical, and health policy journals.

Bhattacharya and his wife, Catherine Su, live in Los Altos, California with their children: Jodie, 7, Matthew, 3, and Benjamin, 1. Bhattacharya enjoys spending his free time playing with his kids, especially geeky video games. He also enjoys non-fiction books of all sorts. Most recently, he has been reading about the history and economics of ancient Rome.

