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### **The Diamond-Mortensen-Pissarides contribution to Economics**

In his Presidential address to the American Economic Association, Milton Friedman<sup>1</sup> defined the “natural rate of unemployment” as “the level that would be ground out by a system of general equilibrium equations,” provided those equations were able to capture important aspects of the economy by having “imbedded in them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, *the cost of gathering information about job vacancies and labor availabilities*, the costs of mobility, and so on.” While he argued persuasively that monetary policy could not influence the natural rate, he left one key question unanswered: Is the natural rate of unemployment optimal, or might there be a role for other policies that systematically affect the unemployment rate?

The research of this year’s economics Nobel Laureates, Peter Diamond, Christopher Pissarides, and Dale Mortensen, fills that important gap. With the unemployment rate in the United States hovering near ten percent for the past year, the award is timely and the Laureates’ work is more relevant than ever.

When Friedman wrote his presidential address, there was no theoretical framework for addressing this question. An early insight of Mortensen was to model search frictions as the periodic arrival of opportunities for workers and employers to benefit from finding each other.<sup>2</sup> Unemployed workers, in return for their job search effort, are periodically offered suitable jobs. Firms seeking to expand employment, in return for their recruiting effort, periodically contact suitable workers. But this did not answer the critical question. Once these search frictions are embedded into an equilibrium model, is the resulting equilibrium “close to” that of the Walrasian general equilibrium model that Friedman had in mind, with all the desirable welfare properties originally observed by Adam Smith? Or does the mere existence of search frictions potentially lead the economy far away from this outcome?

Diamond’s research argues that search frictions can lead the economy away from this desirable outcome, and thus potentially leave a large role for government policy. By embedding search frictions into an equilibrium environment, he showed that they can give rise to multiple rational expectations equilibrium.<sup>3</sup> In one equilibrium, workers anticipate that firms will recruit intensely, and respond by searching hard for a job; firms anticipate that these unemployed workers will look intensely for a job and respond by putting a lot of effort into recruiting. In another equilibrium, however, search intensity of both workers and firms is depressed and everyone is worse off. While no individual worker or firm can do anything to break the economy out of the second, depressed equilibrium, it may be possible for a large actor like the government to do so, for example through a large fiscal expansion. In Friedman’s language, Diamond argued that the natural rate of unemployment is not uniquely determined and that it is not necessarily the best possible outcome.

Mortensen’s research offers a more optimistic view of the search process and its outcome. One key question is how wages are determined in search equilibrium. Once a worker has incurred the cost of

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<sup>1</sup> Friedman, Milton, “The Role of Monetary Policy,” *American Economic Review*, 58 (1968).

<sup>2</sup> Mortensen, Dale, “A Theory of Wage and Employment Dynamics,” in Edmund S Phelps, ed., *Microeconomic Foundations of Employment and Inflation Theory*, Macmillan (1970).

<sup>3</sup> Diamond, Peter, “Aggregate Demand Management in Search Equilibrium,” *Journal of Political Economy*, 90 (1982).

finding a suitable job and a firm has incurred the cost of finding a good worker, they are locked in a bilateral monopoly situation: both the worker and the firm have something to lose if they go their separate ways. So instead of a single market wage, there is a range of wages at which the worker and the firm would be willing to lock themselves in once they have gone to the trouble of finding each other. While Diamond argued that the resulting wage setting may lead to an inefficient equilibrium,<sup>4</sup> Mortensen showed that this need not be the case.<sup>5</sup> It is simply necessary that workers and firms share the gains from finding each other in proportion to their contribution towards the creation of the match. That is, the existence of search unemployment does not indicate that the economy is operating inefficiently.

The early theoretical contributions by Diamond and Mortensen were expressed in terms of abstract models. Pissarides developed their insights into something more relevant for macroeconomists.<sup>6</sup> In his framework, profit maximizing firms decide how many job vacancies to create, each of which has some chance of attracting an unemployed worker. As the number of job vacancies increases, the unemployment rate falls and competition between firms ensures that each has a smaller chance of hiring a worker. Moreover, unemployed workers find jobs faster, pushing up their wage demands until firms no longer find it profitable to hire workers. He showed how such a model can generate persistent fluctuations in unemployment and job vacancies in response to transitory shocks to labor productivity, in line with business cycle data. In empirically reasonable versions of the model, the equilibrium is unique, in contrast to Diamond's earlier prediction, and may also be efficient.<sup>7</sup>

The original Pissarides model assumed that fluctuations in unemployment were primarily driven by changes in how long the unemployed stayed out of work, not just by unemployment incidence itself. That is, workers stayed unemployed longer during recessions, in the model, but there was no spike in layoffs. In the early 1990s, Steven Davis and John Haltiwanger developed new data sets which showed that job destruction was more volatile than job creation.<sup>8</sup> In response, Mortensen and Pissarides extended the basic Pissarides model to incorporate endogenous fluctuations in job destruction rates as firms shed marginal workers during recessions, providing a theoretical framework for understanding the Davis and Haltiwanger data.<sup>9</sup>

The Diamond-Mortensen-Pissarides model has become a workhorse in modern macroeconomics. For example, Mortensen and Pissarides have used it to study how various well-intentioned government programs, such as employment protection legislation and a generous welfare state, can adversely affect labor market outcomes.<sup>10</sup> While they developed their theory to explain the rise in unemployment in continental Europe in the 1970s and 1980s, it is equally applicable to the U.S. economy in the aftermath of the Great Recession. For example, extended unemployment benefits shield workers against the

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<sup>4</sup> Diamond, Peter, "Wage Determination and Inefficiency in Search Equilibrium," *Review of Economic Studies*, 49 (1982).

<sup>5</sup> Mortensen, Dale, "Property Rights and Efficiency in Mating, Racing, and Related Games," *American Economic Review*, 72 (1982).

<sup>6</sup> Pissarides, Christopher, "Short-Run Equilibrium Dynamics of Unemployment, Vacancies, and Real Wages," *American Economic Review*, 75 (1985).

<sup>7</sup> Hosios, Arthur, "On the Efficiency of Matching and Related Models of Search and Unemployment," *Review of Economic Studies*, 57 (1990).

<sup>8</sup> Davis, Steven and Haltiwanger, John "Gross Job Creation, Gross Job Destruction, and Employment Reallocation," *Quarterly Journal of Economics*, 107 (1992).

<sup>9</sup> Mortensen, Dale and Pissarides, Christopher, "Job Creation and Job Destruction in the Theory of Unemployment," *Review of Economic Studies*, 61 (1994).

<sup>10</sup> Mortensen, Dale and Pissarides, Christopher, "Job Reallocation, Employment Fluctuations, and Unemployment," in John B. Taylor and Michael Woodford eds., *Handbook of Macroeconomics* (1999).

worst effects of job loss. While this is good for each worker individually, it mitigates the downward pressure that mass unemployment would otherwise put onto wages. The market then does not provide firms with enough incentive to create new jobs, prolonging everyone's unemployment spells. Moreover, the longer workers remain unemployed, the more their skills atrophy, potentially keeping them out of a job until they eventually retire.<sup>11</sup>

What then is the answer to Friedman's open question? Current research suggests that wages do not fall enough to clear the labor market during recessions.<sup>12</sup> This is due in part to policy interventions that are designed to spread the cost of adverse shocks across the entire economy but that also create disincentives to work and to recruit new workers. It is in part also an intrinsic feature of markets with search frictions,<sup>13</sup> albeit one that may be ameliorated by policies that lower real labor costs, such as countercyclical payroll tax cuts. The framework developed by Diamond, Mortensen, and Pissarides is an ideal laboratory for understanding the consequences of these crucial attempts by governments to respond appropriately to a spike in unemployment.

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<sup>11</sup> Ljungqvist, Lars and Sargent, Thomas, "The European Unemployment Dilemma," *Journal of Political Economy*, 106 (1998).

<sup>12</sup> Shimer, Robert, "The Cyclical Behavior of Equilibrium Unemployment and Vacancies," *American Economic Review*, 95 (2005).

<sup>13</sup> Hall, Robert, "Employment Fluctuations with Equilibrium Wage Stickiness," *American Economic Review*, 95 (2005).