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Employment and hours of work

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ABSTRACT

This paper develops a dynamic model of the labor market in which the degree of substitution between employment and hours of work is determined as part of a search equilibrium. Each firm chooses its demand for working hours and number of vacancies, and the earnings profile is determined by Nash bargaining. The earnings profile is generally nonlinear in hours of work, and defines the trade-off between employment and hours of work. Concave production technology induces firms to overemploy and, as a result, hours of work are below their optimal level. The Hosios condition is not sufficient for efficiency. When there are two industries, workers employed by firms with higher recruitment costs work longer and earn more. That is, "good jobs" require longer hours of work. Interestingly, technology differentials cannot account for working hours differentials.

1. Introduction

There are extensive and intensive margins for adjusting labor input: the number of workers and hours of work per employee. Understanding how firms utilize these two margins is crucial for understanding the long-run trend in hours of work (Prescott, 2004; Rogerson, 2006; Pissarides, 2007), the movements of employment and hours over the business cycle (Burnside et al., 1993), the likely effect of regulation of hours of work (Hoel, 1986; Booth and Schiantarelli, 1987; Hunt, 1998; Marimon and Zilibotti, 2000), and cross-sectional differences in hours of work (Hamermesh, 1993), to name a few.

Recent decades have witnessed declines in hours of work in major developed economies (Rogerson, 2006; Pissarides, 2007). Despite a decline in average working hours, disparities in working hours among workers have gradually increased. This disparity is particularly apparent for workers in their 30s. The Japanese Labour Force Survey (2006) documented that the proportion of male employees aged between 35 and 39 years who work more than 60 h per week rose from 18.9% in 1993 to 23.5% in 2003.[1] Similarly, the proportion of those who work less than 35 h per week also rose from 6.4% to 7.1%. An important question is, what is the major cause of the dispersion in hours of work?

In this paper, we construct a dynamic equilibrium model of labor demand under *search frictions* and focus on how firms utilize employment and hours of work. The idea is that hours of work can be chosen instantly whereas employment adjustment is frictional. A novel feature of this paper is that the source of labor adjustment costs is search frictions, and that the cost of adjustment is influenced by labor market tightness. Thus, the degree of substitution between employment

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[1] For the US economy, Kuhn and Lozano (2005) investigated this issue and documented that "highly educated, high-wage, salaried men" had the greatest increase in long working hours. See also Hamermesh (1993).

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and hours of work is determined as part of the search equilibrium. This sharply contrasts with traditional models of working hours (Hoel, 1986; Booth and Schiantarelli, 1987; Calmfors and Hoel, 1988; Cahuc and Zylberberg, 2004) and adjustment cost models (Sargent, 1978; Hamermesh, 1993), in which the degree of substitution between working hours and employment is structurally given by the production function or by the adjustment cost function.

To understand the role of search frictions, consider the standard neoclassical model (Lucas and Rapping, 1969; Prescott, 2004), in which workers face a labor–leisure choice and choose hours of work optimally, taking the market wage rate as given. In the neoclassical framework, *firms can employ any quantity of labor at the market wage rate*. Thus, from the firm's viewpoint, it does not matter whether workers work longer or shorter hours because the competitive market ensures that the quantity of labor demanded equals the quantity of labor supplied. On the other hand, with search frictions and bilateral trading, if employees work shorter hours, then the firm must pay extra search costs to maintain its labor input. Thus, firms do care about working hours.

The basic model is an extension of Smith (1999), which is particularly useful for our purpose because the number of workers in each firm is determined endogenously, although modeling firm size in a search equilibrium is generally a formidable task.[2] We incorporate the choice of working hours into Smith's (1999) framework. Each firm chooses the number of vacancies and hours of work per employee to maximize the value of the firm.

A novel feature of the model of this paper is that Nash bargaining determines the earnings profile, which relates earnings and hours of work. In particular, the earnings profile is shown to be a nonlinear function of hours of work, which reflects the concave production technology and workers' convex utility costs of longer hours of work. Interestingly, the earnings profile is consistent with the standard upward-sloping labor supply curve, and it defines the trade-off the firm faces when choosing employment and hours of work.

Smith's (1999) main result is that firms overemploy. The mechanism is intuitive. The social planner does not take into account the wage rate when choosing the optimal employment level because wages are simply transfers among the members of society. However, firms do care about the wage rate. When the production technology is concave, an increase in employment results in a reduction in the wage rate. Firms have incentives to exploit this opportunity, resulting in overemployment. This mechanism also operates in our framework.

The overemployment effect has an important implication for the efficiency of hours of work. Since the level of employment is too high, the marginal product of an additional hour of work is inefficiently low. This leads to shorter hours of work. We show that in the absence of the overemployment effect, employment and hours of work are efficient. An important finding is that, because of the overemployment effect, the Hosios (1990) condition is not sufficient for efficiency. To restore efficiency under concave production technology, we need to impose in addition that the firm appropriates all the bargaining surplus. In this case, the overemployment effect is internalized because the firm faces all the costs and benefits of choosing employment and hours of work.

It has become increasingly important to ask whether regulating hours of work to implement some form of "work sharing" increases employment (Hoel, 1986; Booth and Schiantarelli, 1987; Hunt, 1998; Marimon and Zilibotti, 2000). According to our model, under the regulation of working hours, a reduction in hours of work generally increases employment *at each firm*. Whether it expands aggregate employment depends on whether the marginal product of labor exceeds the marginal disutility of work. However, the laissez-faire level of hours of work is below its optimum, suggesting that implementing work sharing may expand employment at the cost of efficiency.

We also study two other forms of regulation. One is wage regulation. We consider a scenario in which the earnings profile is perfectly regulated, and find that an earnings profile that mimics the worker's disutility function induces the efficient levels of employment and hours of work. The key requirement is to match the marginal hourly wage rate to the marginal disutility of longer hours of work. The other regulation we consider is entry regulation. Recently, this issue has become increasingly important (Bertrand and Kramarz, 2002; Blanchard and Giavazzi, 2003; Fang and Rogerson, 2007). We consider a scenario in which the number of firms is regulated. We find that regulation that reduces the number of firms lowers hours of work and increases the number of employees at each firm. However, it results in higher unemployment because there are fewer firms. Interestingly, this result is overturned if a regulation takes the form of imposing a fixed cost of entry. This suggests that the details of implementing entry regulation matter.

Hamermesh (1993) documented that there are sizable differences in working hours across industries. For example, in 1990 in the US, weekly hours of work averaged 44 in mining, 40.8 in manufacturing, 32.6 in services, and 28.8 in retail trade. This finding is interesting because it suggests that there are large differences in working hours among industries, each of which provides a variety of jobs. We extend the basic model to investigate why some individuals work longer than others. In doing so, we focus on job characteristics rather than worker characteristics as determinants of differences in hours of work.

We first address *within-industry* differentials in hours of work, such as full-time–part-time differentials. To explain these differentials, we develop a model of a single industry in which the labor market is pooled for two types of jobs. The key determinant of differentials in working hours is differences in recruitment costs. For example, Hamermesh (1993) documented that firms incur much higher costs in recruiting workers with skills and education than in filling jobs that

[2] Bertola and Caballero (1994), Bertola and Garibaldi (2001), Cahuc and Wasmer (2001), and Cahuc et al. (2008) also developed search models incorporating large firms. See also Kudoh and Sasaki (2010).