



Compensating wage differentials in stable job matching equilibrium



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ABSTRACT

This paper studies implicit pricing of non-wage job characteristics in the labor market using a two-sided matching model. It departs from the previous literature by allowing worker heterogeneity in productivity, which gives rise to a double transaction problem in a hedonic model. Deriving sufficient conditions under which assortative matching is the unique stable job-worker matching, we show that observed wage differentials between jobs reflect not only compensating wage differentials, but also worker productivity gaps between the jobs. We find that the job-worker matching pattern determines the extent to which compensating wage differentials are confounded with the worker productivity gap effect.

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1. Introduction

The theory of equalizing differences has remained one of the most fundamental value theories in economics since Adam Smith's classic discussion in "The Wealth of Nations." Rosen (1974) develops a theory of equalizing differences for a commodity market and shows that implicit markets arise for differentiated products in which hedonic prices adjust so that all markets clear: The observed price differentials reflect the buyer's willingness to pay for a better product.¹ The key idea of equalizing differences also holds in the labor market. Rosen (1986) applies the theory to the labor market and finds that equilibrium wage differentials reflect workers' willingness to pay for job characteristics. His theoretical finding demonstrates how non-wage characteristics of a job are valued and how workers are matched to such jobs.

Although the theory is a rich description of the labor market for heterogeneous jobs, it assumes homogeneous worker productivity. Rosen (1986) notes the importance of workers' productivity heterogeneity, pointing out

"... On the theoretical side of these questions, much more attention must be paid to the value of workers' productivity characteristics and the nature of sorting and selection in those dimensions. ..."

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¹ The theory of equalizing differences has been applied to various types of commodity markets. For example, Scotchmer (1985) develops a hedonic price model in the housing market, and Kanemoto (1988) applies the theory to study the benefits of public projects. The theory is further developed by Ekeland (2010) and Chiappori et al. (2010) who undertake hedonic equilibrium analysis in a more general matching model.

The objective of this paper is to develop a theory of the labor market in which both job characteristics and worker productivity are heterogeneous. Our main question is how labor productivity and job characteristic are valued in the labor market. The difficulty in examining this problem arises from double transactions: workers sell their productivity characteristics to the firms, while the firms implicitly sell job characteristics to the workers. Double transactions are inherent in labor markets and absent in commodity markets. On the one hand, in the commodity market, consumers do not sell their characteristics to firms, and hence their characteristics do not directly affect firms' profits. On the other hand, in the labor market, not only does the wage affect the employer's profit, but so do workers' characteristics. This implies that the wage difference between jobs reflects not only the compensating wage differentials, but also the difference in the productivity of the workers occupying the jobs. The presence of double transactions complicates our problem and prevents us from applying the known results for commodity markets.

Another question that arises is how heterogeneous jobs and workers are matched in the labor market. The double transaction issue also complicates the matching mechanism, since not only do worker's productivity characteristics affect a firm's profit, but the job characteristic in a firm affects worker's utility as well. A match is formed only when a firm and a worker agree on the wage that reflects the net value of the characteristics on both sides. The analysis is even harder when utility is not transferable, because the marginal utility of the job characteristic depends on the wage. The established results (Teulings, 1995; Shimer, 2005) in the optimal assignment literature for heterogeneous jobs and workers do not answer this question, because job characteristics do not affect the utility of a worker², and hence, double transactions do not exist in those models.

In our model workers are heterogeneous in their productivity and jobs differ in their characteristics. Workers derive utility not only from wages, but also from the characteristics of the job they hold. The labor market is frictionless so that all workers can freely choose any job and all firms can freely hire any worker. We find that positive assortative matching is the unique stable matching between jobs and workers, if (i) a good job characteristic increases the marginal utility of consumption or the marginal productivity of a worker and (ii) the worker's utility function is concave in consumption. This result holds even when utility is not transferable.

We then show that the wage difference between two jobs reflects a compensating wage differential and the difference in productivity between workers occupying those two jobs. On the one hand, the former lowers the wage of a better job, because a worker is willing to accept a lower wage in exchange for better job characteristics. On the other hand, the latter raises the wage of a better job in assortative matching, because the worker occupying the better job is more productive. When the worker productivity effect dominates the compensating wage differentials, the observed wage gaps across jobs seem contradictory to the theory of equalizing differences, because the observed wage increases, rather than decreases, with job characteristics. We clearly characterize how this worker productivity effect masks compensating wage differentials in the data, and find that the job-worker matching pattern determines the extent to which the worker productivity effect appears in the wage. We further show that the distributions of jobs and workers pin down the job-worker matching pattern.

Empirical research often fails to find the evidence for compensating wage differentials. Various econometric reasons have been posited for the difficulty in estimating equalizing differences in the labor market. Among them, unobserved heterogeneity (Hwang et al., 1992), omitted variables (Brown, 1980; Lucas, 1977), measurement errors (Duncan and Holmlund, 1983) and an unappealing linear approximation (Ekeland et al., 2004), have all been considered as sources of the counter-intuitive results. All of these papers improve on the econometric methods, but are based on the model by Rosen (1986) in which worker productivity is homogeneous.

An explanation based on economic theory, rather than econometric theory, is provided by Hwang et al. (1998) and Lang and Majumdar (2004). They show that labor market frictions make it less likely to observe compensating wage differentials, using a search model with homogeneous worker productivity. Our model differs in that we allow for heterogeneous worker productivity and consider a frictionless economy. Our explanation is alternative to theirs and emphasizes the job-worker matching pattern as the main cause preventing us from interpreting the wage differences between jobs as compensating wage differentials.

The rest of the paper is structured as follows. We begin by reviewing the theory of equalizing differences in a labor market composed of homogeneous workers in Section 2. Then, we introduce heterogeneous worker productivity in Section 3. We derive sufficient conditions for assortative matching and characterize a stable equilibrium by the wage and matching functions. Section 4 discusses empirical implications of the main theoretical result. Section 5 concludes the paper. Proofs and technical discussions are collected in Appendix A.

2. Equalizing differences

To provide the intuition for equalizing differences, we begin with the analysis of the relationship between wage and job characteristics when labor productivity is homogeneous. Throughout the paper, consider a market with a continuum of firms and workers, each with the total measure of one. Firms differ in the characteristics of their jobs: firm x has a job with characteristic $x \geq \underline{x}$, where $\underline{x} \in \mathbb{R}$ is the lowest job characteristic. Let $H(x)$ be the measure of firms whose job characteristics are no more than x .

² [Sattinger \(1975\)](#) also considers the matching problem, but the worker's utility function is not modeled.

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