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Observability, Job-Match, and Segmentation of Labor Markets*

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Abstract

Much of the dual labor markets literature is devoted to exploring the reasons as to why the markets are segmented along the lines where the observed wage differentials are not a result of underlying skill differentials; and why otherwise comparable workers differ in the duration of their job tenure and incidence of unemployment. The logic of competitive economics denies the possibility of equally skilled workers being treated differently in labor markets. The model presented in this paper shows that workers could be segregated quite simply due to the structure

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of information and job-match quality, even though they are the same in terms of productivity. In general, the model predicts that observability of a worker's productivity and the extent of match specificity are key features of labor market segmentation. An important implication is that the negative feedback from the past labor market experiences, sometimes called as hysteresis effect, helps to restrict mobility of workers among different sectors and results in perpetuation of unemployment in the secondary sector. The model also provides an explanation of the efficient wage scheme in the primary sector.

I. Introduction

The fundamental insight of market economics is that prices and quantities are set by supply and demand. The same is true in the labor market. Traditionally labor markets are studied in the framework of a 'spot market,' based on point-in-time supply and demand curves which are derived from individual utility and firm profit maximization. With free entry, full information, homogeneous workers, and many buyers and sellers of labor, an equilibrium in the market occurs where the hours of labor supplied exactly equal hours demanded. If firms are profit maximizing, the wage will equal the marginal revenue product of labor, a measure of the worker's contribution to the firm. In many cases, however, the spot market predictions do not agree with observations of real life. A clear illustration is that not all workers who want to work can find jobs. In the context of spot labor markets, such unemployment is frictional, and a fall in wages is expected to make it disappear. In reality, however, labor markets show more sustained unemployment and less flexible wages. This implies that the market does not clear in a way that the spot labor market predicts.

The main deficiency of the spot market view is in its treatment of time and labor market institutions. In spot labor markets all decisions are implemented at a moment, so that institutions play no role in the process. For example, consider investment in

human capital. Once a worker makes the investment in skill and knowledge specific to a firm, both the worker and the firm can benefit from that investment for a long time if they maintain a good relationship. Consequently, there exists an incentive for both to enter into a long-term contract to protect the sharing of benefits. When a long-term labor relationship is established, labor allocation and wage determination become impervious to spot market conditions. In this case, the pricing and allocational functions of the labor market take place within the firms rather than outside. The set of rules and procedures within a firm designed to guide and constrain the employment relationship is defined as the 'internal labor market'. Internal labor markets interact on only a limited basis with external labor market conditions and they operate according to their own rules.

With the operation of internal labor markets, the labor market is characterized by a number of complexities absent in the spot labor market. Supply and demand behaviors are no longer represented by simple curves and there is no single market. Instead, there are many segmented markets where quantity and price adjustments depend on specific institutions and procedures within firms. Doeringer and Piore (1971) demarcate the segmented labor markets in a framework of dualism. They identify the practices of internal labor markets with those of the 'primary' sector while they assume the market mechanism of the spot market works in the 'secondary' sector. The jobs belonging to the primary sector offer high wages, stable employment, good working conditions and opportunities for advancement. The secondary sector is characterized by low wages, unstable employment and dead-end jobs with poor working conditions. In the secondary sector, wages and labor allocations are determined by market forces and labor market institutions are inconsequential.

Of key importance to this approach is that mobility among sectors is thought to be limited. Though workers in the secondary sector envy those in the primary sector, there is no equilibrating market force that can erode the demarcation between them. Workers relegated to the secondary sector are tagged as unstable, undesirable workers and are thought to have little hope of acquiring primary sector jobs. Then a question arises as to what makes the labor market segmented as dualists maintain.

Labor market discrimination is usually supposed to be a driving force to bring about segmentation of labor markets, consisting of various noncompeting working groups (Ehrenberg and Smith, 1994). However, this description does not really explain what initially caused workers discriminated. This paper attempts to formulate a process where workers settle into different sectors even if they are intrinsically equal in terms of labor market characteristics. The model presented in this paper shows that the information structure on a worker's productivity and job-match quality contribute to initiating labor market segmentation. An important implication is that the negative feedback from the past labor market experiences, sometimes called as hysteresis effect, helps to restrict mobility of workers among different sectors and results in perpetuation of unemployment in the secondary sector. The model also provides an explanation of the efficient wage scheme in the primary sector.

II. A Model of Segmented Labor Markets²⁾

Suppose that there are two firms, A and B, who compete for worker k . Firm A starts to make a wage offer to worker k . After watching firm A's offer, firm B makes a counteroffer to scout worker k whose value is G to firm B. When the counteroffer is made, firm A has the option to up its bid, followed by firm B's counter, and so forth until one drops out of bidding. For the sake of the purpose of this paper, let's take account of the state of being hired at firm B as that of being unemployed. Then, G can be considered as the level of the reservation wage, the wage below which worker k would refuse to work. Worker k would stay unemployed when the wage offer made by firm A is lower than her/his reservation wage of G .

The worker k is worth M for firm A. Further,

2) The formulation of the model in this section is very similar to the model of raids and offer matching by Lazear (1986). The major differences are the structure of information and the interpretation of turnovers.

$$M=G+S,$$

where G is the worker's general skill and S is specific quality of the match to firm A. G and S are assumed to be random variables, both of which follow uniform distributions: G is uniform on the interval $[0, 1]$ and S is uniform on the interval $[-\alpha/2, \alpha/2]$. As α increases, the match-specific component between worker k and firm A becomes more important. A negative value of S implies that the worker is not suited to the job and both parties will be better off when the match dissolves.

The worker's value is exactly observed with the probability θ . With the probability $(1-\theta)$, however, only its distribution is observed. The difficulty of observing a worker's productivity is attributed to the production technology and the lack of prior information about the worker's general attitudes toward jobs. Depending on the production technology firms employ, costs to monitor a worker's efforts change. In addition, firms may draw some inferences about a worker's productivity, actually negative inferences, when the worker has floated over many firms without good reason or has been unemployed for a long period. Generally speaking, θ can be thought of as an index of the observability of a worker's productivity. For simplicity, I assume θ to be the same for both firms A and B.

The situation is depicted in figure 1. It starts after firm A has offered the wage W to worker k . Wage W , derived below, is the optimal offer consistent with zero profit for firm A. If the exact productivity of worker k can be inferred, node 1 is relevant. When $G \leq W$, it goes to node 1.1, where firm B won't make a counteroffer because it results in losses of $(W-G)$. At this node, firm A's rent is also expected to be negative in the following way:

$$\begin{aligned} E(G+S \mid G < W) - W &= E(G \mid G < W) + E(S) - W \\ &= \frac{W}{2} - W = -\frac{W}{2}. \end{aligned}$$

At node 1.2, when the worker's productivity is observed that $G > W$, firm B will make a counteroffer to steal the worker. If $S > 0$, then firm A will always end up outbidding firm B and the wage will be set at G because firm B drops out of the

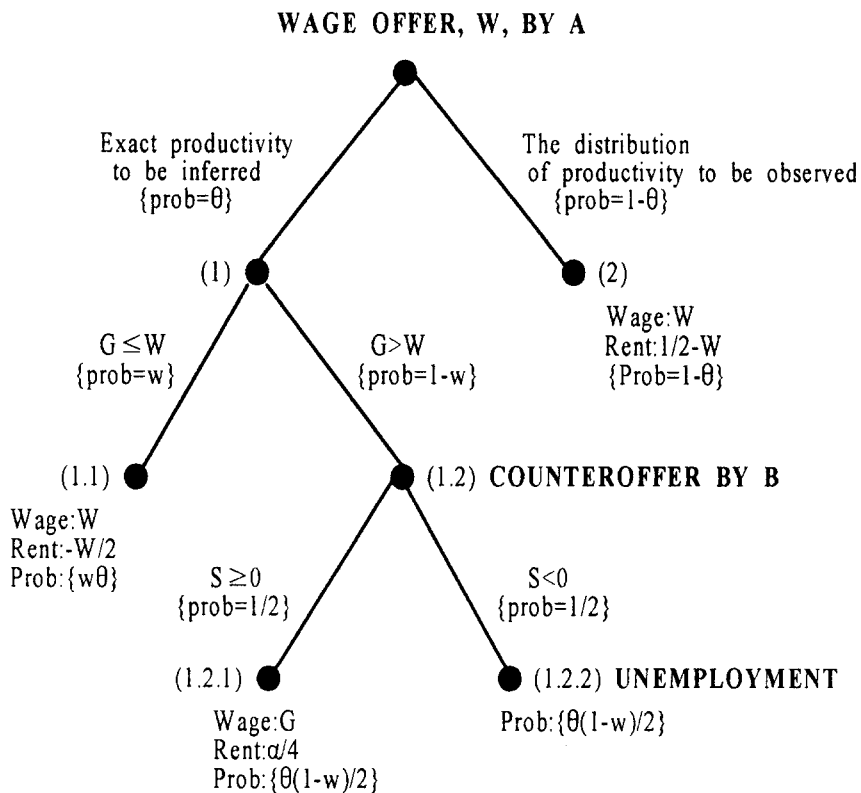
bidding when the wage reaches G . The expected rent that firm A receives is:

$$E(M-G \mid M > W, S > 0) = E(S \mid M > W, S > 0) = \frac{\alpha}{4}$$

On the other hand, if $S < 0$, firm A would lose the bidding. The worker will leave firm A and go to firm B. In this case firm A earns no rent. As mentioned before, it implies that worker k goes unemployed.

If the worker's productivity is observed stochastically, node 2 is reached.

[Figure 1] Wage, Rent and Probability of Getting Each Node



If firm A believes that firm B makes a counteroffer only when firm B believes that

$G > W_B$, expected productivity of worker k on the part of firm A is:

$$\begin{aligned} E(M | G > W_B) &= E(G | G > W_B) + E(S) \\ &= \frac{(W_B + 1)}{2} + 0 > W_B \end{aligned}$$

Thus, it always pays for firm A to bid up firm B's counteroffer. When firm B knows this, it never makes a counteroffer. So the consistent equilibrium at node 2 is that firm A hires worker k at wage W and has an expected rent of $(1/2 - W)$.

Under the conditions of a competitive labor market, firm A's expected rent on hiring worker k at W must be zero. The expected rent is the sum of probability of arriving at each node times the expected rent at the corresponding node. The zero rent condition is given by:

$$0 = \theta W \left(-\frac{W}{2} \right) + \frac{\theta(1-W)}{2} \left(\frac{\alpha}{4} \right) + (1-\theta) \left(\frac{1}{2} - W \right).$$

Solving this for W yields the equilibrium wage rate:

$$W = \frac{1}{8\theta} [-\alpha\theta + 8\theta - 8 + \sqrt{(\alpha\theta - 8\theta + 8)^2 - 16\theta(4\theta - 4 - \alpha\theta)}]. \dots\dots\dots(1)$$

The equilibrium wage is dependent on θ , the observability of the match quality, and α , the importance of match specificity. It is very tedious to derive the derivatives of W with respect to α and θ analytically. Rather, numerical solutions are instructive. Table 1 calculates W for values of α and θ as given by equation 1. It is evident from the table 1 that $\partial W / \partial \theta < 0$ for all values of α , and $\partial W / \partial \alpha > 0$ for $\theta > 0$. When $\theta = 0$, the interpretation of equation 1 is not intuitively clear. But, $\theta = 0$ implies that firms know nothing about the match quality and thus are left with the entire distribution of workers. Then, independent of α , the equilibrium level of W is expected value of output of $(M+S)$ which is equal to 0.5.

III. Observability, Hysteresis Effect and Job-Match Specificity

Recall that worker k is unemployed on node 1.2.1 where its probability is:

$$P = \frac{\theta(1-W)}{2} \dots\dots\dots(2)$$

It is evident that $\partial P/\partial W < 0$ and $\partial P/\partial \theta > 0$.³⁾ The worker who has a higher wage offer is less likely to leave the job, while the probability of unemployment increases as workers are more observable.⁴⁾ When we take account of the fact that frequent job changes create a negative inference about the quality of job-match, an important implication is that the probability of unemployment and observability are mutually reinforcing in a positive way. That is, when the worker has a bad luck to start with an 'unsuitable' job ($S < 0$), s/he is more likely to be entrapped in being out of work or changing jobs. Unemployment due to a simple 'bad luck' carries a negative inference about the worker's match specificity, i.e. $S < 0$, which in turn causes an increase in the probability of unemployment and so on.

This aspect is called hysteresis effect (Blachard and Summers, 1986, 1988; Goldin and Margo, 1991).⁵⁾ That is, the current unemployment experience depends on its past since there exists a negative feedback between early labor market experience of unemployment and later market behavior. A simple bad match imparts negative

3) Table 1 shows that W is bounded by 0 and 1/2.

4) At node 1.2 where $M < W$, the worker may be forced to leave or to suffer a wage cut because the firm runs a deficit. Under the conditions of sticky wages, however, the worker is more likely to leave than to accept a wage cut.

5) In addition to the asymmetric information problem such as a bad luck, Blanchard and Summer(1988) owes the hysteresis effect to union bargains. In the case where union members simply set wages to insure the employment of their incumbent members, it gives rise to a continuum of unemployment for the part of nonunion members, or hysteresis. They use the term of fragile equilibria to refer to situations of this type where unemployment, far from returning to a stable equilibrium over time, is strongly dependent on current and past events.

human capital. Even if workers are inherently homogeneous, the signaling effects of hysteresis differentiate the workers over time. Thus, 'scarred' workers would gradually dead-end in 'bad' jobs and be more likely to fall into unemployment. The presence of hysteresis effects contributes to labor market dualism and can cause a high variance in interindustry wages and unemployment. The negative feedback also helps to restrict mobility between sectors.

Regarding the association between wages and observability, the model suggests that initial wages are lower when workers' productivities are more observable. Employers may find it less costly to set initial wages at a lower level when workers' productivities are easily inferred and vice versa. This explanation of the wage premium for the workers whose productivities are less observable is very similar to that of the 'efficiency wage' scheme. According to the efficiency wage literature (Shapiro and Stiglitz, 1984; Yellen, 1984; Katz and Summers, 1989), the difficulty of observability of a worker's efforts and the resultant higher monitoring costs is a principal reason why firms offer higher wages.⁶⁾ Coping with workers' moral hazard associated with difficulty of observability, employers may elicit more effort from their workers either by watching more closely or by offering higher wages. A worker who is paid less has little incentive to perform well since losing the job would not be costly. Combining this with the result that higher wages decrease the probability of unemployment, the model also predicts that turnover and the initial wage offers are negatively related.

Although the model does not offer an explicit explanation of time-based wages which are a common observation in labor markets, the rents occurring from a good match give a clue to this rationale of wage dynamics. Recall that wages are higher as match specificity is better. This is due to the fact that a firm's rent increases when the match turns out to be good and this in turn is distributed to workers through higher initial wage offers. The agency theory in employment relations argues that deferred wages encourage a worker's efforts and thus improve performance

6) The literature suggests several other reasons as to why some firms pay higher wages than others to workers of equal productivity. They include differences in the costs of turnover (Stiglitz, 1974; Salop, 1979), selection of better quality of the work force (Malcomson, 1981; Weiss, 1980) and provision of necessary nutrition (Leibenstein, 1957; Stiglitz, 1975).

(Lazear, 1981). In fact, such deferred wage arrangements extract a higher level of efforts if the present value of the promised earnings at the start of the job exceeds the present value of earnings on other jobs. Then the model infers that the wage deferral would be more profitable when the matches bring about larger rent, or equivalently, when S is bigger.

<Table 1> Effect of α and θ on W

θ	α					
	0.0	0.2	0.4	0.6	0.8	1.0
0.0	0.500	0.500	0.500	0.500	0.500	0.500
0.1	0.487	0.488	0.490	0.491	0.492	0.494
0.2	0.472	0.475	0.478	0.481	0.484	0.486
0.3	0.456	0.460	0.465	0.470	0.474	0.479
0.4	0.436	0.444	0.451	0.457	0.464	0.470
0.5	0.414	0.424	0.434	0.443	0.452	0.461
0.6	0.387	0.402	0.415	0.427	0.439	0.451
0.7	0.354	0.374	0.392	0.409	0.424	0.439
0.8	0.309	0.338	0.363	0.386	0.407	0.425
0.9	0.240	0.288	0.326	0.358	0.385	0.410
1.0	0.000	0.200	0.272	0.319	0.358	0.390

Regarding the wage profile, we must consider the case where match specificity gets larger over the tenure period as suggested by human capital hypothesis. If a job involves investment in firm-specific training, the match specificity, S , grows over the period on a job. Then, it may be optimal for workers and employers to structure the payments system such that wages are deferred until late in the job so that workers will not quit (Becker, 1964; Mincer, 1974; Mincer and Jovanovic, 1981). Both the effort-incentive wage deferral explanation and human capital explanation predict a rising wage profile over tenure, although they differ in their implications in terms of the relationship between earning and productivity.

Moreover, workers get sorted to their most productive jobs, as the worker who is $S < 0$ is more likely to change jobs. In a similar way, some job matches end in long tenures in the sense that the workers are more productive in those matches. Then,

the specific value of the match is shared between the employer and the worker, and the match is even less likely to get broken off. As a result, longer tenure in the job indicates a better match than those with shorter tenure.

IV. Conclusion

Much of the dual labor markets literature is devoted to exploring the reasons as to why the markets are segmented along the lines where the observed wage differentials are not a result of underlying skill differentials; and why otherwise comparable workers differ in the duration of their job tenure and incidence of unemployment. The logic of competitive economics denies the possibility of equally skilled workers being treated differently in labor markets. The model presented in this paper shows that workers could be segregated quite simply due to the structure of information and job-match quality, even though they are the same in terms of productivity. In general, the model predicts that observability of a worker's productivity and the extent of match specificity are key features of labor market segmentation.

Observability of workers' productivity and match specificity are heavily dependent on firm size and complexity of technology. According to the dualism by Doeringer and Piore (1971), the primary sector is generally large in size and uses a more complex technology so that it shares the characteristics of lower observability of workers' productivity and high leverage of match specificity. In contrast, the secondary sector operates in a small scale unit with simple technology, where workers' productivity is easily visible and, because tasks more often depend on physical rather than mental energy, match specificity is not important.

Taking into consideration the fact that much of different market performances of the primary and secondary sectors reflect the extent to which internal labor markets are operating within firms, the model offers valuable empirical implications regarding the patterns of quantity and price adjustments under the influence of internal labor

market. First, long-term employment relations are common in internal labor markets. According to the model, at least three distinct factors contribute to the efficacy of long-term employment relations in internal labor markets: the increased opportunities to invest in firm-specific human capital; the enhanced ability to make an accurate assessment of workers' productivity; and the sorting of good workers. Second, unemployment would not be a transitory and temporary state with segmentation of labor markets. The hysteresis effect causes unemployment to concentrate on a certain group of workers with greater past experiences of unemployment, and they suffer a higher incidence of unemployment. Finally, an efficient wage incentive scheme would be more prominent in internal labor markets.⁷⁾ In addition, increasing wage profile over tenure would be a common observation in internal labor markets as their tasks involve more investment in human capital and bring about larger amounts of rent.

In conclusion, this paper stresses that the conventional analysis based on the assumption of a spot-labor market encounters difficulties in characterizing the functioning of labor markets, for it overlooks various aspects concerning information structures and, more importantly, past and current states of work experiences. Unemployment, in particular, proves to be very sensitive to shocks and history dependent. It indicates that, to make studies on labor markets more conclusive, researchers should direct their attention more to history and labor market institutions of both societies and individuals rather than to the 'market' in an abstractive sense.

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7) Bulow and Summers (1986) and Esfahani and Salehi-Isfahani (1989) adopt the efficiency wage theory to develop the models of the dual labor market. According to their models, efficient wages in the primary sector replaces the threat of unemployment pool with the threat of having to work in the secondary sector where wages are lower.

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