Pecuniary Mobility Costs in a Two-Sector Model

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This paper develops a dynamic model of the labor market with a union sector and a nonunion sector in which workers who switch sectors have to bear pecuniary mobility costs. With pecuniary costs of workers, there exists a range of equilibria. And the size of the equilibrium range positively depends on pecuniary costs. When a shock is small, workers do not migrate and the wage rate alone absorbs the effects of the shock. The model also shows that a favorable spot sector-specific shock can increase not only unemployment but wage rates and that the economy needs more time to fully accomplish the adjustment process in response to a shock due to pecuniary mobility costs. (*JEL* Classification: J62)

I. Introduction

In constructing segmented labor market models where both a unionized sector and a nonunionized spot sector coexist and where workers are mobile between them, it is generally assumed that labor mobility is not perfect. The source of imperfect labor mobility is either time costs due to time-consuming mobility or pecuniary costs due to setup costs.[1]

Time-consuming labor mobility assumes that workers who switch sectors must be idle for one period in order to be productive in the new sector. There can be several interpretations for this assumption: (i) labor market search takes time since it sometimes involves movement

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[1]In some two-sector models, workers can only migrate in one direction, that is from the nonunion sector to the union sector. See McDonald and Solow (1985) for this type of model.

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in space (technology of location), (ii) since new jobs require training, new migrants are not productive during that period (the training period), and (iii) new workers require construction of physical capital (investment) that takes one period to build, as adapted from the study by Kydland and Prescott (1982). Lucas and Prescott (1974), Rogerson (1987), Hamilton (1988), and Davis and Haltiwanger (1990) are among those who emphasize time-consuming labor mobility.

This assumption, however, seems to be arbitrary and inappropriate to the labor market which consists of both a union sector and a nonunion sector. First, the sectoral relocation discussed in this paper does not involve spatial separation. That is, the union sector and the nonunion sector may coexist in the same site and thus workers can switch sectors without spatial movement. Second, if mobility costs arise from the search activity or the training period, it is not reasonable to assume that all workers must spend one period of unemployment, irrespective of the direction of migration. Workers do not need to forego one period when they leave the union sector for nonunion spot sector employment since they can always find jobs in the spot sector. This paper, therefore, incorporates the second source of imperfect labor mobility, pecuniary costs, in the model.

The two-sector model developed in this paper shows that the incorporation of pecuniary mobility costs yields implications that are different from the model using other source of imperfect mobility. First, whereas the model with other mobility costs obtains a unique equilibrium, the introduction of pecuniary costs makes the model fail to have a unique intersectoral equilibrium. Instead, there exists a range of equilibria since workers do not respond to shocks if their impacts fall short of the threshold level. And rising pecuniary mobility costs reduce labor mobility and make the equilibrium range wider. Second, although spot sector-specific shocks are favorable, they may increase the rate of unemployment as well as wage rates, by preventing workers from changing sectors. That is, unemployment may rise without sectoral relocation, contrary to the previous sectoral analyses which assume time-consuming labor mobility. The model also shows that the pecuniary costs makes the economy need more time until a new equilibrium is restored after a shock.

The rest of this paper is organized as follows: Section II constructs a basic model and introduces pecuniary mobility costs. Section III describes some implications of the two-sector model with pecuniary costs, including the range of equilibriua and effects of sector-specific

shocks. Section IV concludes the paper.

II. The Model

A. The Basic Model

The dynamic model of the labor market with both a union sector and a nonunion spot sector, constructed by Hahn (1992), assumes that firms incur quadratic adjustment costs of employment and that homogeneous workers can freely change sectors. It can be summarized by equations (1) through (5): for $j = 0, 1, 2, \ldots,$

$$L_{1t+j} = \lambda_1 L_{1t+j-1} - \frac{\lambda_1}{c_1} \sum_{i=0}^{\infty} \left(\frac{1}{\lambda_2} \right)^i E_{t+j}[W_{2t+j+i} - \theta_{1t+j+i} - a_1], \tag{1}$$

$$W_{1t+j} = x(a_1 + \theta_{1t+j}) + (1 - x)W_{2t+j} - \frac{x}{2}(b_1 + c_1)L_{1t+j} + xc_1\left(L_{1t+j-1} - \frac{L_{1t+j-1}^2}{2L_{1t+j}} \right), \tag{2}$$

$$N_{2t+j} = \gamma_1 N_{2t+j-1} - \frac{\gamma_1}{c_2} \sum_{i=0}^{\infty} \left(\frac{1}{\gamma_2} \right)^i E_{t+j}(W_{2t+j+i} - \theta_{2t+j+i} - a_2), \tag{3}$$

$$N_{1t+j} + N_{2t+j} = L_{1t+j} + U_{t+j} + N_{2t+j} = \overline{N}, \tag{4}$$

$$V_t = \text{Max}\left\{ \frac{L_{1t}}{N_{1t}} V_{1t} + \left(1 - \frac{L_{1t}}{N_{1t}} \right) V_{1t}^u, V_{2t} \right\}, \tag{5}$$

where L_1 is union sector employment, N_2 is spot sector employment, W_1 is the union sector wage rate, W_2 is the spot sector wage rate, U is unemployment, N_1 is the size of the union sector (that is, $L_1 + U$), $\overline{N}$ is the total labor supply, θ_1 is the technological shock which is union sector-specific, θ_2 is the technological shock which is spot sector-specific, x is the relative bargaining power of a union, a's, b's, c's, λ's, and γs are positive parameters. And V_1 is the expected value for a worker when he is employed in the union sector, V_2 is the expected value in the spot sector, and V_1^u is the expected value of an unemployed worker.

Equations (1) and (2), obtained by the dynamic Nash bargaining process, determine employment and the wage rate of the union sector and equation (3) is a conventional dynamic demand equation of a spot sector firm. Equation (4) states the labor endowment condition and equation (5) is the worker's decision problem to choose a sector and eventually leads to the intersectoral equilibrium condition (see Appen-

dix for the model setup and the derivation of these equations).[2]

B. Introducing Pecuniary Mobility Costs

It is assumed that workers have to bear some pecuniary costs to switch sectors. These pecuniary mobility costs consist of moving, search, and training costs, and are assumed to be entirely paid by a worker.[3] Furthermore, the costs when a worker moves from the spot sector to the union sector (h_1) tend to be higher than the costs from the union sector to the spot sector (h_2). Thus it is assumed that $h_1 \geq h_2$ and that they are constant over time.[4]

With pecuniary costs of workers, equation (5) should be modified while the other equations remain unchanged. In each period, workers should decide whether to join the union sector or the spot sector. Unlikely the case without pecuniary mobility costs, however, union sector and spot sector workers have different problems. In other words, union sector workers solve the following optimization problem:

$$\hat{V}_{1t} = \text{Max}\left\{\frac{L_{1t}}{N_{1t}} V_{1t} + \left(1 - \frac{L_{1t}}{N_{1t}}\right) V_{1t}^{u}, V_{2t} - h_2\right\}, \tag{6}$$

where the first part of the bracket is the expected value of remaining in the union sector and the second part is that of moving to the spot sector.

Similarly, the optimization problem of spot sector workers is

$$\hat{V}_{2t} = \text{Max}\left\{\frac{L_{1t}}{N_{1t}} V_{1t} + \left(1 - \frac{L_{1t}}{N_{1t}}\right) V_{1t}^{u} - h_1, V_{2t}\right\}, \tag{7}$$

where the first part of the bracket is the expected value of moving to the union sector and the second part is that of remaining in the spot

[2]Because the two arguments in equation (5) should be equal in order for workers not to have incentives to switch sectors, the intersectoral equilibrium condition when workers do not bear mobility costs at all, by using the definitions of value functions, reduces to

$$\frac{L_{1t+j}}{N_{1t+j}} W_{1t+j} + \left(1 - \frac{L_{1t+j}}{N_{1t+j}}\right) y = W_{2t+j}, \quad j = 0, 1, 2, \ldots$$

[3]Note that Diamond (1981) assumes that these setup costs are equally divided between a worker and a job through the negotiation.

[4]The case in which they vary over time and a worker must forego one period's wage to change sectors implies that $h_{1t} = W_{1t}$ and $h_{2t} = W_{2t}$.

sector.

III. Implications

A. The Range of Equilibria

Without pecuniary mobility costs, workers respond to all shocks however small they are, because no costs are imposed in responding to the shocks. Workers may subsequently return to the other sector after a period of being in any one sector. This implies that there always exists a unique intersectoral equilibrium. However, this is always not the case when switching sectors imposes pecuniary costs on workers. For union sector workers, they remain in the union sector if the net increase in expected returns from moving to the spot sector is smaller than mobility costs:[5]

$$V_{2t} - \left\{\frac{L_{1t}}{N_{1t}} V_{1t} + \left(1 - \frac{L_{1t}}{N_{1t}}\right) V_{1t}^{u}\right\} \leq h_2. \tag{8}$$

But they move to the spot sector if the former is greater than the latter. Similarly, spot sector workers remain in the spot sector if

$$\frac{L_{1t}}{N_{1t}} V_{1t} + \left(1 - \frac{L_{1t}}{N_{1t}}\right) V_{1t}^{u} - V_{2t} \leq h_1, \tag{9}$$

and move to the union sector otherwise.

In terms of technological shocks (θ_{it}), there will be a flow of workers if shocks satisfy the following condition:

$$|\theta_{it}| > \theta_{it}^{*} > 0, \; i = 1 \text{ or } 2. \tag{10}$$

More specifically, when $i = 1$, spot sector workers move to the union sector if $\theta_{1t} > \theta_{1t}^{*}$ and union sector workers move to the spot sector if $\theta_{1t} < -\theta_{1t}^{*}$. No movement takes place if $-\theta_{1t}^{*} \leq \theta_{1t} \leq \theta_{1t}^{*}$. Similarly, union sector workers move to the spot sector if $\theta_{2t} > \theta_{2t}^{*}$ and spot sector workers move to the union sector if $\theta_{2t} < -\theta_{2t}^{*}$. No movement takes place if $-\theta_{2t}^{*} \leq \theta_{2t} \leq \theta_{2t}^{*}$.

The threshold value θ_i^{*} is an increasing function of pecuniary costs and obviously $\theta_1^{*} \geq \theta_2^{*}$ since $h_1 \geq h_2$. As h_i becomes greater, so is the threshold value and fewer workers will switch sectors, given the shock.

[5]It is assumed that workers do not switch sectors when the net returns equal the mobility costs.

Rising pecuniary costs tend to reduce labor mobility and the economy approaches the one where the two sectors are isolated.

This can be represented in an alternative way. Let $\varepsilon_t = \theta_{1t} - \theta_{2t}$.[6] Then spot sector workers move to the union sector when $\varepsilon_t > \varepsilon^{max} > 0$ and union sector workers move to the spot sector when $\varepsilon_t < \varepsilon^{min} < 0$. There will be no movement when $\varepsilon^{min} \leq \varepsilon_t \leq \varepsilon^{max}$.

If θ_{1t} and θ_{2t} are normally distributed with zero means, ε_t is also normally distributed with zero mean. Let the probability that workers move in either direction be q, then the probability that no movement takes place is

$$1 - q = \phi\left(\frac{\varepsilon^{max}}{\sigma}\right) - \phi\left(\frac{\varepsilon^{min}}{\sigma}\right), \tag{11}$$

where ϕ is the cumulative standard normal distribution function and σ^2 is the variance of ε_t.

All these arguments imply that, with pecuniary costs, workers will not switch sectors unless shocks are so large that extra benefits from switching sectors are greater than costs and that multiple equilibria (a range of equilibria) in which the economy is characterized by the inertia may exist. The size of the equilibrium range depends on pecuniary costs and is an increasing function of the costs. Within the range, either N_1 or N_2 does not vary.

Under these circumstances, workers are not able to exploit every opportunity to take a better job in the other sector. If the government can reduce pecuniary costs without incurring any other costs, the equilibrium range would be narrowed and more workers could migrate to the sector providing higher present value for them.

B. Effects of Various Types of Shocks

The next interesting result from the model is that the response of the economy depends upon whether the shock is union or spot sector-specific.[7] First let us consider the case in which the shock is union sector-

[6]When two types of sector-specific shocks are realized simultaneously, a positive ε_t implies that the net effect of shocks is relatively favorable to the union sector (or relatively unfavorable to the spot sector). The case in which only one type of sector-specific shock is realized at one time is obtained by simply setting either θ_{1t} or θ_{2t} to zero.

[7]In this model, even an aggregate shock produces a change in the unemployment rate since one of the two conditions mentioned by Abraham and Katz (1986) is violated. The two sectors in this paper are asymmetric in their sensitiv-

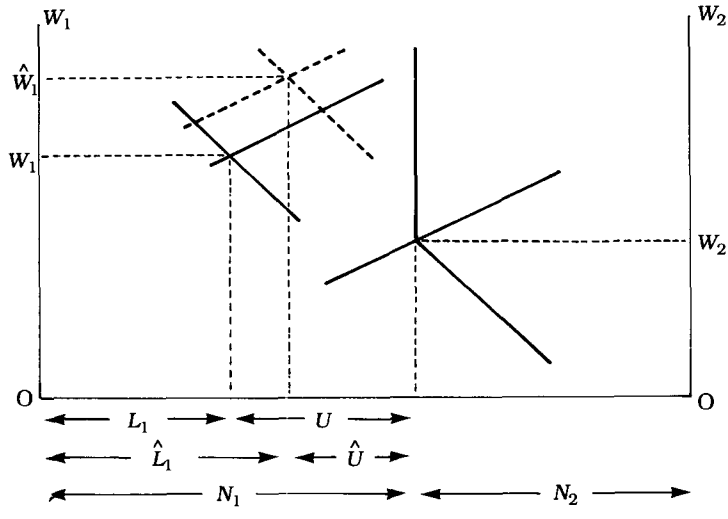

FIGURE 1
EFFECTS OF A FAVORABLE UNION SECTOR-SPECIFIC SHOCK

specific. If the favorable shock is smaller than the threshold value θ_1^*, then the effect of such a shock will be absorbed entirely by the union sector because there is no inflow of workers from the spot sector. The union sector wage rate and employment level will increase without affecting the spot sector wage rate and employment. Thus N_1, N_2, and W_2 do not change while L_1 and W_1 rise to $\hat{L}_1$ and $\hat{W}_1$ respectively as Figure 1 shows. As a consequence, the unemployment rate falls, the overall wage rate rises, and the differential between the two sectors' wage rates widens.

Now suppose that the favorable shock is spot sector-specific and that it is also smaller than the threshold value θ_2^*. The labor supply to the spot sector is invariant as in Figure 2 because there is no inflow of union sector workers into the spot sector. The shock puts upward pressure only on the spot sector wage rate, resulting in $\hat{W}_2$, whereas the level of spot sector employment is the same as that before the shock. On the other hand, the union sector wage rate rises to $\hat{W}_1$ due to the spillover effect from the spot sector and thus employment falls to $\hat{L}_1$.

A couple of points are noteworthy from this result. The first is that

ity to shocks and thus the aggregate shock causes sectoral relocation of the labor force.

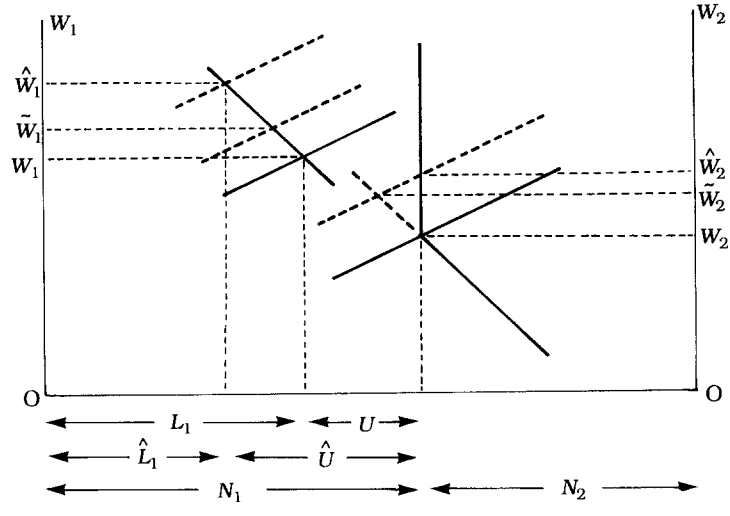

FIGURE 2
EFFECTS OF A FAVORABLE SPOT SECTOR-SPECIFIC SHOCK

the economy as a whole experiences not only rising unemployment (from U to $\hat{U}$) but also increasing wage rates, that is stagflation. The second point is that an increase in unemployment rates can be brought about by favorable shocks if they are spot sector-specific. This happens because the sectoral relocation of the work force does not take place and thus the spot sector fails to hire unemployed workers in the union sector. This result sharply contrasts with the previous sectoral analyses adopting the assumption of time-consuming labor mobility, which attribute increases in unemployment to the sectoral relocation in response to shocks.

Finally, the insulation of workers induced by pecuniary costs also implies that the economy needs more time to fully accomplish the adjustment process in response to a shock. Without mobility costs, the migration of workers and the varying wage rates would share the impact of the shock. However, high pecuniary costs prohibit workers from changing sectors, making the wage rate alone absorb the whole impact of the shock. Therefore the magnitude that wage rates fluctuate will be greater and the time that they require to achieve a new steady state equilibrium will be longer than those without pecuniary mobility costs. In Figure 2, for example, $\tilde{W}_1$ and $\tilde{W}_2$, lower than $\hat{W}_1$ and $\hat{W}_2$ respectively, are the wage rates that would be without pecuniary costs.

IV. Conclusion

The incorporation of pecuniary mobility costs in a two-sector model has been shown in this paper to yield a range of equilibria whose size is positively related to pecuniary costs. It was demonstrated that the range of equilibria could be narrowed if pecuniary mobility costs were successfully cut down. The presence of pecuniary costs has also implied that the unemployment rate rises together with wage rates if sufficiently small shocks are spot sector-specific. Sectoral relocation of workers can also be caused by an aggregate shock as well as a sector-specific shock in this model due to the asymmetry of sectors.

This paper suggests some prospective direction for future research. For example, if marginal mobility costs of workers are an increasing rather than a constant function of the number of migrants, they might alter some implications of the paper. For this purpose, however, the effort to test the hypothesis that mobility costs are quadratic has to precede the effort to construct a model.

Appendix

In the union sector, employment and the wage rate are jointly determined by the bargaining process between firms and a union. This Nash bargaining maximizes equation (A1), given L_{1t-1}, by determining W_{1t+j} and L_{1t+j}.

$$E_t \sum_{j=0}^{\infty} \delta^j z_{t+j}^{x} \pi_{1t+j}^{1-x}, \tag{A1}$$

where $z_{t+j} = L_{1t+j}(W_{1t+j} - W_{2t+j})$,

$$\pi_{1t+j} = (a_1 + \theta_{1t+j})L_{1t+j} - \frac{b_1}{2} L_{1t+j}^2 - W_{1t+j} L_{1t+j} - \frac{c_1}{2}(L_{1t+j} - L_{1t+j-1})^2,$$

and δ is a discount factor satisfying $0 < \delta < 1$. z_{t+j} is the union's utility function and π_{1t+j} is the profit function of a union sector firm. Solving equation (A1) yields equations (1) and (2).

In the nonunion spot sector, wage rates are perfectly flexible. Thus the spot sector's representative firm maximizes the present value of profits (A2), with a given wage rate, by choosing the optimal level of employment.

$$E_t \sum_{j=0}^{\infty} \delta^j \pi_{2t+j}, \tag{A2}$$

where $\pi_{2t+j} = (a_2 + \theta_{2t+j})N_{2t+j} - \frac{b_2}{2} N_{2t+j}^2 - W_{2t+j}N_{2t+j}$

$$- \frac{c_2}{2}(N_{2t+j} - N_{2t+j-1})^2.$$

Solving equation (A2) yields a demand for labor equation in the spot sector, say equation (3).

In each period, there are three groups of workers; working in the union sector with W_1, queuing for a job in the union sector with unemployment payments y, and working in the nonunion sector with W_2. The Bellman's equations for these three groups of workers are

$$\begin{aligned}
V_{1t} &= W_{1t} + \delta E_t\left[\max\left\{\frac{L_{1t+1}}{N_{1t+1}} V_{1t+1} + \left(1 - \frac{L_{1t+1}}{N_{1t+1}}\right)V_{1t+1}^u, V_{2t+1}\right\}\right], \\
V_{1t}^u &= y + \delta E_t\left[\max\left\{\frac{L_{1t+1}}{N_{1t+1}} V_{1t+1} + \left(1 - \frac{L_{1t+1}}{N_{1t+1}}\right)V_{1t+1}^u, V_{2t+1}\right\}\right], \\
V_{2t} &= W_{2t} + \delta E_t\left[\max\left\{\frac{L_{1t+1}}{N_{1t+1}} V_{1t+1} + \left(1 - \frac{L_{1t+1}}{N_{1t+1}}\right)V_{1t+1}^u, V_{2t+1}\right\}\right].
\end{aligned} \tag{A3}$$

A worker, who behaves optimally, faces the problem of deciding whether to join the union sector or the nonunion sector. Then the value function for this worker becomes equation (5), where the maximization is over two actions; (i) join the union sector and receive expected value or (ii) join the spot sector and certainly receive V_{2t}.

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