

A THEORY OF WAGE DISPERSION AND JOB MARKET SEGMENTATION*

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Job market segmentation refers to the idea that there tends to be a correlation among high wages, high productivity, high capital intensity, high value added, few quits relative to layoffs, and low labor turnover. This paper develops a model of wage dispersion and job market segmentation based on the very sparse assumption that the only departure from a strictly orthodox neoclassical world consists of wages being sticky in the short run. Implications of the model are explored and discussed.

INTRODUCTION

Wage rigidity is commonly accepted as having important macroeconomic consequences. Indeed, this assumption drives the results of most standard textbook macroeconomic models. While the macroeconomic implications of wage rigidity are fairly well understood, the microeconomic ramifications of this key assumption are less well explored. What does the microeconomic side of a sticky wage economy look like?

The thesis of this paper is that wage dispersion and segmented job markets are the natural microeconomic counterpart to a Keynesian macroeconomy of fluctuating aggregate demand with sticky wages. If this viewpoint contains a germ of truth, then dualism may not be due primarily to existing characteristics of the labor force. Rather, it can arise more generally because it plays a functional role in the operation of a fluctuating sticky-wage economy and, in so doing, generates a segmented job structure to which workers are forced to adapt. The model of this paper is very sparse in isolating sharply the pure effects of assuming sticky wages and in single-mindedly driving this lone deviation from strict neoclassical orthodoxy to its extreme logical conclusions. While this approach may be conceptually useful, there is no guarantee, of course, that it accurately represents reality. In actuality, a complicated phenomenon like job market segmentation is likely to have several originating strands.¹

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1. For discussion of some alternative approaches, see the recent papers of Dickens and Lang [1988], Dickens and Katz [1987], Gibbons and Katz [1987], Lang [1987], and the references cited in these papers. Lang explains wage dispersions as the outcome of a search theoretic model where some firms wish to pay higher wages in order to increase the probability that their offer will be accepted quickly. An early

Job market segmentation refers to the commonly perceived view that while job characteristics may differ considerably among firms, the variations tend to be systematically related to each other. A popular "stylized fact" about labor markets holds that the following features of a firm (or their opposite) are correlated:

- 1) higher wages
- 2) greater labor productivity
- 3) more capital intensity
- 4) production of relatively higher-value-added goods
- 5) more layoffs, fewer quits, greater job rationing
- 6) lower turnover in the workforce.

While it is probably more accurate to think in terms of a continuous pattern of segmentation, "dual labor market" proponents tend to dichotomize the job market into a "primary" and a "secondary" sector. "Secondary" jobs are characterized by low productivity, little mechanization, low wages, production of low value-added goods, many quits and few layoffs, high labor turnover, and a host of accompanying sociological characteristics which, it is not difficult to understand, tend to go along with that sort of work environment.

This segmentation phenomenon is sufficiently pronounced to create somewhat of an embarrassment for standard versions of neoclassical distribution theory. An orthodox response is to argue that workers are paid their marginal product but that marginal products can vary among workers. The poorly paid workers simply lack the skills, particularly the "human capital," to make them more productive. (A direct policy implication is that wage differentials could be diminished by training programs that raise the skill level of the low paid workers.)

By comparison, the "dual labor market" approach is somewhat harder to characterize.² Essentially, this theory emphasizes that it is more fruitful to think of wages as being attached to *jobs*, rather than to *workers*. Furthermore, the "good" or "bad" *jobs* are not randomly distributed, but tend to go together in "good" or "bad" *firms*. Discrimination then perpetuates job segmentation by restricting certain workers to secondary firms—not so much

model of price dispersion due to sticky prices was presented by Prescott [1975]. Although Prescott's paper treats issues related to those of the present paper, his model of the allocation of hotel rooms has a very specific structure, which is different from the present model, as are the conclusions.

2. For expositions see Dickens and Lang [1988], Marshall [1979], Cain [1976], Doeringer and Piore [1971].

because they lack education or skills per se, but more because these workers are perceived as having outward characteristics resembling those of other workers in the secondary labor market.

Despite an intriguing flavor of descriptive realism, the dual labor market hypothesis suffers from a lack of overall consistency or completeness. The ultimate origins of job market segmentation are not satisfactorily explained. Discrimination may be a strong motive for bosses, but so, after all, is greed. Reading this literature, one gets the impression that something deeply intrinsic to the economic system, perhaps (it is occasionally hinted) something on the demand side, is intended to be responsible for the persistence of job segmentation. But just what this structural something should be is not always made clear.

The present paper offers a formal model of job market segmentation. The formal driving force behind wage dispersion in the model is uncertainty about the state of aggregate demand and about how tight the overall labor market will be. Less formally, aggregate demand uncertainty in the market stands for various states of worker reliability relative to the wage being paid. In a fluctuating economy where wages do not instantaneously adjust, there is room for the coexistence of a variety of labor recruitment strategies. Some firms will choose to pay high wages, committing themselves simultaneously to high capital intensity and to a reliable supply of labor. Other firms will offer low wages, choosing to operate with cheap labor at low capital intensities while taking a chance on not being able to find workers or hold on to them in a tight labor market. Such secondary employers survive only because they are able to thrust the burden of unstable business on a casual work force. The tradeoff between low unit labor costs and a reliable labor supply results in an equilibrium configuration with a multiplicity of firms offering different wage strategies. It will be shown that such an economy exhibits many of the standard features of job market segmentation that have been described in the literature.

Before going further, I would be remiss if I did not close the introduction with a strong disclaimer. The model of this paper is presented at a high level of abstraction. It constitutes a logical exercise in pushing to its extreme limits the implications of the sparse assumption that sticky wages constitute the only deviation from strict neoclassical orthodoxy. The paper shows that this single deviation can cause a number of features resembling the job market segmentation syndrome. While I feel the basic story being told here is empirically relevant, and captures some of the right "flavor" of

the basic tradeoff between reliability and wages, I do not think it constitutes the only reason for a multidimensional phenomenon like segmented labor markets.³

THE MODEL

The model is based on the following noncooperative "employment game" as a description of an economy. There are a large number of potential player-firms, each of which is able to rent capital and hire labor to produce output. No collusion is allowed. An active player rents one (small) unit of capital at a given rate and announces a wage offer. Then the state of aggregate demand is revealed, and each player-firm chooses how many workers it would *like* to hire. Finally, the fixed supply of labor is allocated: first to the highest wage jobs (until they are all filled up); then to the next highest wage jobs (until they are all taken); and so forth until either all labor is employed or every job vacancy has been filled—whichever comes first. The payoff to a player-firm is output revenue minus labor cost minus capital rental. In (Nash) equilibrium, each player is playing a wage strategy yielding maximum expected payoff, and the configuration of wage strategies is self-sustaining. Due to free exit and entry, in equilibrium there will be zero pure profits. The main issue is to examine the basic properties of this model economy.

Consider the familiar simple, orthodox neoclassical model of production. A uniformly homogeneous good is produced, from uniformly homogeneous capital and labor, by a smooth constant-returns-to-scale production function. When L units of labor are applied to one unit of capital, Y units of output are produced, where

$$(1) \quad Y = f(L)$$

is the relevant production function per unit of capital. By assumption, $f' > 0$; $f'' < 0$; $f'(0) = \infty$; $f'(\infty) = 0$.

The state of aggregate demand in each period is summarized by the positive random variable θ . Purely for analytical convenience, θ is taken to have a discrete distribution.⁴ There are n

3. Perhaps the analysis is more directly relevant as a story about intra- rather than interindustry wage dispersion, or for product markets rather than for factor markets, but I hate to speculate much further on just where such an abstract model ought or ought not be applied.

4. A model with a continuous probability distribution could be treated, but only at the cost of introducing several messy measure-theoretic issues, which are extraneous to the economics of the problem itself.

possible states of the world, indexed by $i = 1, 2, \dots, n$. In state of the world i , θ takes on the value θ_i with positive probability p_i , where $\sum p_i = 1$.

Without loss of generality, suppose that the states of the world are so ordered that

$$(2) \quad \theta_1 < \theta_2 < \dots < \theta_{n-1} < \theta_n.$$

In the simplest interpretation, θ stands for the output price, treated as exogenously determined each period on a world market subject to stationary demand fluctuations. More abstractly, θ is a random variable quantifying the marginal value of labor. In any event, when the labor-to-capital ratio is L and the wage rate is W , the return per unit of capital in state of the world θ is

$$(3) \quad \Pi = \theta f(L) - WL.$$

With a wage rate of W and a demand parameter of θ , the profit-maximizing labor to capital ratio $L(W, \theta)$ must satisfy

$$(4) \quad f'(L(W, \theta)) = W/\theta.$$

Maximum return per unit of capital is then

$$(5) \quad \Pi(W, \theta) \equiv \theta \cdot f(L(W, \theta)) - W \cdot L(W, \theta).$$

At this point of the paper must be introduced the model's only significant deviation from strict neoclassical orthodoxy. The labor market is not in full competitive equilibrium each period because wages are sticky. A firm chooses its wage before the state of demand becomes known and is then stuck with that wage for one period.

From a purely theoretical standpoint, the assumption of sticky wages can be viewed as ad hoc, leaving open as it does the possibility of Pareto-improving trades. I might try to justify assuming sticky wages by appealing to fancy theorems and esoteric jargon. But whether or not sticky wages have been ultimately "explained" in this way, I want to show that the assumption of this widespread feature provides a powerful organizing principle for understanding the phenomenon of job market segmentation.

Because of constant returns to scale, there are no natural boundaries by which a firm can be defined. For the purposes of this paper a firm is just a (small) piece of capital with a wage policy. By assumption, each firm must have a wage policy; that is, it must announce at the beginning of every period the wage which it proposes to pay.

For any fixed wage, other things being equal, there will be less demand for labor when θ is smaller. During such times the high-

wage firms will shed labor to the low-wage firms. The low-wage firm pays less for each worker it is able to hire, but will only be able to obtain workers during recessionary states of the world when the high-wage firms are letting them go. The high-wage firm can obtain workers on demand, but only because it is committed to paying more for them. Thus, there is a basic tradeoff between a low-cost work force and a reliable supply of labor.

With n different discrete values of θ , in equilibrium there will also be n different wage rates. Corresponding to state of the world j is the "cutoff wage"

$$(6) \quad W_j.$$

Any firm paying this wage can obtain as much labor as it wants in state of the world $i \leq j$, but cannot obtain any labor in state of the world $i > j$.

Let r be the prevailing rate of return on capital, most conveniently treated as exogenously fixed. Then, in sticky wage competitive equilibrium the following equation must hold for all $j = 1, 2, \dots, n$:

$$(7) \quad \sum_{i \leq j} p_i \Pi(W_j, \theta_i) = r.$$

It follows almost immediately from (7) that

$$(8) \quad W_1 < W_2 < \dots < W_{n-1} < W_n.$$

Thus, the ordering of cutoff wages (8) is the same as the ordering of corresponding states of the world (2).

It is of special interest to interpret the two extreme values of the cutoff wage. Firms paying the highest wage rate

$$W_n$$

can obtain as much labor as they want in all states of the world. At the other extreme, firms paying the lowest wage rate

$$W_1$$

can obtain labor only in the worst state of the world.⁵

Suppose that there is a fixed supply of labor equal to S .⁶ Let

$$(9) \quad K_j$$

5. The analysis is not materially affected if there is some sociologically or politically determined "minimum wage." In that case only the cutoff wages above the exogenously given minimum are relevant. Unemployment occurs in states of the world corresponding to cutoff wages below the minimum.

6. The case of elastically supplied labor can be analogously treated, but only at some cost in terms of expositional and analytical simplicity. The reader should get a sense of what modifications are necessary from the later treatment of a "step function" supply curve where no labor is supplied below a given minimum wage and a fixed amount is available above the minimum wage.

represent the amount of capital (or the number of firms) committed to paying the fixed wage

$$W_j.$$

In sticky wage competitive equilibrium, the following equation must then hold for all $j = 1, 2, \dots, n$:

$$(10) \quad \sum_{i \geq j} K_i L(W_i, \theta_i) = S,$$

where $L(W, \theta)$ is defined by equation (4).

A *sticky wage stochastic competitive equilibrium* is any set of positive wage and capital values (6) and (9) simultaneously satisfying conditions (7) and (10) for all j . The arguments needed to justify this concept are exactly analogous to the arguments that would be made to justify the concept of competitive equilibrium in the present setting for the deterministic case. The concept of a sticky wage stochastic competitive equilibrium is intended to be an analytically convenient polar representation of long-run structural tendencies in a competitive economy characterized by wage stickiness and extreme stationarity of demand fluctuations.

While the primary emphasis in the model is on the phenomenon of job market segmentation, a more general interpretation is possible. The more abstract formulation might even be considered more appropriate when applied to some other situations, since labor markets are notoriously impure and complicated in practice. I have in mind product market applications such as, perhaps, independent oil refiners or different classes of electricity users.

Under the more general interpretation, there is a fixed total supply S of some divisible commodity L , whose monetary value to each identical consumer or user is

$$(11) \quad \theta f(L),$$

where θ is some positive random variable with the known discrete distribution previously described.

For a fixed hookup fee of r , a potential consumer or user can enter into a contract entitling the buyer to purchase with probability

$$(12) \quad q_j \equiv \sum_{i \leq j} p_i$$

(i.e., in all states of the world $i \leq j$) as much as desired of the generalized commodity at a unit cost of W_j . For states of the world $i > j$, no amount of the commodity is delivered on this contract of

type j . In equilibrium, there will be K_j consumers of contract type j , and consumers in the economy are indifferent between each contract, including the null option of not hooking into any contract at all.

Among the contracts, there is a tradeoff between greater reliability of supply (higher q) and greater unit cost (higher W). The task of the present paper can be interpreted as analyzing the exact nature of the tradeoff between W and q in an equilibrium contract.

While the main interpretation of this paper uses the terminology of job market segmentation, it should be borne in mind that the model actually describes what is generically a much broader situation and may, in fact, be a more appropriate description of some other markets.

SOME FORMAL PROPOSITIONS

THEOREM 1 (existence). There exists a unique sticky wage stochastic competitive equilibrium.

Proof. That each equation of (7) solves for a positive cutoff wage having the appropriate ordering (8) is almost immediate, given the definition of a profit function (5).

The proof that (10) has a positive solution in capital values is by backwards induction on j . The equation (10) corresponding to $j = n$ obviously yields a positive solution for

$$K_n.$$

Suppose for some integer j' between n and 1 that it has been established that there exist positive values of

$$\{K_j\}$$

satisfying equation (10) for all integers j between n and j' . Then it will be proved by induction that the same proposition holds for $j' - 1$.

First, rewrite (10) as

$$(13) \quad S - \sum_{i \geq j'} K_i L(W_i, \theta_j) = 0.$$

Next, observe that from (2) it follows that

$$(14) \quad L(W_i, \theta_{j-1}) < L(W_i, \theta_j)$$

holds for all i .

Now define

$$(15) \quad K_{j'-1} \equiv \frac{S - \sum_{i \neq j'} K_i L(W_i, \theta_{j'-1})}{L(W_{j'-1}, \theta_{j'-1})}.$$

From (13) and (14), expression (15) is positive. By construction, equation (10) holds for $j = j' - 1$.

Q.E.D.

At this stage it is useful to compare the wage structure generated by a sticky wage stochastic equilibrium with the completely flexible wage that would be generated by an ideal, perfectly adjusting, fully competitive labor market. Let

$$(16) \quad W_i^*$$

stand for the ideal, perfectly competitive wage in state of the world i , for all $i = 1, 2, \dots, n$.

Let

$$(17) \quad K^*$$

stand for the expected-profit-maximizing fixed capital stock in such a perfectly competitive environment.

Then it must hold that

$$(18) \quad L(W_j^*, \theta_j) = S/K^* \quad \text{for all } j = 1, 2, \dots, n$$

and

$$(19) \quad E\Pi(W_i^*, \theta_i) \left(\equiv \sum p_i \Pi(W_i^*, \theta_i) \right) = r.$$

Conditions (18) and (19) form $n + 1$ equations, which define the $n + 1$ unknowns (16) and (17).

Note that from the definition of the profit function (5), and from (18), (19), it follows that

$$(20) \quad \Pi(W^*, \bar{\theta}) = r,$$

where

$$(21) \quad W^* \equiv EW_i^* = \sum p_i W_i^*$$

is the average competitive wage and

$$(22) \quad \bar{\theta} \equiv E\theta_i = \sum p_i \theta_i$$

is the average value of the aggregate demand parameter.

Finally, let

$$(23) \quad \bar{W} \equiv \frac{\sum_j p_j \sum_{i \geq j} W_i K_i L(W_i, \theta_j)}{S}$$

stand for the average wage being paid under a sticky wage stochastic competitive equilibrium.

The following result provides some basis for comparing the wage structure generated by a sticky wage stochastic equilibrium with the wage structure that would be generated by an ideal, perfectly adjusting, fully competitive labor market.

THEOREM 2.

$$(24) \quad W_n > W^* > \bar{W}.$$

Proof. From the convexity of the profit function, it follows that

$$(25) \quad \sum p_i \Pi(W, \theta_i) > \Pi(W, \bar{\theta})$$

for all W .

But from (7),

$$(26) \quad \sum p_i \Pi(W_n, \theta_i) = r.$$

Combining (25) with (26) yields

$$(27) \quad r > \Pi(W_n, \bar{\theta}).$$

Combining (27) with (20) yields

$$(28) \quad \Pi(W^*, \bar{\theta}) > \Pi(W_n, \bar{\theta}).$$

From the definition of a profit function, (28) can hold only if

$$(29) \quad W_n > W^*,$$

which proves the first half of (24).

Let

$$(30) \quad Y_i^*(K) = \theta_i K f(S/K)$$

be the profit-maximizing perfectly competitive value of output in state of the world i as a function of total fixed capital stock K .

Since K^* defined by (17) is in effect being chosen to maximize over K

$$(31) \quad \sum p_i Y_i^*(K) - rK,$$

it follows that

$$(32) \quad W^* = \frac{\sum p_i Y_i^*(K^*) - rK^*}{S}$$

maximizes the expected return to labor over all possible labor and fixed capital allocations.

Because the average wage defined by (23) is merely one particular realization of

$$(33) \quad \frac{\sum p_i Y_i - rK}{S} (= \bar{W})$$

attainable with a fixed labor supply S , and one that is clearly Pareto inefficient, it follows that

$$(34) \quad W^* > \bar{W},$$

which completes the proof.

Q.E.D.

The following result gives some insight into how the distribution of sticky wages depends on the distribution of θ .

THEOREM 3. A mean-preserving spread of θ increases W_n .

Proof. Let

$$\{\theta'_i, p'_i\}$$

represent a mean-preserving spread of

$$\{\theta_i, p_i\}.$$

From convexity of the profit function, it follows that

$$(35) \quad \sum p'_i \Pi(W, \theta'_i) > \sum p_i \Pi(W, \theta_i)$$

for all $W > 0$.

From (7),

$$(36) \quad \sum p'_i \Pi(W'_n, \theta'_i) = r = \sum p_i \Pi(W_n, \theta_i).$$

Since the profit function (5) is monotone decreasing in W , it follows from (35) and (36) that

$$(37) \quad W'_n > W_n,$$

the proposition to be proved.

Q.E.D.

PROPERTIES OF A STICKY WAGE STOCHASTIC COMPETITIVE EQUILIBRIUM

The model suggests that systematic labor allocation patterns are likely to arise among firms in a fluctuating, sticky wage economy and that these patterns are largely independent of any initial distribution of work skills. The high-wage "primary" firms will exhibit a more stable employment history, producing more of their higher value added output during good times and less during bad times (when workers are laid off), always choosing to utilize relatively more capital per unit of labor, which results in higher labor productivity; furthermore, primary jobs are rationed. The low-wage "secondary" firms will demonstrate a more pronounced cyclical employment pattern, hiring more labor per unit of capital when they can get it during periods of limited demand, producing their relatively cheap output at low labor productivity, while having their work force leave during upswings to take on jobs at the better paying firms. Thus, during relatively good times the economy as a whole exhibits wage structure compression around a higher average wage and cyclical upgrading of jobs.⁷

Naturally a simple model like this greatly exaggerates certain structural tendencies. But, presumably, the introduction of more realistic features might dampen the tendencies highlighted by the model without eliminating them altogether. Note that wage dispersion in this model results from a combination of wage stickiness and demand fluctuations. Neither feature alone could produce wage dispersion. If wages were perfectly flexible, they would adjust each period to equate marginal products and instantaneously clear the labor market for any state of aggregate demand. In the long-run equilibrium of a stationary deterministic environment, on the other hand, it would make no difference if wages displayed some stickiness, since there would be no need for rapid adjustments.

The model does not formally display unemployment, but that is in part an artifice caused by the assumption that unemployed

7. There is some evidence for this; see, e.g., Okun [1973].

workers will take any job no matter how low paying. Suppose, instead, that labor supply is a step function, i.e., there is some minimum wage, say W , below which no one takes a job. Then, it is readily determined, the entire theory goes through except that all cutoff wages in equation (7) below the minimum are eliminated and the corresponding capital stock amounts of equation (10) are set equal to zero. Thus, (7) and (10) hold for values of j with cutoff wages W_j greater than W . Now all states of the world whose corresponding cutoff wages are below the minimum will exhibit some unemployment, with greater unemployment showing for lower values of the demand parameter θ . Unemployed workers would like to have the higher-than-minimum-wage jobs that are being voluntarily offered to other, more fortunate, individuals, but such jobs are not universally available. Thus, the unemployed worker experiences the frustration of being involuntarily turned into a disenfranchised outsider who is arbitrarily denied the job opportunities at good wages that others are somehow able to obtain.

So far nothing has been said about which workers get rationed the higher paid jobs and which get the lower paid jobs (or no jobs at all in the case of a minimum wage). Without yet inquiring deeply into where it comes from, suppose for the sake of argument that there exists some ranking or labeling system. In any bilateral choice facing the firm, the worker with a higher label is employed before and laid off after the worker with a lower label.

I want to indicate how easy it is for a number of "natural" labeling systems to become dangerously self-fulfilling, resulting in a segmented labor market. Suppose, for example, that workers are ranked by their average productivity in previously held jobs. Then those individuals labeled as "high-productivity workers" will be first offered the high-paying, high-productivity jobs and will in fact become "high-productivity workers." Conversely, anyone labeled as a "low-productivity worker" will be the last hired and first fired from the high-paying jobs and will in fact become a "low-productivity worker." Labeling systems that rank workers by their experience with equipment, or their average wages received in previous employment are similarly self-fulfilling. If workers are ranked by their turnover record, or their ability to maintain primary sector jobs, that too becomes a self-fulfilling labeling system.

The implication of this, I believe, is not that productivity differences do not exist among different groups of workers, but rather that the economic system itself may have an inherent tendency to magnify such differences out of proportion to their

actual relevance. In this view of labor market segmentation, the wages paid to a worker may look as if they are related to his or her productivity, but in fact they may bear very little relation to true productivity. The labor market segmentation is arising more generally as an intrinsic structural feature of a "Keynesian" economy with sticky wages and fluctuating demands.

How "realistic" is the present model? This is a difficult question to answer. The model is formally capturing a large number of stylized facts about labor market segmentation, wage dispersion, and cyclical behavior of labor markets. And it seems to have the right flavor of the basic tradeoff between wages and reliability, at least for some instances. But at the same time the model is pitched at such a high level of abstraction that it is difficult to know operationally how to distinguish it from other explanations at a similarly high level of abstraction. It does strain credulity to think of the major difference between McDonalds and General Motors as being that McDonalds is essentially producing at low cost during down periods. Clearly there are other effects at play. The analysis probably has more to do with intraindustry than interindustry wage differences. One thinks of a stylized comparison between Hewlett-Packard and Texas Instruments as perhaps suggestive of the kind of story being told here. Hewlett-Packard basically hires flexible high-cost labor that can be relied upon to move up the product lifecycle rapidly. Texas Instruments, by comparison, tends to hire dedicated lower cost labor that fluctuates more. Both personnel strategies are viable, and indeed they can coexist in the same industry.

REDUCING LABOR MARKET SEGMENTATION

The model suggests several policy alternatives for dealing with dualism. Note, though, from Theorems 2 and 3, that while a sticky wage stochastic competitive equilibrium is inefficient, and hence lowers the average wage below what would be possible in an ideal allocation, it raises wages in the primary labor market. The high wage primary sector workers would thus generally be hurt by elimination or even reduction of labor market segmentation and might therefore not be favorably disposed to such changes.

One policy that would probably *not* be terribly effective in the context of this type of world is manpower training. The essence of the segmentation problem here does not center on any differences in skills, so that remedial efforts aimed at this aspect would at best have only indirect effects.

A partial approach that attacks some symptoms of labor market segmentation, but without really eliminating the central inefficiency, is to reverse the rankings of the labeling systems described in the previous section. If the lowest paid, least mechanized, lowest productivity, highest turnover workers were hired first and fired last, that would tend to break up the segmentation, at least in the context of the present model. At this stage such ideas do not seem very practical, although some "reverse discrimination" schemes might in principle have the effect of unscrambling traditional rankings.

Finally, I want to touch upon an unusual "solution" of sorts that has been proposed for reducing Keynesian unemployment in a more aggregative setting.⁸ The point of departure for this approach is the observation that job market segmentation is arising in the present model from pay parameter stickiness in a very specific, if widespread, form of labor contract—namely the wage system. A "share contract," by comparison, would tend to reduce or eliminate segmentation even when its parameters are sticky.

Consider, for concreteness, a pure revenue-sharing or value-added-sharing form of contract. If λ is the sticky share parameter and L units of labor are hired in state of the world θ , then each worker is paid

$$(38) \quad [\lambda\theta f(L)]/L.$$

With such sharing contracts, it is not difficult to show that there will be excess demand for labor in the sense that the firm would always like to hire more workers but is limited by the inability to obtain more of them on the given contract.⁹

Suppose that instead of agreeing beforehand to pay a fixed wage as was previously analyzed, each unit of capital commits itself to paying some share λ of total revenues to labor; the parameter λ is individually selected to maximize profits given the values that every other unit of capital is selecting. After the sticky share parameters are chosen, the workers allocate themselves, first to the highest remuneration jobs, then to the next highest, etc., until each worker's pay is equalized across every firm.

It is tedious but not difficult to show that the unique sticky share stochastic competitive equilibrium satisfies

$$(39) \quad \frac{\lambda^*\bar{\theta}f(S/K^*)}{S/K^*} = W^*.$$

8. See, e.g., Weitzman [1983, 1985].

9. These features are more fully explained in Weitzman [1983, 1985].

In other words, a sticky share competitive equilibrium attains the same allocation as a frictionless wage system by hiring K^* units of capital and paying each worker the competitive wage,

$$(40) \quad W_i^* = \frac{\lambda^* \theta_i f(S/K^*)}{S/K^*} = \frac{\theta_i}{\theta} W^*,$$

in state of the world i .

Another example of a share contract takes the following form. Suppose that each unit of capital commits itself to paying out a total "wage bill" B irrespective of how much labor it hires. If L units of labor are hired, each worker is compensated B/L . The wage bill is individualistically selected by each unit of capital to maximize profits given the values that every other unit of capital is selecting. After the sticky wage bills are chosen, the workers allocate themselves, first to the highest remuneration jobs, then to the next highest, etc., until the wage bill per worker is equalized across every firm. The firm always wishes it could obtain more labor on any given wage bill contract, since its short-run labor costs are in effect fixed irrespective of the number of hires.

It is not difficult to show that the unique sticky wage bill stochastic competitive equilibrium satisfies

$$(41) \quad B = W^* S/K^*.$$

In other words, this deterministic share contract pays every worker in each state of the world the maximum average return to labor W^* .

These examples show that the specific form of the wage contract is crucial to obtaining the inefficient segmentation result when pay parameters are sticky. A share form of labor contract, by comparison with the wage system, tends to reduce the degree of segmentation or, as these two examples demonstrate, eliminates segmentation altogether.¹⁰ A sticky share system reduces the poten-

10. Whether share contracts are institutionally stable for this environment in the sense that they might be expected to arise spontaneously without government intervention depends on the form of the share contract. The pure value-added sharing form of contract discussed in the first example of the text might in principle be expected to arise spontaneously because it automatically pays a high wage to attain workers in good states of nature and a low wage in bad states of the world. On the other hand, the deterministic wage bill used as the second example in the text could not be individualistically sustained because it would always be in the interest of any one firm to pay each worker that same fixed amount of remuneration in the form of a wage and then be able to choose the level of employment. In countries where a bonus with profit-sharing overtones is an important part of the compensation system, i.e., Japan, Korea, and Taiwan, it is often said that there is a more equal distribution of income. To what extent this is due to profit sharing is surely a very difficult question to answer.

tial for job market segmentation because all employers want to retain labor after an adverse shock. There is no advantage in a share system to a low-pay-parameter strategy that survives by picking up cheap layoffs from high paying firms during periods of depressed demand. That kind of strategy makes sense only in the context of a wage system.

SUMMARY

This paper has shown that the combination of sticky wages and fluctuating demand in an otherwise neoclassical setting will tend to cause wage dispersion and job market segmentation. The segmentation phenomenon is driven by the tradeoff between the possibility of obtaining a low-cost work force during periods of weak demand and the option of having a reliable supply of labor at all times.

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