A THEORY OF JOB MARKET SEGMENTATION

by

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comments appreciated.
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Summary

Job market segmentation refers to the idea that there tends to be a correlation among high wages, high productivity, high mechanization, production of expensive goods, few quits relative to layoffs, low labor turnover. This paper develops a theory of job market segmentation based on the very sparse assumption that the only departure from a strictly orthodox neoclassical model consists of wages being sticky in the short run. Implications are explored. The segmentation phenomenon arises generally in a sticky-wage fluctuating economy because of the basic tradeoff between a low-wage policy that can obtain cheap labor during times of weak aggregate demand and a high-wage policy that guarantees a secure labor supply at all times.

Introduction

There is a 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 goods
5) more layoffs and fewer quits
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 cheap 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 embarassment 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. (An obvious policy implication is that wage differentials could be diminished by training programs which raise the skill level of the low paid workers.) As an application of economic theory the "human capital" approach is logical and consistent, although its empirical relevance has sometimes been called into question.

By comparison, the "dual labor market" approach is somewhat harder to characterize. Essentially, this theory holds that wages are attached to jobs, rather than to workers (as neoclassical theory asserts). 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 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 badly from a lack of overall consistency or completeness. The ultimate origins of job market segmentation are never
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 exactly made clear.

The present paper offers a formal model of job market segmentation. The 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. 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 hold workers 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 secure labor supply results in an equilibrium configuration with a multiplicity of firms offering different wages. 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.

The Model

The model is based on the following non-cooperative "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

\[ Y = f(L) \]

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

The state of aggregate demand in each period is summarized by the positive random variable $\theta$. Purely for analytical convenience, $\theta$ is taken to have a discrete distribution. There are $n$ possible states of the world, indexed by $i=1,2,\ldots,n$. In state of the world $i$, $\theta$ takes on the value $\theta_i$ with positive probability $p_i$, where $\Sigma p_i=1$. 
Without loss of generality, suppose the states of the world are so ordered that

\[ \theta_1 < \theta_2 < \ldots < \theta_{n-1} < \theta_n. \]

In the simplest interpretation, \( \theta \) stands for the output price, treated as exogenously determined each period on a world market subject to stationary demand fluctuations. More abstractly, \( \theta \) 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 \( \theta \) is

\[ \Pi = \theta f(L) - WL. \]

With a wage rate of \( W \) and an output price of \( \theta \), the profit-maximizing labor to capital ratio \( L(W, \theta) \) must satisfy

\[ f'(L(W, \theta)) - W/\theta. \]

Maximum return per unit of capital is then

\[ \Pi(W, \theta) = \theta \cdot f(L(W, \theta)) - W \cdot L(W, \theta). \]

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.

The thesis of this paper is that segmented job markets can be viewed as the natural microeconomic counterpart to a Keynesian macroeconomy of fluctuating aggregate demand and wage stickiness. 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.³

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 \( \theta \) 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 laying them off. 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 secure supply of labor.

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

\[
W_j
\]

(6)

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 \( j = 1, 2, \ldots, n \):

\[
\sum_{i \leq j} p_i \Pi(W_j, \theta_i) = r.
\]

(7)

It follows almost immediately from (7) that

\[
W_1 < W_2 < \ldots < W_{n-1} < W_n.
\]

(8)

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.\(^4\)
Suppose that there is a fixed supply of labor equal to $S$. Let

\begin{equation}
K_j \tag{9}
\end{equation}

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 $j=1,2,...,n$:

\begin{equation}
\sum_{i \in j} K_i L(W_i, \theta_j) = S, \tag{10}
\end{equation}

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 only 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.

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

$$q_j = \sum_i p_i$$

(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. In equilibrium, a consumer is indifferent between all of the contracts, including the null option of not hooking into any contract.

Among the contracts, there is some tradeoff between greater reliability of supply (higher $q$) and greater unit cost (higher $W$). The task of this paper is to analyze, in a competitive contract, the exact nature of the tradeoff between $W$ and $q$.

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 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) \[ S - \sum_{i=1}^{n} K_i L(W_i, \theta_j') = 0. \]

Next, observe that from (2) it follows that

(14) \[ L(W_i, \theta_j' - 1) < L(W_i, \theta_j') \]

holds for all i.

Now define

(15) \[ K_{j' - 1} = \frac{S - \sum_{i=1}^{n} K_i L(W_i, \theta_j' - 1)}{L(W_{j' - 1}, \theta_j' - 1)} \]

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

At this stage it is useful to compare the wage structure generated by a sticky wage stochastic equilibrium with the completely flexible wage structure
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 \(i=1,2,\ldots,n\).

Let

\[(17) \quad K^*\]

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

Then it must hold that

\[(18) \quad L(w_i^*, \theta_i) = S/K^* \quad \text{for all } j=1,2,\ldots,n\]

and

\[(19) \quad E \Pi(w_i^*, \theta_i) = \Sigma p_i \Pi(w_i^*, \theta_i) = r\]

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

\[(20) \quad \Pi(W^*, \overline{\theta}) = r,\]

where

\[(21) \quad W^* = E W_i^* = \Sigma p_i W_i^*\]

is the average competitive wage and

\[(22) \quad \overline{\theta} = E \theta_i = \Sigma p_i \theta_i\]
is the average value of the aggregate demand parameter.

Finally, let

\[ \bar{w} = \frac{\sum \pi_j \sum \bar{w}_i K_i L(\bar{w}_i, \theta_i)}{s} \]

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:

\[ W_n > \bar{w} > \bar{w}. \]

**Proof:** From the convexity of the profit function, it follows that

\[ \sum \pi_i \Pi(W, \theta_i) > \Pi(W, \bar{\theta}) \]

for all \( W \).

But from (7),

\[ \sum \pi_i \Pi(W_n, \theta_i) = r. \]

Combining (5) with (26) yields

\[ r > \Pi(W_n, \bar{\theta}). \]

Combining (27) with (20) yields

\[ \Pi(W^*, \bar{\theta}) > \Pi(W_n, \bar{\theta}). \]
From the definition of a profit function, (28) can hold only if

\[(29) \quad \bar{W}_n > \bar{W}^*,\]

which proves the first half of (22).

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 being chosen to maximize

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

it follows that

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

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

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

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

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

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

which completes the proof.
The following result gives some insight into how the distribution of sticky wages depends on the distribution of \( \theta \).

Theorem 3: A mean-preserving spread of \( \theta \) 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

\[
\Sigma p'_i \Pi(W, \theta'_i) > \Sigma p_i \Pi(W, \theta_i)
\]

for all \( W > 0 \).

From (7),

\[
\Sigma p'_i \Pi(W'_i, \theta'_i) = r = \Sigma p_i \Pi(W_n, \theta_i).
\]

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

\[
W'_n > W_n.
\]

the proposition to be proved.

Properties of a Sticky Wage Stochastic Competitive Equilibrium

The model strongly 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 output during good times and
less during bad times when workers are laid off, choosing always to utilize relatively more capital per unit of labor, which results in higher labor productivity. 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 labor force quit during upswings to take on jobs at the better paying firms. 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 any unemployment, but that is in part an artifice caused by the assumption that unemployed workers will take any job no matter how low paying. Suppose there is some minimum wage, determined either by social or political considerations, below which no one takes a job. This assumption is ad hoc, but seems realistic enough in the present context to serve as a point of departure. 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 values of equation
(now inequality) (10) are set equal to zero. 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 $\theta$. Unemployed workers would like to have the higher-than-minimum-wage jobs which 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 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 where it comes from, suppose for the sake of argument there exists some ranking or labeling system. In any bilateral choice facing the firm, the worker with a higher label is employed before and layed 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, 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". Labelling systems which 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 far 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.

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 more central approach might be to better stabilize the aggregate economy, since the labor market segmentation is a by-product of demand fluctuations.

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 labelling 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. 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 a 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

$$\frac{\lambda \theta f(L)}{L}.$$

With such sharing contracts, it is not difficult to show 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.

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 $\lambda$ of total revenues to labor; the parameter $\lambda$ is individualistically 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 in every firm.

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

\[ (39) \quad \frac{\lambda^* \vartheta f(S/K^*)}{S/K^*} - \underline{w}^* \]

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

\[ (40) \quad \underline{w}_i^* - \frac{\lambda^* \vartheta_i f(S/K^*)}{S/K^*} - \frac{\vartheta_i}{\vartheta} \cdot \underline{w}^* \]

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

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. A sticky share system reduces the potential 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 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 secure supply of labor at all times.
References


Endnotes

1 For expositions see Marshall (1979), Cain (1976), Doeringer and Piore (1971).

2 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.

3 For discussion of some alternative approaches, see the recent papers of Dickens and Katz (1987), Gibbons and Katz (1987), Lang (1987), and the references being cited in these papers.

4 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.

5 The case of elastically supplied labor can be analogously treated, but only at some cost in terms of expositional and analytical simplicity.


7 These features are more fully explained in Weitzman (1983, 1985).