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# A Test of Dual Labor Market Theory

By WILLIAM T. DICKENS AND KEVIN LANG\*

This paper presents a test of two of the most important claims of dual market theory—that there is a distinct low-wage (secondary) labor market in which there are no returns to schooling and workers do not receive on-the-job training, and that there are noneconomic barriers that prevent at least some secondary workers from obtaining better (primary) jobs.

Human capital theory has tended to emphasize differences among people, rather than among jobs, as a determinant of the distribution of income. Workers in low-wage jobs are viewed simply as low-productivity workers who are unwilling or unable to obtain the skills that are necessary for access to higher paying jobs. It follows from this approach that the way to eliminate poverty is to provide individuals with more skills, or with incentives to obtain skills.

Dual market theorists have maintained that jobs can be roughly divided into two groups: those with low wages, bad working conditions, unstable employment, and little opportunity for advancement (secondary jobs), and those with relatively high wages, good working conditions and opportunities for advancement into higher paying jobs (primary jobs) (Peter Doeringer and Michael Piore, 1971). Advocates of this view have argued that primary sector jobs are rationed, and that, in particular, women, blacks, and other minorities find it difficult to obtain primary employment. Since, in the view of dual

market theorists (Suzanne Berger and Piore, 1980), it is unlikely that rationing can be eliminated, training programs will not be successful in eliminating poverty and the major roles for policy are providing income support, ensuring that the rationing system is “fair,” and minimizing the extent of the secondary sector by stabilizing aggregate demand.

Despite significant differences in their views of the low-wage labor market, neither the advocates of dual market theory nor its critics have specified potentially conclusive tests of either the dual market typology or the hypothesis of noneconomic barriers to entering the primary sector. Difficulties arise because tests of the dual market hypothesis often rely on circular definitions of the sectors.

We propose strong tests of both hypotheses. Our results provide considerable support for the view that there are two distinct labor markets—a primary labor market with a wage profile similar to that predicted by human capital theory, and a secondary market with a completely flat (low) wage profile. Our results also provide support for the hypothesis that there are noneconomic barriers that prevent nonwhites from entering the primary sector.

In Section I, we review some of the most noteworthy empirical work on dual market theory. In the second section, we outline what we consider to be the essential differences between dual market and human capital theory, and develop a formal test that allows us to distinguish between the two hypotheses. The results are presented in Section III.

## I. A Partial Review of Empirical Work on Dual Market Theory

Although advocates of dual market theory may differ on the particulars, all agree on two basic tenets:

1. The dual market typology described above is a useful characterization—most jobs

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strongly resemble the description of either primary or secondary jobs.

2. At most times there is rationing of primary sector jobs.

A number of attempts have been made to test either or both of these hypotheses.

Studies of the validity of the dual market typology have taken two forms, factor analysis of job and/or worker characteristics, and comparisons of wage equations for different occupations and industries. The authors who have used factor analysis have found a dominant factor fitting the dual market typology and have found bimodal distributions of factor scores (David Gordon, 1971; Robert Buchele, 1976a,b; Gerry Oster, 1979). However, the correlation of certain attributes such as low wages and bad working conditions does not provide strong support for the dual market hypothesis of the existence of sectors with distinct wage-setting mechanisms.

Consequently, some researchers have attempted to test more directly the hypothesis that the wage-setting mechanisms are different in the two sectors. The approach these authors have followed is to divide occupations and/or industries into two sectors on the basis of the characteristics of the jobs, or of workers in those occupations or industries. Having thus divided the sample, they test for differences in the wage equations for the two sectors. Some have found patterns corresponding roughly to dual market theory (Paul Osterman, 1975; M. Carnoy and R. Rumberger, 1980; Buchele, 1976a,b; Samuel Rosenberg, 1976; Eric Wright, 1979); others have found little support for the hypothesis (Lynne Zucker and Carol Rosenstein, 1981; Robert Bibb and William Form, 1977; Randy Hodson, 1977). In addition, none of these studies has been entirely free of anomalies.

Unfortunately, dividing the sample on the basis of occupation or industry has major drawbacks. Since a worker's choice of industry or occupation is not independent of unmeasured characteristics, there is danger of sample selection bias. Often industries and occupations are classified as secondary because they offer low wages. It is not surprising to find that in low-wage jobs the return to schooling is relatively low (Glenn Cain, 1976). In addition, the assumption that

all members of an occupation or industry are in the secondary sector may significantly reduce the power of the test. For example, no one would argue that managers and skilled workers in industries which employ a substantial number of secondary workers are themselves in secondary jobs. It is possible that the anomalous results found in this literature are due to inaccurate classification.

Both the factor analyses and attempts to test for the existence of distinct wage equations for the primary and secondary sectors described above are essentially concerned only with the dual market typology. As noted in the introduction, dual market theorists maintain not only that they have developed an accurate typology but that primary jobs are rationed. In fact, it is the latter position which constitutes the major break with human capital theory.

Several authors have suggested that the existence of distinct wage equations for the primary and secondary sectors would constitute a refutation of human capital theory (Buchele, 1976a,b; Osterman), but this is not the case. If an individual can move out of the secondary sector in order to obtain returns on experience or education, the existence of a sector in which there are no returns is inconsequential (Cain). Thus the basis of the allocation of workers between the sectors is crucial; are primary sector jobs rationed?

Several authors have addressed the issue of mobility between the two sectors. Duane Leigh (1976) finds substantial and comparable earnings growth for black and white workers and suggests that this refutes the dual market hypothesis. Bradley Schiller (1977) reports extensive upward mobility of individuals at the bottom of the income distribution during the period 1957 to 1971. He argues that this constitutes a refutation of dual market theory.

On the other hand, Rosenberg (1976) and Carnoy and Rumberger find that minority workers are more likely to begin their careers in the secondary sector and, having started there, are less likely to leave than are whites. Rosenberg also finds that human capital variables do not help to explain the upward mobility of minority workers. These authors argue that this differential mobility supports dual market theory.

In fact, measuring mobility does not provide a test of rationing of primary market jobs. As Rosenberg (1979) notes, some mobility is consistent with dual market theory, while purely random movement is not implied by human capital theory. It is easy to derive a simple human capital model with firm-specific training in which there is no mobility between jobs whatsoever. No one has specified, and it is probably impossible to do so correctly, what levels of mobility would constitute refutations of dual market or human capital theory. Although studies of differential mobility between races are suggestive, the key issue is whether there are qualified individuals who would like to work in the primary sector but cannot find a job there. No study has addressed this issue.

Thus empirical work contrasting dual market and human capital theory has suffered from two major drawbacks. The taxonomies that have been developed simultaneously bias the results in favor of the dual market hypothesis by virtue of the selection criteria and are too gross to allow accurate testing of the hypothesis. Furthermore, the crucial issue of barriers to entry has not been addressed.

In Section II we propose a technique that allows us to derive the probability of sector attachment directly from the observed distribution of wages and worker attributes. This resolves the problem of attributing primary or secondary sector employment to everyone in a given industry or occupation. We then propose a direct test for involuntary confinement of workers to the secondary sector.

## II. A Formal Test

How can we test the descriptive power of the dual market hypothesis without prior knowledge of the sector a person is in? Consider how we might proceed if people's earnings potential could be summarized by a single observable trait—for example, education—and an unobserved trait which was uncorrelated with education. In that case we could plot a scatter diagram of log wages and education. The standard view of the labor market holds that such a scatter diagram should resemble Figure 1. From dual

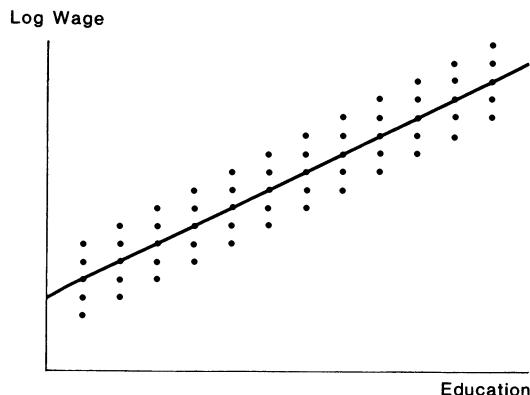


FIGURE 1. HYPOTHETICAL SCATTER PLOT—  
STANDARD HUMAN CAPITAL THEORY

market theory we would expect a scatter diagram similar to Figure 2. A straightforward test of the theories would therefore entail plotting the scatter diagram and assessing whether it corresponds to either the human capital model or the dual market model.

Two problems complicate such an approach. First, wages are determined by many observable characteristics other than education. To control for all variables simultaneously, we would have to plot a scatter diagram for each subgroup in the sample. As the number of other variables increased, the number of observations on each diagram would decrease considerably. With a reasonable number of controls, the number of diagrams and the sparseness of observations would certainly make it impossible to discern any pattern. Second, even if we were able to plot all the scatter diagrams, we would still lack a formal mechanism for testing the hypotheses. Each researcher would be free to decide for him/herself whether the diagrams correspond more nearly to the predictions of human capital or dual market theory. These problems can be resolved by the use of the formal methods described in the following paragraphs.

The question of whether a plot looks more like Figure 1 or 2 can be rephrased: do two wage equations fit the data significantly better than one, and do the best-fitting equations fit the predictions of the dual market

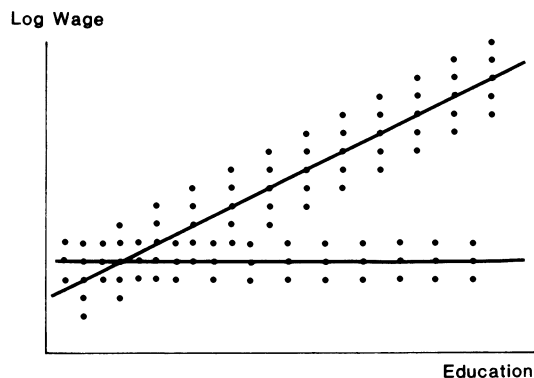


FIGURE 2. HYPOTHETICAL SCATTER PLOT—  
DUAL MARKET THEORY

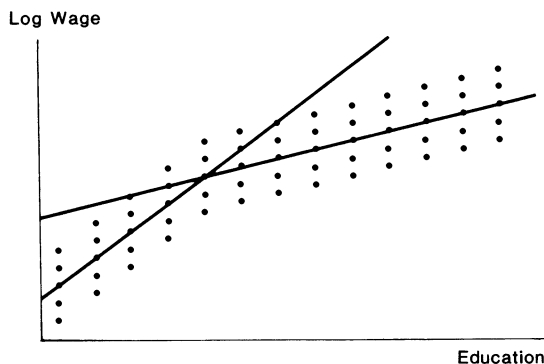


FIGURE 3. HYPOTHETICAL SCATTER PLOT—  
HUMAN CAPITAL THEORY WITH NONLINEAR  
WAGE-EDUCATION RELATION

hypothesis? We can imagine fitting first one, and then two lines by hand to Figure 2. To compare the explanatory power we might, for example, compute the distance from each point to the closest line. The reduction in the sum of squares going from one line to two would be much larger for Figure 2 than for Figure 1.

Of course, two equations having more explanatory power than one is not, by itself, a test of the dual market hypothesis. For example, two equations might have significantly more explanatory power than one for a scatter diagram such as Figure 3. However, there is no identifiable secondary market. Thus, in addition to requiring two equations to have significantly more explanatory power than one, we also require the best-fitting lines to have characteristics consistent with the dual market hypothesis. To correspond to the predictions of dual market theory, one wage equation should be upward sloping in schooling and experience, while the other equation should be flat with respect to human capital variables and below the other at most points. Since we are dealing with a sample of adult males, we also expect that there will be fewer observations associated with the low-wage line.

Formally, we may fit two wage equations using maximum likelihood techniques. Since we do not know a priori with which wage equation to compare an individual, we estimate a switching model with unknown regimes. To do this we must specify two wage

equations and a third equation that predicts sector attachment, and estimate all three equations simultaneously. The likelihood function for this model can be found in the Appendix. Since the single-equation model is nested in the switching model, we may test the hypothesis that the two-equation model fits significantly better than the single-equation model by comparing the log-likelihood values for the two models. If we reject the single-equation hypothesis, we may examine the coefficients of the two wage equations to see if they fit the dual market hypothesis.

The existence of two sectors with different wage-setting mechanisms is fundamental to dual market theory, but it is not incompatible with human capital theory. While neo-classical economics tends to emphasize the development of models which are continuous and therefore tractable in calculus, if the technology were sharply discontinuous in the way suggested by Piore (1980b), no fundamental assumptions of mainstream economics would be violated. In this case, individuals would choose the sector of employment that maximized the expected present value of their lifetime utility.

The second tenet of dual market theory, that primary sector jobs are rationed, is less compatible with human capital theory. Dual market theory maintains that individuals cannot always choose the sector which they prefer—some workers who would prefer to be employed in the primary sector cannot find jobs there. As a general phenomenon

this would be incompatible with the standard neoclassical view. However, rationing as a general phenomenon is believed to be restricted to recession periods (Piore 1980a). During other periods only women and minorities are likely to experience rationing. This contention is no more troublesome than the widely acknowledged importance of race and sex discrimination in the determination of wages.

To test for the presence of noneconomic barriers to primary sector employment, we need to postulate a mechanism for allocating workers between the sectors in the absence of rationing. To begin, we assume that experience in one sector raises wages in the sector more than it raises wages in the other sector.<sup>1</sup> We also assume that workers will behave so as to maximize utility over their lifetime. Utility is assumed to be increasing with the net present value (*NPV*) of lifetime income. If we then assume that people's preferences with respect to the nonpecuniary aspects of jobs do not change over their lifetime, and that workers are perfectly informed about the characteristics of all jobs, we can conclude that workers will choose employment in one of the two sectors at the beginning of their careers and stay in that sector for their entire working life.<sup>2</sup>

If the nonpecuniary characteristics of the two sectors were similar, we would expect workers to pick the sector that yields the highest lifetime income. However, dual market theorists are unanimous in maintaining that the nonpecuniary aspects of secondary employment are inferior to those obtained in primary employment. On the other hand, starting wages in some secondary jobs may be higher than in the primary sector, and this

could be attractive to a worker who plans to leave and enter the labor force frequently or change jobs often. In addition, secondary employers may be less concerned with lateness and absenteeism and the work pace may be slower in secondary jobs. Formally, we assume that workers will choose primary sector employment if the log of the *NPV* of their income stream in the primary employment exceeds the log of the *NPV* of secondary employment by more than an amount *C*—the additive inverse of the compensating differential for secondary employment. We may write the probability that a worker is employed in the primary sector (denoted *P*) as

$$(1) \quad P = \Pr\{\ln(NPV_p) - \ln(NPV_s) > C\}$$

where the subscripts *p* and *s* denote primary and secondary. To model the *NPV* in the two sectors, we write two wage equations:

$$(2) \quad \ln(W_p) = XB_p + Ya_p + e_p;$$

$$(3) \quad \ln(W_s) = XB_s + Ya_s + e_s,$$

where *X* is a vector of individual characteristics, *Y* is years of job experience, *W<sub>p</sub>* is the wage received in the primary sector, *e<sub>p</sub>* is a normally distributed error representing unobserved characteristics affecting the primary sector wage, and *B<sub>p</sub>* and *a<sub>p</sub>* are parameters. The terms *W<sub>s</sub>*, *e<sub>s</sub>*, *B<sub>s</sub>*, and *a<sub>s</sub>* are similarly defined for the secondary sector. Approximating the length of the individual's working life by infinity, and using (2) and (3), equation (1) becomes

$$(4) \quad P = \Pr\{X(B_p - B_s) + e_p - e_s + C' > 0\},$$

where

$$(5) \quad C' = \ln((d - a_s)/(d - a_p)) - C,$$

and *d* is the discount rate.

If we assume that *C'* is equal to a constant (*C''*) plus a normally distributed error term (i.e., people's preferences with respect to the nonpecuniary aspects of employment and their discount rates do not vary with observable characteristics (*X*)), we may test the hypothesis that people choose their sector of

<sup>1</sup>This assumption appears reasonable in light of recent empirical evidence on experience-earnings profiles. James Brown (1983, p. 20) shows that experience in other firms counts very little towards earnings for workers on their current jobs. The assumption entails the existence of sector-specific training. If some training is firm specific, it is ipso facto sector specific.

<sup>2</sup>It might be argued that young people, in particular, lack the necessary career information to make informed job choices. They may also have different preferences. Since we estimate our model on a sample of heads of households, these problems should not greatly affect our results.

employment to maximize their utility. We do this by estimating an equation to determine sector membership and testing the hypothesis that the coefficients on the  $X$ 's are equal to  $B_p - B_s$ , or that the  $B_w$ 's in

$$(6) \quad X(B_p - B_s + B_w) + C'' + e_p - e_s + e_w$$

are equal to zero.

It may not be reasonable to assume that preferences for the nonpecuniary aspects of primary or secondary employment are not related to any observed worker characteristics. If they are related, we would expect at least some of the  $B_w$ 's to be different from zero even if workers are free to choose the sector they are employed in. In this case we may be able to find some  $X$ 's that should not be related to tastes, or to suggest inequality constraints on the effects of certain characteristics on tastes. Specific tests of this type are proposed in Section III.

An intuitive explanation of this approach uses the example of race. Suppose that the lines fitting the scatter diagram in Figure 2 were the same for blacks and whites. Suppose further that the distribution of education was the same for the two groups, but that a higher proportion of blacks than of whites were scattered around the lower line. Under these circumstances, we would conclude that either blacks are less averse to secondary employment than are whites, or that blacks face discrimination in obtaining primary jobs. Supplementary evidence would support the latter explanation.

The data used in this study are drawn from the thirteenth wave (1980) of the *Panel Study of Income Dynamics*. We limited the sample to men who were heads of households, working more than 1000 hours in the previous year, did not work in government and for whom data on education and marital status were available. Estimates were obtained for both the full sample (2812 cases) and with only members of the Survey Research Center sample (1696 cases).

### III. Results

Table 1 presents the results for *OLS* estimation and the dual market model. Since the results for the samples are similar, we discuss

only the restricted sample here. The *OLS* results are similar to those obtained by other researchers. The return to schooling is about 6 percent while the return to experience is about 1 percent. Whites receive wages about 13 percent higher than nonwhites, holding other factors constant. Workers living in an SMSA earn wages almost 20 percent higher than equivalent workers outside an SMSA, and workers who have never been married earn considerably less than other workers. All the coefficients are significant at conventional levels.

The second part of Table 1 tells a very different story. The primary sector wage equation resembles the *OLS* equation, but there are some striking differences. Most notably, the white-nonwhite differential falls to zero (although it is measured very imprecisely). In addition, the effect of living in an SMSA declines and the returns to schooling and experience increase somewhat.

The secondary sector wage equation contrasts sharply with the *OLS* equation. None of the coefficients is statistically significant at conventional levels. We cannot reject the hypothesis that the secondary sector wage equation is completely flat. The return to experience (which is measured quite precisely) is essentially zero. Further, the secondary sector wage equation is almost everywhere below the primary sector. For a nonwhite living in an SMSA who has never been married and has a sixth-grade education, the predicted primary sector wage is greater than the secondary wage after one year's experience. For all other workers, except those with less education, the predicted primary sector wage is always higher than the predicted secondary sector wage. Since the coefficients of the secondary sector wage equation are measured imprecisely, it might be presumed that, in fact, there is only one labor market. However, using a likelihood ratio test, we can easily reject the single labor market (*OLS*) model at any conventional level of significance.<sup>3</sup> Two wage equations fit the data considerably better than one.

<sup>3</sup> Twice the difference between the log-likelihood values for the two models is 177. Although the single equation model is nested in the switching model, when

TABLE 1<sup>a</sup>

Variable	Mean	OLS	Switching Model		
			Primary	Secondary	Switch
<b>Restricted Sample</b>					
Constant	1.00	.874 (.075)	.996 (.297)	1.32 (3.33)	−.006 (.574)
SMSA	0.67	.197 (.025)	.112 (.060)	.197 (1.28)	.361 (.158)
Never Married	0.08	−.305 (.044)	−.261 (.055)	−.244 (.580)	−.157 (.354)
School	12.7	.059 (.005)	.067 (.005)	−.003 (.072)	.020 (.031)
White	.91	.134 (.040)	.008 (.166)	−.192 (2.73)	.796 (.328)
Experience	18.4	.010 (.001)	.013 (.001)	.001 (.002)	
Covariance with Switching Error			.068 (.389)	−.009 (4.42)	
Standard Error Log-Likelihood		.477 −1151.4	.374	.381 −1062.9	b
<b>Full Sample</b>					
Constant	1.00	.760 (.051)	.982 (.108)	1.27 (.636)	−.389 (.379)
SMSA	0.69	.194 (.020)	.078 (.036)	.073 (.452)	.526 (.144)
Never Married	0.10	−.265 (.031)	−.286 (.047)	−.268 (.263)	.238 (.338)
School	12.07	.063 (.004)	.069 (.005)	.006 (.034)	.037 (.024)
White	0.67	.180 (.020)	.006 (.059)	−.139 (.781)	.885 (.190)
Experience	17.9	.010 (.001)	.014 (.001)	.000 (.002)	
Covariance with Switching Error		−	.155 (.084)	−.019 (1.18)	b
Standard Error Log-Likelihood		.471 −1875.3	.392	.373 −1772.9	

<sup>a</sup>Standard errors are shown in parentheses; dependent variable is log hourly wage.

<sup>b</sup>Normalized to 1.

the switching equation model is constrained to yield the single-equation model, several parameters are unidentified. This problem complicates the calculation of the degrees of freedom. In addition, it is possible that the asymptotic likelihood ratio statistic does not have a *chi*-squared distribution. However, Monte Carlo tests (Steven Goldfeld and Richard Quandt, 1976) suggest that setting the degrees of freedom equal to the number of constraints plus the number of unidentified parameters yields a conservative test using the *chi*-squared distribution. For our problem, this computation yields fourteen degrees of freedom. The 1 percent critical value for the *chi*-squared distribution with fourteen degrees of freedom is 29.14—far smaller than our computed likelihood ratio test statistic.

Thus we can reject the single labor market model and cannot reject the predictions of dual market theory that there are no returns to education or experience in the secondary sector. As noted above, this characterization of the market, while not commonly assumed in mainstream economics, is not incompatible with it. A more crucial aspect of dual market theory is the assumption that primary sector jobs are rationed. Testing this assumption entails testing constraints on the switching equation. Using the restricted sample, we were unable to get the constrained likelihood



function to converge. Since a Wald test of the constraints is not invariant with respect to the choice of normalization,<sup>4</sup> a likelihood ratio test is preferable. In the following paragraphs, we report the results of likelihood ratio tests performed on the full sample.

If workers were free to choose between the sectors and tastes for the nonpecuniary aspects of employment were not related to the location of a worker's residence, his marital status, education, or race, we would expect the coefficients of these variables in the switching equation to equal the difference between the coefficients in the two wage equations. However, it is probably not reasonable to expect workers' preferences with respect to nonpecuniary job attributes to be independent of these variables. For example, we would not be surprised to find that workers outside of SMSAs required less of a compensating differential to get them to take secondary work since they may often be engaged in agricultural labor. We therefore test the hypothesis that  $B_w$  in equation (6) equals zero for school, white, and never married. Twice the difference between the log-likelihoods for the constrained and unconstrained models is 14.92. The 1 percent critical value for the *chi*-square with two degrees of freedom is 9.21.<sup>5</sup> The hypothesis of free choice is easily rejected.

Since married workers may have a greater desire for stable primary work, we may want to restrict our attention to the coefficients of education and race in the switching equation. We can reject the hypothesis that these coefficients are both equal to the difference

between their corresponding coefficients in the primary and secondary wage equations ( $\chi^2 = 14.56$ , 1 percent critical value for one degree of freedom = 6.63). We are left with three potential explanations for our results. First, highly educated workers prefer secondary employment more than less-educated workers. This hypothesis seems unlikely. We would expect more-educated workers to be more averse to the poor working conditions of secondary employment. Shulamit Kahn (1983) finds that the demand for occupational safety increases with education. A second explanation is that blacks are less averse to secondary jobs than are whites, but this runs counter to evidence that blacks are more likely to support unions in representation elections (Henry Farber and Daniel Saks, 1980; Dickens, 1983), are less likely to quit a job (W. Kip Viscusi, 1979), and have greater demand for occupational safety than equivalent whites (Kahn). Primary jobs are more likely to be unionized, and offer more stable employment and better job safety. If we cannot accept these other two explanations, we are forced to conclude that blacks face noneconomic barriers to employment in the primary sector. At the present time there is no formal way of establishing which of these three explanations is correct. However, since the first two hypotheses appear to be inconsistent with other studies of the demand for job quality, the most reasonable explanation is the last—blacks are discriminated against when seeking primary employment.

If we accept the dual market hypothesis, we may use the model to determine the composition of the primary and secondary sectors.<sup>6</sup> According to our estimates, about 12 percent of working male heads of households are employed in the secondary sector.

<sup>4</sup>In the unrestricted model it is not possible to simultaneously identify all the coefficients of the switching equation and its error variance. This is a problem common to all discrete dependent variable estimation. Thus any one restriction on the coefficients of the switching equation cannot be tested as it would only constitute a normalization. It is possible to perform a Wald test if there is more than one constraint, but the test is not invariant to the normalization chosen. In all cases reported below, the results of the Wald test were inconclusive since the Wald test rejected the null hypothesis for some reasonable normalizations but not for others.

<sup>5</sup>We are imposing three constraints, but we also relax the normalization that the variance of the switching equation equals one. Thus there are only two degrees of freedom.

<sup>6</sup>A straightforward application of the Bayes theorem gives the result that the probability that worker  $i$  is in the primary sector conditional on the observed wage and personal characteristics is

$$\frac{\Pr(\epsilon_{wi} > -Z_i\Gamma|Z_i, X_i, \epsilon_{pi})f(\epsilon_{pi})}{\Pr(\epsilon_{wi} > -Z_i\Gamma|Z_i, X_i, \epsilon_{pi})f(\epsilon_{pi}) + \Pr(\epsilon_{wi} \leq -Z_i\Gamma|Z_i, X_i, \epsilon_{si})f(\epsilon_{si})}$$

where the notation is described in the Appendix. The percent of workers is estimated by computing the average value of the probability of primary sector attachment for all workers.

TABLE 2—COMPOSITION OF SAMPLE AND SECONDARY SECTOR

	Percent of Sample in Category	Unrestricted Model <sup>a</sup>		Restricted Model <sup>a</sup>	
		Percent of Secondary Sector Workers in Category	Percent of Workers in each Category in Secondary Sector	Percent of Secondary	Percent in Secondary
SMSA	66.9	55.3	10.3	46.7	7.9
Not SMSA	33.1	44.7	16.8	53.3	18.3
Married	91.8	89.5	12.1	90.9	11.2
Not Married	8.2	10.5	15.9	9.1	12.6
Education < 12	19.9	28.4	17.8	26.1	14.9
Education = 12	39.8	40.2	12.5	39.9	11.4
Education > 12	40.3	31.4	9.7	34.0	9.6
White	90.6	76.3	10.5	84.9	10.6
Nonwhite	9.4	23.7	31.1	15.1	18.2
Age					
< 25	13.9	21.4	19.1	20.6	16.8
25–29	20.8	19.2	11.5	19.2	10.5
30–39	29.8	22.6	9.4	23.2	8.8
40–49	14.4	12.6	10.8	12.5	9.8
50–59	15.7	11.6	9.2	11.3	8.2
60 +	5.3	12.6	29.5	13.2	28.1
Total			12.4		11.3

<sup>a</sup> Numbers in columns for both models were estimated using the formula described in fn. 6.

This seems large, especially since we would expect a sample containing teenagers, women, and the unemployed to have a higher proportion of secondary workers. Table 2 shows the makeup of the sample and the secondary market. It also shows the percent of each type of worker in the secondary market. Since many of the parameters of the switching model are estimated with a great deal of error, we also estimated a restricted model (parameter estimates are shown in Table 3) where the wage equation in the secondary sector was constrained to be flat and education and marital status were removed from the switching equation. (A likelihood ratio test fails to reject the constraints at the .1 level.)<sup>7</sup> Both models show the same pattern evident in the parameters of the switching equation: workers in SMSAs, married workers, more educated workers, and whites are less likely to be in the secondary sector. In addition, heads of household less

TABLE 3—ESTIMATES FOR RESTRICTED MODEL<sup>a</sup>

Variable	Primary	Secondary	Switching
Constant	.887 (.073)	1.22 (.093)	.503 (.281)
SMSA	.108 (.026)	<sup>c</sup>	.537 (.132)
Never married	-.288 (.037)	<sup>c</sup>	<sup>c</sup>
School	.069 (.004)	<sup>c</sup>	<sup>c</sup>
White	.083 (.043)	<sup>c</sup>	.433 (.227)
Experience	.013 (.001)	<sup>c</sup>	<sup>c</sup>
Log-Likelihood	-1069.1		
SE	.3773	.4098	<sup>b</sup>

<sup>a</sup>Standard errors are shown in parentheses; dependent variable: log of hourly wage.

<sup>b</sup>Normalized to 1.

<sup>c</sup>Constrained to zero.

<sup>7</sup>Again we note that the measured returns to schooling and education in the primary sector are larger than in the OLS equation. Also, the "discrimination coefficient" is roughly 40 percent smaller.

than 25-years old or 60-years or older are disproportionately in the secondary sector.

Finally, we examine how sharply the model distinguishes between workers in the primary and secondary sectors. Figure 4 shows the distribution of predicted probabilities of being in the primary market. The distribu-

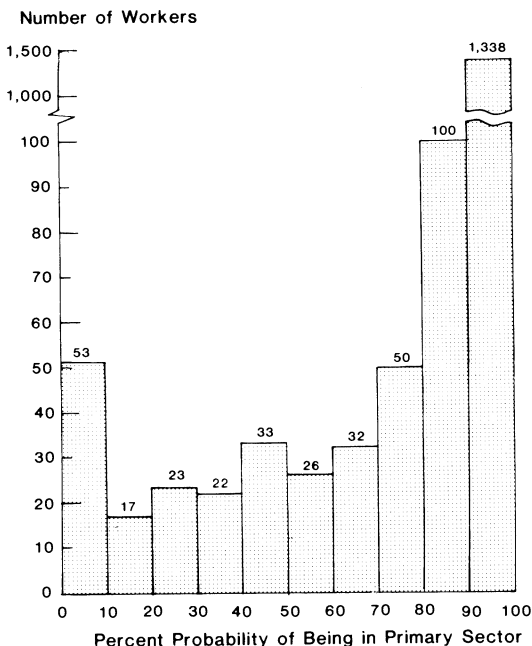


FIGURE 4. PREDICTED PROBABILITY OF BEING IN PRIMARY SECTOR—FREQUENCY DISTRIBUTION OF NUMBER OF WORKERS (SAMPLE SIZE: 1,696)

tion is distinctly bimodal, with the two modes of 0–10 and 90–100 percent probability. There is a large group of workers who are clearly identifiable as being in the secondary sector, and a larger group with a high probability of being primary workers. It appears that there is a distinct secondary sector which the model can identify.

#### IV. Conclusions

Our results provide strong support for two of the basic tenets of dual market theory: there are two distinct sectors of the labor market with different wage-setting mechanisms, and there is a queue for primary sector jobs. We believe that our approach and results represent a considerable advance over previous research in this area. By allowing the distribution of wages and worker attributes to determine our “assignment” of workers to sectors, we avoid the problems of arbitrariness and sample selection bias that complicate the interpretation of earlier re-

search. In addition, our approach allows us to estimate the size and composition of the secondary work force in a noncircular manner.

Of course, we cannot exclude other interpretations of these results that postulate different distributions of the error term, or some unusual nonlinear functional form for the wage equation. While we cannot deny these possibilities, we suggest that in the absence of our results, such a distribution would not be suggested. It was dual market theory that led to our test, and the results therefore tend to corroborate that theory.

Given the strength of the reactions (deifying or executing the messenger) of some of the individuals with whom we discussed preliminary results, it is important to take stock of exactly what it is that we have and have not shown. Piore (1983) suggests that the strength of opposition to dual market theory is due, in part, to the use of participant observer techniques rather than econometric techniques that are more common in mainstream economics. We have shown that the dual market hypothesis can be derived and supported from standard data and statistical techniques. It is, however, unlikely that standard approaches would have uncovered labor market duality, a fact that suggests that there is a role for other methods in mainstream economics.

On the other hand, the fact that we can test dual market theory using mainstream techniques suggests that the two theories are not as incompatible as would appear from the antagonisms in the profession. We have already suggested that neoclassical economics makes few assumptions regarding the nature of technology. It is relatively straightforward to develop a model in which a high fixed cost/low variable cost technology is used in the “stable” demand sector and a low fixed cost/high variable cost technology is used to accommodate fluctuations in demand. Piore (1980b) gives a verbal description of such a theory and Elie Appelbaum and Chin Lin (1982) present a formalization. It is a direct consequence of human capital theory that workers and firms will invest little in firm-specific training if the worker is

not expected to remain with the firm for very long. Thus the existence of two markets with distinct wage profiles can be easily accommodated by mainstream theory.

Similarly, while when first proposed, the view that there is a queue for primary sector jobs may have appeared to be incompatible with neoclassical theory, there are an increasing number of imperfect information models which imply that there can be a queue for jobs. In particular, Andrew Weiss (1980), Steve Stoft (1982), Carl Shapiro and Joseph Stiglitz (1984), and Samuel Bowles (1985) have developed models in which job queues arise in firms in which there are unobserved skills or effort. Thus there could well be a queue for primary sector jobs. If there are few skill differences in secondary sector jobs, there would be no queues for them.

While these models are compatible with queues, we have presented evidence that rather than allocating jobs randomly, primary sector employers discriminate against nonwhites. This may appear to be incompatible with neoclassical economics. However, discrimination is an anomaly which remains to be explained, whether or not one accepts dual market theory. In fact, these results may help to explain the existence and persistence of discrimination. According to the point estimates presented in the last section, more than 40 percent of white-nonwhite wage differences can be explained in the restricted model by the fact that nonwhites are crowded into the secondary sector, while in the unrestricted model the within-sector differential is zero. If a queue for primary jobs exists because wages are at least partially socially determined (George Akerlof, 1982), primary employers with a "taste" for discrimination may indulge it by hiring fewer nonwhites from the queue without sacrificing profits. No economic incentive exists for the elimination of this sort of discrimination. If, on the other hand, the queue results from "economic" causes such as unobservable skills or effort, the usual result that competition should eliminate discrimination applies, and its existence continues to present theoretical difficulties.

We do not wish to imply that there are no incompatibilities between dual market theory

and neoclassical economics. For example, dual market theorists have generally assumed that preferences are endogenous, a position strongly resisted by most mainstream economists despite some exceptions.

Perhaps more important, dual market theorists have developed very elaborate theories of the origin and operation of labor market institutions which are rich in historical detail.<sup>8</sup> These descriptions are quite remote in many ways from the neoclassical description of the labor market. However, we have not attempted to test these aspects of dual market theory (Reich, 1984, does).

Finally, we call the reader's attention to the title of this paper. We have chosen to refer to our work as a test of dual market theory rather than as a test of human capital theory because, in our view, dual market theory is not necessarily incompatible with standard neoclassical analysis. Our results therefore point to the need for additional work to understand the origins of these institutions rather than to abandon the neoclassical model of the labor market. In addition, our results point to the value of noneconometric techniques for uncovering and understanding labor market institutions.

## APPENDIX

### Estimation of the Switching Model with Unknown Regimes

Consider the system composed of wage equations for each sector and an equation determining "tendency to be in the primary sector":

$$(A1) \quad \ln W_i = X_i \beta_p + \varepsilon_{pi},$$

$$(A2) \quad \ln W_i = X_i \beta_s + \varepsilon_{si},$$

$$(A3) \quad y_i^* = Z_i \Gamma + \varepsilon_{wi},$$

where  $W_i$  is the individual's wages,  $X_i$  and  $Z_i$  are vectors of explanatory variables,  $\beta_p$ ,  $\beta_s$ , and  $\Gamma$  are vectors of parameters,  $\varepsilon_p$ ,  $\varepsilon_s$ , and  $\varepsilon_w$  are normally distributed error terms,

<sup>8</sup>For example see Piore (1980a), Richard Edwards (1979), and Gordon, Edwards, and Michael Reich (1982).

and  $y^*$  is a latent variable measuring tendency to be in the primary sector. Equation (A1) is the wage equation if the individual is in the primary sector; (A2) is the wage equation if the individual is in the secondary sector; and (A3) is the switching equation.

We do not observe  $y^*$ . However, if  $y^* > 0$ , the individual's wage is determined by (A1); otherwise it is determined by (A2). Equivalently, the individual works in the primary sector if and only if

$$(A4) \quad \varepsilon_{wi} > -Z_i\Gamma.$$

The likelihood function for the problem is therefore given by

$$(A5) \quad \Pr(\varepsilon_{wi} > -Z_i\Gamma | Z_i, X_i, \varepsilon_{pi}) \cdot f(\varepsilon_{pi}) \\ + \Pr(\varepsilon_{wi} \leq -Z_i\Gamma | Z_i, X_i, \varepsilon_{si}) \cdot f(\varepsilon_{si})$$

where  $f(\cdot)$  is the density of the error  $\varepsilon_p$  or  $\varepsilon_s$ . If we assume that  $\varepsilon_p$ ,  $\varepsilon_s$ , and  $\varepsilon_w$  are normally distributed, the log-likelihood is thus:

$$(A6) \quad \sum_{i=1}^N \ln \left\{ \left[ 1 - \Phi \left( \frac{-Z_i\Gamma - \frac{\sigma_{pw}}{\sigma_{pp}} \varepsilon_{pi}}{\left( 1 - \frac{\sigma_{pw}^2}{\sigma_{pp}^2} \right)^{.5}} \right) \right] \cdot \phi(\varepsilon_{pi}, \sigma_{pp}) \right. \\ \left. + \Phi \left( \frac{-Z_i\Gamma - \frac{\sigma_{sw}}{\sigma_{ss}} \varepsilon_{si}}{\left( 1 - \frac{\sigma_{sw}^2}{\sigma_{ss}^2} \right)^{.5}} \right) \cdot \phi(\varepsilon_{si}, \sigma_{ss}) \right\}$$

where  $\phi(\cdot)$  and  $\Phi(\cdot)$  are the normal density and cumulative distribution, respectively, and  $\sigma_{jk}$  is the covariance of  $\varepsilon_{ji}$  and  $\varepsilon_{ki}$ ;  $\sigma_{ww}$  is normalized to equal one. Maximum likelihood estimates for  $\Gamma$ ,  $\beta_p$ ,  $\beta_s$ , and the  $\sigma$ 's can be obtained using standard search algorithms provided that care is taken to prevent the program from iterating into regions for which the likelihood function is unbounded.

It is easy to see that if  $\beta_p$  equals  $\beta_s$ , and  $\sigma_{pw}$  equals  $\sigma_{sw}$ , then  $\varepsilon_{pi}$  equals  $\varepsilon_{si}$  and the

likelihood function reduces to the standard normal density. It is therefore possible to test for the existence of two regimes by comparing the log-likelihood values for *OLS* and unknown regime estimates by performing a likelihood ratio test.

The likelihood functions used here were maximized using the Ernst Berndt et al. (1974) algorithm. While the nonlinearity of the system made convergence difficult, we did not experience any difficulties with unboundedness. All unconstrained specifications converged to interior solutions from *OLS* starting values.

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