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TESTING DUAL LABOR MARKET THEORY: A RECONSIDERATION OF THE EVIDENCE

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Testing Dual Labor Market Theory: A Reconsideration of the Evidence

ABSTRACT

This paper replicates and extends our earlier analysis of dual market theory. We use a technique which estimates for each worker a probability of being in the primary sector on the basis of his characteristics. We use this information to determine the occupational and industrial composition of the sectors. We continue to produce results which are very supportive of the theory. In studies by other authors, workers were "assigned" to the primary or secondary sector on the basis of the industry or occupation in which they are employed and educated guesses about the industries or occupations which make up the two sectors. We find that previous studies, which produced mixed and inconclusive results, had serious misclassification problems. In the cases examined, at least half of all full time prime age male workers identified as being in the secondary sector by these classification schemes are found to have a high probability of primary sector attachment. Past studies which were most supportive of dual market theory are found to have had the least severe misclassification problems.

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Testing Dual Market Theory

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Dual labor market theory maintains that there are two sectors of the labor market: one with high wages, good working conditions, stable employment, rewards for education and job experience and opportunities for advancement (primary sector) and one with low wages, bad working conditions, unstable employment, no rewards for education or job experience and no opportunities for advancement (secondary sector). The secondary market can persist because primary jobs are rationed -- not everyone who wants and is qualified for a primary job is able to obtain one. In particular, women and minorities face discrimination in obtaining primary sector employment (Doeringer and Piore, 1971; Piore, 1980a&b).

While the characteristics of the jobs within each sector vary, there is substantial evidence that jobs can be usefully thought of as falling into one of two categories as dual market theory predicts. When industry, occupation or worker characteristics are factor analyzed, there are a dominant factor fitting the dual market typology and bimodally distributed factor scores (Gordon, 1971; Buchele, 1976a&b; Oster, 1979). However, these studies do not address the two aspects of dual market theory which are of greatest economic and sociological interest -- that there are no returns to education and experience in the secondary sector and that not everyone who wants and is qualified for a primary job can get one.

A number of studies have attempted to determine whether secondary wages increase with education and experience (Beck, Horan and Tolbert, 1978&80; Bibb and Form, 1977; Hodson, 1977; Osterman, 1975; Carnoy and Rumberger, 1980; Buchele, 1976a&b; Rosenberg, 1976; Wright, 1979; Zucker and Rosenstein, 1981). These studies divide occupations or industries into two sectors on the basis of the characteristics of the jobs or of the workers in those occupations and industries. Having divided the sample they test for differences in the wage equations in the two sectors. In particular the returns to education and experience are examined for congruence with dual market theory. Some studies have found patterns corresponding roughly to dual market theory, others have found little support for the hypothesis. None of the studies is entirely free of anomalies. Zucker and Rosenstein (1981) suggest that the differences are largely due to the use of different classification systems.

The contribution of our 1985 paper was the development of a technique (described below) which allowed the simultaneous determination of the probability that a worker is in the primary or secondary sector and the form of the wage determination mechanisms in the sectors. This allowed us to avoid relying on judgement to classify industries or occupations as primary or secondary. The technique also allowed a direct test of the hypothesis that not everyone who wants and is qualified for a primary sector job can find one, an issue which had not been addressed previously.[1] Our results were strongly supportive of both major tenets of dual market theory -- that there are two sectors fitting the dual market typology and that at least some minority workers are involuntarily confined to the secondary sector.

In this paper we extend and replicate this analysis using a new data set. In addition, we use our approach to determine the sectoral composition of industries and occupations. With this information we are able to reexamine the classification systems used by past authors. The sectoral composition of industries and occupations corresponds roughly to the expectations implied by the classification systems used by past authors. We find that it is possible to identify industries and occupations which are composed almost entirely of primary workers. However, no industries are made up entirely of secondary workers. Thus all of the classification systems are subject to substantial misclassification error. Five classification schemes are analyzed in detail. We find that those which produce results which are most supportive of dual market theory are also the ones with the least severe misclassification problems.

The rest of this paper is divided into four sections. In the next section we discuss methods for testing dual market theory. In section II we describe the data used for this analysis and the results of the extensions to our earlier work. In section III we present results on the location of the secondary sector and the reevaluation of the classification systems used by past authors. Finally, section IV is a conclusion which reviews the results, discusses their implications, and suggests directions for future research.

I. Testing Dual Market Theory

If we knew which workers were in the primary sector and which were in the secondary sector we might try to test the hypothesis that the process determining wages in the two sectors was different by estimating separate wage equations for the two groups. Following the standard practice of letting the log of the wage be a function of personal characteristics, we might estimate:

$$(1) \qquad \ln w_i = X_i B_p + e_{pi}$$

if person i is in the primary sector and

$$(2) \qquad \ln w_i = X_i B_s + e_{si}$$

if he or she is in the secondary sector, where w is the wage, X is a vector of personal characteristics, B_p and B_s are vectors of parameters and e_p and e_s are random error terms. Under the dual labor market hypothesis the B_p coefficients on education and experience would be large and significant while the B_s coefficients on education and experience would be small and insignificant.

Formally we could test the hypothesis that the two sets of coefficients are equal. If they were not, we could consider informally whether the pattern of coefficients corresponds to that predicted by dual labor market theory. The formal test determines whether the wage equations for the two sectors are the same and, hence, whether two

equations have substantially more predictive power than one. If the coefficients were significantly different and two equations fit significantly better than one, we might conclude that there are at least two sectors. The informal test allows us to determine whether the two sectors are those described by dual market theory.

This is the procedure used in tests of dual labor market theory which address the issue of whether there are different returns to education and experience in the two sectors. It suffers from two important defects. If unobserved characteristics which determine wages also determine sector attachment, estimates of the wage equations can be badly biased in a manner which will tend to give results supportive of dual labor market theory. For example, suppose that the classification system used in a study divided workers into the sectors on the basis of their wages. It would not be surprising to find that the effect of education on wages among low wage jobs is small. To take an extreme case, suppose that the researcher assumed that the secondary sector consisted only of jobs paying the minimum wage. Obviously, the only variable affecting the wage in jobs paying the minimum wage is the constant term; education and experience have no effect. In general, dividing the sample in this way will bias the estimated returns to education and experience towards zero in both sectors. However, since the secondary sector is smaller than the primary sector, the bias in the secondary sector equation will be greater (see figure 1). Thus, even though there is only one wage equation common to both sectors, when a wage equation is estimated for the set of low wage jobs, wages are estimated to be unaffected by education. In technical

terms, this happens because the truncation of the sample produces a correlation between the errors of the wage equations and the X variables.

The techniques for handling this problem are well known (Maddala, 1983). To eliminate truncation bias, we specify a third equation measuring the tendency to be in the primary sector,

$$(3) \qquad y^*_i = X_i B_w + e_{wi}$$

where y* is the tendency to be in the primary sector and all other variables are defined analogously to those in equations (1) and (2). Equation (3) is known as the switching equation because individuals are in the primary sector if y* is greater than zero and in the secondary sector if y* is less than zero.[2] There are several techniques for estimating the system of equations (1) - (3). Their use would allow us to correct for the bias caused by the correlation between the X variables and the errors in the wage equations.

A second difficulty with the standard approach is that we do not know whether workers are in the primary or secondary sector. Even if there are two sectors of the labor market, our estimates of B_p and B_s will be similar if we misclassify a substantial portion of the sample. All existing systems necessarily involve some misclassification of workers. For example, if workers are classified on the basis of industry, managers in industries composed mostly of secondary workers will be incorrectly classified as secondary workers. The janitor in a social science consulting firm will be treated in the same way as the professional

researchers. Classifications based on occupations are also flawed. The same occupation may be primary in one firm or industry and secondary in another. Assembly workers in some firms may be well paid and may have opportunities for advancement, and in others they may not. Consequently, any classification scheme based on occupations or industries will misclassify some workers. The solution is to treat each worker's sector of employment as unknown. This is the approach we use.

The statistical technique we employ is known as endogenous switching with unknown regimes. For those not familiar with the technique, we provide only a brief nontechnical explanation here. We provide a technical and extensive intuitive description in our 1985 paper.

Consider a scatter diagram such as diagram 2 which plots log wages against education. We can imagine fitting first one line and then two lines. In the first case, we might, as in the case of ordinary least squares, choose the line which minimizes the sum of squared distances of the points from the line. It is then natural to fit two lines by minimizing the sum of squared distances from the closest line. Alternatively, we could assign a probability that the point is determined by the first line rather than the second line. We would then measure the distance of each point from both lines and weight each squared distance by the probability that the point was determined by that line. We could then establish whether two lines were preferable to one line by determining whether the sum of squared distances was substantially smaller with two lines than with a single line.

In practice we should not determine the probability that a point was determined by a particular line by measuring the distance of the point from the two lines. Instead, we should allow the probability to depend on the worker's characteristics (X_{3i} in equation 3). Note that if we allow the probability to depend on the individuals' characteristics, we obtain not only an estimate of the parameters of the equations which describe the two lines, but an estimate of the probability that a particular worker's wage is determined by the first as opposed to the second line.

The actual estimation technique used in this paper differs slightly from the approach we have just described. The probability of the wage being determined by the first or the second line is modeled as a nonlinear function of the worker's characteristics and the error terms in equations (1) and (2). The particular form of this function is derived by assuming that the error terms in equations (1) - (3) are normally distributed. The parameters of equations (1) - (3) are estimated jointly using a maximum likelihood technique. Nevertheless, the nontechnical description above describes, in essence, the estimation technique used in this paper.

Simply testing for the existence of two sectors does not provide a complete test of the dual labor market hypothesis. To provide support for the theory, our results should give estimates of the wage equations which correspond to the sectors of dual market theory. The wages that most workers would receive if they were employed in the primary sector should be higher than the wages they would receive in the secondary sector. The primary sector wage should increase with education and experience while the secondary sector wage should be nearly unaffected by these variables.

Since we will be dealing with a sample of adult male heads-of-households we would also expect most of the sample to be associated with the primary sector.

As noted above, in addition to postulating the existence of two sectors with distinct wage setting mechanisms, dual labor market theory maintains that blacks and women have difficulty obtaining primary sector employment. To see how to test this hypothesis, consider again the scatter diagram of log wages and education. For simplicity, assume that the best fitting lines are the same for blacks and for whites. In that case, for each level of education blacks can expect to receive the same wages as whites do in that sector (an assumption we relax in our empirical work). Under these assumptions, if there is no job discrimination, for each level of education, the points for blacks and whites should be equally likely to be scattered around the primary sector line. In other words, if eighty percent of white high school graduates are scattered around the primary sector line, eighty percent of black high school graduates should be scattered around the primary sector line. If we find that blacks are more likely to be associated with the secondary sector line, we must choose between two hypotheses -- blacks like secondary sector employment more than whites do or blacks have more difficulty obtaining primary employment. Our approach does not allow us to distinguish between these two hypotheses, but auxiliary evidence discussed in footnote 12 suggests that the latter is more probable.

We use this approach to replicate and extend the test of the dual labor market hypothesis in our 1985 paper. However, the primary objective of this paper is not replication of our earlier work but reconsideration of tests of the dual market hypothesis which have relied on occupation or industry based classification schemes. As noted above, there is reason to believe that the anomalous and conflicting results obtained by earlier studies reflect significant misclassification of workers. Our approach allows us to estimate the distribution of workers across industries and occupations. This distribution can be compared to the classification schemes used by previous authors and the extent of misclassification judged.

Equation (3) tells us what proportion of workers with the same personal characteristics (X_is) we would expect to be in the primary sector if we knew nothing about how much they were earning. For workers of the same type, each individual's wage conveys additional information which can help us determine which sector he is in. Figure 2 can help explain how this is done. It shows the primary sector and secondary sector wage by education for workers who are otherwise identical. A worker with wage and education at point A where the two wage lines cross would be assigned the average probability of being in the primary sector of all workers of his type -- his wage tells us nothing about which sector he is in. Worker B will have a very high probability of being in the primary sector because his point is very near the primary sector line and far from the secondary sector line. Worker C will have a very low probability of being in the primary sector. Worker D will be assigned a

probability of being in the secondary sector which is only slightly higher than for similar workers. Even though he is closer to the secondary sector wage line than to the primary sector line, he could be assigned a higher probability of being in the primary sector than the secondary sector if other people with his non-wage characteristics are disproportionately in the primary sector.

Note that while our estimation technique entails calculating a probability of being in each sector for each worker, the above explanation shows that we can get better estimates of the probability. The two probabilities have very different interpretations. The probability calculated in the course of the estimation of the model is the probability that the worker will end up in the primary or secondary sector given his non-wage characteristics. However, by the time we observe him in our sample, each worker is either in the primary sector with probability one or in the secondary sector with probability one. The ex post probability we calculate is therefore a measure of our ignorance -- how certain we are that this individual is in the primary sector. Thus, if we estimate that an individual has a 99% probability of being in the primary sector, we are reasonably certain that he is in the primary sector while if we estimate that he has a 50% probability of being in the primary sector, we have no information about sector of attachment. Therefore, to describe the composition of an industry or occupation we calculate the proportions of workers in that industry or occupation whom we can accurately classify as being in the primary or secondary sector and the proportion for whom sector of employment cannot be accurately ascertained.[4]

III. Data and Extensions

The data used for this study are drawn from the 1983 Current Population Survey. All male heads-of-household between 20 and 65 years of age who were employed, reported that they normally worked more than twenty hours a week, earned more than the minimum wage, and for whom data on wages[5] and all independent variables were available were included in the sample. Screening on this basis left us with 4,391 observations in January, and 48,411 for the year. For cost reasons, the tests which largely replicate our earlier study use only the January sample. The final tests and estimates of the distribution of workers between the sectors use the larger sample. The sample was restricted to men because of the substantially different nature of many women's jobs and the difficulty of fitting them into the dual market typology. In particular, pink collar jobs have many characteristics of both primary and secondary jobs. The other restrictions are made to ensure that if a secondary sector is identified by the analysis, it consists of more than part time earners or those with transient labor market attachment. As a result, ours is a very conservative test of dual market theory. We will fail to find a secondary market unless there are a substantial number of prime age males in it.

Our earlier work specified wage equations for the two sectors which included a constant, number of years of education and post school job experience and dummy variables for residence in an SMSA, never having been married and race.[6] Our first concern is that our previous finding of a distinct secondary sector and rationing of primary jobs was a consequence

of not including the square of the number of years of experience in the wage equations. Such a term is frequently included in wage equations because the rate at which wages increase with experience is expected to be greater for earlier years of experience than for later years of experience. Hence the coefficient on experience squared should be negative, indicating that the wage increase associated with an additional year of experience declines and may even become negative as the amount of experience the worker has already accumulated increases. Since many of the people we identified as having a high probability of being secondary workers were over 50 and since it is well known that average wages peak at about 50 years and then begin to fall, it is possible that those people we identified as being secondary workers were just older workers earning less than a wage equation with no second order term would predict.

We therefore begin by estimating our original model with the single modification that experience squared is included in the wage equations. This does not significantly alter the results. The results are reported in Table 1. The first column of the table gives ordinary least squares (OLS) estimates of a standard wage equation while the second through fourth columns give the estimates of the dual labor market model. The second and third columns give the estimated wage equations for the primary and secondary sectors (equations 1 and 2 in the text) while column four gives the estimates for the switching equation (equation 3 in the text) which determines the probability that an individual will obtain primary employment. The second and third columns can therefore be interpreted in the same way as standard wage equations. Since the dependent variable is

the natural logarithm of the wage, the coefficients are percentage changes associated with a one unit change in the explanatory variable. The parameters of the switching equation do not have an analogous interpretation since the probability of obtaining primary sector employment is a nonlinear function of the coefficients. However, positive coefficients indicate that the variable increases the probability that an individual with that characteristic will obtain primary employment.

As in our previous work, the primary sector equation is similar to that obtained using OLS estimation. The return to education is somewhat higher in the primary sector than in the OLS equation and the black-white wage differential somewhat lower. In the secondary sector there is no return to schooling and a small although statistically significant return to experience. In both sectors the effect of experience squared is negative so that the return to experience decreases as experience already accumulated increases. There are also somewhat surprisingly large effects of living in an SMSA and never having been married on secondary sector wages. Using a likelihood ratio test we can formally reject at the .01 level the hypothesis that only one wage equation is needed to describe the data.[7]

Expected wages are higher in the primary sector for most workers. For example, a white who had never married, did not live in an SMSA, had eight years of education and no experience would earn marginally more in the primary sector than in the secondary sector. After twenty years of experience, he would earn nearly two dollars an hour more in the primary sector than in the secondary sector.

Examination of the coefficients of the switching equation shows that having been married, having a lot of education and being white increases the likelihood of being in the primary sector.

Our results also confirm our previous finding of noneconomic barriers to primary sector employment for blacks. Blacks and/or more educated workers are more likely to be employed in the secondary sector than we would expect if they were free to choose between the two sectors. To understand how we reach this conclusion, consider the case in which there are no noneconomic barriers to employment and individuals choose to work in the sector in which they receive the highest wages over their lifetimes. In our earlier paper, we demonstrated that under reasonable assumptions, this implies that the coefficients of the switching equation should be equal to the difference between the coefficients of the primary and secondary wage equations.[8] Intuitively, if a characteristic like education earns a larger reward in one sector than in another, people with that characteristic should be more likely to be in the sector where they earn the reward. Therefore, if education is more valuable in the primary sector than in the secondary sector, the coefficient in the switching regression should be positive -- people with more education should be more likely to be in the primary sector. In fact, this relation holds, but the effect is not as large as would be expected given how much more educated people earn in the primary sector.

Of course, even if there were no noneconomic barriers to primary sector employment, workers would not choose their sector of employment

solely on the basis of the wages they would earn but would also consider working conditions and other nonpecuniary aspects of employment in the two sectors. If personal characteristics affect how workers respond to the nonpecuniary aspects of employment, the coefficients in the switching equation may not be equal to the difference between the primary and secondary sector coefficients even if workers are free to choose their sector of employment. Since we anticipate that people who do not live in an SMSA or who have never been married may view the nonpecuniary aspects of secondary employment differently from those in SMSAs or who have been married, we test only the constraint that the coefficients on race and schooling in the switching equation are equal to the difference between the coefficients in the wage equations for the two sectors. The likelihood ratio test statistic for this constraint is 7.96. With one degree of freedom[9] we reject the hypothesis at the .01 level. Both coefficients are larger than what we would expect if individuals were free to choose between the sectors. We therefore conclude that at least some blacks and/or more educated people are confined to jobs in the secondary sector.[10] Of course, tastes for the nonpecuniary aspects of employment may differ by race and education. However, other studies show that blacks and more educated workers value the nonpecuniary aspects of primary employment more rather than less than other workers.[12]

Since we reject the hypothesis that individuals are free to choose their sector of employment, the assumption that individuals make a one time decision regarding their sector of employment (as they would if there were free choice and sector specific skills) is not valid. Consequently,

the exclusion of experience and experience squared from the switching equation is not justified. Columns 5 - 7 of Table 1 give estimates of the model with experience and experience squared in the switching equation using the sample for the entire year. The results are not substantially different from those obtained using the smaller sample and without the experience variables in the switching equation except that standard errors are generally smaller and the return to experience in the secondary sector is now estimated to be negative in the early years of a worker's career and positive only towards the end. In contrast to our previous paper, we can now reject the hypothesis of no black-white wage differential in the primary sector although our estimate of this differential remains smaller than that obtained using OLS estimation. Again, using a likelihood ratio test, we can reject the single sector model.

The division of the work force into two sectors would be without consequence if workers were free to move between sectors and skills were fully portable. In this case, workers would be employed in whichever sector offered them the highest wage adjusted for nonpecuniary attributes of employment. Following the same reasoning used to derive the test of free choice when some skills are not perfectly portable, we can test the above model by testing whether the coefficients in the switching equation are equal to the difference between the primary and secondary wage coefficients. Again, since the other variables may be related to the value attached to nonpecuniary benefits, we limit ourselves to testing this equality for education and race. The hypothesis of free choice can be rejected at the .01 level.

These results are strongly supportive of dual market theory. We can not reject any of the predictions of dual market theory and we can reject the alternative hypothesis that the dual structure does not exist or that people are free to choose between the sectors. In particular, we find that the returns to education are near zero in the secondary sector and that that the return to experience is considerably smaller in the secondary sector than in the primary sector. Past work has not been so unambiguously supportive of dual market theory. We turn now to the question of whether our method can shed light on why past work has not been as decisive.

III. Locating the Secondary Sector.

Table 2 shows the breakdown of sector attachment for several types of workers. These are estimates of the ex post probabilities that the worker is actually in a given sector rather than the ex ante probability that he will obtain employment in that sector. The three columns next to each category show the percent of people in that category who had a 0-30% probability of being in the secondary sector (secondary workers) a 30-70% probability (?s) and a 70-100% probability (primary workers).[11]

In the entire sample 7.5% of workers appear to be associated with the secondary sector. While this may seem small, 13.5% have unknown attachment of whom many presumably are in the secondary sector. Further, it should be remembered that we are using a sample of male full time workers who are heads of households. If women, teenagers and part time workers were taken into account, the proportion of workers in the secondary sector would be higher.

As might be expected, people who live in SMSAs, who are or have been married, whites, and the more educated are most likely to be found in primary sector jobs. Also union workers and those who have jobs with a union contract are much more likely to be found in the primary sector.

Tables 3 and 4 present the same breakdown for various industries and occupations. The results are substantially in accord with descriptive work on the dual market. Agricultural workers, retail sales workers, and service workers are more likely to be associated with the secondary market. Most manufacturing workers are very likely to be in the primary sector, but textile and apparel workers are not. Also, more secondary workers can be found among operatives in manufacturing than among the skilled crafts. One notable attribute of these tables suggests why past studies have often produced anomalous and inconsistent results -- None of the industries or occupations examined are identifiable as being entirely secondary. It seems that even in those industries or occupations which are substantially secondary, there are many people who are probably primary workers. This finding is not an artifact of our choice of industries or occupations for this table. It was true of all detailed (three digit census codes) occupations and industries for which there were enough people in our sample to be confident of the composition estimates. With over 48,000 people this was nearly all categories.

A large number of classification schemes have been used in previous research. The large degree of misclassification which is inherent in industry or occupation based schemes suggests that one reason for the inconsistency of results across studies may be varying degrees of

inaccuracy. To cast light on this possibility, we review four industrial classification schemes (Beck, Horan and Tolbert, 1978; Tolbert, Horan and Beck, 1980; Bibb and Form, 1977; Hodson, 1977) and one occupational classification scheme (Osterman, 1975). We chose these studies because Zucker and Rosenstein (1981) have reanalyzed the four industrial schemes and present a direct comparison of their results. Osterman's occupational classification system is the most accessible and one of the most widely used.[13]

Zucker and Rosenstein compare the industrial classification schemes first by examining the average characteristics of workers in each sector. Of the seventeen characteristics examined, Beck, Horan and Tolbert's classification system produced the anticipated differences in means for twelve, Tolbert, Horan and Beck's system produced differences with the expected sign for nine characteristics, Bibb and Form's system produced seven with the anticipated sign and Hodson's scheme produced six.

In addition, Zucker and Rosenstein estimated separate earnings equations for each sector for the four classification schemes. Beck, Horan and Tolbert's (1978) system was the only one which produced significantly different results in the two sectors. Thus among the industrial classification schemes, Beck, Horan and Tolbert seems to have performed somewhat better than the others, followed by Tolbert, Horan and Beck, Bibb and Form and Hodson.

Studies which have used occupational classifications have generally been more supportive of dual market theory than those using industrial classification (Rosenberg, 1976; Osterman, 1975). In particular, Osterman

estimates sharply differing wage equations for the primary and secondary sectors, and the differences correspond to the predictions of dual labor market theory.

Table 5 presents our estimates of the true distribution of workers in each of the five studies' "sectors". Our results suggest that all five schemes are broadly consistent with the data. Sectors classified as "periphery" or "secondary" contain a higher fraction of secondary workers and fewer primary workers. However, all five schemes also misclassify a large number of workers. Thus it is not surprising that the evidence generated by using these classification systems is so mixed. Of course, these classification systems might perform better for women, teenagers and part time workers. However, prime age males make up a substantial proportion of employment in nearly all three digit occupations and industries. Thus, even in a broader sample there would be substantial misclassification.

Osterman's occupationally based classification scheme does a much better job than the industrial schemes of dividing workers between sectors although substantial misclassification remains. It nevertheless appears that his results are strongly supportive of the dual labor market hypothesis because his classification scheme is more accurate than those used by other researchers. Further, it is worth noting that the two schemes used by Beck, Horan and Tolbert, which performed marginally better in Zucker and Rosenstein's comparison, perform slightly better than the other two systems. Both have fewer primary workers misclassified as being in the periphery, and more secondary workers who are correctly classified.

IV. Conclusion.

Past attempts to test the two most important tenets of dual market theory -- that workers receive no returns to human capital investments in the secondary sector and primary sector jobs are rationed -- have produced mixed and inconclusive results. A major problem with past studies was the use of a priori classification systems. The analysis in our 1985 paper and here avoids this problem. We use a statistical technique which allows the simultaneous determination of the sector workers are in and the characteristics of the sectors. Both the analysis in our earlier paper and the extensions presented here are strongly supportive of dual market theory.

Further, in this paper we have used the switching model to determine the sectoral composition of industries and occupations. We have used this information to evaluate the classification systems used by past researchers. We find that there are almost no occupations or industries which are entirely secondary. Consequently, none of the systems used by previous researchers avoids substantial misclassifications. Using our sample of adult mall full time workers, we find that between 52% and 71% of those classified as being in the secondary sector or periphery by the five systems we evaluate are probably primary sector workers. Only 11 to 20% of those classified as secondary by these schemes are identified as having a high probability of being secondary by our model. Finally, of the schemes we analyzed, those with marginally less severe misclassification problems produce results more in accord with dual market theory.

Taken together these findings provide extremely strong support for the view that labor market segmentation is an important determinant of the distribution of value in the U.S. The results which suggest that at least nonwhites may not have easy access to primary sector jobs should raise questions about the efficiency and fairness of the mechanism by which primary sector jobs are allocated.

One important area for future research is continued examination of how primary sector jobs are allocated and what can be done to make the system of allocation fair and efficient. In particular, patterns of mobility between the sectors are of interest for what they reveal about the effects of segmentation on lifetime income. These are issues we intend to address in future research.

Footnotes

1. Some studies have attempted to examine the related issue of restricted mobility between the sectors. The results are mixed and difficult to interpret. Leigh (1976) and Schiller (1977) find substantial upward mobility for blacks and those at the bottom of the income distribution and argue that this refutes dual market theory. On the other hand, Rosenberg (1976) and Carnoy and Rumberger (1980) 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 whites. These authors argue that differential mobility supports dual market theory. However, dual market theory does not rule out all mobility between the sectors. These studies do not address the key issue -- whether there are qualified individuals who would like to work in the primary sector but cannot find a job there.

2. The use of zero as a cutoff point is an inconsequential normalization. Any other cutoff point could be used without substantively altering the results.

3. More formally, suppose that there are some sector specific skills so that workers choose their sector of employment at the beginning of their careers. We assume that workers would choose to enter the secondary sector only if the ratio of the present discounted value of their lifetime earnings in the secondary sector to the present discounted value of their lifetime earnings in the primary sector exceeds some amount which compensates them for the poorer working conditions in the secondary sector. The assumption that the effect of experience on wages is multiplicative is nearly universal in empirical work. Under this assumption, the condition that workers enter the secondary sector is just

$$(4) \qquad X_i(B_s - B_p) + e_{si} - e_{pi} > C$$

where X excludes experience and C is a function of the compensation required for secondary employment and the returns to experience in the two sectors. If, given the pecuniary benefits of being in the primary and secondary sectors, blacks are more likely than whites to be in the secondary sector, our estimates will indicate that C is lower for blacks than for whites. As noted in the text, this suggests that either blacks are less averse to secondary employment or blacks are not free to choose between the sectors.

4. A straightforward application of Bayes theorem shows that the probability that a worker is in the primary sector is the likelihood for the primary sector for that observation divided by the likelihood for the whole observation.

5. For salaried workers, wages are computed by dividing weekly earned income by normal hours of work.

6. Job experience is measured as Age - (Years of schooling + 5).

7. Although the single equation model is nested in the switching model, when 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, if we reinterpret the null hypothesis as being that there is a single sector and that the unidentified parameters are zero, it is clear that the test follows a chi-squared distribution with degrees of freedom equal to the number of constraints plus the number of unidentified parameters. Treating the degrees of freedom in this way therefore yields a conservative test using the chi-squared distribution.

8. The assumptions are that experience is worth more in the sector where it was acquired then in the other sector and that utility can be expressed as being proportional to the present discounted value of lifetime earnings where the factor of proportionality is different for the two sectors. Under these assumptions, the experience variables are not included in the switching equation because, following the above assumptions, sector attachment is a once-and-for-all choice. Therefore under these assumptions the probability of primary sector attachment should not vary with job experience.

9. Two coefficients are constrained, but imposing the first constraint constitutes a normalization of the unidentified variance of the switching equation error (previously normalized to one). Thus only one constraint is truly binding and the two constraints involve the loss of only one degree of freedom.

10. Note that if we assumed that living in an SMSA and/or never having been married do not affect valuations of the nonpecuniary aspects of employment, we would also reject the hypothesis of free choice. The chi squared statistic would be at least 7.96 which is statistically significant at the .05 even for three degrees of freedom.

11. Percentages are calculated using the CPS household weights.

12. Blacks are more likely to support unions in representation elections (Farber & Saks, 1980; Dickens, 1983), are less likely to quit a job (Viscusi, 1979) and have greater demand for occupational safety than equivalent whites.

13. Osterman's classification was based on the 1960 census codes. We modified his classification system to correspon to the 1970 census codes. It is possible that we therefore underestimate the accuracy of his system.

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Figure 1. Hypothetical Scatter Plot--
Standard Human Capital Theory

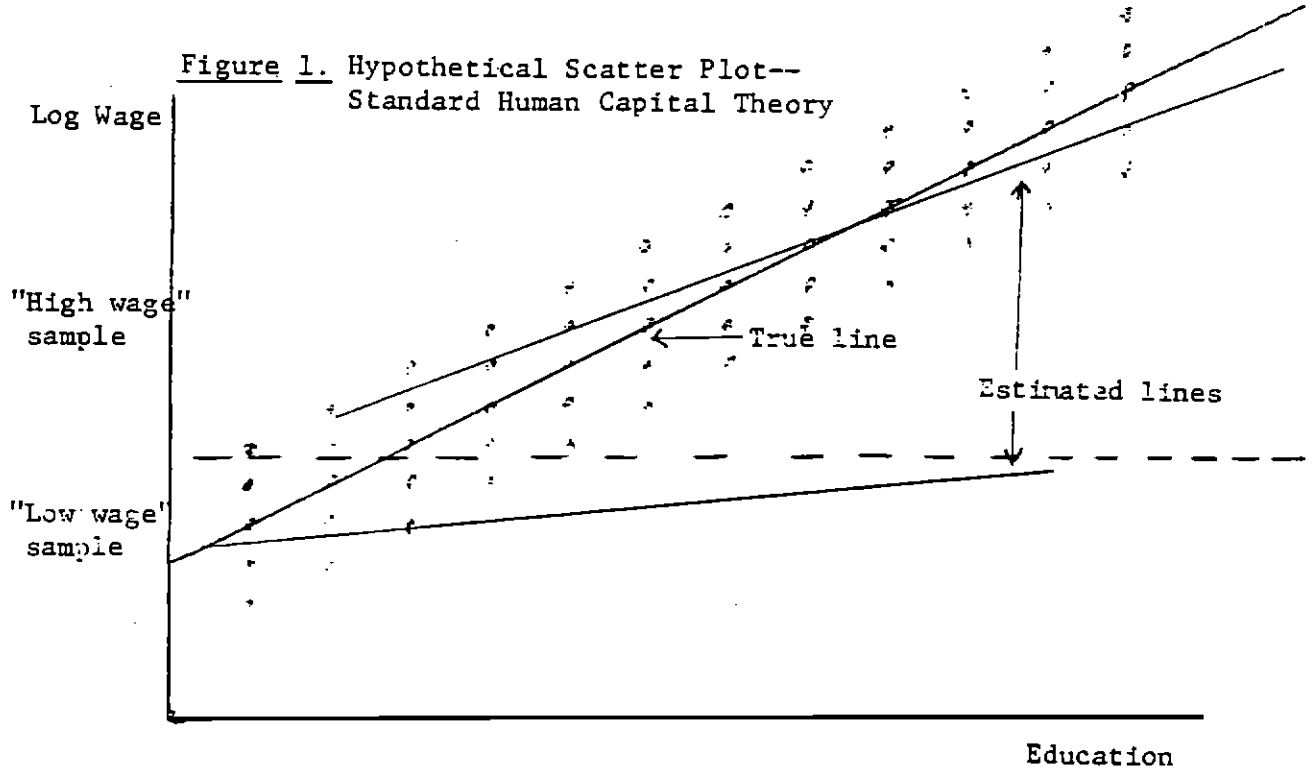

Figure 2. Hypothetical Scatter Plot--
Dual Market Theory

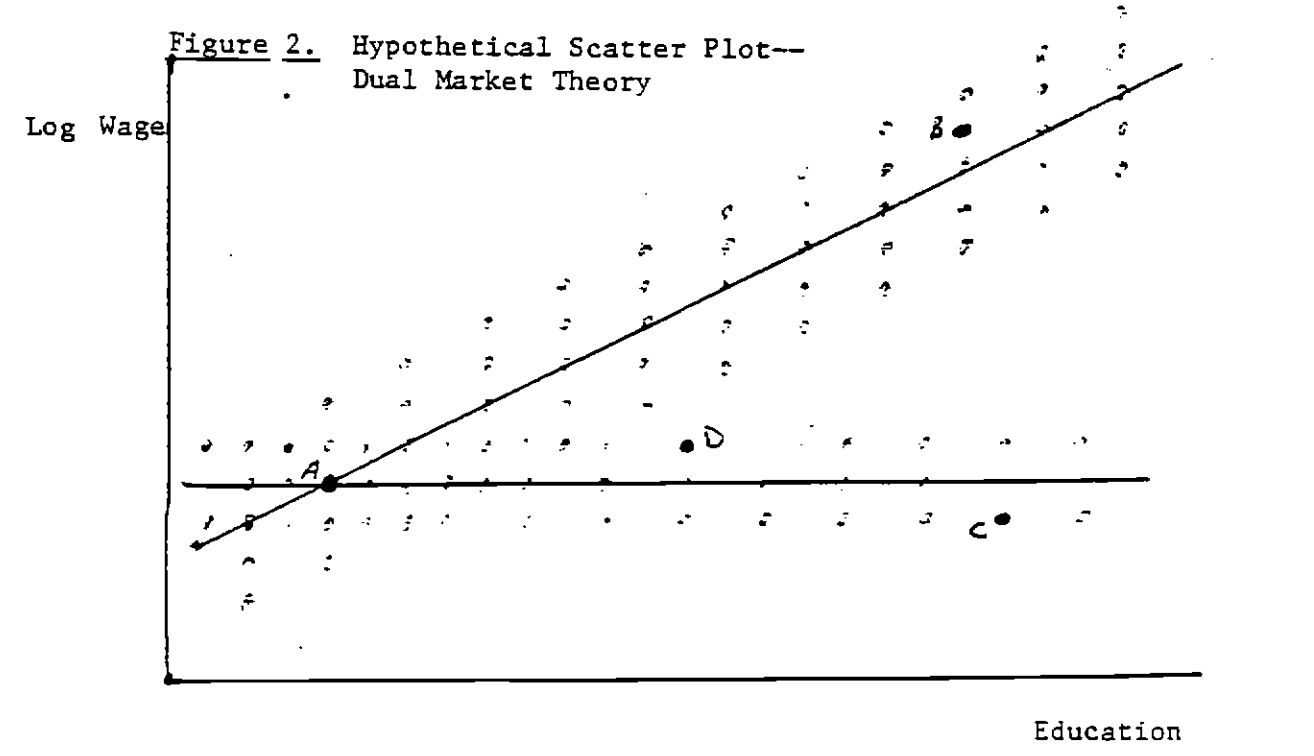

TABLE 1

PARAMETER ESTIMATES FOR SINGLE AND DUAL LABOR MARKET MODELS

VARIABLE	OLS	SWITCHING MODEL 1			SWITCHING MODEL 2		
	COEFF.	Primary COEFF.	Secondary COEFF.	Switch COEFF.	Primary COEFF.	Secondary COEFF.	Switch COEFF.
Constant	0.730	0.607	1.187	-0.246	0.720	1.146	-0.315
	(0.014)	(0.303)	(0.245)	(0.238)	(0.086)	(0.107)	(0.137)
SMSA	0.109	0.101	-0.403	0.567	0.078	-0.330	0.445
	(0.004)	(0.085)	(0.095)	(0.119)	(0.018)	(0.030)	(0.035)
Never married	-0.106	-0.025	0.365	-0.602	-0.057	0.397	-0.577
	(0.007)	(0.103)	(0.124)	(0.143)	(0.027)	(0.048)	(0.006)
School	0.069	0.081	-0.003	0.022	0.077	0.005	0.018
	(0.001)	(0.004)	(0.014)	(0.019)	(0.001)	(0.006)	(.007)
White	0.158	0.127	-0.222	0.477	0.127	-0.321	0.515
	(0.007)	(0.082)	(0.125)	(0.161)	(0.023)	(0.045)	(0.054)
Experience	0.030	0.032	0.011	-	0.030	-0.025	0.048
	(0.001)	(0.002)	(0.005)		(0.002)	(0.005)	(0.006)
Experience Squared	-0.00046	-0.00047	-0.00023	-	-0.00041	0.00066	-0.00107
	(0.00001)	(0.00005)	(0.00009)		(0.00005)	(0.0001)	(0.00012)
Std. Error	0.418	0.338	0.722	*	0.347	0.772	*
Covariance with switching error		0.047	-0.698	-	0.028	-0.757	-
		(0.369)	(0.079)		(0.106)	(0.023)	
Log Likelihood	-26467.04	-2259.01			-25283.039		
N	48411	4391			48411		

* The standard error of the switch equation is normalized to one.

TABLE 2
SECTORAL COMPOSITION

TYPES OF WORKERS	PCT. SECONDARY	?	PCT. PRIMARY
ALL WORKERS	7.5	13.5	79.0
LIVING IN SMSA	6.3	10.3	83.4
NOT LIVING IN SMSA	10.1	21.4	68.5
NEVER MARRIED	15.9	30.6	53.5
MARRIED BEFORE	6.6	12.1	81.3
WHITE	6.7	12.3	81.0
NON-WHITE	14.4	27.5	58.1
UNION MEMBER	2.7	7.9	89.4
NOT UNION MEMBER	9.2	16.0	74.8
NO UNION CONTRACT	9.3	16.0	74.7
UNION CONTRACT	2.9	8.4	88.7
YEARS OF SCHOOL			
5	4.1	42.5	53.4
6	5.3	39.4	55.3
7	4.8	32.9	62.3
8	4.6	31.4	64.0
9	6.5	23.8	69.7
10	6.3	21.4	72.3
11	6.5	20.6	72.9
12	7.9	18.6	73.5
13	7.2	13.7	79.0
14	7.2	13.3	79.6
15	8.1	11.1	80.8
16	10.8	12.5	76.7
17	7.8	8.4	83.8
18	8.0	6.6	85.4
19 OR MORE	9.2	6.8	84.0

TABLE 3

COMPOSITION OF INDUSTRY EMPLOYMENT

INDUSTRY	SECONDARY	?	PRIMARY
AGRICULTURE, FORESTRY AND FISHERIES	25.29	36.39	38.32
MINING	2.07	8.64	89.29
CONSTRUCTION	3.75	13.12	83.13
NONDURABLE MANUFACTURING			
FOOD AND KINDRED PRODUCTS	5.60	16.50	77.90
TOBACCO	8.52	13.80	77.68
TEXTILE MILL PRODUCTS AND APPAREL	6.97	26.11	66.92
PAPER AND ALLIED PRODUCTS	2.27	7.11	90.62
PRINTING, PUBLISHING AND ALLIED IND.	7.83	11.12	81.05
CHEM., PETROL., COAL, RUB. AND PLASTIC	2.76	10.33	86.91
LEATHER AND LEATHER PRODUCTS	12.35	30.70	56.95
DURABLE MANUFACTURING			
LUMBER,WOOD AND FURNITURE	9.33	26.14	64.53
STONE, CLAY, GLASS AND CONCRETE PROD.	3.59	14.92	81.49
PRIMARY METALS	2.26	7.20	90.54
MACHINERY AND EQUIPMENT	2.42	7.74	89.84
TRANSPORTATION	6.27	10.53	83.20
COMMUNICATIONS (EXCEPT TELEPHONE)	9.69	15.52	74.79
UTILITIES AND TELEPHONE	1.40	5.01	93.59
WHOLESALE	6.94	14.50	78.56
RETAIL (EXCEPT EATING, DRINKING AND LIQ.)	13.35	21.60	65.06
EATING & DRINKING PLACES, LIQUOR STRS.	29.29	32.11	38.60
FINANCE, INSURANCE AND REAL ESTATE	7.06	11.73	81.20
BUSINESS AND REPAIR SERVICES			
ADVERTISING, RESEARCH AND COMPUTERS	2.75	6.05	91.21
SERVICES TO BLDGS AND PERSONNEL SUPPLY	24.21	24.12	51.67
DETECTIVES AND PROTECTIVE SERVICES	48.66	17.83	33.51
REPAIR AND SERVICES N.E.C.	8.35	20.31	71.34
PERSONAL SERVICES	23.94	26.88	49.18
ENTERTAINMENT AND RECREATIONAL SERVICES	18.75	22.91	58.34
PROFESIONAL AND RELATED SERVICES			
OFFICES OF HEALTH PROFESSIONALS	9.69	7.05	83.26
HOSPITALS AND HEALTH SERVICES N.E.C	11.33	18.04	70.63
NURSING, CHILD AND RESIDENTIAL CARE	26.61	22.09	51.30
EDUCATION AND RELATED INSTITUTIONS	15.51	15.29	69.19
OTHER PROFESIONAL SERVICES	2.79	5.78	91.43

TABLE 4

COMPOSITION OF EMPLOYMENT BY OCCUPATION

OCCUPATION	SECONDARY	?	PRIMARY
MANAGERS AND PROFESSIONALS(EXECPT THOSE BELOW)	3.44	5.83	90.73
THERAPISTS AND PHYSICIANS' ASSISTANTS	11.81	16.34	71.85
POST SECONDARY TEACHERS AND LIBRARIANS	9.73	7.53	82.74
ECONOMISTS*	0.00	4.71	95.29
SOCIOLOGISTS*	29.00	0.00	71.00
OTHER TEACHERS	19.15	16.11	64.74
SOCIAL, RECREATIONAL AND RELIGIOUS WORKERS	36.41	20.16	43.43
WRITERS, ARTISTS, ENTERTAINERS AND ATHLETES	7.54	11.08	81.37
TECHNICAL, SALES AND ADMINISTRATIVE SUPPORT OCCUPATIONS			
HEALTH TECHNOLOGISTS AND TECHNICIANS	5.69	15.87	78.44
TECHNOLOGISTS AND TECHNICIANS EXCEPT HEALTH	2.10	6.95	90.95
SALES			
RETAIL	22.68	23.61	53.72
OTHER THAN RETAIL	6.68	11.67	81.65
ADMINISTRATIVE SUPPORT			
SUPER., COMP. OP. AND SECRETARIES	4.23	11.65	84.13
INFORMATION CLERKS	19.24	17.00	63.76
MESSENGERS, OFFICE MACHINE OPERATORS, MAIL, RATE,			
PERSONNEL, LIBRARY AND BOOKKEEPING CLERKS	18.38	22.09	59.53
BANK CLERKS	26.09	29.19	44.72
OTHER	5.97	16.64	77.39
SERVICE OCCUPATIONS			
PROTECTIVE SERVICES(EXCEPT GUARDS)	16.04	0.00	83.96
GUARDS	39.05	22.87	38.08
FOOD PREPARATION AND SERVICE	34.29	34.07	31.64
HEALTH SERVICE OCCUPATIONS	23.94	44.93	31.13
CLEANING, HOUSEHOLD AND PERSONAL SERVICES	24.61	28.09	47.31
FARM, FORESTRY AND FISHING OCCUPATIONS	27.42	37.57	35.01
PRECISION PRODUCTION, CRAFT AND REPAIR OCCUPATIONS			
MECHANICS AND REPAIRERS	3.72	13.05	83.23
CONSTRUCTION SUPERVISORS	2.10	6.22	91.68
CONSTRUCTION TRADES(EXCEPT SUPERVISORS)	3.26	13.45	83.29
EXTRACTORS, PLANT AND SYSTEM OPERATORS, CRAFT			
SUPERVISION AND INSPECTION AND METAL CRAFTS	2.07	7.38	90.55
OTHER PRECISION PRODUCTION	5.14	19.15	75.70
OPERATIVES(EXCEPT TEXTILE, APPAREL AND FURNISHINGS)	4.33	15.09	80.58
OPERATIVES(TEXTILE, APPAREL AND FURNISHINGS)	9.60	36.98	53.42
TRANSPORTATION, AND MATERIAL MOVING OCCUPATIONS			
MOTOR VEHICLE OPERATORS	10.08	19.68	70.24
RAIL AND WATER TRANSPORTATION	5.46	8.45	86.09
MATERIAL MOVING EQUIPMENT OPERATORS	3.99	15.74	80.27
HANDLERS, EQUIPMENT CLEANERS, HELPERS, AND LABORERS			
GARAGE WORKERS, VEHICLE WASHERS AND PACKERS	20.07	39.39	40.55
OTHERS	10.56	21.82	67.62

*BASED ON SMALL NUMBER PEOPLE IN OCCUPATION

TABLE 5

COMPARISON OF DUAL LABOR MARKET CLASSIFICATION SYSTEMS

BECK, HORAN AND TOLBERT (1978) INDUSTRIAL CLASSIFICATION

	SECONDARY	?	PRIMARY
Core	4.97	10.63	84.39
Periphery	14.19	22.66	63.14

BIBB AND FORM (1977) INDUSTRIAL CLASSIFICATION

	SECONDARY	?	PRIMARY
Core	3.38	10.04	86.58
Periphery	11.29	17.37	71.32

HODSON (1977) INDUSTRIAL CLASSIFICATION

	SECONDARY	?	PRIMARY
Core	3.05	9.68	87.27
Periphery	12.02	18.42	69.56
State	1.33	6.01	92.66

TOLBERT, HORAN AND BECK (1980) INDUSTRIAL CLASSIFICATION

	SECONDARY	?	PRIMARY
Core	3.52	9.69	86.80
Periphery	14.98	21.97	63.03

OSTERMAN (1975) OCCUPATIONAL CODING SYSTEM

	SECONDARY	?	PRIMARY
Upper Tier, Primary	8.81	8.32	82.87
Lower Tier, Primary	5.48	12.31	82.21
Secondary	20.42	27.77	51.81