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A GOODNESS OF FIT TEST OF DUAL LABOR MARKET THEORY

William T. Dickens

Kevin Lang

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ABSTRACT

We subject our dual labor market model to a goodness of test fit and compare the results with those obtained using a single equation model with a complex error structure. The dual labor market does an excellent job of predicting the wage distribution except for failing to explain bunching at $7.50 and $10.00 per hour. The null hypothesis that the model is correct cannot be rejected at the .05 level. In contrast, the wage distribution predicted by the single labor market model differs significantly from the observed distribution.

William T. Dickens
Department of Economics
University of California
Berkeley, CA 94720

Kevin Lang
Department of Economics
Boston University
270 Bay State Road
Boston, MA 02215

I. Introduction

In a recent paper (Dickens and Lang, 1985), we tested the dual labor market view by estimating an endogenous switching model of wage setting with unknown regimes. While the paper has been well received, certain criticisms have led us to undertake additional tests of the model. In the next section we summarize our initial results and outline the major criticisms -- the most important being that our results were artifacts of our distributional assumptions. In the third section, we describe the results of a goodness of fit test of our distributional assumptions. The paper ends with a brief conclusion.

II. Results and Criticisms

In our 1985 paper we assumed that there were two sectors of the labor market, the primary and secondary sectors, with the wage of worker i given by

$$(1) \quad \ln w_i = X_i B_j + e_{ji} \qquad j = p,s.$$

Sector of employment was determined by a "switching" equation given by

$$(2) \quad y^*_i = X_i B_w + e_{wi} > 0$$

if and only if the individual is employed in the primary sector. Sector of employment was not assumed to be known. Instead, under the assumption that the error terms were jointly normally distributed, the three equations (1)-(2) were estimated by maximum likelihood.

Our results were very suportive of the dual labor market view. The

dual labor market model significantly outperformed a standard log wage equation with a homoskedastic error term.[1] The wage equation coefficients corresponded closely to the predictions of the dual labor market model. In addition, we showed that given assumptions about between group differences in the disutility of secondary sector employment, it was possible to test whether blacks face nonprice barriers to primary sector employment. The results were supportive of the existence of nonprice barriers.

Critics have raised two important and closely related points which we feel merit further investigation. The first view can be summarized as follows: "I always knew that the standard OLS wage equation specification was too simple and that the true error terms were heteroskedastic. When you take account of this heteroskedasticity, your results are exactly what I expect to find." In our original paper, we recognized that our model was equivalent to assuming a particular (but probably bizarre) distribution for the error term in the single equation model but argued that in the absence of our results, such a distribution would not be suggested. We still maintain this position. Although all of the people who have made variants of the above comments have estimated numerous OLS wage equations, none makes a practice of assuming a heteroskedastic error term. Nevertheless, we recognize that some of our critics may have better intuition than ours even if they have failed to act on it. We therefore compare our model with a single equation model which assumes a quite complex heteroskedastic structure below.

The related view can be summarized as "Your results rest on restrictive assumptions about functional form. If your equations are misspecified -- for example if there are more than two sectors or the error terms are not

normally distributed, your tests are incorrect." This argument was made most clearly in Heckman and Hotz (1986). While in our paper, we were quite specific about recognizing the limitations of our test, in retrospect, we may not have emphasized the potential problems sufficiently. We are not particularly concerned that the degree of labor market segmentation may exceed that posited in our work. There is a sense in which dualism as opposed to more general segmentation is unlikely to be more than a useful simplification. However, it is true that our test of nonprice barriers is sensitive to assumptions about functional form. Any of the problems listed above could account for our rejection of the null hypothesis of no nonprice barriers.

To a certain extent this is a criticism of all sophisticated econometric testing of economic theories. More generally, the argument takes the following form. All models are wrong not just because they are approximations to a complicated reality but also because the extent of our knowledge is inherently limited. Therefore any tests of economic theories which rely on models are based on assumptions which we know to be false, and it is impossible to tell whether we are rejecting the false assumptions or the theory we claim to reject. Heckman and Hotz come close to embracing this position in their recognition that human capital theory is no more testable than dual labor market theory (p530). Summers (1987) makes essentially this argument.

To the extent that our critics take this nihilistic position, we have considerable sympathy with their comments and are undertaking new tests which rely less heavily on a constrained model. Nevertheless, we believe that some light can be cast on the usefulness of the test by subjecting the

model on which it is based to a standard test of specification to determine whether the model is clearly incompatible with the data. The results are presented below.

II. Goodness of Fit Tests

The strategy we use in this paper is quite simple. We begin by calculating the Moore (1977) goodness of fit test statistic and by visually comparing the predicted and empirical wage distributions for the unrestricted dual market model using the PSID data set extract from our 1985 paper which excludes observations from the SEO sample. This data set contains 1696 observations on male heads-of-households.

We began by using $.25 intervals but discovered that the model failed[2] apparently because of its inability to predict the tendency of wages to cluster at exact dollar values. This result serves to underscore the view that all models are wrong. However, when we used $1 intervals, we could not reject the hypothesis that the model was correctly specified at the .05 level. The test statistic was 28.4 which has a probability of exactly .1 with twenty degrees of freedom. Moreover, as can be seen in figure 1, the dual labor market predicted distribution tracks the empirical distribution very well.

The intervals ranges are less than $1.71, $1.71 to $2.70, ... $20.71 and up.[3] Peaks appear in the intervals covering $7.50 and $10.00 per hour which are not captured by the model, but otherwise the model tracks the empirical distribution remarkably accurately. Thus we conclude that the dual labor market model provides a good representation of the wage distribution except for its inability to account for the attraction of

certain round numbers.

Of course, the fact that the dual labor market model represents the wage distribution well does not demonstrate that the heteroskedastic error models which other people "knew about all along" do not fit the distribution equally well. Since there are undoubtedly a large number of such models, it is a little difficult to know how to proceed. Nevertheless, we believe that the following approach will generally be viewed as reasonable.

Our model used 21 parameters. Out of a sense of good sport and fair play, we decided to allow the alternative model 22 parameters, 11 to describe the regression line and 11 to describe the heteroskedastic structure of the disturbance term. The first seven terms were obvious -- a constant and the effects of living in an SMSA, never having been married, race, schooling, experience and its square. Somewhat less obvious but we thought likely to be chosen by most people were schooling and experience interacted and race and schooling interacted. For the remaining two terms, we chose between interacting race and the experience terms and adding schooling squared and its interaction with race. The second specification performs better in the sense that the R^2 is higher for both the wage equation and the equation explaining the heteroskedastic structure. We therefore tested that specification using a goodness of fit test.

The heteroskedastic single equation model is easily rejected. The Chernoff-Lehmann test statistic is 67.5 with 20 degrees of freedom which is significant at any conventional level. Moreover, as can be seen from figure 1, compared with the dual labor market model, the predicted distribution based on the single equation model conforms notably less well to the empirical distribution. While we have not exhausted the set of error

distributions which people will have known about all along, we have given the single equation model a fair chance, and it has not performed up to the standards of the dual labor market model. We therefore conclude that the dual labor market model provides a better description of the wage distribution than single equation models.

III. Conclusion

While the dual labor market model outperforms a reasonable single equation alternative and "passes" a goodness of fit test, it is clear that the dual labor market model developed in our paper does not provide a complete description of the wage distribution. At the very least, it cannot account for certain spikes in the distribution. Moreover, it seems likely that with a sufficiently large data set, even a test based on the wage intervals used in this paper would allow us to reject the model.

While we find these results supportive of the dual labor market description of the wage distribution, they pose a more serious problem for our test of the existence of nonprice barriers to primary sector employment. Without considerable Monte Carlo experimentation which would be prohibitively expensive, it is impossible to determine precisely the effect on our test of apparently minor departures from the normality assumption. While we recognize this as a limitation of our test and that it serves to underline the importance of pursuing other avenues for testing the same hypothesis, it should nevertheless be recognized that this criticism is not particular to our model and test but instead is quite general. It can be applied to all attempts to test theories in the context of complex models.

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Footnotes

1. As we noted in our paper, the sampling distribution of the likelihood ratio test statistic we used is not well-defined, but Monte-Carlo evidence suggested that the approach we used was, in fact, conservative.

2. Our initial tests used the Chernoff-Lehmann test statistic because of its greater simplicity.

3. The use of these particular intervals was largely accidental. We initally used intervals expressed in logs. The upper and lower bounds were used to keep all predicted frequencies from falling notably below ten.

FIGURE 1