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UNION AND DEMOGRAPHIC WAGE, HOURS AND EARNINGS DIFFERENTIALS IN THE AGRICULTURAL LABOR MARKET

by

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This study's simultaneous structural equation model of wages and hours in the agricultural hired labor market produces four key results. First, the labor supply curve is virtually vertical, with a slight upward slope. Second, wages rise significantly with the number of hours worked per week. Third, currently there are no demographic wage differentials, though there were large union differentials in the 1970s. Fourth, there are some large demographic hours differentials which lead to large earnings differentials.

Wage and income differentials between various demographic groups of farmers and agricultural workers and between workers in agriculture and workers in other industries are cited as justification for various government programs (such as price supports, payment-in-kind, marketing orders, welfare, minimum wage laws, and labor relations acts). Yet little has been known about how wages, hours, and earnings differ across agricultural workers of various demographic and union status characteristics.

Unlike most previous research on hired agricultural workers, this study is based on a random sample of individual workers and calculates wage, hours, and earnings differentials adjusting for variations in education, experience, and other personal characteristics. Special attention is paid to union and other demographic differences among workers.

This paper is divided into four parts. First, a brief survey of the literature is presented. In the second section, both a reduced form and a structural model of wage and hours determination is estimated. Next, the relative contribution of wage and hours to earnings differentials are calculated. The paper ends with a summary and conclusions.

The Literature

Very little is known about the determinants of wage, weekly hours, and weekly earnings differentials of hired workers in the agricultural production sectors. Several good institutional studies of these markets present some summary statistics (see, for example, Mines and Martin, Martin and Rochin, Huffman, Mamer, and Hayes) and theoretical discussions (Ladd on unions). Most detailed empirical studies to date, however, rely on aggregate data, and hence are unable to study variations in wages or other variables based on individual differences.

These aggregate studies of agricultural labor markets examine the responsiveness of demand and supply to wages (Schuh); the markets for hired labor, unpaid family labor, and operator labor differences (Tyrchniewicz and Schuh); the effects of schooling on wages and labor supply (Gisser); and the interaction of schooling and minimum wage laws on farm wages and employment (Gallasch and Gardner).

Apparently, there are only two previous regression studies that use a random sample of individuals to examine wage, hours, or earnings differentials.[1] The first, Scott, Smith, and Rungeling, estimates wage differentials and labor force participation probabilities based on individuals' characteristics for four Southern rural counties. The second, Perloff, estimates wage and hours differentials for Californian and U. S. agricultural workers for the mid-1970s.[2]

Thus, there ~~has~~ have been no other empirical studies of union differences using either aggregate or individual data for any geographic region. Nor do there appear to be any other studies which have estimated differences in hours worked per week according to individual characteristics and hence no studies which have explained weekly earnings differences on the basis of these wage and hours effects.

A Model of Wage and Hours Determination

Given the availability of a national random sample of hired agricultural production workers, it is possible to simultaneously estimate wage and hours equations for individuals. Wages are determined by demographic characteristics, union status, location, and hours worked; while hours are determined by demographic characteristics, union status, location, and the wage. These two equations can be identified by zero restrictions. The maintained hypotheses in the following model are that hours, but not wages, are affected by a worker's marital status and the size of a worker's family; and wages, but not hours are affected by measures of education (cf, Gisser, however).

The linear reduced form model implied by these structural equations may be efficiently estimated using an iterative seemingly unrelated equation technique. Alternatively, the two structural equations can be efficiently estimated simultaneously using an iterative three-stage least squares technique. Both such methods of estimation are reported below.

Both the reduced form and structural models use a semi-log specification for the wage equation and a linear specification for the hours equation. Most nonagricultural studies have used these specifications (e.g., White and Olson and Perloff and Sickles). Box-Cox analysis on the reduced form equations show that the wage equation is closer to semi-log than linear and the hours equation is closer to linear (indeed, on the basis of a likelihood ratio test, we cannot reject these specifications).

The Data

One under-utilized source of information about agricultural production workers is the U. S. Bureau of the Census's annual May Current Population Survey (CPS). This random survey of tens of thousands of individuals throughout the U. S. contains a wealth of information on demographic and economic characteristics. As individuals in the sample are chosen by geographic location, the survey includes non-citizens.

This study is based on the surveys for the years 1975, 1978, 1981, and 1984.[3] In the wage and hours studies reported below, the sample was restricted to hired agricultural production workers only (individuals in horticulture and agricultural services as well as farmers and farm family members were excluded).[4] Since many agricultural workers are paid on a piece-work basis, usual hourly earnings are used to determine such workers' "wages," and these terms are used interchangeably below.

Unfortunately, the CPS does not report the crop or a worker's occupation (beyond "laborer," "foreman," or "manager"). So long as workers are free to choose their occupations and the crops they work on, there is no problem interpreting the results. Since fringe benefits are not included, though, the union earnings differentials reported below may underestimate the total earnings differentials which include fringe benefits.

The means of the variables used are shown in Table 1. The first column gives the data for the entire sample (averaged over the time period), the next two columns are for union and nonunion workers, while the last two columns are for females and males.5

Probably the most striking fact concerning these means is that union workers tend to have a decade more experience than other workers (where experience is defined as age minus years of education minus six). Union workers are more likely to be nonwhite, female, Mexican, and relatively less educated than other farm workers.

In general, women and men have similar numbers of years of experience and education. Men are twice as likely to be foremen or managers than are women. Most other characteristics of farm workers do not vary greatly by sex.

Table 2 shows the wages (usual hourly earnings), hours, and earnings for each of the four years. In general, nominal wages and earnings have trended upward, while workers put in almost three more hours per week in 1978 and 1984 than in 1975 and 1981. The standard deviations for all these figures are substantial (generally over a third of the mean).

Estimation

Tables 3 and 4 show the estimated reduced form and structural models for the log of the usual real hourly earnings and weekly hours equations. The GNP deflator was used to convert nominal wages into real (1975) wages.

The reduced form model, Table 3, was estimated using an iterative seemingly unrelated equations technique. The system R2 is 0.51, while the R2 for the log wage equation is 0.27 and for the weekly hours equation is 0.30. The covariance between the two equations is -1.21. As we are more interested in the structural model, Table 4, the coefficients of the reduced form equation are not discussed in detail. In general, of course, the results are consistent with those from the structural estimates, with the exceptions noted below.

Not surprisingly the correlation between observed versus predicted values is lower in the structural model than in the reduced form estimates for the log wage and hours equations. The reported system R2, however, is higher. These R2 measures should be interpreted with caution since an instrumental variables technique is used. The covariance between the two equations is -9.64, which indicated that unexplained variations in hours are negatively correlated with unexplained variations in wages.

Probably the most striking wage results of this analysis are the changes in the racial and union markups over time and the lack of discrimination against Hispanics and females. The time trends are captured by using time interactive dummy variables. The 17 percent wage premium that white hired workers received in 1975 vanished by 1978.[6]

The union wage differential has varied over time. It was 21 percent in 1975 and 61 percent in 1978. Apparently there was no statistically significant union differential in 1981, but the relatively large standard error on that coefficient may be due to the small sample of union members (six) in

1981. Since there were no union members in the 1984 sample, a union differential can not be estiamted for that year. F-tests reject the hypothesis that the coefficients on other variables varied over time.

None of the variables involving Chicanos, Mexicans, or females have coefficients that are statistically significantly different from zero at the 0.05 level. F-tests reject the hypothesis that the coefficients of other variables vary with sex. Thus, Chicanos, Mexicans, and women do not earn statistically significantly different wages than do white male, non-Hispanic workers. Foremen and managers, of course, earn more than other workers.

A number of geographic variables are statistically significantly different from zero at the 0.05 level. Given limited mobility due to information and other factors, these wage differentials are not surprising. Since the data are for May, some of these differentials may also reflect seasonal differences across regions. Although the reduced form estimates indicate that the real wage fell in 1984, the structural model does not show a statistically significant effect at the 0.05 level.

Not surprisingly, formal education does not have a statistically significant effect on hired workers' wages (though it does in the reduced form equation). The effect of experience on wages is not clear, since the null-hypotheses of no effect of experience and experience squared cannot be rejected at the 0.10 level but can be at the 0.05 level. In the reduced form equation, the experience variables are highly statistically significant, but that may reflect indirect hours effects.

The coefficient on the logarithm of usual hours is 0.444 and it is measured very precisely. That is, a 10 percent increase in the number of hours worked per week leads to a 4.4 percent increase in the wage. Thus, part-time workers (such as teenagers and housewives) may receive lower wages than others, all else the same.

While there is no evidence of wage discrimination, females work fewer hours than do males, either for reasons of tastes or discrimination. Unlike in the reduced form equation, the coefficient on the female dummy is not statistically significant; however, the relationship between experience and hours worked is substantially different for females than for males. While males work more hours per week as their experience (age) increases up to 26.9 years of experience (and fewer hours per week after that), females work essential the same number of hours every week regardless of experience. For example, a male with 18 years experience (the sample mean) works 8.4 more hours a week than a similarly experienced female.

There are some geographic variations in hours worked, but there is no trend in weekly hours over time. Foremen and managers work about 10 fewer hours per week than do other workers (controlling for wage differences). Married workers work over two hours more per week than single ones.

The coefficient on the real wage in the hours equation is precisely measured as 0.147. That is, a one dollar increase in the hourly wage increases weekly hours by 0.15. That is, the supply curve is slightly upward sloping in the relevant range.

Sample Selection

One might argue that treating union status as predetermined may bias the results. It is possible that union membership is not randomly determined. To test this possibility, a probit equation of union status was estimated. Then, based on the probit estimates, Heckman's test of sample selection bias is used.

Table 5 shows the probit estimates. Several factors have a statistically significant effect (at the 0.05 level). Whites are less likely to be union members. Increased experience raises the probability of being a union member until 35 years of experience, and then additional experience reduces the probability. Union membership is also more common in certain regions than others. The predictive powers of this equation are limited, however. Based on the equation, most workers are classified as nonunion members, as shown at the bottom of Table 5. Such limited predictive powers are not surprising since only a little over 3 percent of the total sample are unionized.

The hypothesis of sample selection bias can be rejected in both reduced form equations, using Heckman's test. The t-statistics are -0.96 for the log wage equation and -0.22 for the hours equation.

Simulations

Weekly earnings may be computed using the weekly hours and log wage as shown in the Appendix. The following simulations show the size of the earnings differentials and the degree to which they are due to wage or hours differentials.

The reduced form equations are used to compute the simulations in Table 6 so that the total effect of a change in a right-hand side variable can be easily calculated. That is, the wage differentials reported below do not hold hours constant; similarly the hours differentials do not hold wages constant. The figures in Table 6 are based on the coefficient point estimates, even when the null-hypothesis of zero effect cannot be rejected.

The table shows that a married white, male, nonunion, non-Hispanic, Californian with average experience and education and two children in 1984 was paid a wage of $2.86 (in 1975 dollars), worked 47.25 hours per week, and earned $131.53. A female worker with similar characteristics to this comparison worker would have earned $35.86 less per week (27 percent less), while working 10.3 fewer hours. Her wage, however, would be only 18¢ less (this wage differential is not statistically significant). Even using the point estimate for the wage effect, 80.2 percent of the earnings differential is due to the hours differential.[7]

Foremen earned $37.19 more and managers $44.76 more than other workers while working approximately one more hour per week. Their wages were 73 to 86¢ per hour more than that of other workers.[8] Only 7 to 8 percent of these differentials in earnings is due to hours effects.

The point estimates indicate that Hispanics' weekly earnings are $10-12 higher than other workers (8 to 9 percent higher). A little over one-third of the earnings differential is due to hours effects (but none of these differentials are statistically significant).

Workers with 30 years of experience earned nearly 30 percent more per week than the comparison worker with 18 years of experience. Workers with only 1 year of experience earned 21 percent less, while workers with 5 years of experience earned 9 percent less. Roughly 60 percent of each of these earning differentials is due to the hours differentials.

A worker who is not living with a spouse earns 17 percent less than a married worker. Nearly 78 percent of this differential is due to the hours differential. Similarly a worker with three children earns 3 percent less than one with two children, of which half this differential is due to the hours effect.

The impact of unions has varied greatly over time. In 1975, a union worker earned 33 percent more per week; in 1978, 71 percent more; and in 1981, 42 percent more. The differential in 1981 is not statistically significant at the 0.05 level. Union members worked longer hours in 1975 (8 percent more) and 1981 (13 percent more) than nonunion members. In these years, hours differentials explain 25 and 32 percent, respectively, of the weekly earnings differential. Union members worked fewer hours in 1978 than nonmembers. Since the union wage differential in that year was roughly twice that in the other years, it is conceivable that the lower union hours were partially in response to the unusually high union wage.

The only statistically significant race differential occurred in 1975. In that year, nonwhites earned 19 percent less than whites. Almost all of this earnings differential is due to the wage differential.

A Comparison with Other Studies

Several earlier studies estimated the effect of education on wages. Using aggregate, cross-sectional data (from 1950 and 1960), Gisser calculated that a one year increase in the average number of years per schooling in a State would raise the average wage in that State by approximately 10 percent. Based on individual data from four Southern counties, Scott, Smith, and Rungeling estimated that an extra year of schooling would raise one's wage by between 5 and 17 percent (depending on one's race and sex). This study's structural model finds no significant effect of education on wages of workers in agriculture. Even using the reduced form model, at the sample mean of 9.5 years of education, an extra year of schooling would lead to less than a 3 percent increase in wages. Thus, this study finds a lower return to education than did earlier studies.[9]

The Scott, Smith, and Rungeling study calculated the effect of age on wages. Since our measure of experience is highly related to age (age minus education minus six), the effects of age and experience might be expected to be quite similar. In their study, an increase in age of one year from 34 (the mean of our sample) would increase the wage of the average household head by about 2 percent.

Using a 0.05 confidence level, the structural model does not reject the null hypothesis of no effect of experience on wages. While the experience variables are statistically significant in the reduced form model, an increase of one year from the sample mean would raise the wage by less than 0.5 percentage points.

As discussed above, however, the structural model does show a substantial effect of experience on hours, so that earnings vary with experience. Based on the reduced form estimates, a married white Californian male with two kids, and 18 years exerience and average education would be paid a wage of 8 percent above that of a worker with only 1 year of experience and would earn 21 percent more per week. In contrast this worker would be paid a 10 percent lower wage and earn 30 percent less per week than a worker with 30 years experience. Thus, this study finds large experience effects, but these effects are largely due (60 percent) to the increased hours worked by more experienced workers.

Conclusions

This study is the first to use a structural model based on individual data to examine hired agricultural workers' wages and hours. There are four key results. First, an individual's labor supply curve is virtually vertical. Since most experienced workers work well in excess of 40 hours per week, it is not surprising that their supply curves are inelastic. As a result, industry supply can only be increased by attracting new workers to the industry.

Second, substantially higher wages are paid to individuals who work longer hours. Apparently, over time, workers find higher paying jobs with relatively long hours. Only inexperienced and other part-time workers take relatively low-paying jobs.

Third, currently there are no demographic wage differentials. Racial wage discrimination ended by 1978 and there appears to be no wage discrimination against women or Hispanics. Union differentials were large in the 1970s. Due to small samples of union members in the 1980s, the size of the union differential now is unclear, but it may have dissipated. The only persistent differentials are geographic. They may indicate high costs to migration or may be due to seasonality effects (since only May data are used).

Fourth, there are some substantial demographic hours differentials. In particular, females' hours do not vary with experience as do men's. On average, females work fewer hours per week than do men, so that their weekly earnings are lower by 27 percent. Whether this differential is due to personal preferences or discrimination remains to be determined.

In short, these results show that earnings differentials are not due to wage discrimination. Individuals in part-time jobs are the ones who receive the lowest wages. As a result, hours and wages are positively correlated so that earnings vary more with experience than do wages or hours.

Appendix

Earnings

In this appendix, the formula for earnings is derived given estimates of log wages and hours which are bivariate normally distributed.10 This model is a special case of the one in Perloff and Sickles. Let u be the natural logarithm of the wage, while h is hours. Then expected earnings are:

$$E(e^u h) = \int_{-\infty}^{-\infty} \int_{-\infty}^{-\infty} e^u \, h \, f(u,h) \, du \, dh,$$

where

$$\begin{pmatrix} u \\ h \end{pmatrix} \sim N\left(\begin{pmatrix} \mu_u \\ \mu_h \end{pmatrix}, \begin{pmatrix} \sigma_{uu} & \sigma_{uh} \\ \sigma_{uh} & \sigma_{hh} \end{pmatrix}\right),$$

and $f(u,h)$ is a bivariate normal density function. Further, $g(u|h)$ is a conditional joint normal density function, and $f_1(u)$ is a marginal normal density function.

Then,

$$E(e^u h) = \int_{-\infty}^{-\infty} e^u \, f_1(u) \int_{-\infty}^{-\infty} hg(h|u) \, dh \, du,$$

$$= \int_{-\infty}^{-\infty} e^u \, f_1(u) \, [\mu_h + \frac{\sigma_{uh}}{\sigma_{hh}} (u - \mu_u)] \, du$$

$$= (\mu_h - \frac{\sigma_{uh}}{\sigma_{hh}} \mu_u) \int_{-\infty}^{-\infty} e^u \, f_1(u) \, du + \frac{\sigma_{uh}}{\sigma_{hh}} \int_{-\infty}^{-\infty} e^u u \, f_1(u) \, du$$

$$= (\mu_h - \frac{\sigma_{uh}}{\sigma_{hh}} \mu_u) \; e^{\mu_u + .5\sigma_{uu}} + \frac{\sigma_{uh}}{\sigma_{hh} \; 2\pi\sigma_{uu}} \int_{-\infty}^{-\infty} e^u u \; \exp\{\frac{-1}{2\sigma_{uh}} (u - \mu_u)^2\} \; du$$

$$= e^{\mu_u + .5\sigma_{uu}} \; [\mu_h - \frac{\sigma_{uh}}{\sigma_{hh}} \mu_u + \frac{\sigma_{uh}}{\sigma_{hh}} (\mu_u + \sigma_{hh})]$$

$$= e^{\mu_u + .5\sigma_{uu}} \; [\mu_h + \sigma_{uh}] \; .$$

Table 1
Means of Variables
May 1975, 1978, 1981, and 1984 Current Population Survey

	Agricultural Production Workers				
	All	Union	Nonunion	Female	Male
Union	.032	1.0	0.0	.046	.030
Female	.151	.214	.149	1.0	0.0
White	.849	.643	.856	.765	.864
Chicano	.054	.048	.054	.041	.056
Mexican	.120	.214	.117	.173	.111
Foreman	.029	.024	.029	.015	.031
Manager	.039	0.0	.041	.020	.043
Experience	18.076	28.214	17.737	18.929	17.924
Education	9.517	7.98	9.569	9.393	9.540
North East	.036	0.0	.038	.046	.035
Mid-Atlantic	.043	.024	.044	.046	.043
East North Central	.981	.143	.097	.107	.096
West North Central	.140	.024	.144	.077	.151
South Atlantic	.105	.024	.108	.163	.095
East South Central	.056	.024	.057	.041	.058
West South Central	.066	.024	.067	.046	.069
Mountain	.131	.024	.134	.087	.138
West	.049	.310	.041	.082	.044
California	.138	.381	.129	.184	.129
Texas	.080	.024	.082	.031	.089
Florida	.059	0.0	.061	.092	.053
Number of Children	1.613	1.405	1.620	1.653	1.606
Married, Living Together	.551	.690	.547	.612	.540
1978	.456	.452	.457	.480	.452
1981	.053	.143	.049	.092	.045
1984	.088	0.0	.091	.077	.090
Sample Size	1295	42	1253	196	1099

Note: South Atlantic does not include Florida, East South Central does not include Texas, and West does not include California. The classification "Chicano" includes individuals who describe themselves as "Mexican American" or "Chicano."

Table 2
Means of Nominal Wages, Hours, and Nominal Earnings
May 1975, 1978, 1981, and 1984 Current Population Survey
Wage and Earnings in Cents per Hour
(Standard Deviations in Parentheses)

	1975	1978	1981	1984
Wage	236.30	291.31	369.74	404.93
	(120.03)	(176.74)	(108.85)	(155.32)
Hours	41.222	44.892	41.382	45.009
	(18.345)	(18.331)	(12.637)	(16.742)
Earnings	97.770	127.96	150.75	178.41
	(62.762)	(76.249)	(56.129)	(84.077)
Sample Size	522	591	68	114

Note: Standard deviations are in parentheses.

Table 3
Reduced Form, Iterative Seemingly Unrelated Regressions

	Log Usual Hourly Earnings		Usual Weekly Hours	
	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	4.898	62.57	31.229	8.70
Union x 1975	0.289	3.51	1.431	0.38
Union x 1978	0.486	6.00	-6.251	-1.69
Union x 1981	0.031	0.22	1.528	0.24
Female	0.011	0.22	-5.002	-2.30
White x 1975	0.194	4.34	0.914	0.46
White x 1978	0.009	0.21	-0.439	-0.22
White x 1981	-0.082	-0.83	-1.232	-0.27
White x 1984	0.110	1.23	3.482	0.85
Chicano	0.055	1.15	1.528	0.70
Mexican	0.047	1.16	1.339	0.72
Foreman	0.228	4.04	0.987	0.38
Manager	0.264	5.28	1.360	0.59
Experience	0.013	6.02	1.129	11.37
Experience squared	-0.0002	-5.47	-0.020	-11.43
Female x Experience	-0.010	-1.94	-0.973	-4.12
Female x Experience sq.	0.0002	1.59	0.019	3.99
Education	-0.013	-1.30	-1.078	-2.31
Education squared	0.002	3.11	0.101	3.96
Number of Children	-0.016	-2.81	-0.869	-3.31
Married, Living Together	0.041	1.84	6.211	5.12
North East	0.067	1.07	3.020	1.05
Mid-Atlantic	0.103	1.70	3.665	1.32
East North Central	0.201	3.93	-0.471	-0.20
West North Central	0.157	3.27	2.475	1.13
South Atlantic	0.062	1.23	-4.557	-1.98
West South Central	0.089	1.66	0.516	0.21
Mountain	0.104	2.12	5.360	2.38
West	0.319	5.36	-2.264	-0.83
California	0.297	5.79	3.013	1.28
Texas	0.035	0.63	4.566	1.82
Florida	0.213	3.80	-0.597	-0.23
1978	0.189	3.54	4.143	1.70
1981	0.285	2.98	1.463	0.33
1984	0.077	0.87	-2.715	-0.67

R2 (Observed and Predicted)	0.267			0.294
System R2			0.514	
$\chi^2(68)$			915.48	
Variance-Covariance Matrix:	0.1068	-1.2108		
	-1.2108	224.33		

Note: The t-statistics are against a null-hypothesis that a coefficient equals zero. Nominal wages were converted into real hourly earnings using the GNP deflator.

Table 4
Iterative Instrumental Variables Estimates

	Log Usual Hourly Earnings		Usual Weekly Hours	
	Coefficient	asymptotic t-statistic	Coefficient	asymptotic t-statistic
Intercept	3.483	19.48	13.173	2.65
Union x 1975	0.240	2.27	-9.244	-1.45
Union x 1978	0.528	5.09	-35.468	-5.03
Union x 1981	0.0006	0.03	0.621	-0.06
Female	0.054	0.86	-4.017	-1.09
White x 1975	0.188	3.29	-6.169	-1.75
White x 1978	0.040	0.73	-2.652	-0.80
White x 1981	0.037	-0.29	1.324	0.18
White x 1984	0.070	0.61	-1.705	-0.25
Chicano	-0.006	-0.10	0.206	0.06
Mexican	-0.003	-0.06	0.139	0.50
Foreman	0.214	2.99	-9.597	-2.13
Manager	0.243	3.89	-10.016	-2.45
Experience	-0.006	-1.72	0.698	4.27
Experience squared	0.0001	1.74	-0.013	-4.27
Female x Experience	0.002	0.27	-0.582	-1.45
Female x Experience sq.	-0.0001	-0.38	0.012	1.52
Education	-0.002	-0.44	--	--
Education squared	0.0004	1.15	--	--
Number of Children	--	--	-0.210	-1.00
Married, Living Together	--	--	2.304	2.63
North East	0.032	0.40	0.298	0.06
Mid-Atlantic	0.079	1.01	-0.263	-0.06
East North Central	0.198	3.03	-8.187	-2.04
West North Central	0.130	2.11	-3.883	-1.04
South Atlantic	0.134	2.06	-9.765	-2.51
West South Central	0.076	1.10	-1.671	-0.41
Mountain	0.054	0.86	1.236	0.33
West	0.344	4.55	-13.570	-2.85
California	0.266	4.06	-7.757	-1.87
Texas	-0.008	-0.11	3.491	0.83
Florida	0.202	2.82	-9.622	-2.18
1978	0.117	1.70	-0.727	-0.18
1981	0.210	1.72	-7.113	-0.97
1984	0.096	0.85	-2.958	-0.44
Log usual hours	0.444	8.81	--	--
Usual hourly earnings	--	--	0.147	8.78

R^2 (Observed and Predicted)	0.06		0.01
System R^2		0.6388	
$\chi^2(66)$		1291.1	

Variance-Covariance Matrix:

0.1753	-9.6434
-9.6434	625.90

Table 5
Probit Estimate of Union Status

	Coefficients	Asymptotic t-statistics
Intercept	-2.501	-3.76
Female	-0.206	-0.33
White	-0.706	-2.67
Chicano	0.121	0.29
Mexican	-0.264	0.81
Foreman	-0.381	-0.75
Manager	-5.386	-0.002
Experience	0.056	2.74
Experience squared	-0.0008	-2.28
Female x Experience	0.015	0.27
Female x Experience sq.	-0.0004	-0.42
Education	0.023	0.28
Education squared	-0.0002	-0.04
Number of Children	-0.052	-0.89
Married, Living Together	0.037	0.18
North East	-4.316	-0.001
Mid-Atlantic	0.445	0.68
East North Central	1.072	2.01
West North Central	-0.002	-0.003
South Atlantic	-0.174	-0.30
West South Central	-0.055	-0.09
Mountain	-0.028	-0.05
West	1.627	3.11
California	0.984	1.93
Texas	-0.05	-0.08
Florida	-5.03	-0.002
1978	-0.161	-0.85
1981	0.425	1.45
1984	-5.70	-0.003

Likelihood Ratio Test (versus the constant alone) = 108.755 (28 d.f.)

Maddala R^2	0.08
Cragg-Uhler R^2	0.33
McFadden R^2	0.29
Chow R^2	0.88

Predicted Success Table

		Actual 0	Actual 1
Predicted	0	1225	40
	1	1	2

Note: The asymptotic t-statistic is against the null-hypothesis that a coefficient equals zero.

Table 6
Simulation Results

	Earnings ($)	Wage ($)	Hours
Comparison Worker	131.53	2.86	47.25
Female	95.67	2.68	36.92
Chicano	143.51	3.02	48.78
Mexican	141.88	2.99	48.59
Foreman	168.72	3.59	48.24
Manager	176.30	3.72	48.61
1 Year of Experience	104.04	2.62	40.96
5 Years of Experience	120.10	2.74	44.98
30 Years of Experience	170.78	3.15	55.34
6 Years of Education	113.74	2.65	44.07
12 Years of Education	139.96	2.96	48.53
3 Children	126.99	2.81	46.39
Not Married	109.25	2.74	41.04
1975	132.88	2.88	47.40
1978	141.40	2.89	50.19
1981	132.09	2.90	46.72
Union, 1975	177.10	3.53	51.40
Union, 1978	242.09	5.19	47.86
Union, 1981	187.61	3.63	52.96
Nonwhite, 1975	107.24	2.37	46.49
Nonwhite, 1978	141.36	2.86	50.63
Nonwhite, 1981	147.19	3.15	47.95

Comparison Worker: Married, white, male, nonunion, nonhispanic, 18 years of experience, 9.5 years of education, Californian, 2 children, 1984.

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Footnotes

[1]There are, however, several papers by Martin and Mines (separately and together) which have used less involved statistical techniques to analyze micro data. See, for example, Martin and Vaupel and Mines. There is also a sophisticated analysis of farmers' off-farm wages, hours, and participation based on individual data by Sumner.

[2]That paper was written for a lay audience, uses older data, uses only a reduced form specition, and does not report the statistical tests included in this paper. It does, however, compare agriculture to other sectors of the economy and report family income differentials which are not discussed here.

[3]Under the Reagan administration, the monthly CPS sample sizes were reduced, so that the May 1981 and 1984 samples include only 68 and 114 usable observations (compared to 591 in 1978 and 522in 1975) so that pooling across years was used to produce a substantial sample size. Because individuals are included in the CPS sample for two successive years, using data for all available years would greatly complicate the error structure of the model. Pooling samples at three year intervals provides an adequate size sample of 1295 individuals. In 1984, the CPS samples for all months include the relevant economic variables; however, this sample was restricted to May because relevant economic variables are only available for that month in the earlier years.

[4]In addition observations were dropped where at least one of the variables used in the regression analysis are missing or in which the hours or wages are implausible (over 95 hours worked per week or wages below $1 or above $30).

[5]In the 1984 sample, there were no union workers. Given the average percent unionized in the three earlier periods, this result is not terribly surprising since only three or four such workers were likely to have been included in a sample of that size. The 1981 sample only includes six union workers. Further, there are no unionized managers (of course), and no union workers in the North East or in Florida.

[6]In order to calculate the demographic wage markups reported in the text, a technique designed to reduce the bias from just exponentiating the relevant coefficient and subtracting one is used:

$$\text{The Markup} = \exp(c - (1/2)\,\mathrm{Var}(c)) - 1,$$

where c is the estimated coefficient and Var(c) is the estimated variance of that coefficient. See, e.g., Goldberger and Kennedy. When more than one dummy is involved (such as to calculate the wage markup of a Californian union member), the generalization of this procedure involves covariance terms as well.

[7]The earnings differential is a function of the wage and hours differential:

$$\Delta e/e = \Delta w/w + \Delta h/h,$$

where e is earnings, w is wage, and h is hours. Here, we define the change in the earnings differential due to the hours differential as $(\Delta h/h)/(\Delta e/e)$. That is, it is one over the easticity of earnings with respect to hours.

[8]As noted above, the structural model shows that foreman and managers work fewer hours per week (holding wages constant), while the simulation shows that they actually work slightly more hours. Part of this difference is due to the higher wage which managers and foremen earn. The rest is due to the difference between the reduced form and the structural estimates.

[9]Part of the difference between the Scott, Smith, and Rungeling study and this

one is that they used a linear wage equation rather than this study's semi-log specification. Further, they assumed the effect of education on wages was linear, while this study allows education to have a quadratic effect as well.

[10] I wish to thank Jeff LaFrance for providing me with an analogous derivation.