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Some Evidence on Cross-Sector Effects of the Minimum Wage

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This paper tests Mincer's minimum-wage model by estimating reduced-form wage and employment equations for both the covered and uncovered sectors in nine regions of the United States. As theory predicts, in regions with comparatively small covered-sector demand elasticities, the northern and midwestern regions, the uncovered-sector wage increases after a minimum-wage hike; and in regions with comparatively large demand elasticities, the southern and western regions, the uncovered-sector wage decreases. Because of data limitations the uncovered-sector employment effect could not be estimated sharply, and so its relationship to the covered-sector demand elasticity is weak.

I. Introduction

Economic theory predicts that a minimum-wage hike decreases employment of low-skill workers in the covered sector. Theory also suggests that a minimum-wage hike affects the equilibrium wage and the level of employment in the uncovered sector though, as pointed out by Mincer (1976), the directions of the uncovered-sector effects are ambiguous. On the one hand, if the absolute labor demand elasticity is relatively small so that firms eliminate only a few covered jobs after the wage hike, then workers find the minimum wage attractive enough to justify the risk of unemployment while searching for jobs in the covered sector. In this case labor leaves the uncovered sector, and the wage thereby increases. On the other hand, if the

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demand elasticity is relatively large so that the return to search is low, then displaced workers enter the uncovered sector, and the wage decreases.

The objective of this paper is to test Mincer's characterization of the effects of a minimum-wage hike on the uncovered sector. In the empirical work the covered sector is an aggregation of four low-wage nondurable manufacturing industries; the uncovered sector is agriculture prior to coverage under the Fair Labor Standards Act. Time-series data are used to estimate the covered-sector labor demand elasticity and the uncovered-sector wage and employment effects of a minimum-wage hike for nine regions of the United States. As theory predicts, in regions with comparatively small demand elasticities, the northern and midwestern regions, the uncovered-sector wage increases after a minimum-wage hike; and in regions with comparatively large demand elasticities, the southern and western regions, the uncovered-sector wage correspondingly decreases. The uncovered-sector employment effect is not as sharply estimated as the wage effect, and so its relationship to the demand elasticity is weak. This result is explained by limitations of the data.

There is a potentially serious problem with using regional time-series data to test the minimum-wage model. The problem arises because it is impossible to get long time series of data on the level of employment of persons earning exactly the minimum wage. Although average hourly earnings in the four low-wage industries are among the lowest in the economy, they are still well above the minimum wage, indicating that the data series contain contributions from high-wage labor. Thus the dependent variables in the regressions are total employment and the average wage, both aggregated over the wage distribution. It is conceivable, then, that the observed regional variation in the covered-sector demand elasticity is a statistical artifact reflecting regional differences in the mix of low- and high-wage labor. In other words, the true demand elasticity for minimum-wage grade labor could be the same in all regions, while the estimated demand elasticity is larger in the South simply because there are more low-wage workers there.

The evidence presented in subsequent sections suggests that the spurious aggregation effect is small. Briefly, the argument is as follows. Think of low- and high-wage labor as imperfect substitutes in a production function with constant returns to scale. Now let the minimum wage increase by 1 percent. There are both scale (output) and substitution effects. The scale effect causes employment of both factors, and hence total employment, to decline equiproportionately. The substitution effect, on the other hand, causes low-wage employment to decline and high-wage employment to increase. Intuitively, and as is shown in Appendix A, the observed proportionate increase in the average wage ($\Delta\overline{W}/\overline{W}$) is no less than the share (s_1) of low-wage labor in total labor costs; if the substitution effect is zero, then $\Delta\overline{W}/\overline{W}$ equals s_1. The regional estimates of $\Delta\overline{W}/\overline{W}$ from the regressions turn out to be very close to regional estimates of s_1 derived from independent wage distribution data. This can happen only if the major impact of a minimum-wage hike is the scale effect and not the substitution effect. Since the scale effect dominates, the observed proportionate decline in total employment must be close to the proportionate decline in low-wage employment; that is, the aggregation bias is small in the covered sector.

The importance of the scale effect together with the cost-share data can explain why there are regional differences in the demand elasticity. The size of the scale effect depends upon the increase in the marginal cost of production caused by a hike in the minimum wage. Since s_1 is 0.14 in the North and 0.32 in the South, the proportionate increase in marginal cost is larger in the South, and so output and total employment contract proportionately more there. This is consistent with the idea that one purpose of the national minimum wage is to reduce the cost advantage of firms located in low-wage regions of the country. It is also consistent with Silberman and Durden's (1976, p. 325) finding that Southern congressmen are less likely than other congressmen to vote in favor of a minimum-wage hike.

The remainder of this paper is organized as follows. Section II describes a simple two-sector labor market model which is used to guide the empirical work. Sections III and IV report the empirical findings for the covered and uncovered sectors. Section V uses the theoretical model to interpret the results. Section VI contains the concluding remarks.

II. Two-Sector Model

The following two-sector model of the low-wage labor market is used to illustrate the restrictions being tested and to guide the empirical work. The model consists of two labor demand schedules (one for each sector), an equilibrium condition connecting the minimum wage and the competitively determined uncovered-sector wage, and an aggregate labor supply relationship. Formally, the model is:

$$\text{labor demand (covered):}\quad N^c = D^c(W/W_2, X^c),\quad D_1^c < 0, \tag{1a}$$

$$\text{labor demand (uncovered):}\quad N^u = D^u(W^u/W_2, X^u),\quad D_1^u < 0, \tag{1b}$$

$$\text{equilibrium condition:}\quad W^u = \left(\frac{\delta N^c}{U + \delta N^c}\right) W,\quad \delta > 0, \tag{1c}$$

$$\text{labor supply:}\quad N^c + N^u + U = S(W^u/P),\quad S' > 0, \tag{1d}$$

where N^c, N^u = employment in the covered (c) and uncovered (u) sector; W = minimum wage; W^u = wage in the uncovered sector; W_2 = control wage, $W_2 > W$; X^c, X^u = vectors of exogenous shift variables; U = unemployment; δ = turnover parameter; and P = general price level. The labor demand equation (1a) expresses employment in the covered sector, N^c, as a function of the relative minimum wage, W/W_2, where W_2 is an exogenously determined measure of high-skill wages, and as a function of exogenous shift variables, X^c. Similarly, equation (1b) expresses employment in the uncovered sector as a function of the uncovered-sector wage relative to the high-skill wage, W^u/W_2, and as a function of exogenous variables, X^u. Equation (1c) is from Mincer (1976). In equilibrium the uncovered-sector wage must equal the expected return from search in the covered sector (equal to the probability of getting a job times minimum wage). The parameter δ in (1c) is the proportion of covered-sector employees who each period must enter an employment lottery with the unemployed. Finally, equation (1d) relates the total labor force to the real wage in the uncovered sector.

The four endogenous variables in the system (1) are N^c, N^u, W^u, and U; the exogenous variables are W, W_2, P, X^c, and X^u. Note first that (1a) is the reduced-form expression for N^c. Now write the reduced form for the other three endogenous variables as

$$N^u = N^u(W, W_2, P, X^c, X^u), \tag{2a}$$

$$W^u = W^u(W, W_2, P, X^c, X^u), \tag{2b}$$

$$U = U(W, W_2, P, X^c, X^u). \tag{2c}$$

Theory places restrictions on the reduced-form equations. Specifically, Mincer shows

$$\frac{\partial W^u}{\partial W} \gtreqless 0 \quad \text{as} \quad e^c \lesseqgtr \delta, \tag{3a}$$

$$\frac{\partial N^u}{\partial W} \lesseqgtr 0 \quad \text{as} \quad e^c \lesseqgtr \delta, \tag{3b}$$

where e^c is the absolute elasticity of labor demand in the covered sector (the absolute elasticity of [1a] with respect to the minimum wage). The unemployment effect is positive,

$$\frac{\partial U}{\partial W} > 0, \tag{4}$$

and the sign of the labor force effect agrees with the sign of the uncovered-sector wage effect,

$$\frac{\partial N^c}{\partial W} + \frac{\partial N^u}{\partial W} + \frac{\partial U}{\partial W} \gtreqless 0 \quad \text{as} \quad e^c \lesseqgtr \delta. \tag{5}$$

Some of these results have been previously investigated empirically. There are, of course, many studies of the disemployment effect (1a) and of the unemployment effect (4). The Mincer study measures the labor force effect (5) for teenagers and young adults. After finding a negative labor force effect, Mincer infers $e^c > \delta$ and uses (3) to conclude that $\partial W^u/\partial W < 0$, that is, that, as a group, low-wage workers' prospects decline after a minimum-wage hike. Gardner's (1972) earlier work with aggregate U.S. agricultural data is consistent with Mincer's findings, though Gardner's estimates lack statistical significance at conventional levels. The purpose of this study is to use regional variation in the demand elasticity e^c to test the characterization (3a) and (3b). If there is small regional variation in the parameter δ, then regions with relatively small values of e^c should show $\partial W^u/\partial W > 0, \partial N^u/\partial W < 0$, and vice versa for regions with relatively large values of e^c.

III. The Covered Sector

The first step in the empirical work is to estimate the demand equation (1a) to get regional estimates of the covered-sector demand elasticity, e^c.[1] The data are annual observations on employment (1949–74) and average hourly earnings (1958–74) in an aggregation of four low-wage nondurable manufacturing industries: tobacco (SIC 21), textiles (SIC 22), apparel (SIC 23), and leather (SIC 31).[2] As mentioned in the Introduction, there is a problem because the employment variable includes workers for whom the legal minimum wage is economically ineffective. The effects of this skill-group aggregation can be characterized. Appendix A shows that regardless of the substitution pattern within aggregate labor, the observed (absolute) disemployment elasticity underestimates the sought-after demand

[1] The states within each region are: New England: Vt., Mass., N.H., Conn., R.I., Maine; Middle Atlantic: N.Y., Pa., N.J.; East North Central: Ohio, Wis., Ill., Ind., Mich.; West North Central: Mo., Iowa, N.Dak., S.Dak., Nebr., Kans., Minn.; South Atlantic: Va., Del., Ga., Md., W.Va., N.C., S.C., Fla.; East South Central: Ky., Tenn., Miss., Ala.; West South Central: Ark., La., Tex., Okla.; Mountain: Nev., Wyo., Mont., N.Mex., Utah, Idaho, Colo., Ariz.; Pacific: Calif., Oreg., Wash.

[2] Two-digit manufacturing industries were defined as low-wage industries if U.S. average hourly earnings in 1960 were no more than $1.70; the legal minimum was upped from $1.00 to $1.15 in September 1961. Only the four indicated nondurable manufacturing industries met the criterion. No other two-digit nondurable manufacturing industry had an average wage below $2.00 in 1960; the lowest average wage in 1960 of two-digit durable industries was $1.88 in furniture (SIC 25). Annual observations on state employment and average hourly earnings were collected from U.S. Bureau of Labor Statistics (1977). In the case of missing values, the data from nearby larger states were spliced into the shorter series. This allowed development of usable state employment series from 1949 forward and wage series from 1958 forward. The series were aggregated over the four industries and over contiguous states to nine regions.

TABLE 1

COVERED-SECTOR EMPLOYMENT AND WAGE EQUATIONS: SIGNIFICANCE TESTS[a]

	DEPENDENT VARIABLE: n^c (1949–74) SIGNIFICANCE TEST $F(3,17)$		DEPENDENT VARIABLE: w^c (1958–74) SIGNIFICANCE TEST $F(3,8)$	
	w [−1 to +1]	w_2 [−1 to +1]	w [−1 to +1]	w_2 [−1 to +1]
United States	****	****	*	****
New England	...	****	...	****
Middle Atlantic	...	****	...	****
East North Central	****	****	...	****
West North Central	*	****	**	****
South Atlantic	****	****	**	****
East South Central	****	****	***	****
West South Central	****	****	****	****
Mountain	****	****	N.A.[b]	N.A.
Pacific	****	****	...	****

NOTE.—Dependent variables: n^c = log of total employment, four low-wage nondurable manufacturing industries, by region as indicated; w^c = log of average hourly earnings, four low-wage nondurable manufacturing industries, by region as indicated. Independent variables: w = log of minimum wage; w_2 = log of average hourly earnings, all manufacturing, excluding average hourly earnings in the four low-wage industries; z = log of the FRB index of industrial production, all manufacturing. Lags are in brackets; negative lags are leads (future terms).

[a] Test that indicated group of distributed lag coefficients is zero.

[b] No wage data are available for the Mountain region.

* 15%.

** 10%.

*** 5%.

**** 1%.

elasticity. In addition, the observed elasticity of the covered-sector wage with respect to the minimum wage overestimates the share of minimum-wage grade labor in total labor costs. Below, evidence will be presented that e^c is only slightly underestimated.

To focus attention on economics the less important technical details of the regressions are put in Appendix B. The results in tables 1 and 2 are from distributed lag regressions of the logs of covered-sector employment and average hourly earnings, n^c and w^c, on the log of the minimum wage, w, the control wage, w_2, and the cyclical index, z. The control wage is the log of average hourly earnings, all manufacturing, net of wages in the four low-wage industries; the cyclical variable is the log of the FRB index of industrial production.[3] Each regression

[3] w, w_2, and z are the logarithms of the annual average of monthly values. The level W_2 was computed as $W_2 = (EW - \Sigma_j E_j W_j)/(E - \Sigma_j E_j)$, where E is production worker employment and W is production worker average hourly earnings. Unsubscripted values refer to all manufacturing; the subscript j indexes the four low-wage industries. The basic data were taken from U.S. Bureau of Labor Statistics (1976) and from issues of *Employment and Earnings* (U.S. Bureau of Labor Statistics 1976–77). The industrial production index was taken from U.S. Department of Commerce (1976) and issues of the *Survey of Current Business* (U.S. Department of Commerce 1976–77).

TABLE 2

COVERED-SECTOR EMPLOYMENT AND WAGE EQUATIONS: SUMS OF DISTRIBUTED LAG COEFFICIENTS
(Long-Run Effects)

	Dependent Variable: n^c			Dependent Variable: w^c		
	w [−1 to +1]	w_2 [−1 to +1]	z [0]	w [−1 to +1]	w_2 [−1 to +1]	z [0]
United States	−.2897	−.3124	.4370	.1865	.6936	−.0164
	(.0328)	(.0599)	(.0373)	(.0872)	(.1205)	(.0591)
New England	−.0394	−.9013	.5185	.1574	.5848	−.0836
	(.0847)	(.1468)	(.0794)	(.1148)	(.1590)	(.0777)
Middle Atlantic	−.1242	−.5710	.4159	.1406	.5827	−.1322
	(.0545)	(.0856)	(.0508)	(.1045)	(.1410)	(.0704)
East North Central	−.3812	−.3972	.5066	−.0099	.4943	−.2096
	(.0714)	(.1209)	(.0671)	(.1289)	(.1790)	(.0872)
West North Central	−.0987	.4048	.4261	.3500	.2371	−.2633
	(.0712)	(.0997)	(.0640)	(.1134)	(.1541)	(.0766)
South Atlantic	−.2237	−.2899	.4270	.1580	.8821	.1406
	(.0571)	(.0925)	(.0533)	(.0725)	(.0989)	(.0490)
East South Central	−.2042	−.2431	.5651	.3569	.6847	.0319
	(.0496)	(.0687)	(.0443)	(.0713)	(.0926)	(.0471)
West South Central	−.6360	−.0883	.6708	.4442	.6483	.0340
	(.0875)	(.1185)	(.0774)	(.1456)	(.1197)	(.0985)
Mountain	−.7589	.5059	1.4860	N.A.	N.A.	N.A.
	(.3909)	(.5911)	(.3606)			
Pacific	−.3984	1.0035	.5304	.2072	.4694	−.0685
	(.0746)	(.1178)	(.0694)	(.1366)	(.1899)	(.0924)

NOTE.—SE in parentheses. In the employment and wage equations df = 17, 8, respectively. See table 1 for the definitions of the variables. N.A. = data not available. Lags are in brackets.

included trend and a constant.[4] The regressions do not control for state minimum wages because in this sample state minimums are either at or below the federal minimum wage.[5]

The F-tests in table 1 indicate that the distributed lag coefficients on the minimum wage are significant as a group in nearly all of the equations. Now consider the long-run elasticities reported in table 2. As theory predicts, the sign of the minimum-wage effect is negative in all of the employment equations and positive in all but one wage equation. Moreover, the magnitude of the effect displays important regional variation. The disemployment effect appears to be negligible in the Northeast and upper Midwest, and it seems to be rather important through the South, the Southwest, and the Pacific coast. Also, the elasticities of employment and the average wage with respect to the minimum wage are consistent with one another, in the sense that, wherever the effect on the wage is small, so is the effect on employment.

To my knowledge, there are no other comparable published estimates of the disemployment effect by region or state. The estimated elasticity of −0.29 for the United States, however, is comparable with the findings of many other researchers. It is just outside Gramlich's (1976, p. 431) bounds of −0.05 to −0.25 for published estimates.[6]

Comparing these long-run effects to regional data on the wage distribution in the covered sector suggests that the major impact of the minimum wage is the scale or output effect. To see this, consider the 1964 wage distribution displayed in table 3. These data were

[4] Throughout this paper regional dependent variables are regressed on national variables. This is due to data limitations, but a strong case can be made for this practice even if regional data were available. Truly exogenous variables are driven by broad economy-wide forces and should not contain endogenous local fluctuations. For the quarterly agricultural regressions of Section IV it was possible to compute regional agricultural prices but only on an annual basis. Quarterly models with these prices repeated four times gave much lower $\bar{R}^2$ than the reported equations. Evidently, the time variation is more important than the regional variation.

[5] In the Northeast, state minimum wages tend to be just at the federal wage, and outside the Northeast they are usually well below the federal wage. Movements in state wage floors tend to parallel changes in the federal wage, and the main effect of state minimums is to extend coverage to industries only partly covered by federal legislation: retail trade, laundries, services, etc., industries excluded from the sample. In 1970 the federal minimum was $1.60, while the simple averages of state minimums by region were: New England, $1.60; Middle Atlantic, $1.60; East North Central, $.98; West North Central, $.65; South Atlantic, $.77; East South Central, $.18; West South Central, $.84; Mountain, $1.07; and Pacific, $1.50. New York was the only state with a minimum wage above $1.60; its minimum was raised from $1.60 to $1.85 effective July 1, 1970. Washington, D.C., and Alaska had 1970 minimums of $1.80 and $2.00, respectively, but were excluded from the sample. Source: U.S. Employment Standards Administration (1972*b*, p. 52, table 5).

[6] Many of these studies use the ratio of teenage to adult employment as the dependent variable, and so they estimate only a pure substitution effect (Welch 1974). This study estimates a combined scale and substitution effect.

TABLE 3

WAGE DISTRIBUTION FOR THE AGGREGATION OF FOUR NONDURABLE MANUFACTURING INDUSTRIES, March 1964 (%)

Straight-Time Wage ($) Less Than	United States	Northeast	South	North Central	West
1.25	1	1	1	1	1
1.30	16	11	22	18	14
1.35	23	16	30	23	19
1.40	29	21	39	31	22
1.45	36	28	47	37	28
1.50	41	32	53	42	31
2.50	91	85	98	94	83
3.50	98	96	100	100	97
Total	100	100	100	100	100
Average hourly earnings ($)	1.76	1.90	1.59	1.72	1.92
Under $1.40 shares of total:					
Employment (k_1)	.29	.21	.39	.31	.22
Labor costs (s_1)	.22	.14	.32	.24	.15

NOTE.—In September 1963 the basic minimum wage was raised from $1.15 to $1.25; in February 1967 it was raised to $1.40. The distributions were computed from table 4 of U.S. Wage and Hour and Public Contracts Divisions (1965). Accounting identities and interpolations were used to get complete data for the North Central and West regions, and so the distributions for these two regions are less reliable than the other distributions.

collected in a special survey of firms by the Department of Labor. Define low-wage workers to be those within 10 percent of the minimum wage of $1.25 (10 percent was about the average percentage increase in the minimum wage in the early 1960s). Then the share of low-wage labor in total labor costs is 0.14 in the Northeast and 0.32 in the South. These cost shares indicate that, if firms held employment constant, then a 10 percent minimum-wage hike would drive up labor costs by 1.4 and 3.2 percent in these two regions. Furthermore, if firms respond to the wage hike by contracting low- and high-wage employment equiproportionately, then the average wages in the North and South would increase by 1.4 and 3.2 percent. According to the regressions in table 2, the average wages actually increase by 1.5 percent in the North and 3.2 percent in the South. (These figures are 10 times the unweighted mean elasticity for the two northern regions and three southern regions.) A similar agreement between the cost share and the wage elasticity exists in the North Central region and in the West. The data appear to say that covered-sector firms respond to a minimum-wage hike by taking steps to reduce total labor input and that both groups of workers suffer equiproportionate disemployment. Furthermore, since the substitution effect appears to be small relative to the scale effect, the estimated disemployment elasticities are close to the true demand elasticities for low-wage labor.

IV. The Uncovered Sector

The purpose of this section is to estimate the minimum-wage effect on uncovered (agricultural) employment and wages. The reduced-form equations (2a) and (2b) give the specifications. Specifically, the logs of agricultural employment and wages are regressed on the minimum wage, the control wage, the general price level, and the shift variables appearing in (1a) and (1b). Data are available quarterly, and the operational definitions are as follows. Employment and wages, n^u and w^u, are, respectively, the logs of hired farm employment and the hourly wage exclusive of room and board. Agricultural economists consider this wage to be more reliable than the U.S. Department of Agriculture's various composite measures. In the list of independent variables, the minimum wage variable is cw, the legal minimum multiplied (before logging) by the Moore index of the proportion of nonagricultural employees covered by the legislation. Intuitively, the impact of a 10 percent minimum-wage hike on the uncovered agricultural labor market is much different if 20 versus 90 percent of the nonagricultural work force is covered. The control wage w_2 and the cyclical index z are the same variables as used in Section III. The general price level p is the log of the CPI. Finally, the uncovered-sector shift variables are the logs of the USDA's index of prices received by farmers, p^u, and the index of prices paid by farmers for production items q. The index q excludes wages.[7]

The basic sample period (before lags and leads) is 1947:I–1966:IV. Truncation at 1966 restricts the estimation to a period in which agriculture was effectively uncovered by federal legislation. On February 1, 1967, coverage was extended to employees of large farms. The Department of Labor estimated that by 1971 about 48 percent of the agricultural work force was covered by federal legislation.[8] Also, after extension of federal coverage to agriculture, several states expanded their coverage to agriculture. Prior to 1967, state agricultural minimums were considered unimportant.[9]

[7] The agricultural employment and wage series were obtained from various issues of *Farm Labor* (U.S. Department of Agriculture 1951–75). The input and output prices indexes were obtained from issues of *Agriculture Prices, Annual Summary* (U.S. Department of Agriculture 1961–72).

[8] For details see U.S. Employment Standards Administration (1972*a*, pp. 5–9).

[9] In 1966 only three states in the sample had a minimum wage applicable to agricultural workers: California, $1.30; Michigan, $1.15; and Wisconsin, $1.00. The California and Wisconsin minimums applied only to women and minors. Source: U.S. Wage and Hour and Public Contracts Divisions (1966, p. 30, table 12). Michigan and Wiscon-

Two conclusions are apparent from the regressions. First, the significance tests in table 4 confirm the well-known fact that aggregate cyclical forces play a strong role in the determination of agricultural labor supply. According to the U.S. long-run elasticities in table 5, a 10 percent increase in industrial production is associated with an 11.3 percent decrease in hired farm employment and a 2.9 percent increase in the hired farm wage. This is important because it indicates that there are indeed sizable labor flows between agriculture and the covered sector.

Second, and most important, changes in the minimum wage do affect agricultural employment and wages. The F-tests in table 4 show that as a group the distributed lag coefficients on the minimum wage are significant at 10 percent in five of 10 employment equations and in eight of 10 wage equations. Note that in table 5 the long-run U.S. employment elasticity of $-.18$ is insignificant, but the wage elasticity of $-.08$ is significant. The latter measurement indicates that for the entire United States a minimum-wage hike tends to depress the uncovered-sector wage. This finding is consistent with both Mincer's and Gardner's results.

Examination of the regional results in table 5 suggests that there are important regional differences in the welfare effects of the minimum wage. Notice that the effect on the uncovered-sector wage is significantly positive in the New England, Middle Atlantic, and West North Central regions; it is significantly negative in the South Atlantic and Pacific regions. Thus, as indicated by (3a), the wage in the uncovered sector can indeed rise or fall after a minimum-wage hike in the covered sector. Viewed in isolation, however, the uncovered-sector results are insufficient to verify the model. Indeed, if the hypothesized economic mechanisms are really at work, then the absolute disemployment elasticities from Section III should be largest in the regions where the uncovered-sector wage falls.

V. Sectoral Comparisons

Consider the inequality (3a). If the demand elasticity e^c is less than the turnover parameter δ, then after a minimum-wage hike the flow of labor out of the uncovered sector increases the wage there; if e^c is greater than δ, then the flow of labor into the uncovered sector decreases the wage. Therefore, if there is small regional variation in

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sin are in the East North Central region, and their agricultural minimum wages possibly could explain the results for that region. Consider, though, the fact that California accounts for 88 percent of agricultural employment in the Pacific region, and it turns out that after a hike in the U.S. minimum wage the agricultural wage *declines* in the Pacific region.

TABLE 4

UNCOVERED-SECTOR EMPLOYMENT AND WAGE EQUATIONS: SIGNIFICANCE TESTS

	DEPENDENT VARIABLE n^u (1948:IV–1966:I)						DEPENDENT VARIABLE w^u (1948:IV–1966:I)					
	cw [0–10]	w_2 [0–5]	z [0–4]	p^u [0–5]	p [0–7]	q [0–7]	cw [0–10]	w_2 [0–5]	z [0–4]	p^u [0–5]	p [0–7]	q [0–7]
United States	***	****	***	***	*	****	****	****	****	****	****	****
New England	...	...	...	...	...	...	****	****	****	****	****	****
Middle Atlantic	...	...	*	...	...	...	****	**	****	****	**	***
East North Central	...	...	***	***	*	*	**	...	****	***	**	...
West North Central	**	****	*	***	...	***	...	...	****	****	...	****
South Atlantic	**	***	***	***	**	***	****	*	****	***	***	...
East South Central	...	*	**	...	*	...	****	...	****	***	****	**
West South Central	**	**	****	...	...	***	...	...	...	...	...	...
Mountain	*	****	**	*	...	*	***	*	...	*	**	*
Pacific	****	***	***	...	...	...	****	***	****	****	***	****

NOTE.—Test statistics are F- statistics with numerator degrees of freedom equal to the number of included lag coefficients for each variable and denominator degrees of freedom equal to 18. Lags are in brackets. Dependent variables: n^u = log of hired farm employment, by region as indicated; w^u = log of hourly wage for hired farm labor exclusive of room and board, by region as indicated. Independent variables: cw = log of coverage-weighted minimum wage; w_2 = log of average hourly earnings, all manufacturing excluding average hourly earnings in the four low-wage manufacturing industries; z = log of the FRB index of industrial production, all manufacturing; p^u = log of the USDA index of prices received by farmers; p = log of the consumer price index, all items; q = log of the USDA index of prices paid by farmers for production items.

* 15%.

** 10%.

*** 5%.

**** 1%.

TABLE 5

UNCOVERED SECTOR EMPLOYMENT AND WAGE EQUATIONS: SUMS OF DISTRIBUTED LAG COEFFICIENTS (Long-Run Effects)

	Dependent Variable n^u						Dependent Variable w^u					
	cw [0–10]	w_2 [0–5]	z [0–4]	p^u [0–5]	p [0–7]	q [0–7]	cw [0–10]	w_2 [0–5]	z [0–4]	p^u [0–5]	p [0–7]	q [0–7]
United States	−.18	3.23	−1.13	1.29	−3.60	−.60	−.08	1.28	.29	.71	−1.59	−.08
	(.13)	(1.44)	(.29)	(.85)	(2.89)	(1.29)	(.02)	(.23)	(.07)	(.14)	(.47)	(.22)
New England	−.17	5.99	−1.24	−.97	−3.60	1.57	.07	1.12	.29	.78	−.92	−.82
	(.39)	(4.40)	(.90)	(2.61)	(8.77)	(3.94)	(.03)	(.35)	(.09)	(.20)	(.71)	(.30)
Middle Atlantic	.09	.87	−.95	.14	1.33	−.13	.08	.63	.26	.15	.22	−.23
	(.19)	(2.32)	(.49)	(1.30)	(4.72)	(1.83)	(.02)	(.23)	(.07)	(.13)	(.48)	(.21)
East North Central	−.15	5.82	−1.17	3.28	−7.49	−2.80	.05	−.14	.56	−.11	2.14	−.30
	(.24)	(2.54)	(.50)	(1.48)	(5.22)	(2.13)	(.04)	(.43)	(.09)	(.24)	(.89)	(.36)
West North Central	−.27	7.58	−.85	4.83	−9.85	−3.95	.06	.73	.34	.98	.41	−1.25
	(.18)	(1.99)	(.41)	(1.14)	(4.02)	(1.63)	(.03)	(.37)	(.08)	(.20)	(.77)	(.28)
South Atlantic	.09	2.10	−1.12	1.55	−5.79	−1.12	−.10	−1.19	.79	−.53	3.55	−.17
	(.19)	(1.95)	(.42)	(1.13)	(3.98)	(1.63)	(.05)	(.56)	(.12)	(.30)	(1.21)	(.41)
East South Central	.29	−1.55	−.00	−1.07	5.07	1.78	.08	1.42	.24	.88	−2.57	−.34
	(.45)	(4.60)	(.87)	(3.41)	(8.95)	(5.26)	(.08)	(.84)	(.18)	(.55)	(1.64)	(.83)
West South Central	−.57	2.55	−2.26	1.62	1.87	−2.70	−.05	.06	.50	.19	−.91	.58
	(.31)	(4.40)	(.68)	(2.25)	(9.46)	(3.67)	(.04)	(.47)	(.11)	(.29)	(.94)	(.44)
Mountain	−.11	5.83	−.07	1.89	−9.76	−.77	−.07	.62	.13	1.00	−2.07	−.57
	(.17)	(1.73)	(.37)	(.98)	(3.60)	(1.42)	(.06)	(.70)	(.14)	(.50)	(1.38)	(.75)
Pacific	−.15	2.45	−1.14	.79	−1.48	−.33	−.12	.75	.49	.84	.13	−1.16
	(.16)	(1.70)	(.35)	(1.00)	(3.40)	(1.51)	(.03)	(.32)	(.08)	(.18)	(.66)	(.28)

NOTE.—SE in parentheses. In both equations, df = 18. See table 4 for definitions of variables. Lags are in brackets.

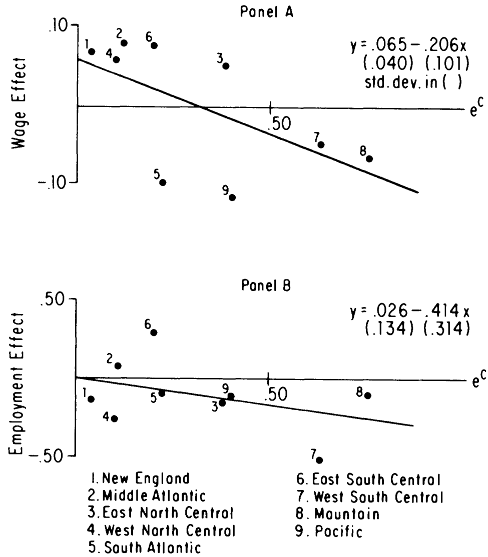

FIG. 1.—The relationship between the uncovered-sector wage and employment effects and the covered-sector disemployment elasticity.

the parameter δ, then plotting regional observations on the effect of the minimum wage on the wage in the uncovered sector against the demand elasticity e^c should give a downward sloping relationship crossing the horizontal axis at δ. By (3b), plotting the effect of the minimum wage on employment in the uncovered sector against e^c should give an upward sloping relationship also crossing the horizontal axis at δ. Panels *A* and *B* of figure 1 are the corresponding empirical diagrams. The dependent variable in panel *A* is the observed long-run elasticity of the uncovered-sector wage with respect to the minimum wage (from table 5); the dependent variable in panel *B* is the long-run uncovered-sector employment elasticity (also from table 5). The independent variable in each panel is the absolute value of the long-run covered-sector disemployment elasticity (from table 2).

As predicted by theory, panel *A* indicates an inverse relationship between the effect of the minimum wage on the uncovered-sector wage and the demand elasticity. The fitted line's horizontal intercept of 0.32 is an estimate of the critical demand elasticity (δ) that determines the sign of the wage effect in the uncovered sector. The estimate $\delta = 0.32$ says that in the steady state at least 32 percent of covered-sector employees compete with the unemployed for employment. In contrast, panel *B* suggests no relationship between the effect of the minimum wage on uncovered employment and the demand elasticity. The data points are essentially random deviations about the horizontal axis. Note that the F-tests in table 4 indicate that the minimum wage affects uncovered employment. The sign and size of the long-run effect, however, are measured very imprecisely.

The skill-group aggregation in the uncovered sector data can account for the apparent conflict between theory and panel B of figure 1. When the low-skill wage changes in the uncovered sector, there are scale and substitution effects. As noted before and as proved in Appendix A, the larger is the substitution effect relative to the scale effect, the smaller is the observed (absolute) employment elasticity relative to the true proportionate change in low-wage labor. Evidently, the elasticity of substitution between low- and high-skill labor in agriculture is large enough to make this skill-group aggregation suppress the uncovered employment effect to an undetectable level. Notice that this is the reverse of the situation in the covered sector. As was noted in Section III, in the covered sector the scale effect dominates the substitution effect; in contrast, in the uncovered sector the substitution effect dominates the scale effect.

VI. Summary and Conclusion

This paper examines the covariation over regions in the effects of the minimum wage on wages and employment in the covered and uncovered sectors. Its major empirical finding is that the pattern of results is consistent with theory. Specifically, after a minimum-wage hike the uncovered-sector wage increases in the five regions with relatively small covered-sector demand elasticities: New England, Middle Atlantic, East North Central, West North Central, and East South Central; it decreases in the four regions with the relatively large covered-sector demand elasticities: South Atlantic, West South Central, Mountain, and Pacific. In addition, Mincer's and Gardner's earlier work suggesting that the uncovered-sector wage decreases in the entire United States is consistent with these findings, for their results are dominated by the four large regions (in terms of low-wage employment) in which the uncovered-sector wage falls. This paper's results have some bearing on the issue of welfare effects of the minimum wage. It seems fair to conclude that the minimum wage increases the well-being of all low-wage workers in the New England, Middle Atlantic, East North Central, West North Central, and East South Central regions. In the remaining regions, however, the minimum wage increases the well-being of only those workers having covered-sector employment.

Appendix A

The purpose of this Appendix is to characterize the effects of using total employment and the average wage as dependent variables in the regressions. Suppose low-skill class 1 labor (N_1) and high-skill class 2 labor (N_2) are imperfect substitutes in a production function with constant returns to scale. Let the class 1 wage (W_1) increase. Then

$$\tilde{N}_1 = (\text{scale effect} - s_2\sigma_{12})\tilde{W}_1,$$

$$\tilde{N}_2 = (\text{scale effect} + s_1\sigma_{12})\tilde{W}_1,$$

where $\tilde{}$ denotes proportionate change, s_1 and s_2 are the factors' shares in expenditures, and $\sigma_{12} > 0$ is the absolute Hicks-Allen partial elasticity of substitution. Let k_1 and k_2 denote the factors' shares in total employment; then the proportionate change in total employment is

$$\begin{aligned}\tilde{N} &= k_1\tilde{N}_1 + k_2\tilde{N}_2 \\ &= [\text{scale effect} + (k_2 - s_2)\sigma_{12}]\tilde{W}_1,\end{aligned}$$

which is less negative than $\tilde{N}_1$. The change in the average wage is

$$\begin{aligned}\tilde{\bar{W}} &= (k_1W_1 + k_2W_2) \\ &= s_1\tilde{W}_1 + (s_1 - k_1)(\tilde{N}_1 - \tilde{N}_2) \\ &= [s_1 - (s_1 - k_1)\sigma_{12}]\tilde{W}_1,\end{aligned}$$

which exceeds $s_1\tilde{W}_1$ because $s_1 < k_1$ (class 1 labor is the low-wage factor). Clearly the characterization applies equally well to either sector. (The above arguments were found by an anonymous referee.)

Appendix B

This Appendix discusses the technical econometric issues associated with the empirical work.

Specification

There are three important points concerning the covered-sector equations. First, adjustment costs (hiring and separation costs) induce a dependence of factor demand on lagged and expected future factor prices (Sargent 1978). This motivates using distributed lag methods and including a lead value of the minimum wage, for its movements are known well in advance. Second, minor distortions due to temporal aggregation (the unavoidable use of annual instead of monthly data) are apparently the cause of a significant lead coefficient on the control wage. This was verified by using Geweke's (1978) results. The effects of the temporal aggregation are minor because the explanatory variables are annual averages and the long-run effects are therefore estimated consistently (see Geweke's theorem 2). Third, the temporal aggregation and the forecasting of factor prices are good reasons to expect the homogeneity of degree zero of (1a) in nominal variables to break down in practice. Consequently, w and w_2 are entered separately in (1a) and the homogeneity constraint tested (and rejected). The coefficients have a "real" interpretation, for the entire history of each nominal variable is held constant.

The same comments apply to the uncovered sector regressions, though

TABLE B1

Exogeneity Tests

	Covered Sector								Uncovered Sector[a]											
	Dependant Variable n^c				Dependent Variable w^c				Dependent Variable n^u						Dependent Variable w^u					
	w [−2]	w_2 [−1]	w_2 [−2]	z [−1]	w [−2]	w_2 [−1]	w_2 [−2]	z [−1]	cw	w_2	z	p^u	p	q	cw	w_2	z	p^u	p	q
United States	...	****	...	...	...	***	...	...	...	...	...	...	...	...	...	...	...	...	...	...
New England	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Middle Atlantic	...	...	...	...	...	**	...	...	...	...	...	...	***	**	...	...	**	...	...	...
East North Central	...	*	...	...	...	...	...	...	...	...	...	...	...	**	***	****	...	...	...	...
West North Central	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
South Atlantic	...	****	*	...	...	***	...	*	...	...	...	...	...	...	...	...	...	***	...	...
East South Central	...	...	...	...	...	***	...	...	...	...	...	...	...	...	...	...	...	...	...	...
West South Central	***	****	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mountain	***	****	...	...	N.A.	N.A.	N.A.	N.A.	...	**	...	...	...	...	*	...	...	...	...	...
Pacific	...	****	...	...	...	...	...	...	...	...	**	...	...	...	...	...	**	***	...	...

NOTE.—Tests are for indicated lead coefficients equal to zero. The statistics are $t(17)$ in the n^c equation, $t(8)$ in the w^c equation, and F (3,18) in both the n^u and w^u equations. Leads are in brackets.

[a] All leads in the n^u and w^u equations are −1 to −3.

* 15%.

** 10%.

*** 5%.

**** 1%.

with quarterly data the temporal aggregation problems are absent. To purge the series of seasonal effects, each regression included seasonal dummies and the products of seasonals with trend.

Serial Correlation

In the annual covered-sector regressions a first-order Cochrane-Orcutt correction was used; in the quarterly uncovered-sector regressions ad hoc prefilters were used together with fifth-order Cochrane-Orcutt.

Exogeneity

Table B1 reports the outcome of batteries of Sims's (1972, 1977) exogeneity test. The test consists of the appropriate F- or t-test on lead coefficients. The paucity of rejections indicates no serious problems with a lack of exogeneity in either set of results. Since lead values of w and w_2 enter the covered-sector equations for other reasons, the test's power is obviously low in that set of results.

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