THE EFFECTS OF INCREASES IN THE
FEDERAL MINIMUM WAGE ON SELECTED
INDUSTRY LABOR MARKETS FOR THE 1960 - 63 PERIOD

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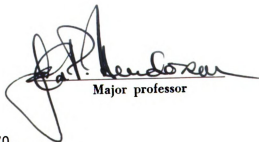MICHIGAN STATE UNIVERSITY
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ABSTRACT

THE EFFECTS OF INCREASES IN THE
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By

James Francis McCarley

Since the enactment of the Fair Labor Standards Act
of 1938, economic literature has been filled with studies
attempting to determine its impact on employment. These
studies have been undertaken by both the Department of Labor
and independent investigators. In general, they have used
a static-tabular approach in their analysis.

The Department of Labor studies have been interpreted
as indicating that increases in the statuatory minimum have
had negligable, and in some cases, even positive effects
on employment. These results have been rationalized by some
economists on the grounds that wage costs are not an impor-
tant consideration to firms or that existing unskilled
labor suddenly became more efficient.

Critics of the Department of Labor studies maintain
that the unorthodox conclusions result from a failure to
consider changes in exogenous variables and to employ ade-
quate statistical procedures. The independent investigators,

however, have often been guilty of the same criticisms raised against the Department of Labor.

To overcome these shortcomings we have attempted in this study to specify a model which was subject to inferential tests. To accomplish this task, a model was developed to explain desired and equilibrium levels of industry employment, and from it a reduced form expression was obtained. Because incomplete adjustment to equilibrium levels of industry employment may occur, a stock adjustment model was introduced. A reduced form expression for the observed level of industry employment as a function of the minimum wage, the average wage rate in the industry, a trend variable, and the lagged observed level of industry employment was then obtained.

The final form of the model developed was used to estimate the impact from increasing the federal minimum wage on selected high and low wage SIC three digit manufacturing industries for the 1960-63 period. Both ordinary least squares and ZEF estimation procedures were used, with and without log conversions. In each case the results were theoretically consistent.

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CHAPTER I

INTRODUCTION

In 1938 the Congress passed the Fair Labor Standards
act to eliminate poverty resulting from substandard wages,
to maintain purchasing power at sufficiently high levels
to insure full employment, to prevent downward wage spirals
during periods of falling aggregate demand, and to foster
fair methods of competition.[1] To accomplish these goals,
the 1938 Act established a minimum hourly rate for all
industries engaged in interstate commerce of 25 cents between
October 24, 1938 and October 23, 1939, and provided for an
additional increase to 30 cents an hour beginning October
24, 1938.[2] It also provided that by October 24, 1945 the
minimum rate for all industries covered by the Act would
be increased to 40 cents an hour.[3] The minimum rate, how-
ever, could be raised to 40 cents an hour for some indus-
tries before the 1945 deadline, after appropriate testimony

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[1]Donald E. Cullen, "Minimum Wage Laws," New York State
School of Industrial and Labor Relations, Bulletin 43,
(Ithaca, N. Y.: Cornell University, February, 1961), p. 3.

[2]U. S., Statutes at Large, Vol. LII (1938), "Fair
Labor Standards Act of 1938," June 25, 1938, ch. 676, sec. 6,
p. 1062.

[3]Ibid.

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before industry committees, by the Administrator of the

Wage and Hour Division of the Department of Labor, pro-

viding such increases did not substantially reduce employ-

ment or give a competitive advantage to a particular group.[4]

Subsequent amendments to the Fair Labor Standards Act

of 1938 increased the minimum hourly rate to 75 cents on

January 25, 1950[5] and to $1.00 an hour on March 1, 1956.[6]

In addition, the minimum rate was raised to $1.15 an hour

on September 3, 1961 on those occupations previously covered

and to $1.00 on those employments then included under the

Act.[7] In September of 1963 the minimum rate was again

increased to $1.25 an hour on previously covered jobs and

to $1.15 an hour on those occupations initially covered

in 1956.[8] The most recent extension of the minimum wage

raised the minimum hourly rate to $1.40 on February 1, 1967

and provided for an additional increase to $1.60 an hour

on February 1, 1968.[9] In addition the 1966 amendments

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[4]Ibid., sec. 8, p. 1064.

[5]U.S., Statutes at Large, Vol. LXIII, pt. 1 (1949), "Fair Labor Standards Amendments of 1949," Oct. 26, 1949, ch. 736, sec. 6, p. 912 and Ibid., sec. 16, p. 920.

[6]U.S., Statutes at Large, Vol. LXIX (1955), "Fair Labor Standards Amendments of 1955," Aug. 12, 1955, ch. 867, sec. 3, p. 711.

[7]U.S., Statutes at Large, Vol. LXXV (1961), "Fair Labor Standards Amendments of 1961," May 5, 1961, Pub. L. 87-30, sec. 5, p. 67.

[8]Ibid.

[9]U.S., Statutes at Large, Vol. LXXX, pt. 1, (1966), "Fair Labor Standards Amendments of 1966," Sept. 23, 1966, Pub. L. 89-601, sec. 301, p. 8381.

provided for a minimum hourly rate of $1.00 for those indus-
tries that were not previously covered by the Act.[10]

I. Review of Impact Studies

Following the enactment of the Fair Labor Standards
Act and its subsequent extensions, a great deal of contro-
versy arose regarding the effect of establishing wage rates
at levels different than those determined by the market.
As a result of this controversy various industry studies
were undertaken to determine the impact of such action after
the passage of the original Act and each of its amended
forms.

Studies Following the FLSA of 1938

H. M. Douty analyzed the impact of establishing a
minimum wage in the seamless hosiery industry from Septem-
ber, 1938 to September, 1940.[11] The study was composed of
two samples: the first related the effect of the wage
change on all the firms in the industry in 1938 and 1940,
and the second compared 91 plants which were included in
the Bureau of Labor Statistics surveys of 1938 and 1940,
and still in business in 1940.[12] The establishment of
these minima had a decided upward push on wages in the

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[10]Ibid., sec. 302-303, p. 838-839.

[11]H. M. Douty, "Minimum Wage Regulation in the Seam-
less Hosiery Industry," Southern Economic Journal, Vol. VIII,
(October, 1941), p. 176.

[12]Ibid., p. 179.

industry increasing average hourly earnings from 35.1 cents to 41.3 cents between 1938 and 1940.[13] The effect of establishing a minimum wage in this industry varied greatly among plants with widely separated wage levels.[14] Of the 91 plants included in both the 1938 and 1940 surveys there was a 3.9 per cent reduction in employment.[15] When all plants in the survey were considered the average decline in employment was greatest for those plants which were paying average wages below the 32.5 cent average for the industry in 1938.[16] This largely explains the narrowing of average wage rates between the North and the South[17] and the larger decreases in employment in the South as opposed to those in the North (employment decreased by 5.5 per cent in the South and increased by 5.0 per cent in northern plants).[18] In those southern plants where average hourly rates were 32.5 cents, employment also increased.[19] This study did not indicate that minimum wages resulted in the dislocation of employment because of plant failures, although some

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[13]Ibid.   [14]Ibid., p. 182.

[15]Ibid., p. 183.   [16]Ibid.

[17]Ibid., p. 179.

[18]Ibid., p. 184. Conclusions similar to these were also reached by: J. F. Maloney, "Some Effects of the Federal Fair Labor Standards Act Upon Southern Industry, Southern Economic Journal, Vol. 9, (July, 1942), pp. 15-23.

[19]Douty, loc. cit.

transfer of workers from low to high wage firms did occur.[20] While total employment for the industry did not appear to be significantly affected, Douty does suggest that there may have been some improvements in managerial performance and a substitution of new machinery for old.[21]

A second study utilizing the 1938 and 1940 surveys of 97 plants in the seamless hosiery industry attempts to determine the effect of the minimum wage on employment in the low wage mills between October, 1938 and September, 1939.[22] This investigation divides the sample into three groups: the first paying average hourly earnings of less than 25 cents before October 24, 1938, the second paying average hourly earnings between 25 cents and 27.5 cents and the third paying average hourly earnings between 29 cents and 35.5 cents.[23] After the imposition of the 25 cent minimum the average hourly earnings for all three groups increased with the largest increase occurring in those plants included in Group I.[24] The Group I plants, however, experienced significant decreases in both the number employed and man-hours worked while both of these factors either remained constant or increased for the

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[20]Ibid., p. 186. [21]Ibid.

[22]A. F. Hinrichs, "Effects of the 25-cent Minimum Wage on Employment in the Seamless Hosiery Industry," Journal of the American Statistical Association, Vol. XXXV (March, 1940), p. 13.

[23]Ibid., p. 15. [24]Ibid., p. 17.

Group II and Group III plants.[25] In addition to the wage and employment adjustments which occurred in the low wage mills there were changes in production methods from those that were labor intensive to those that were capital intensive.[26]

Studies Following the 1949
Amendment to the FLSA

The effect of the 1949 amendment to the Fair Labor Standards Act on southern sawmills, fertilizer, men's dress shirts and nightwear, men's seamless hosiery, and wood furniture industries was analyzed by the Bureau of Labor Statistics for the payroll periods just before and after the Act became effective.[27] In each of these five industries a substantial number of employees were earning less than 75 cents an hour in 1949.[28] Examination of payroll records after the new Act became effective indicated adjustments in average earnings higher than necessary to comply with the new minimum, a narrowing of wage rates paid by firms in these industries, and a narrowing of occupational wage differentials in those industries paying their employees by piece rate.[29] The investigation did not, however, indicate any significant nonwage adjustments in the five industries surveyed.[30] The change in capital expenditures

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[25]Ibid., p. 19.   [26]Ibid., p. 22-23.

[27]H. S. Kantor, "Economic Effects of the Minimum Wage," Monthly Labor Review, Vol. LXXVIII (March, 1955), p. 308.

[28]Ibid.   [29]Ibid., p. 309.   [30]Ibid.

and hours worked did not significantly change for the
short period considered except in the fertilizer and saw-
milling industries where the trend toward mechanization
was continued.[31] Additional surveys made for high wage and
low wage covered and noncovered industries for the period
1938 to 1951 did, however, indicate increases in average
hourly earnings of 121 per cent for the first group, 171
per cent for the second group and 125 per cent for the
third group.[32] It was also concluded from these later
studies that the effect from establishing wage minima was
not only to increase but to substantially maintain the
relative improvements in earnings for those workers affected
by the minimum wage increase.[33]

Studies Following the 1955 Amendment of the FLSA

The effect of raising the minimum wage from 75 cents
to $1.00 an hour was investigated by the Department of
Labor for selected low-wage industries. These studies
attempted to determine the impact from increasing the
minimum wage on nonseasonal and seasonal industries as
well as any diffusive effects it might have. They all
utilized payroll surveys taken by the Bureau of Labor
Statistics prior to and following the effective date of
the 1955 amendment.

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[31]Ibid.

[32]Ibid., p. 311.

[33]Ibid.

Nonseasonal industries.--The effect of the 1955 amendment on the cigars, fertilizer, seamless hosiery, and wooden containers industries was examined by the Bureau of Labor Statistics for the August, 1955, February and April 1956, and April, 1957 payroll periods.[34] The initial impact on these industries followed the same pattern as in previous studies,[35] i.e., average hourly earnings in each industry increased, a larger proportion of workers just earned the new minimum compared to those that had previously earned the 75 cent minimum, and a narrowing of the dispersion of average hourly earnings.[36] Most of these changes occurred on the date the new amendment became effective.[37] Analysis of subsequent payroll periods, however, indicated that the wage structure in these industries restored itself with the degree of restoration varying widely in each industry.[38]

Employment for the five industries decreased by slightly over 4 per cent between August 1955 and April 1956, and by more than 8 per cent between April 1956 and April 1957.[39] Total employment between the 1955 and 1957

[34]N. J. Samuels, "Effects of the $1 Minimum Wage in Five Industries," Monthly Labor Review, Vol. LXXXI (May, 1958), p. 492.

[35]N. J. Samuels, "Effects of the $1 Minimum Wage in Seven Industries," Part I, Monthly Labor Review, Vol. LXXX (March, 1957), pp. 323-28 and Part II, Monthly Labor Review, Vol. LXXX (April, 1957), pp. 441-46.

[36]Samuels, loc. cit.

[37]Ibid., p. 493.   [38]Ibid., p. 492.   [39]Ibid., p. 493.

payroll periods declined between 6 per cent and 15 per cent for those industries studied.[40] Some of this decline was attributed to changes in factors such as product demand, rather than from cost increases resulting from the higher minimum.[41] Other studies conducted by the Bureau of Labor Statistics found that only about 15 per cent of the reporting firms attributed the discharge of employees to the $1.00 an hour minimum, with the most widely used adjustment being increased expenditures for machinery and equipment.[42]

Seasonal industries.--The payroll surveys in the fruit and vegetable canning and freezing, raw cane sugar manufacturing, and tobacco stemming and redrying industries, which are composed of a generally transitory unskilled work force, were taken at peak employment periods in 1955 and 1956.[43] The effect on earnings and employment in these industries again followed patterns similar to those in other low wage industries. There was an immediate increase in the wage level, a greater concentration of workers at the new minimum and a substantial reduction in

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[40]Ibid.   [41]Ibid., p. 494.

[42]N. J. Samuels, "Plant Adjustments to the $1 Minimum Wage," Monthly Labor Review, Vol. LXXXI (October, 1958), p. 1138.

[43]N. J. Samuels, "Effects of the $1 Minimum Wage in Three Seasonal Industries," Monthly Labor Review, Vol. LXXX (September, 1957), p. 1087.

occupational and geographic wage differentials.[44] Employ-

ment decreased by 12.5 per cent in raw cane sugar manufact-

uring and by 11.3 per cent in fruit and vegetable canning

and freezing, but increased by 1.6 per cent in tobacco stem-

ming and redrying.[45] The total employment for all three

industries fell by 3.5 per cent between the 1955 and 1956

period.[46] The variations in employment in the raw cane

sugar manufacturing was attributed to obsolescence of exist-

ing plants which made them unprofitable and necessitated

some of them closing.[47] It was believed, however, that in

tobacco stemming and redrying normal fluctuations in employ-

ment could have accounted for the 1.6 per cent increase in

employment recorded.[48]

.   Diffusive effects.--Area studies were conducted using

payroll data which divided industries into groups subject

to the $1.00 an hour minimum and those not covered by the

1955 amendment. In these studies the average pay levels

between the subject and nonsubject industries widened when

the new minimum became effective and narrowed in the

following year, but remained wider in April 1957 than in

February, 1956.[49] A comparison of the April 1957 payroll

period with the June 1959 payroll period indicated no clear

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[44]Ibid.   [45]Ibid., Table I, p. 1088.

[46]Ibid.   [47]Ibid., p. 1090.   [48]Ibid., p. 1091.

[49]L. Badenhoop, "Effects of the $1 Minimum Wage in
Seven Areas," Monthly Labor Review, Vol. LXXXI (July, 1958),
p. 737.

pattern of change in relative wage differentials between covered and noncovered industries.[50] Comparing the firms which were required to adjust with those that were not it was found that the adjusting firms increased production more, introduced more machinery, increased efficiency at a faster rate, and utilized opportunities to reduce over-time more than did firms not facing an adjustment mandate.[51] In most cases it was believed that wage and nonwage adjustments were made with little or no general effect on employment.[52]

M. R. Colberg, utilizing data for 517 manufacturing plants, compared the impact of the $1.00 an hour minimum on high and low wage Florida counties.[53] During the four month period between January and April 1956 the new legal minimum had only a slight effect on man-hours worked in high wage counties but a very substantial dimunitive effect in the low wage group.[54] From January 1956 to January 1957, however, man-hours worked increased 5.1 per cent for the

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[50]H. Schaffer, "Effects of the $1 Minimum Wage in Six Areas," Monthly Labor Review, Vol. LXXXIII (May, 1960), p. 474.

[51]P. A. Brinker, "The $1 Minimum Wage Impact of Fifteen Oklahoma Industries," Monthly Labor Review, Vol. LXXX, (September, 1957), p. 1092.

[52]Ibid., p. 1092 and Badenhoop, loc. cit.

[53]M. R. Colberg, "Minimum Wage Effects on Florida's Economic Development," Journal of Law and Economics, Vol. III, (October, 1960), pp. 106-117.

[54]Ibid., p. 113.

high wage counties and decreased by less than 1 per cent in the low wage group.[55] The increase in employment in the high wage counties was largely attributed to increases in product demand during this period.[56] In the low wage group it was felt that the small decline in employment was due to a movement toward a better quality of worker and an attempt to utilize these workers more effectively during seasonal peaks.[57] The decreases in employment were found to be greater the larger the required increase in the wage rates.[58] Colberg attributes part of the decline in population in the low-wage counties to a lack of employment opportunities resulting from the $1.00 an hour minimum wage.[59]

Studies Following the 1961 Amendment of the FLSA

The 1961 amendment to the Fair Labor Standards Act initially increased the minimum rate from $1.00 to $1.15 an hour and extended its coverage mainly to workers in the retail and construction industries at $1.00 an hour. At a later date it raised the $1.15 an hour rate to $1.25 and the $1.00 an hour rate to $1.15. To determine the impact of these changes the Department of Labor conducted a nation-wide survey of the retail trade and selected surveys for non-metropolitan areas in the North Central and southern regions and small metropolitan areas of the South.

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[55]Ibid., p. 113.   [56]Ibid., Table 3, p. 112.

[57]Ibid.   [58]Ibid.   [59]Ibid., p. 116.

The surveys conducted between 1960 and 1962 indicated no general upward pressure on the wage structure resulting from increases in the statutory minimum.[60] The wage effects that did occur were generally confined to those increases necessary to bring the wages of covered workers to the new minimum level.[61] The greatest impact occurred in the non-metropolitan areas of the South where 44 per cent of the workers in the wholesale trade and 27 per cent of those in manufacturing received the wage increases necessary to bring their hourly earnings to $1.15.[62] In some low wage areas employees earning $1.15 an hour or slightly higher did receive wage increases but there was no consistent pattern to these increases.[63] In addition, workers in noncovered industries did not benefit from the changes that occurred in subject industries, except for food service workers in newly covered retail stores.[64]

Further studies that were conducted indicated that not only did unemployment decrease between 1961 and 1965 but that employment increased at a faster rate and to a greater extent among the less skilled groups in the society

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[60]U.S. Department of Labor, Wage and Hour and Public Contracts Division, Report Submitted to the Congress in Accordance with the Requirements of Section 4 (d) of the Fair Labor Standards Act, (Washington: Government Printing Office, January 1963), p. 111.

[61]Ibid.

[62]Ibid., p. v.

[63]Ibid., p. 111.

[64]Ibid.

during this period.[65] Other studies that included 34 areas in the North Central and southern nonmetropolitan areas, as well as metropolitan localities in the South, indicated that in 25 areas employment increased, in eight areas employment decreased and in one area there was no change.[66] In the 25 areas showing employment advances 15 had increases of 15 per cent or more, and in the eight areas where employment declined the percentage of decline was six per cent or less.[67] These studies maintained that there was no reason to believe employment increases would have been any larger if the minimum wage had not been raised or extended.[68] In general, the conclusions reached were that the 1961 amendment did not result in employment decreases, inflation, a retardation of economic development or smaller profits.[69]

The Department of Labor also conducted a nationwide survey of the impact of the new wage minima on the retail trade for the June 1965 payroll period, which was nine months after the $1.15 an hour edict became effective for this sector. This study followed previous surveys which

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[65]U.S. Department of Labor, Wage and Hour and Public Contracts Division, Minimum Wage and Maximum Hour Standards Under the Fair Labor Standards Act – An Evaluation and Apprisal, (Washington: Government Printing Office, January 1966), p. 7.

[66]Ibid.

[67]Ibid., pp. 7-8.

[68]Ibid., p. 7.

[69]Ibid., p. 10.

were made in June 1961, which was one month after the $1.00

an hour minimum became effective, and in June 1962 which

was nine months after its effective date.[70]   In this case

about 70 per cent of the employees were at the new minimum.[71]

Employers, however, seemed to anticipate the $1.25 an hour

minimum which was to become effective in three months since

more workers were concentrated at this rate than at the

$1.15 an hour level.[72]   The greatest proportional effects

on employee earnings occurred in the nonmetropolitan areas

and in the southern regions.[73]   In the noncovered portions

of the retail trade the proportion of workers earning less

than $1.25 an hour was reduced by 33 1/3 per cent since the

June 1962 study.[74]   Employment levels were higher for all

regions surveyed after the introduction of each of the

minima.[75]   Much of the employment decline which occurred

in nonmetropolitan areas was thought to be due to a statis-

tical reclassification of these areas resulting from popu-

lation growth.[76]   In the various retail lines employment

decreases were greatest in the limited price variety stores

where the decline in employment levels more than offset

the increases that occurred after the $1.00 an hour minimum

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[70]U. S. Department of Labor, Wage and Hour and Public
Contracts Division, Studies of the Effects of the Minimum
Wage and Maximum Hour Standards of the Fair Labor Standards
Act in the Retail Trade, (Washington: Government Printing
Office, January, 1966), p. 1.

[71]Ibid., p. 3.   [72]Ibid.   [73]Ibid.

[74]Ibid.   [75]Ibid., p. 4.   [76]Ibid.

became effective.[77] In the noncovered segments of the retail trade sector, employment levels increased during each of the periods surveyed.[78]

Summary and Evaluation of Studies

The investigations of the Department of Labor on the impact of various minimum wages found (1) an increase in average hourly earnings, (2) a narrowing of occupational and geographic wage differentials, (3) some diffusive effects but no consistent pattern to their change, (4) some concentration of workers' average hourly earnings at the new minimum, or its anticipated level, (5) some, but not complete, restoration of prior wage differentials over longer periods and (6) only slight increases or decreases in employment.

The conclusions of these studies regarding the effects on employment from increasing wage rates by imposing minimum wages have been challenged by several authors.[79] In general, it is the contention of this group that labor

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[77]Ibid.   [78]Ibid.

[79]Note for example the following studies: Yale Brozen, "Minimum Wage Rates and Household Workers," The Journal of Law and Economics, Vol. 5, (October, 1962), pp. 103-109; M. R. Colberg, op. cit., pp. 106-116; David E. Kaun, "Minimum Wages, Factor Substitution and the Marginal Producer," Quarterly Journal of Economics, Vol. 79, (August, 1965), pp. 478-486; G. Macesich and C. T. Stewart, "Recent Department of Labor Studies of Minimum Wage Effects," Southern Economic Journal, Vol. 26, (April, 1960), pp. 281-290; J. M. Peterson, "Employment Effects of Minimum Wages, 1938-50," Journal of Political Economy, Vol. 65, (October, 1957), pp. 412-30 and C. P. Sawaya, "The Employment Effects of Minimum Wage Regulation in the Southern Pine Lumber Industry," (unpublished Doctoral dissertation, University of Indiana, June 1958).

markets are substantially competitive in nature and that wage increases through statutory means must therefore result in unemployment in the low wage groups. If unemployment is not apparent they feel that it must either have been off-set by changes in exogenous variable or hidden by considering only gross changes in employment. A further contention seems to be that the statistical analysis utilized is sufficiently unsophisticated as to neither preclude nor conclude the results derived from the above studies.

Other authors, however, believe that the results obtained from the Department of Labor studies are substantially valid. They contend that statutory increases do not cause unemployment either because (1) wage costs are not an important consideration to non-profit maximizing firms[80] or (2) that existing factors suddenly become more efficient and therefore do not necessitate changes in the firm's factor mix.[81] It is the belief of these authors

[80]Richard A. Lester, "Shortcomings of Marginal Analysis for Wage-Employment Problems," American Economic Review, (March, 1946), p. 76. Professor Machlup in an article rebutting Lester and other anti-marginalists contended their failure to see the applicability of marginal analysis was often due to a lack of full insight into the theory itself, to the utilization of inappropriate research techniques, or to an inability to interpret correctly the results of their investigations. He concluded that Lester's study has neither discredited or disproved orthodox theory of the firm. Fritz Machlup, "Marginal Analysis and Empirical Research," American Economic Review, Vol. XXXVI, No. 4, Pt. 1, (September, 1946), pp. 519-54.

[81]Lloyd G. Reynolds, Labor Economics and Labor Relations, (New York: Prentice-Hall, Inc., 1956), p. 661.

that the assumption of a competitive model is invalid and
that orthodox theory is generally inept in this instance.

II. The Present Study

The studies previously discussed in this chapter
have typically assumed that industry labor markets were in
equilibrium prior to an increase in the minimum wage. Since
the demand for labor is a derived demand, this assumption
implies that industry product markets were also in equili-
brium during these periods. An indication that this con-
tention may not be valid can be seen in Table 1.1 which
shows changes in the Federal Reserve Board Index of pro-
duction activity for selected manufacturers. During the
periods of the 1950, 1956 and the 1963 increases of the
federal minimum wage, aggregate output was in general expand-
ing for each of these industry classifications. For the
1961 change in the minimum wage, however, production activity
was declining for most industry groups.

Under the above conditions the impact of the minimum
wage need not lead to a decrease in equilibrium levels of
employment. Since manufacturing industries were already
expanding employment in an attempt to increase output, it
is possible that the equilibrium level of industry employ-
ment could increase, decrease, or remain constant after the
increase in the federal minimum.

The disemploying effects of an increase in the mini-
mum wage may, however, still be present. They result

TABLE 1.1.--Changes in Industrial Production Indexes, Selected Manufacturers, 1949-64 [1957-59 = 100].

Year	Durable Manufactures							Nondurable Manufactures			
	Primary Metals	Fabricated Metal Products	Machinery	Transportation Equipment	Instruments and Related Products	Clay, Glass and Lumber	Furniture and Misc.	Textile Apparel & Leather Products	Paper & Printing	Chemicals Petroleum and Rubber Products	Food Beverages & Tobacco
1949	-14.9	- 7.4	- 7.5	+ .2	- 6.0	- 7.4	- 5.8	- 3.9	- .1	- 1.4	+ .8
1950a	+20.9	+15.6	+13.7	+ 9.3	+ 8.1	+15.4	+12.1	+ 8.5	+ 7.4	+11.3	+ 2.8
1951	+ 8.8	+ 5.8	+10.3	+ 6.5	+ 8.4	+ 4.3	- 3.5	- 1.7	+ 2.7	+ 6.7	+ 1.8
1952	- 9.4	- 2.2	+ 9.1	+10.2	+12.4	- 2.7	+ 2.2	+ 2.1	- 1.7	+ 2.5	+ 1.9
1953	+13.2	+11.3	+ 8.4	+18.6	+ 7.2	- 3.4	+ 7.3	- 1.2	+ 4.9	+ 5.3	+ .9
1954	-21.2	-10.1	-12.8	- 7.9	- 2.4	- 3.1	- 2.9	- 3.3	+ 2.4	- .5	+ 1.6
1955	+27.1	+ 8.1	+ 8.8	+13.2	+ 5.8	+11.1	+11.1	+ 8.6	+ 7.5	+12.1	+ 3.3
1956a	- 2.0	+ .5	+10.6	- 4.6	+ 6.7	+ 1.3	+ 3.1	+ 2.5	- 4.6	+ 4.6	+ 3.5
1957	- 4.2	+ 2.7	- 2.9	+ 9.0	+ 2.6	- 4.5	- 3.4	- 1.1	+ .7	+ 4.2	+ .1
1958	-24.7	- 8.6	-15.4	-16.9	- 5.9	- 3.4	- 4.3	- 1.9	- .8	+ .1	+ 2.7
1959	+12.9	+12.6	+18.3	+14.5	+17.8	+14.4	+15.7	+13.1	+ 8.2	+13.4	+ 4.5
1960	+ .9	+ 2.1	+ 3.7	+ 4.2	+ 6.6	- 2.8	+ 4.3	- .6	+ 3.8	+ 5.0	+ 2.7
1961a	- 2.4	- 1.1	- .4	- 4.6	+ .7	- 1.2	+ .8	+ .9	+ 3.4	+ 5.0	+ 3.6
1962	+ 5.7	-10.6	+13.1	+14.7	+ 7.2	+ 4.8	+10.4	+ 6.7	+ 4.3	+12.3	+ 3.1
1963a	+ 8.7	+ 6.3	+ 5.7	+ 8.7	+ 7.2	+ 5.1	+ 4.6	+ 3.4	+ 3.4	+10.6	+ 3.5
1964	+15.8	+ 9.3	+12.2	+ 3.7	+ 6.2	+ 6.7	+ 9.3	+ 6.7	+ 7.4	+10.7	+ 4.0

aYear of increase in the federal minimum wage.

Source: Economic Report of the President, U. S. Government Printing Office, Washington: 1969, p. 269.

because the equilibrium level of output that would have
maximized profits of the firms in the industry before the
minimum was raised may be greater than the level of employ-
ment after the increase in the federal minimum.

These disemploying effects of an increase in the
minimum wage on unskilled labor can be illustrated in
Figure 1.1 where N_1 is the equilibrium level of employment
at the present level of the minimum wage, W_m, in the industry
labor market. The period of expansion in the industry can
be represented in this graph by a shift in the demand curve
for unskilled labor from D_j to D_j'. With this increase in
the demand for unskilled labor the new profit maximizing
level of employment in the industry would be N_2^* at the
wage rate W_m. An increase in the minimum wage to W_m' at this
point would cause this industry to employ N_2 units of labor
instead of the level N_2^*. The effect of an increase in the
federal minimum would, therefore, cause a decrease in the
potential level of employment by the quantity $N_2^* - N_2$.
The magnitude of this decrease will depend upon the elas-
ticity of the demand function for unskilled labor in the
industry.

The above analysis is used in the present study, but
it is modified because data is only available for observed
levels of total industry employment. The total employment,
however, may be interpreted as the sum of the unskilled
and skilled levels of industry employment. A model to

Wage
Rate

W'_m

W_m

D_j

D'_j

N_1 N_2 N^*_2
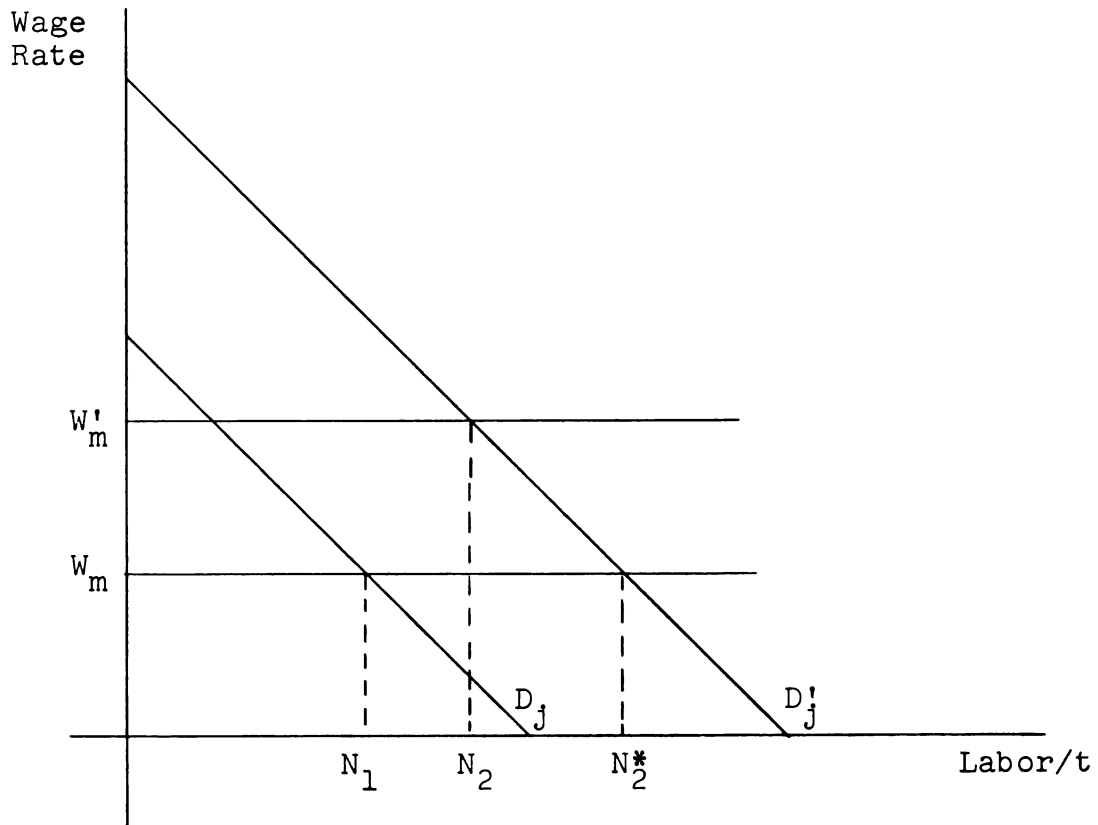
Labor/t

Figure 1.1.--Industry Labor Markets (Unskilled Labor).

establish profit maximizing or equilibrium levels of each
type of labor can be developed and a reduced form expres-
sion for the total equilibrium level of industry employ-
ment obtained. Because of incomplete adjustment, the
equilibrium level of industry employment are in general
unobservable. An expression for the observed level of
industry employment is, therefore, derived.

The final form of the model developed is applied to selected high and low wage SIC three digit manufacturing industries for the 1960-63 period. Both ordinary least squares and Zellner's two stage Aitken's estimation procedures are used. The hypothesis to be tested is that the minimum wage increases may have reduced observed levels of industry employment.

CHAPTER II

THE MODEL

Introduction

In this chapter we examine the effect of minimum wage increases on an industry's equilibrium level of employment. First, a model is developed to explain the determination of profit maximizing levels of employment for an individual firm. The aggregate equilibrium level of employment is then obtained by summing these quantities over the individual firms. A stock adjustment model is then introduced to allow for the possibility that industry labor markets do not instantaneously adjust to their desired levels of employment. The final form of this model is used in Chapter III to test the central hypothesis of this study.

Equilibrium Levels of Employment

For the period of this study the following assumptions will be made: 1) the firms in each industry are rational economic units that have sufficient knowledge of their cost and revenue data to maximize profits; 2) the firms' production functions are multivariable with first derivatives that are positive and monotonically decreasing over the relevant range of input quantities; 3) technology is constant; 4) product demand is a function of and

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varies inversely with product prices; 5) the industry supply functions of labor are perfectly elastic; and 6) unskilled labor operates at the minimum wage rate and skilled labor at the skilled rate.

The equilibrium level of employment for the $i\underline{th}$ firm in a typical industry can be determined, given the above assumptions, once the product demand, production and profit functions for the firms have been specified. Assume that these functions for the $i\underline{th}$ firm have the following form:

$$x_{i,t} = X(n_{1,i,t}, n_{2,i,t}) \quad \text{(production function)} \quad (2.1)$$

$$\frac{\partial X}{\partial n_{1,i,t}} \; , \; \frac{\partial X}{\partial n_{2,i,t}} \; , \; \frac{\partial^2 X}{\partial n_{1,i,t} \partial n_{2,i,t}} > 0$$

$$\text{and} \quad \frac{\partial^2 X}{\partial n_{1,i,t} \partial n_{1,i,t}} \; , \; \frac{\partial^2 X}{\partial n_{2,i,t} \partial n_{2,i,t}} < 0$$

$(i = 1, 2, 3, \ldots, n)$

$(t = 1, 2, 3, \ldots, m)$

$$P_{i,t} = P(x_{i,t}, t) \quad \text{(product demand function)} \quad (2.2)$$

$$\frac{\partial P}{\partial x_{i,t}} < 0$$

$$\Pi_{i,t} = x_{i,t} P_{i,t} - w_{1,t} n_{1,i,t} - w_{2,t} n_{2,i,t} - f_{i,t} \quad (2.3)$$

where the arguments are defined in the following way:

$x_{i,t}$ = the output of the ith firm in a typical industry during period t.

$p_{i,t}$ = the output price of the ith firm in a typical industry during period t.

$\Pi_{i,t}$ = the profits of the ith firm in a typical industry during period t.

$n_{1,i,t}$ = the input of unskilled labor by the ith firm in a typical industry during period t.

$n_{2,i,t}$ = the input of skilled labor by the ith firm in a typical industry during period t.

t = a trend variable which represents autonomously induced shifts in the firm's product demand functions.

$f_{i,t}$ = the fixed costs of the ith firm in a typical industry during period t.

$w_{1,t}$ = the level of the federal minimum wage during period t.

$w_{2,t}$ = the skilled wage rate in a typical industry during period t.

The equilibrium and profit maximizing levels of employment are obtained from the first order conditions for profit maximization. Setting the first partial derivatives of the profit function with respect to each type of labor equal to zero, we obtain the following:

$$\frac{\partial \Pi_{1,t}}{\partial n_{1,i,t}} = x_{i,t} \left\{ \frac{\partial P}{\partial x_{i,t}} \frac{\partial X}{\partial n_{1,i,t}} + \frac{\partial P}{\partial t} \frac{\delta t}{\delta n_{1,i,t}} \right\} \qquad (2.4)$$

$$+ \ P \frac{\partial X}{\partial n_{1,i,t}} - w_{1,t} = 0$$

and

$$\frac{\partial \Pi_{1,t}}{\partial n_{2,i,t}} = x_{i,t} \left\{ \frac{P}{\partial x_{1,t}} \frac{\partial X}{\partial n_{2,i,t}} + \frac{\partial P}{\partial t} \frac{\delta t}{\delta n_{2,i,t}} \right\} \quad (2.5)$$

$$+ P \frac{\partial X}{\partial n_{2,i,t}} - w_{2,t} = 0$$

From these two profit maximizing equations, the production function and the demand equation, we can derive reduce form expressions for the equilibrium quantities of unskilled and skilled labor. Both the quantity of unskilled and skilled labor depend only upon the predetermined variables $w_{1,t}$ $w_{2,t}$ and t. These reduced form equations can be written as:

$$n_{1,i,t} = N_1 (w_{1,t}, w_{2,t}, t) \quad (2.6)$$

and

$$n_{2,i,t} = N_2 (w_{1,t}, w_{2,t}, t) \quad (2.7)$$

The equilibrium levels of unskilled and skilled labor can now be derived for a particular industry by summing over the profit maximizing levels of $n_{1,i,t}$ and $n_{2,i,t}$ for the various firms in that industry. If there are n firms in the industry the equilibrium levels of each type of employment can be expressed as follows:

$$n_{1,t}^* = \sum_{i=1}^{n} n_{1,i,t} = N_1^* (w_{1,t}, w_{2,t}, t) \qquad (2.8)$$

$$(i=1,2,3, \ldots ,n)$$

$$n_{2,t}^* = \sum_{i=1}^{n} n_{2,i,t} = N_2^* (w_{1,t}, w_{2,t}, t) \qquad (2.9)$$

where $n_{1,t}^*$ and $n_{2,t}^*$ are equilibrium quantities of unskilled and skilled labor desired by firms in a typical industry during period t. The other arguments have the same meaning as before.

The exact mathematical form of equations (2.8) and (2.9) are unknown. As is well known, however, a wide class of functions can be closely approximated by a linear function.[82] Therefore, equations (2.8) and (2.9) will be written in the following form.

$$n_{1,t}^* = B_{10} + B_{11} w_{1,t} + B_{12} w_{2,t} + B_{13}\, t \qquad (2.10)$$

and

$$n_{2,t}^* = B_{20} + B_{21} w_{1,t} + B_{22} w_{2,t} + B_{23}\, t \qquad (2.11)$$

From equations (2.1) through (2.9) we would expect that:

$$B_{11} = \frac{\partial n_{1,t}^*}{\partial w_{1,t}} < 0$$

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[82] Arthur S. Goldberger, _Econometric Theory_, (John Wiley and Sons, Inc., New York), p. 127.

$$B_{12} = \frac{\partial n_{1,t}^*}{\partial w_{2,t}} \gtrless 0$$

$$B_{13} = \frac{\partial n_{1,t}^*}{\partial t} > 0$$

$$B_{21} = \frac{\partial n_{2,t}^*}{\partial w_{1,t}} \gtrless 0$$

$$B_{22} = \frac{\partial n_{2,t}^*}{\partial w_{2,t}} < 0$$

$$B_{23} = \frac{\partial n_{2,t}^*}{\partial t} > 0$$

Since:

$$n_t^* = n_{1,t}^* + n_{2,t}^* \qquad (2.12)$$

where n_t^* is the total equilibrium quantity of labor in a typical industry during period t, and the variables $n_{1,t}^*$ and $n_{2,t}^*$ are to be interpreted as they were previously defined in equations (2.9) and (2.10).

Then:

$$n_t^* = B_{10} + B_{11}w_{1,t} + B_{12}w_{2,t} + B_{13}\,t + \qquad (2.13)$$

$$B_{20} + B_{21}w_{1,t} + B_{22}w_{2,t} + B_{23}\,t$$

Since skilled wage rates, as they have been defined above, are generally unavailable for manufacturing industries, an alternative formulation is used. This can be accomplished by interpreting the average wage rate in the industry as a weighted average of the unskilled and skilled wage rates during period t. Mathematically, this relationship is as follows:

$$\bar{w}_t = \frac{n_{1,t}}{n_t} w_{1,t} + \frac{n_{2,t}}{n_t} w_{2,t} \qquad (2.14)$$

or

$$w_{2,t} = \frac{n_t}{n_{2,t}} \bar{w}_t - \frac{n_{1,t}}{n_{2,t}} w_{1,t} \qquad (2.15)$$

where $\bar{w}_t$ is the average wage rate in a typical industry during period t; $n_{1,t}$ is the observed number of unskilled workers in a typical industry during period t; $n_{2,t}$ is the observed number of skilled workers in a typical industry during period t; n_t is the sum of $n_{1,t}$ and $n_{2,t}$; and the other arguments are to be interpreted as before.

Substituting equation (2.15) for $w_{2,t}$ in equation (2.13) and simplifying yields:

$$n_t^* = (B_{10}+B_{20}) + \{(B_{11}+B_{21}) - (B_{12}+B_{22}) \frac{n_{1,t}}{n_{2,t}}\} w_{1,t} \qquad (2.16)$$

$$+ \{(B_{12}+B_{22}) \frac{n_t}{n_{2,t}}\} \bar{w}_t + (B_{13}+B_{23}) t$$

or

$$n_t^* = \beta_0 + \beta_1 w_{1,t} + \beta_2 \bar{w}_t + \beta_3 t \qquad (2.17)$$

where it follows that:

$$\beta_0 = (B_{10} + B_{20})$$

$$\beta_1 = \{ (B_{11} + B_{21}) - (B_{12} + B_{22}) \frac{n_{1,t}}{n_{2,t}} \} = \frac{\partial n_t^*}{\partial w_{1,t}} \gtrless 0$$

$$\beta_2 = \{ (B_{12} + B_{22}) \frac{n_t}{n_{2,t}} \} = \frac{\partial n_t^*}{\partial \bar{w}_t} \gtrless 0$$

$$\beta_3 = (B_{13} + B_{23}) = \frac{\partial n_t^*}{\partial t} > 0$$

Partial Adjustments to Equilibrium Levels of Employment in Industry Labor Markets

In the previous section we have developed a model to establish equilibrium on desired levels of employment for industry labor markets. Even though these equilibrium levels of employment are desired by the industry their adjustment to them may not be complete during any given period t. The following stock adjustment model is, therefore, employed to allow for these possible differences between the desired and observed levels of industry employment.

$$(n_t - n_{t-1}) = \lambda(n_t^* - n_{t-1}) \quad 0 \le \lambda \le 1 \qquad (2.18)$$

or

$$n_t = \lambda n_t^* + (1-\lambda) n_{t-1} + \varepsilon_t \qquad\qquad (2.19)$$

Where n_{t-1} is the observed level of employment in a typical industry during period t-1; λ is the coefficient of adjustment; ε_t is an error term which meets the standard assumptions of the Classical Linear Regression Model;[83] and the other arguments have their previous interpretations.

The coefficient of adjustment (i.e., λ) in equation (2.18) reflects the degree to which the desired and observed change in industry employment have approached each other between the periods t and t-1. Theoretically λ can take on any value between zero and one. If the value of λ equals one, then $n_t = n_t^*$ and the industry labor market has made a complete adjustment to its desired or profit maximizing level of employment in the current period. If, however, the industry has failed to make any adjustment toward the equilibrium level of employment, then $n_t = n_{t-1}$ and the value of λ equals zero.

Since n_t^* in equation (2.19) is unobservable we will replace it with equation (2.17) and obtain the following:

$$n_t = \lambda \beta_0 + \lambda \beta_1 w_{1,t} + \lambda \beta_2 \bar{w}_t + \lambda \beta_3 t \qquad\qquad (2.20)$$

$$+ (1-\lambda) n_{t-1} + \varepsilon_t$$

where the arguments have the same meaning as before.

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[83]Goldberger, op. cit., p. 162.

Summary and the Final Form of the Model

In this chapter, we have developed a model to explain the desired and equilibrium levels of employment in industry labor markets. From this model a reduced form expression was obtained. Due to incomplete adjustments, however, the equilibrium levels of employment are in general unobservable. We, therefore, derived an expression for the observed level of industry employment as a function of the predetermined variables $w_{1,t}$, $\bar{w}_t$, t and n_{t-1}. The final form of our model appears as:

$$n_t = \delta_0 + \delta_1 w_{1,t} + \delta_2 \bar{w}_t + \delta_3 t + \delta_4 n_{t-1} + \varepsilon_t \qquad (2.21)$$

where:

$$\delta_0 = \lambda \beta_0$$

$$\delta_1 = \lambda B_1$$

$$\delta_2 = \lambda \beta_2$$

$$\delta_3 = \lambda \beta_3$$

$$\delta_4 = 1 - \lambda$$

The coefficients in equation (2.22) can theoretically take on negative or non-negative values. This results because the coefficient of adjustment (i.e., λ) is assumed to be a non-negative number between zero and one. If λ

happens to be positive then our previous discussion regarding the signs of the coefficients in equation (2.17) will still apply.

CHAPTER III

THE EMPIRICAL STUDY

Introduction

The reduced form expression of the model developed
in Chapter II was used to estimate the impact of increases
in the federal minimum wage on observed levels of employ-
ment in selected high and low wage three-digit manufac-
turing industries for the years 1960 through 1963. In
addition, the selection of industries, the data ulitized,
and the estimation procedure are discussed in this chapter.
The empirical results are then presented. In Chapter IV
some concluding remarks are given.

The Empirical Model

The reduced form of the model developed in Chapter
II appears as follows:

$$n_t = \delta_0 + \delta_1 w_{1,t} + \delta_2 \bar{w}_t + \delta_3 t + \delta_4 n_{t-1} + \varepsilon_t \qquad (3.1)$$

where n_t is the observed level of employment in a typical
industry during period t; $w_{1,t}$ is the level of the federal
minimum wage in period t; $\bar{w}_t$ is the average wage rate in
a typical industry during period t; t is a trend variable,
n_{t-1} is the level of employment in a typical industry during

the period t-1 and ϵ_t is an error term. As stated pre-
viously, it follows that:

$$\delta_0 = \lambda \beta_0$$

$$\delta_1 = \lambda \beta_1 = \frac{\partial n_t}{\partial w_{1,t}} \lessgtr 0$$

$$\delta_2 = \lambda \beta_2 = \frac{\partial n_t}{\partial \overline{w}_t} \lessgtr 0$$

$$\delta_3 = \lambda \beta_3 = \frac{\partial n_t}{\partial t} \geq 0$$

$$\delta_4 = 1 - \lambda \qquad\qquad (0 \leq \lambda \leq 1)$$

The ZEF estimation procedure will provide asymptotically
efficient and unbiased estimates of the coefficients in equa-
tion (3.1) if certain assumptions regarding the statistical
properties of the model are fulfilled. These assumptions
include the following: 1) the function is linear in the
explanatory variables and ϵ_t; 2) ϵ_t is normally and inde-
pendently distributed with zero mean and constant variance;
and 3) the disturbance covariances across industries are
not necessarily equal to zero.

The Selection of Industries and the Data

The reduced form of the model presented in equation
(3.1) was used to estimate the impact of federal minimum
wage increases on five low and five high wage three digit
manufacturing industries for the years 1960 through 1963.
The low wage industries included saw mills and planning

mills, men's and boy's furnishing, knitting mills, women's and misses' outerwear, and household furniture. Since some previous investigatory work has been done in these areas, it was felt that comparisons of the results may be possible. In selecting these industries, however, consideration was also given to the number of observations in each industry group. The high wage industries chosen were iron and steel foundries, construction and like equipment, metal working machinery, communication equipment, and steel rolling and finishing. The criteria for selecting this group were the average wage rate in the industry, as well as, the number of observations.

The employment and wage data for the above industries were obtained from the 1963 Census of Manufacturers, and the 1962, 1961 and 1960 Annual Surveys of Manufacturers. Since the cross sectional and time series data were pooled, the collection of observations on employment and wage rates required a four period matching of this data for a given three digit industry and state. When this was not possible, the industry for that state was dropped as a sample observation.

Only the employment of production workers and their respective wage rates were considered in estimating equation (3.1). Total employment was rejected in favor of production employment because the former category included supervisory personnel and corporate officers. Since this latter group is usually salaried, it was believed that

production employment would be more representative of any
effect which changes in the minimum wage may have upon
industry employment.

As noted in Chapter I of this study, the federal mini-
mum wage was increased twice in the 1960-63 period. It was
raised from $1.00 an hour to $1.15 an hour in 1961, and to
$1.25 an hour in 1963.

Because average wage rates for production workers
are not published for each state, this variable had to be
constructed. This was accomplished by dividing the total
wages paid to production workers in each year by the corres-
ponding total man-hours worked by this group. The resulting
variable should not be interpreted as average straight time
hourly earnings since total wages paid to production work-
ers includes additional payments such as overtime premiums.
This variable should also be viewed with some degree of
caution in the apparel industry since the man-hours of pro-
duction workers were not well reported because work in the
industry is generally conducted on a piece rate basis.

The Estimation Procedure

To estimate the coefficients in equation (3.1) the
above cross sectional data was pooled for the 1960-63
period. Consistent estimates of these coefficients were
obtained by ordinary least squares under the stated assump-
tions.

Zellner's two stage Aitken's estimates (abbreviated as ZEF) were also obtained.[84] This procedure produces unbiased estimates that are efficient relative to those obtained by ordinary least squares when the disturbances across equations are highly correlated.[85] If the disturbances are uncorrelated the ZEF estimates are only slightly worse in small samples than those obtained by ordinary least squares.[86]

The ZEF procedure was applied to groupings of industries that were expected on <u>a priori</u> grounds to have highly correlated disturbances. Generally, an attempt was made to combine industries in the same SIC two digit classification.

<u>The Results</u>

The ZEF results from estimating equation (3.1) appear in Table 3.1.[87] For convenience the average wage rate and

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[84]For a more detailed description of the ZEF procedure and its properties, see: Jan Kmenta and Roy F. Gilbert, "Small Sample Properties of Alternative Estimators of Seemingly Unrelated Alternative Estimators," <u>American Statistical Association Journal</u>, (December, 1968), pp. 1180-1200.

[85]<u>Ibid</u>., p. 1192.

[86]<u>Ibid</u>., p. 1195.

[87]The ordinary least squares results are given in Appendix A. Also shown are the results from using log conversions and applying both estimation procedures. Generally the ZEF results are superior to those obtained by ordinary least squares. When this was not the case, the results are only slightly worse. In addition, the use of log conversions did not usually increase the efficiency of the estimates of the coefficients. A notable exception is industry 232 where the use of ZEF with logs made all the estimates of the coefficients significant at the ten per cent level.

the coefficient of adjustment for each three digit industry are also shown. The industries are listed in the table from the low to the high wage group.

The minimum wage variable in the reduced form of the empirical model is both significant at better than the five per cent level and possesses a negative sign for five of the ten industries investigated. Four of these were previously classified as high wage. The fifth industry in this category has the lowest average wage rate of the ten industries considered. The remaining five industries, however, do not have estimated values for this coefficient that vary significantly from zero at the ten per cent level. These results all correspond with those theoretically expected.

Theoretically consistent results are also obtained for the average wage variable. In all but two industries the coefficient for this variable did not vary significantly from zero at the ten per cent level. In the two remaining industries, it was significant and positive for the high wage industry, and significant and negative for the low wage industry with the same level of confidence.

The trend variable is significant and positive for seven industries at $\alpha = .10$. In the remaining industries, it does not vary significantly from zero with a ten per cent confidence level. These results are also within those previously anticipated.

TABLE 3.1--ZEF Results From Estimating Equation (3.1).

SIC	Description	N	$\bar{w}^1$	λ^2	δ_0	δ_1	δ_2	δ_3	δ_4	R^2
242	Sawmills and Planning Mills	48	$1.47	.088** (.035)	8945.87** (3741.51)	-10120.19** (3914.88)	450.31** (335.64)	972.92** (318.10)	.912** (.035)	.970
232	Men's and Boys' Furnishings	32	1.52	.017 (.045)	14562.72 (10913.63)	-13126.52 (11186.64)	-2082.22 (1358.82)	1595.98* (893.97)	.983** (.045)	.963
225	Knitting Mills	32	1.64	.008 (.020)	-9559.18 (11537.79)	7628.28 (11748.56)	1327.06 (2290.59)	-687.83 (937.02)	.992** (.020)	.990
233	Womens' and Misses' Outerwear	32	1.67	.009 (.014)	-1358.22 (15530.86)	1328.77 (15269.63)	-984.24 (3033.37)	847.93 (1246.92)	.991** (.014)	.995
251	Household Furniture	48	1.85	-.002 (.027)	4609.81 (3740.91)	-4538.50 (3859.96)	-788.00* (433.91)	791.17** (309.04)	1.002** (.027)	.971
332	Iron and Steel Foundries	28	2.75	.064 (.045)	-365.55 (6067.79)	-12092.52** (4285.02)	4446.67** (1991.67)	1033.70** (383.74)	.936** (.045)	.992
353	Construction and Like Equipment	32	2.75	.017 (.025)	18453.23** (8224.90)	-21563.12** (7882.25)	348.84 (1203.33)	2068.83** (644.46)	.983** .025	.985
354	Metal Working Machinery	32	2.86	-.005 (.055)	28429.87** (12289.79)	-29995.59** (9911.80)	174.63 (2749.20)	2144.38** (845.23)	1.005** (.055)	.979
366	Communication Equipment	28	2.89	-.059 (.105)	11737.36 (26401.83)	-15860.68 (26198.33)	949.64 (3542.31)	1987.20 (2111.28)	1.059** (.105)	.875
331	Steel Rolling and Finishing	48	3.44	.016 (.013)	56030.67** (17096.93)	-58952.70** (15746.23)	343.46 (2735.29)	4113.14** (1282.44)	.984** (.013)	.993

NOTE: Estimated standard errors are in parentheses. One * indicates significance at the ten per cent level and a double ** indicates a five per cent significance level.

[1] This figure represents the average wage rate in the industry for the 1960-63 period.

[2] $\lambda = 1-\delta_4$

The coefficient of adjustment is always significantly different <u>from</u> <u>one</u> at confidence levels of better than one-half of one per cent. It does not, however, differ significantly <u>from</u> zero at the ten per cent level for any of the industries studied except saw mills and planning mills. In each case λ has the appropriate magnitude and sign.

Some Implications of the Results

Our results indicate that increases in the federal minimum wage reduced observed levels of employment in five of the ten industries investigated for the 1960-63 period. This is surprising only because four of these industries were among these classified as high wage. In the remaining industries increases in the minimum wage did not appear to have any significant effect on observed levels of industry employment at the ten per cent level. This does not imply, as some studies seem to indicate, that increases in the minimum wage do not adversely affect equilibrium levels of unskilled employment in industry labor markets. It simply means that the total effect upon the sum of observed skilled and unskilled employment did not vary significantly from zero. This may occur because the coefficient λ and/or the coefficient β_1 in equation (2.17) are equal to zero.

Even though the coefficient of the average wage rate variable did not vary significantly from zero in eight of the ten industries studied, we <u>cannot</u> conclude

that skilled wage rates and equilibrium levels of skilled employment are not inversely related. In addition, these results do not imply that wages are not an important consideration to profit maximizing firms. The only implication is that the effect on observed levels of total industry employment is not significant. The insignificance of the average wage rate coefficient may occur because λ is zero and/or because the coefficient β_2 in equation (2.17) is zero.

Since the trend variable was both positive and significant for seven of the industries studied, it appears that increases in product demand have caused most industries to expand employment for the period we are considering. This result seems to imply that these industries were already attempting to expand employment when the minimum wage was increased. It may also explain why some studies that assume equilibrium in industry labor markets conclude that increases in the federal minimum wage caused employment increases. In the three industries where the trend variable was not significant, it may be that the coefficient of adjustment was equal to zero. This possibility is further evidenced by the fact that none of the variables for these industries are significant and that λ did not vary significantly from zero.

The estimates of the coefficient of adjustment for the ten industries investigated during the 1960-63 period seem to indicate that industry labor markets adjust very

slowly to their desired levels of employment. Only industry
242, which had the lowest average wage rate, yielded an λ
estimated value of λ which was significantly different from
zero and positive.

Summary

In this chapter the reduced form expression of the
model developed in Chapter II was estimated by ordinary
least squares and ZEF procedures for ten three digit manu-
facturing industries during the 1960-63 period. Theoreti-
cally consistent results were obtained in each instance.
In general these results indicated that: 1) minimum wage
increases significantly reduced observed levels of employ-
ment in half of the industries studied; 2) changes in aver-
age wage rates seldom had a significant effect on observed
levels of employment; 3) most industries were expanding
employment because product demand was increasing; and 4)
industry labor markets adjust very slowly to desired levels
of employment regardless of the cause of the disequilibrium.

CHAPTER IV

CONCLUDING REMARKS

A substantial part of the investigatory work to deter-
mine the impact on employment from increasing the federal
minimum wage has been done by the Department of Labor.
In general, the results of these studies have been inter-
preted as indicating that increases in the statutory
minimum have had little or no effect on employment. In
some cases, the assertion has even been made that employ-
ment increased more rapidly in those periods after the
minimum wage increase than it had previously.

Some authors feel that the conclusions reached in
the Department of Labor studies are generally valid. They
believe that increases in the federal minimum wage do not
reduce employment either because wage costs are not an
important consideration to firms or that the existing
unskilled labor employed by the firm suddenly becomes
more efficient. These same authors further contend that
these results nullify the assumptions of the competitive
model and point out the ineptness of orthodox theory in
this instance.

Critics of the Department of Labor studies maintain
that the unorthodox conclusions result from a failure to

consider changes in exogenous variables and to employ adequate statistical procedures. They contend that since the minimum wage was usually raised during expansionary periods in the economy a comparison of gross changes in employment does not correctly reflect its impact.

Independent investigations, however, have often been guilty of the same criticisms raised against the Department of Labor studies. In many cases these studies have also used static-tabular analysis to determine the effect on employment from increasing the minimum wage in low wage industries. In one instance, only the gross movement of workers into low wage non-covered areas of employment was considered an adequate indication of unemployment resulting from minimum wage increases. These studies were also generally devoid of adequate statistical procedures to effectively determine the impact from increasing the statutory minimum wage.

To overcome these shortcomings, we have attempted in this study to specify a model that could be tested empirically. To accomplish this task a model was developed within the framework of orthodox theory to explain desired and equilibrium levels of industry employment, and from it a reduced form expression was obtained. Because incomplete adjustment to equilibrium levels of employment in industry labor markets may occur, a stock adjustment model was introduced. A reduced form expression for the observed level of industry employment as a

function of the minimum wage rate, the average wage rate in the industry, a trend variable, and the lagged observed level of industry employment was then obtained.

The final form of the model developed was used to estimate the impact from increasing the federal minimum wage on five high and low wage SIC three digit manufactuing industries for the 1960-63 period. Both ordinary least squares and ZEF estimation procedures were used. Each procedure was also applied after the variables had been converted to logs. The ZEF results without log conversions were the most satisfactory. In each case the results were theoretically consistent.

The results from applying the ZEF procedures indicated that: 1) increases in the statutory minimum reduced observed levels of employment in half the industries studied and most often among the high wage group; 2) average wage rates often had no significant effect on observed levels of employment; 3) increases in product demand was causing most industries to expand employment; and 4) the adjustment of industry labor markets to equilibrium levels of employment is slow regardless of the cause for the disequilibrium.

The results do not imply that minimum wage increases have neutral or positive effects on equilibrium levels of employment, or that wage costs are unimportant to profit maximizing firms. In half of the industries, even observed

levels of industry employment appeared to be inversely related to increases in the minimum wage. Failure to note this relationship in the past may be due to the concentration of most studies on selected low wage industries.

It also appears that increases in product demand may have been causing most of the industries studied to expand employment during the 1960-63 period. If this is the case, then the direct relationship between minimum wage increases and observed levels of employment are understandable. This would seem to be a more realistic explanation for the above phenomenon than either the conclusion that firms disregard profits or that unskilled labor magically becomes more efficient.

There seems to be sufficient evidence to accept our hypothesis that increases in the federal minimum wage may have reduced observed levels of industry employment. The sign of the coefficient of the minimum wage variable was negative for eight of the industries studied, but significant at the ten per cent level, for only five of them. Regardless, this result only gives us the relationship between observed employment and minimum wages, not equilibrium levels of employment. It should be remembered, however, that reductions in observed levels of employment may veil even greater decreases in potential levels of employment.

BIBLIOGRAPHY

BIBLIOGRAPHY

<u>Books</u>

Bry, G. "Wages and Productivity." <u>Manufacturing by Industry and State</u>. New Brunswick, New Jersey: Rutgers University Press, 1962.

Carter, Allan M. <u>Theory and Wages and Employment</u>. Homewood, Illinois: Richard D. Irwin, Inc., 1959.

Christ, C. G. <u>Econometric Models and Methods</u>. New York: John Wiley and Sons, Inc., 1966.

Dixon, Wilfrid J. and Massey, Frank J., Jr. <u>Introduction to Statistical Analysis</u>. 2nd ed. New York: McGraw-Hill Book Company, Inc., 1957.

Ferguson, C. E. <u>Microeconomic Theory</u>. 2nd ed. Homewood, Illinois: Richard D. Irwin, Inc., 1969.

Friedman, M. <u>Capitalism and Freedom</u>. Chicago: University of Chicago Press, 1962.

_____. <u>Essays in Positive Economics</u>. Chicago: University of Chicago Press, 1953.

_____. <u>Price Theory: A Provisional Text</u>. Chicago: Aldine, 1962.

Goldberger, Arthur S. <u>Econometric Theory</u>. New York: John Wiley and Sons, Inc., 1964.

Henderson, J. M., and Quandt, R. E. <u>Microeconomic Theory: A Mathematical Approach</u>. New York: McGraw-Hill Book Company, 1958.

Henderson, John P. <u>Labor Market Institutions and Wages in the Lodging Industry</u>. East Lansing, Michigan: Michigan State University Business Studies, 1965.

Hicks, J. R. <u>Theory of Wages</u>. London: MacMillan and Co., 1935.

_____. The Theory of Wages. 2nd ed. London: Macmillan and Co. Ltd., 1964.

_____. Value and Capital. 2nd ed. London: Oxford University, 1946.

Johnston, J. Econometric Methods. New York: McGraw-Hill Book Company, 1963.

Klein, Lawrence R. Econometrics. New York: Row Peterson and Co.

_____. An Introduction to Econometrics. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962.

Reynolds, Lloyd G. Labor Economics and Labor Relations. New York: Prentice-Hall Inc., 1956.

Stigler, George. "Economic Problems in Measuring Changes in Productivity." Output, Input and Productivity Measurement." National Bureau of Economic Research. Vol. XXV. Princeton: Princeton University Press, 1961.

Articles and Pamphlets

Badenhoop, L. "Effects of the $1 Minimum Wage in Seven Areas." Monthly Labor Review, Vol. LXXXI (July, 1958), pp. 737-43.

Brinker, P. A. "The $1 Minimum Wage Impact of Fifteen Oklahoma Industries." Monthly Labor Review, LXXX (September, 1957), pp. 1092-95.

Bronfenbrenner, M. "Minimum Wages, Unemployment and Relief: A Theoretical Note." Southern Economic Journal, Vol. X (July, 1943), pp. 52-59.

Brown, W. "Some Effects of a Minimum Wage Upon the Economy as a Whole." American Economic Review, XXX (March, 1940), pp. 98-107.

Brozen, Yale. "Minimum Wage Rates and Household Workers." The Journal of Law and Economics, Vol. V (October, 1962), pp. 103-109.

Colberg, M. R. "Minimum Wage Effects on Florida's Economic Development." Journal of Law and Economics, III (October, 1960), pp. 106-16.

Cullen, Donald E. _Minimum Wage Laws_. New York State School
    of Industrial and Labor Relations. Cornell University,
    Bulletin 43, February, 1961.

Douty, H. M. "Minimum Wage Regulation in the Seamless
    Hosiery Industry." _Southern Economic Journal_, VIII
    (October, 1941), pp. 176-90.

_____. "Earnings and Employment of Women Factory Workers."
    Monthly Labor Review, LXXVIII (October, 1955), pp. 1126-
    31.

Finegan, T. A. "Hours of Work in the U. S.: A Cross Sec-
    tional Analysis." _Journal of Politcal Economy_, LXX
    (October, 1962), pp. 452-70.

Hamberg, D. "Minimum Wages and the Level of Employment."
    Southern Economic Journal, XV (January, 1949), pp. 321-
    36.

Hinrichs, A. F. "Effects of the 25-Cent Minimum Wage on
    Employment in the Seamless Hosiery Industry." _Journal
    of the American Statistical Association_, XXXV (March,
    1940), pp. 13-23.

Kantor, H. S. "Economic Effects of the Minimum Wage."
    Monthly Labor Review, LXXVIII (March, 1955), pp. 308-11.

Kaun, David E. "Minimum Wages, Factor Substitution and the
    Marginal Producer." _Quarterly Journal of Economics_,
    Vol. LXXIX (August, 1965).

Kmenta, Jan and Gilbert, Roy F. "Small Sample Properties of
    Alternative Estimators of Seemingly Unrelated Alter-
    native Estimators." _American Statistical Association
    Journal_, (December, 1968).

Lester, R. A. "Employment Effects of Minimum Wages."
    Industrial and Labor Relations Review, XIII (January,
    1960), pp. 254-64.

_____. "Marginalism, Minimum Wages, and Labor Markets."
    American Economic Review, XXXVII (March, 1947), pp. 134-
    48.

_____. "Shortcomings of Marginal Analysis for Wage-
    Employment Problems." _American Economic Review_,
    (March, 1946), pp. 63-82.

Long, C. D. "Impact of Effective Demand on the Labor
    Supply." _American Economic Review, Proceedings_.
    (May, 1953), pp. 458-67.

Macesich, G., and Stewart, C. T. "Recent Department of Labor Studies of Minimum Wage Effects." Southern Economic Journal, XXVI (April, 1960), pp. 281-90.

Machlup, Fritz. "Marginal Analysis and Empirical Research." American Economic Review, XXXVI, no. 4, pt. 1 (September, 1946), pp. 519-54.

Moloney, J. F. "Some Effects of the Federal Fair Labor Standards Act Upon Southern Industry." Southern Economic Journal, IX (July, 1942), pp. 15-23.

Motheral, Cornelia Little. "Minimum Wages, Factor Substitution, and the Marginal Producer: Comment." Quarterly Journal of Economics, LXXXI (May, 1967), pp. 343-46.

Nerlove, M. "The Market Demand for Durable Goods: A Comment." Econometrica, XXVIII (January, 1960), pp. 132-42.

Peterson, J. M. "Employment Effects of Minimum Wages, 1938-50." Journal of Political Economy, LXV (October, 1957), pp. 412-30.

_____. "Employment Effects of Minimum Wages: Reply." Industrial and Labor Relations Review, XIII (January, 1960), pp. 264-73.

_____. "Research Needs in Minimum Wage Theory." Southern Economic Journal, XXVIII (July, 1962), pp. 1-9.

Samuels, N. J. "Effects of the $1 Minimum Wage in Five Industries." Monthly Labor Review, LXXXI (May, 1958), pp. 492-501.

_____. "Effects of the $1 Minimum Wage in Seven Industries." pt. 1. Monthly Labor Review, LXXX (March, 1957), pp. 323-28.

_____. "Effects of the $1 Minimum Wage in Seven Industries." pt. 2. Monthly Labor Review, Vol. LXXX (April, 1957), pp. 441-46.

_____. "Effects of the $1 Minimum Wage in Three Seasonal Industries." Monthly Labor Review, LXXX (September, 1957), pp. 1087-91.

_____. "Plant Adjustments to the $1 Minimum Wage." Monthly Labor Review, LXXXI (October, 1958), pp. 1137-42.

Schaffer, H. "Effects of the $1 Minimum Wage in Six Areas." Monthly Labor Review, LXXXIII (May, 1960), pp. 472-78.

Stigler, G. J. "Domestic Servants in the United States, 1900-1940." National Bureau of Economic Research. Occasional Paper No. 24.

Stigler, G. J. "Professor Lester and the Marginalists." American Economic Review, XXXVII (March, 1947), pp. 147-54.

_____. "The Economics of Minimum Wage Legislation." American Economic Review, XXXVI (June, 1946), pp. 357-65.

Stone, R. and Rowe, D. A. "The Market Demand for Durable Goods." Econometrica, XXV (July, 1957), pp. 423-43.

Tolles, N. A. "American Minimum Wage Laws: Their Purposes and Results." Industrial Relations Research Association, Proceedings, XII (December, 1959), pp. 116-33.

_____. "The Purpose and Results of United States Minimum Wage Laws." Monthly Labor Review, LXXXIII (March, 1960), pp. 238-42.

Van Sickle, J. "Geographical Aspects of a Minimum Wage." Harvard Business Review, XXIV (Spring, 1946), pp. 277-94.

Weiss, H. "Minimum Wage Fixing Under the United States Fair Labor Standards Act." International Labor Review, LI (January, 1945), pp. 18-48.

Government Publications and Documents

Economic Report of the President. Washington, D.C.: Government Printing Office, 1969.

"The Effects of Minimum Wage Determination in Service Industries: Adjustments in Dry-Cleaning and Power Laundry Industries." Bulletin No. 166. Women's Bureau: Washington, D.C., 1938.

Schultze, C. L., and Tryon, J. L. "Prices and Costs in Manufacturing Industries." Study Paper No. 17 prepared for the Joint Economic Committee. Congress of the United States, January, 1960.

U.S. Bureau of the Census. Census of Manufacturers, 1963, Vol. III, Area Statistics. Washington, D.C.: Government Printing Office, 1966.

U.S. Bureau of the Census. Annual Survey of Manufacturers, 1962. Washington, D.C.: Government Printing Office, 1964.

U.S. Bureau of the Census. Annual Survey of Manufactures, 1961. Washington, D.C.: Government Printing Office, 1963.

U.S. Congress. Senate. Economic Factors in Statutory Minimum Wages. S. Doc. 146, 80th Cong., 2nd Sess., Library of Congress. Washington, D.C.: Government Printing Office, 1948.

U.S. Department of Labor, Wage and Hour and Public Contracts Division. Manufacturing Industries: A Study to Evaluate the Minimum Wage and Maximum Hours Standards of the Fair Labor Standards Act. January, 1965.

U.S. Department of Labor, Wage and Hours and Public Contracts Division. Minimum Wage and Maximum Hours Standards Under the Fair Labor Standards Act, The 1966 Amendments. January, 1967.

U.S. Department of Labor, Wage and Hour and Public Contracts Division. Minimum Wage and Maximum Hour Standards Under the Fair Labor Standards Act -- An Evaluation and Apprisal. Washington, D.C.: Government Printing Office, January, 1966.

U.S. Department of Labor, Wages and Hour and Public Contracts Division. Report Submitted to the Congress in Accordance with the Requirements of Section 4(d) of the Fair Labor Standards Act. Washington, D.C.: Government Printing Office, January, 1963.

U.S. Department of Labor, Wage and Hour and Public Contracts Division. Retail Trade: A Study to Measure the Effects of the Minimum Wage and Maximum Hours Standards of the Fair Labor Standards Act. Janaury, 1966.

U.S. Department of Labor, Wage and Hour and Public Contracts Division. Studies of the Economic Effects of the $1.00 Minimum Wage. March, 1957.

U.S. Department of Labor, Wage and Hour and Public Contracts Division. Studies of the Effects of the $1 Minimum Wage. Part 1. Washington, D.C.: Government Printing Office, January, 1959.

U.S. Department of Labor, Wage and Hour and Public Contracts Division. Studies of the Effects of the Minimum Wage and Maximum Hour Standards of the Fair Labor Standards Act in the Retail Trade. Washington, D.C.: Government Printing Office, January, 1966.

U.S. Department of Labor, Wage and Hour and Public Contracts Division. Wholesale Trade: A Study to Evaluate the Minimum Wage and Maximum Hours Standards of the Fair Labor Standards Act. January, 1965.

U.S. Statutes at Large, Vol. LII (1938). "Fair Labor Standards Act of 1938." June 25, 1938.

U.S. Statutes at Large, Vol. LXIII, p. 1 (1949). "Fair Labor Standards Amendments of 1949," October 26, 1949.

U.S. Statutes at Large, Vol. LXIX, (1955). "Fair Labor Standards Amendments of 1955," August 12, 1955.

U.S. Statutes at Large, Vol. LXXV, (1961). "Fair Labor Standards Amendments of 1961." May 5, 1961.

U.S. Statutes at Large, Vol. LXXX, pt. 1, (1966). "Fair Labor Standards Amendments of 1966." September 23, 1966.

Unpublished Doctoral Dissertations

Kaun, David E. "Economics of the Minimum Wage: The Effects of the Fair Labor Standards Act, 1945-1960." Unpublished Ph.D. dissertation, Stanford University, 1963.

Peterson, J. M. "The Employment Effects of a Minimum Wage." Unpublished Ph.D. dissertation, University of Chicago, 1955. (Microfilm).

Sawaya, C. P. "The Employment Effects of Minimum Wage Regulation in the Southern Pine Lumber Industry." Unpublished Ph.D. dissertation, Indiana University, June, 1958.

APPENDIX A

TABLE A.1.--Ordinary Least Squares Results From Estimating Equation (...).

SIC	Description	N	$\bar{w}^1$	λ^2	δ_0	δ_1	δ_2	δ_3	δ_4	R^2
242	Sawmills and Planning Mills	48	$1.47	.096** (.036)	8871.82* (3743.12)	-10081.78** (3915.11)	566.96 (354.73)	954.69* (318.62)	.904 (.036)	.970
232	Men's and Boy's Furnishings	32	1.52	.016 (.041)	14289.20 (10917.78)	-13123.98 (11186.64)	-1909.87 (1370.64)	1591.16 (893.99)	.984 (.041)	.963
225	Knitting Mills	32	1.64	.005 (.019)	-10080.50 (11542.31)	7514.20 (11749.93)	1696.53 (2306.44)	-694.14 (937.03)	.995 (.019)	.990
233	Women's and Misses' Outerwear	32	1.67	.013 (.016)	-2093.16 (15554.20)	1513.89 (15270.88)	-526.21 (3069.36)	805.17 (1247.68)	.987 (.016)	.995
251	Household Furniture	48	1.85	-.006 (.028)	4734.21 (3747.83)	-4534.06 (3859.96)	-886.84** (459.24)	796.55 (309.13)	1.006 (.028)	.971
332	Iron and Steel Foundries	28	2.75	.059 (.041)	-301.01 (6219.38)	-12098.16* (4285.23)	4401.73** (2079.54)	1039.60* (387.16)	.941 (.041)	.992
353	Construction and Like Equipment	32	2.75	.017 (.025)	18446.43* (8227.40)	-21558.76* (7882.31)	352.00 (1205.49)	2068.02 (644.52)	.983 (.025)	.985
354	Metal Working Machinery	32	2.86	-.002 (.056)	27984.46* (12299.18)	-29891.67* (9912.28)	329.29 (2754.13)	2125.43* (845.46)	1.002 (.056)	.979
366	Communication Equipment	28	2.89	-.041 (.110)	10469.70 (26478.42)	-15784.09 (26198.61)	1507.15 (3627.47)	1956.39 (2112.80)	1.041 (.110)	.876
331	Steel Rolling and Finishing	48	3.44	.014 (.013)	55216.74* (17125.76)	-59056.91* (15746.43)	615.05 (2755.21)	4093.57 (1282.81)	.986 (.013)	.993

NOTE: Estimated standard errors are in parentheses. * indicates significance at the ten per cent level and ** indicates a five per cent significance level.

[1]This figure represents the average wage rate in the industry for the 1960-63 period.

[2]$\lambda = 1-\delta_4$

TABLE A.2.--Ordinary Least Squares Results From Estimating Equation (3.1) (In Ln).

SIC	Description	N	$\bar{W}^1$	λ_2	δ_0	δ_1	δ_2	δ_3	δ_4	$\bar{R}^2$
242	Sawmills and Planning Mills	48	$1.47	0.0203 (0.0286)	0.0501 (0.1143)	-1.0305** (0.4224)	0.0368 (0.0429)	0.1838** (0.0657)	0.9797** (0.0286)	.977
232	Men's and Boy's Furnishings	32	1.52	-0.0031 (0.0367)	0.0153 (0.1639)	-1.5221* (0.8838)	-0.1979 (0.1334)	0.2582* (0.1362)	1.0031** (0.0367)	.973
225	Knitting Mills	32	1.64	0.0056 (0.0236)	0.0300 (0.1136)	0.0228 (0.9662)	0.1936 (0.2243)	-0.0177 (0.1479)	0.9944** (0.0236)	.985
233	Women's and Misses' Outerwear	32	1.67	0.0038 (0.0231)	0.0017 (0.0845)	0.0410 (0.8604)	0.0064 (0.2087)	0.0524 (0.1348)	0.9962** (0.0231)	.990
251	Household Furniture	48	1.85	-0.0024 (0.0221)	-0.0010 (0.0854)	-0.6053 (0.4776)	-0.1355* (0.0722)	0.1727** (0.0737)	1.0024** (0.0221)	.981
332	Iron and Steel Foundries	28	2.75	0.0591 (0.0422)	-0.2699** (0.1264)	-1.4638** (0.6632)	1.1469* (0.5624)	0.2212* (0.1073)	0.9409** (0.0422)	.989
353	Construction and Like Equipment	32	2.75	0.0147 (0.0208)	0.0829 (0.1055)	-1.8805** (0.7372)	-0.0990 (0.2184)	0.3417** (0.1153)	0.9853** (0.0208)	.989
354	Metal Working Machinery	32	2.86	0.0011 (0.0231)	0.0072 (0.0800)	-2.2819** (0.5649)	0.0459 (0.2321)	0.3084** (0.0882)	0.9989** (0.0231)	.992
366	Communication Equipment	28	2.89	0.0253 (0.0650)	0.0887 (0.2325)	-0.7658 (1.4287)	0.1118 (0.3867)	0.1706 (0.2217)	0.9747** (0.0650)	.938
331	Steel Rolling and Finishing	48	3.44	-0.0046 (0.0101)	-0.0704 (0.1043)	-1.0770** (0.4781)	0.1125 (0.2244)	0.1361* (0.0758)	1.0046** (0.0101)	.996

NOTE: Estimated standard errors are in parentheses. * indicates significance at the ten per cent level and ** indicates a five per cent significance level.

[1]This figure represents the average wage rate in the industry for the 1960-63 period.

[2]$\lambda = 1-\delta_4$

TABLE A.3.--ZEF Results From Estimating Equation (3.1) (In Ln).

SIC	Description	N	$\bar{w}$[1]	λ_2	δ_0	δ_1	δ_2	δ_3	δ_4	R^2
242	Sawmills and Planning Mills	48	$1.47	0.0138 (0.0277)	0.0250 (0.1109)	-1.0346** (0.4424)	0.0224 (0.0406)	0.1869** (0.0657)	0.9862** (0.0277)	.997
232	Men's and Boy's Furnishings	32	1.52	-0.0013 (0.0365)	0.0266 (0.1631)	-1.5244* (0.8838)	-0.2222* (0.1329)	0.2597* (0.1362)	1.0013** (0.0365)	.973
225	Knitting Mills	32	1.64	0.0092 (0.0225)	-0.0171 (0.1108)	0.0174 (0.9658)	0.2034 (0.2155)	-0.0176 (0.1473)	0.9908** (0.0225)	.985
233	Women's and Misses' Outerwear	32	1.67	-0.0019 (0.0219)	-0.0302 (0.0822)	-0.0555 (0.8598)	0.0446 (0.1925)	0.0474 (0.1344)	1.0019** (0.0219)	.990
251	Household Furniture	48	1.85	-0.0028 (0.0212)	-0.0005 (0.0821)	-0.6057 (0.4776)	-0.1443** (0.0677)	0.1733** (0.0737)	1.0028** (0.0212)	.981
332	Iron and Steel Foundries	28	2.75	0.0561 (0.0421)	-0.2674** (0.1259)	-1.4622** (0.5603)	1.1121** (0.6632)	0.2235** (0.1073)	0.9439** (0.0421)	.989
353	Construction and Like Equipment	32	2.75	0.0148 (0.0207)	0.0875 (0.1051)	-1.8822** (0.7372)	-0.1090 (0.2177)	0.3426** (0.1153)	0.9852** (0.0207)	.989
354	Metal Working Machinery	32	2.86	0.0011 (0.0230)	0.0195 (0.0797)	-2.2820** (0.5649)	0.0182 (0.2310)	0.3100** (0.0882)	0.9989** (0.0230)	.992
366	Communication Equipment	28	2.89	0.0273 (0.0649)	0.0869 (0.2316)	-0.7636 (1.4287)	0.1346 (0.3859)	0.1688 (0.2217)	0.9727** (0.0649)	.936
331	Steel Rolling and Finishing	48	3.44	-0.0070 (0.0099)	-0.0765 (0.1026)	-1.0800** (0.4781)	-1.1043** (0.2206)	0.1372** (0.0757)	1.0070** (0.0099)	.996

NOTE: Estimated standard errors are in parentheses. * indicates significance at the ten per cent level and ** indicates a five per cent significance level.

[1]This figure represents the average wage rate in the industry for the 1960-63 period.

[2]$\lambda = 1 - \delta_4$