Appendix

Interindustry Factor Mobility and Technological Change: Evidence on Wage and Profit Dispersion Across U.S. Industries, 1820-1990

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Michael J. Hiscox

A. Wages Data

Table 1 provides a description of the wages data from each source, listing the manufacturing industries for which data are reported. The primary data from the Weeks and Aldrich reports are the industry averages compiled by Long. For the censuses prior to 1914, I began with the list of 17 industry categories for which Long extracted data for the period 1860 to 1890, and amended this list to extend the series for 15 industries from 1820 to 1910. I added 5 more industries (the last 5 entries in the list in Table 1) for which data were available over that entire period. After1900 the *Census* and the *Annual Survey of Manufactures* report data in 15 categories, and from 1947 they report data for 19 categories (including the last 4 on the list in Table 1).

[Table 1]

As a basic check on the correspondence between the different series, I calculated simple correlation coefficients between them for overlapping years and common industries (see Table 2). Although for some pairs of series there are only a small number of matching industry categories in overlapping years, the correlations are all positive and high in most cases. Relatively lower correlations between the census measures of earnings and the daily wage data

from the Weeks and Aldrich reports raise some concern, but given the variety of weaknesses with these sources it is difficult to make a clear judgment about which series should be preferred.

[Table 2]

B. Profits Data

Table 3 lists the industries for which profits data are reported from each source. To compile data from the censuses prior to 1919 I used the same list of 15 and 20 industries constructed for the analysis of wages. For the data from the *Census* and the *Annual Survey of Manufactures* after 1947 I used the full list of 19 industry categories.

[Table 3]

Table 4 reports correlations between the different profit series for overlapping years and common industries. There is a strong positive correlation between the measure of profits (value-added minus wage costs) per man-hour based upon *Census* and *Annual Survey of Manufactures* data after 1950 and the measure of profits as a percent of equity reported for listed companies in each industry by the Securities and Exchange Commission. These are the only two series from different sources of any length reported in Figure 1. But I have also compared the profit estimates used in Figure 1 with alternative data on profits available for particular years. The census data on profits as a percent of capital invested is correlated very strongly and positively with various measures of corporation profitability in different industries in the interwar period reported by Crum, Epstein, and Sloan. For example, Crum estimates that the most profitable sector in 1916 was the iron and steel industry, where net income of corporations averaged 47.6 percent of sales; Epstein estimates that the same industry had the highest rate of income as a percent of capital invested in 1917 (59 percent) using a different set of data; and using the census data on value

added and costs, the iron and steel also records the highest estimated profit as percent of capital invested in 1920 (21.8 percent).

I also compared the estimates of industry profits calculated from the census for aggregate industries in 1850 and 1860 with the estimates provided by Bateman and Weiss using census records on a sample of manufacturing establishments in the southern states in those same years. Again, the comparison suggests that the measures are strongly, positively related. Many of the estimates for particular industries (presumably those represented in large numbers in the southern states) are actually close approximates; for instance, the general estimates for profit rates in the leather industry are 32 (1850) and 21 (1860) percent, while the Bateman-Weiss estimates are 27 and 22 percent, respectively.

C. Estimated Wage Equations using Individual-Level Survey Data

The results reported here were generated by following the approach used by Krueger and Summers. I used the labor force survey data from the March individual extracts from the *Current Population Survey* which goes back to 1968. The surveys compile cross-sectional data on members of households 14 years and older. The earnings variable used was personal weekly earnings divided by usual weekly hours and those earning less than $1 an hour or more than $250 an hour are treated as outliers and excluded. Krueger and Summers studied workers in 40 different two-digit industries (including the mining, utilities, trade, finance, and services sectors as well as the manufacturing sector). I narrowed the study to the same 19 two-digit manufacturing industries for which I have examined aggregate data..

The method involves controlling for human capital, demographic, and working conditions as well as possible, then analyzing the effect of industry dummy variables on relative wages. The

control variables are education, age, 8 occupation dummies, 3 region dummies, dummies for gender, race, central city residence, union membership, ever married, and veteran status. The results are presented in Table 5. The estimated industry wage differentials are normalized (as per Krueger and Summers) as deviations from the employment-weighted mean differential, and these deviations are reported in the table: they can be interpreted as the proportionate difference in wages between an employee in a specific industry and the average manufacturing employee. The standard errors reported in parentheses are the unadjusted standard errors for the OLS estimates of the industry differentials.

[Table 5]

The overall variability in industry wages is measured by the standard deviation of the estimated differentials.[1] The results indicate substantial dispersion in wages across industries in recent years that cannot be explained by observable differences in skills and other characteristics of workers or working conditions. In 1968, the standard deviation of wage differentials was 9.8 percent and in 1992 it was 15.4 percent. These measures of variation in wages among industries are clearly lower than those based on aggregate data that were discussed in the text. Nevertheless, the substantial levels of variation that remain, and the trend towards increased wage dispersion, suggest that the lessons drawn from the aggregate data are unlikely to have been distorted by a failure to control for more detailed aspects of labor quality and conditions.

D. Estimated Profit Equations using Four-Digit Level Census Data

The results reported here follow in a similar vein those discussed above. I used available

[1] I follow Krueger and Summers in calculating an adjusted standard deviation, since the industry differentials are estimated with a least-squares sampling error which otherwise leads to a slight overestimation of the simple standard deviation of the differentials. The adjusted standard deviation for K industries equals $(\text{var}(\beta) - \sum\sigma^2/K)^{-2}$. See Krueger and Summers, "Efficiency Wages,"p.267.

Census of Manufactures data on profit (value added minus wage costs) per man-hour for 419 four-digit SIC industry classes in 1972 and 1992. Risk for each industry is measured simply as the standard deviation of annual profit rates over the 20-year period.[2] Other key control variables include the 4-firm concentration ratio, as a measure of market structure, and value-added per man-hour, as a measure of capital intensity (the latter is important, since the measure of profits here is biased in favor of capital-intensive industries). Profit equations are then estimated controlling for risk and these other industry characteristics, and the effect of two-digit SIC industry dummy variables on relative profits is examined. The results are presented in Table 6. The estimated industry profit differentials are normalized (in similar fashion to the wage differentials above) as deviations from the mean differential. These deviations are reported in the table and can be interpreted as the proportionate difference in profits between a four-digit product group in a specific two-digit industry and the average product group in manufacturing. Again, the standard errors reported in parentheses are the unadjusted standard errors for the OLS estimates of the industry differentials.

[Table 6]

The overall variability in industry profits is measured (as above) by the adjusted standard deviation of the industry differentials. The results are consistent with the conclusions drawn based on aggregate data in the text. Controlling for the riskiness of different investments, market structure, and capital intensity, there remains substantial dispersion in profits across industries that has risen in recent years. In 1972 the adjusted standard deviation of profit differentials was 102.6 percent, while by 1992 it had risen to 596.2 percent. The trend towards greater profit

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[2] A similar measure has been used by Reitzes and Rousslang in their study of profits earned by multinational corporations in different industries. See Reitzes and Rousslang, "Domestic versus International Capital Mobility."

dispersion is clear even when controlling for industry differences in risk and other variables.

Table 1: Data on Wages in Manufacturing by Source

Weeks Report: Daily Wages, 1860-1880	Aldrich Report: Daily Wages, 1860-1890	Census of Manufactures: Annual Earnings, 1820-1910
Stove foundries	Stone	Foundry and machine shop
Furniture	Metals	Carriages and wagons
Flour and grist mills	Agricultural implements	Agricultural implements
Hardware, cutlery, etc.	Leather	Iron and steel mills
Tin and sheet iron works	Carriages and wagons	Liquors, distilled
Saw and planing mills	White lead	Glass
Carriage and wagon works	Illuminating gas	Cigars and cigarettes
Flint and window glass	Books and newspapers	Flour and grist mills
Tanneries	Ale, beer, and porter	Leather
Machinery	Lumber	Lumber
Cigars and tobacco	Paper	Iron and steel furnaces
Iron blast furnaces	Woolen goods	Paper
Paper manufacture	Cotton goods	Woolen goods
Brick making		Cotton goods
Clothing		Brick and tile
Breweries and distilleries		Boots and shoes
Woolen manufactures		Machinery
Cotton manufactures		Hardware
		Clothing
		Printing

NICB: Hourly Wages, 1920-1937	Department of Labor: Hourly Earnings, 1947-	Census of Manufactures/ASM Annual Earnings, 1900-
Agricultural implements	Food and kindred products	Food and kindred products
Automobiles	Tobacco manufactures	Tobacco manufactures
Boots and shoes	Textiles	Textiles
Chemicals	Apparel	Apparel
Cotton	Lumber	Lumber
Electrical manufacturing	Furniture	Furniture
Foundry and machine shop	Paper	Paper
Furniture	Printing	Printing
Hosiery and knit goods	Chemicals	Chemicals
Iron and steel	Petroleum products	Petroleum products
Leather tanning	Rubber products	Rubber products
Lumber	Leather and leather products	Leather and leather products
Meat packing	Stone, clay, and glass products	Stone, clay, and glass products
Paint and varnish	Primary metal industries	Electrical machinery
Paper and pulp	Fabricated metal products	Instruments
Paper products	Machinery (except electrical)	Primary metal industries
Book and job printing	Electrical machinery	Fabricated metal products
News and magazines	Transportation equipment	Machinery (except electrical)
Rubber	Instruments	Transportation equipment
Silk		
Wool		

Table 2: Correlations between Data on Wages across Industries from Alternative Sources

	Weeks and Aldrich: Daily wages, 6 Industries	Weeks and Census: Daily/Annual, 13 Industries	Aldrich and Census: Daily/Annual, 8 Industries
1860	0.69	0.83	0.80
1870	0.70	0.47	0.48
1880	0.66	0.46	0.35

	Census and Census-ASM(prod workers): Annual earnings, 7 Industries	NICB and Census-ASM (prod workers): Hourly/Annual earnings, 9 Industries
1900	0.75	
1910	0.88	
1920		0.68
1925		0.64
1930		0.62
1935		0.80

	Department of Labor and Census-ASM: Hourly/Annual Earnings, 19 Industries
1950	0.94
1955	0.96
1960	0.97
1965	0.98
1970	0.98
1975	0.98
1980	0.98
1985	0.99
1990	0.98

Table 3: Data on Profits in Manufacturing by Source

Census: Profits as a percent of capital, 1820-1910	Census of Manufactures/ASM: Profits per man-hour, 1947-	Securities & Exchange Commission: Profits as percent of equity, 1933-
Foundry and machine shop	Food and kindred products	Food and kindred products
Carriages and wagons	Tobacco manufactures	Tobacco manufactures
Agricultural implements	Textiles	Textiles
Iron and steel mills	Apparel	Apparel
Liquors, distilled	Lumber	Lumber
Glass	Furniture	Furniture
Cigars and cigarettes	Paper	Paper
Flour and grist mills	Printing	Printing
Leather	Chemicals	Chemicals
Lumber	Petroleum products	Petroleum products
Iron and steel furnaces	Rubber products	Rubber products
Paper	Leather and leather products	Leather and leather products
Woolen goods	Stone, clay, and glass products	Nonmetal products
Cotton goods	Electrical machinery	Primary metals
Brick and tile	Instruments	Fabricated metals
Boots and shoes	Primary metal industries	Machinery (excluding electrical)
Machinery	Fabricated metal products	Electrical machinery
Hardware	Machinery (except electrical)	Transportation equipment
Clothing	Transportation equipment	Instruments
Printing		

Table 4: Correlations between Data on Profits across Industries from Alternative Sources

	Census-ASM and Securities & Exchange Commission: Profits per man-hour/as % equity, 18 industries
1960	0.74
1970	0.67
1980	0.59
1990	0.65

Census profits as percent of capital invested in 1920 and:

	Crum's mean corporation net income as % sales, 8 industries	Epstein's mean corporation net income as % capital, 9 Industries	Sloan's mean corporation earnings as % capital, 7 industries
1916	0.45		
1917		0.72	
1926	0.97		0.99

	Census and Bateman-Weiss (southern manufacturing): Profits as % capital invested, 10 Industries
1850	0.77
1860	0.49

Table 5: Estimated Wage Differentials for 2-Digit Manufacturing Industries -March CPS[a]

Industry	1968	1992
Food	-.043	-.052
	(.033)	(.040)
Tobacco	.031	.030
	(.086)	(.125)
Textiles	-.094	-.061
	(.036)	(.047)
Apparel	-.133	-.244
	(.036)	(.044)
Lumber	-.139	-.140
	(.018)	(.019)
Furniture	-.094	-.101
	(.045)	(.050)
Paper	.081	.176
	(.039)	(.046)
Printing	-.035	-.049
	(.036)	(.041)
Chemicals	.063	.140
	(.036)	(.042)
Rubber	-.086	-.064
	(.044)	(.045)
Petroleum	.095	.195
	(.052)	(.074)
Leather	-.154	-.177
	(.047)	(.071)
Stone, Glass	.007	-.006
	(.041)	(.050)
Primary Metals	.125	.083
	(.035)	(.046)
Fab. Metals	.052	-.046
	(.034)	(.043)
Machinery	.075	.035
	(.033)	(.040)
Electrical	.036	.020
	(.034)	(.041)
Automobile	.157	.165
	(.036)	(.043)
Transport	.110	.142
	(.036)	(.049)
Instruments	.066	.057
	(.044)	(.047)
Miscellaneous	-.119	-.136
	(.043)	(.056)
Standard Deviation	.101	.164
Adj. Standard Deviation[b]	.098	.154
Sample	14, 209	10,543

a. Differentials from the employment-weighted mean are reported (not raw coefficients). Standard errors in parentheses. Other explanatory variables include education, age, 8 occupation dummies, 3 region dummies, dummies for gender, race, central city residence, union membership, ever married, and veteran status.
b. Calculated as $(\text{var}(\beta) - \sum\sigma^2/K)^{-2}$. See text for discussion.

Table 6: Estimated Profit Differentials for 2-Digit Manufacturing Industries[a]

Industry	1972	1992
Food	1.051	5.040
	(.012)	(1.187)
Tobacco	1.660	18.228
	(.808)	(3.412)
Textiles	.078	3.592
	(.398)	(1.546)
Apparel	.832	3.949
	(.383)	(1.433)
Lumber	.620	2.355
	(.430)	(1.736)
Furniture	.244	1.183
	(.449)	(1.880)
Paper	-.088	.284
	(.480)	(1.675)
Printing	-1.862	-6.392
	(.471)	(1.822)
Chemicals	1.019	-.900
	(.353)	(1.404)
Rubber	.467	-.709
	(.801)	(2.754)
Petroleum	-.235	.491
	(.706)	(1.774)
Leather	.721	3.691
	(.477)	(2.004)
Stone, Glass	.129	.009
	(.354)	(1.469)
Primary Metals	-.790	-3.271
	(.377)	(1.476)
Fab. Metals	-.521	-2.276
	(.330)	(1.327)
Machinery	-1.245	-7.310
	(.331)	(1.212)
Electrical	-.032	-2.021
	(.358)	(1.317)
Transport	-2.526	-8.638
	(.405)	(1.644)
Instruments	-.474	-8.724
	(.480)	(1.667)
Miscellaneous	.256	1.419
	(.411)	(1.657)
Standard Deviation	1.101	5.992
Adj. Standard Deviation[b]	1.026	5.962
Sample	354	457

a. Differentials from the employment-weighted mean are reported (not raw coefficients). Standard errors in parentheses. Other explanatory variables include risk, 4-firm concentration ratios, and value-added per man-hour.
b. Calculated as $(\text{var}(\beta) - \sum\sigma^2/K)^{-2}$. See text for discussion.