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# *Labor Force and Employment,* *1800–1960*

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## I

### *Historical Comparison of U.S. and U.K. Employment*

The full meaning of the employment trends shown in Tables 1 and 2 for this lengthy period can be understood best by reviewing the entire span of American history. So laudable an enterprise must be left to others. Here we seek only to consider a few obvious implications. In this section we make some contrasts with the concurrent employment changes in the United Kingdom—that colonial power once dominating this country, our competitor in third country markets, and perhaps our closest ally (Table 3). To do so we telescope our history into five periods.

#### 1840–60

From the late 1830's, with Jackson's frigid treatment of joyous entrepreneurial expectations in banking, down to the eve of the Civil War, the United States decisively expanded its home market, while the United Kingdom extended its outward markets even more than those at home. The 60 per cent rise in U.S. farm employment was twice the rate of gain for the U.K. But exports were not the key. U.S. grain exports constituted an undistinguished footnote to the rise: wheat exports rose from \$2 million to a mere \$4 million; and while cotton exports gained from 744,000 to 1,768,000 pounds, tripling in value, neither category accounted for the bulk of the rise in farm employment. Even were we to attribute all the rise in farm slave employment to export sales—and a large segment was surely attributable merely to maintenance and expansion of the slave capital stock—the rise of over 50 per cent in the free farm labor force was another matter. That gain derived primarily from the support of a massive population increase—in city slums, in the open country, on frontier farms.

TABLE 1  
THE LABOR FORCE, BY INDUSTRY AND STATUS 1800-1960  
(thousands)

	Manufacturing													Teachers	Domestic Service	
	Agriculture			Mining			Construction	Total Persons Engaged	Cotton Textile		Primary Iron and Steel		Transport			
	Total	Free	Slave	Fishing	Mining	Wage Earners			Wage Earners	Wage Earners	Wage Earners	Ocean Vessels	Rail-way			Trade
1800	1,900	1,370	530	1,400	5	10	1	75	1	1	1	40	40	5	40	
1810	2,330	1,590	740	1,950	6	11	10	5	10	5	60	60	12	70	70	
1820	3,135	2,185	950	2,470	14	13	12	5	12	5	50	50	20	110	110	
1830	4,200	3,020	1,180	2,965	15	22	55	20	55	20	70	70	30	160	160	
1840	5,660	4,180	1,480	3,570	24	32	290	500	72	24	350	95	7	45	240	
1850	8,250	6,280	1,970	4,520	30	102	410	1,200	92	35	530	135	20	80	350	
1860	11,110	8,770	2,340	5,880	31	176	520	1,530	122	43	890	145	80	115	600	
1870	12,930	6,790	28	8,920	41	280	780	2,470	135	78	1,310	135	160	170	1,000	
1880	17,390	8,920	41	11,470	60	440	900	3,290	175	130	1,930	125	416	230	1,130	
1890	23,320	9,960	60	15,360	69	637	1,510	4,390	222	149	2,960	120	750	350	1,580	
1900	29,070	11,680	68	18,390	69	637	1,665	5,895	303	222	3,970	105	1,040	436	1,800	
1910	37,480	11,770	68	25,710	68	1,068	1,949	8,332	370	306	5,320	150	1,855	595	2,090	
1920	41,610	10,790	53	30,820	53	1,180	1,233	11,190	450	460	5,845	205	2,236	752	1,660	
1930	48,830	10,560	73	38,270	73	1,009	1,988	9,884	372	375	8,122	160	1,659	1,044	2,270	
1940	56,290	9,575	60	46,715	60	925	1,876	11,309	400	485	9,328	150	1,160	1,086	2,300	
1950	65,470	7,870	77	57,600	77	901	3,029	15,648	350	550	12,152	130	1,373	1,270	1,995	
1960	74,060	5,970	45	68,090	45	709	3,640	17,145	300	530	14,051	135	883	1,850	2,489	

<sup>a</sup> Persons engaged (employees, wage earners, salaried, self-employed, and unpaid family workers), unless otherwise specified. Aged ten and over.

TABLE 2  
 PERCENTAGE DISTRIBUTION OF THE LABOR FORCE, BY INDUSTRY AND STATUS

Total Labor Force	Free	Slave	Farm	Nonfarm	Primary (Farm, Fishing, Mining)			Manufacturing	Trade	Ocean and Rail Transport		Domestics
					Fishing, Mining)	Construc- tion	Manufac- turing			Domestics	Domestics	
1800	72.1	27.9	73.7	26.3	74.5					2.1	2.1	2.1
1810	68.2	31.8	80.9	19.1	81.6					2.6	3.0	3.0
1820	69.7	30.3	78.8	21.2	79.6		2.8			1.6	3.5	3.5
1830	71.9	28.1	68.8	31.2	69.7					1.7	3.8	3.8
1840	73.8	26.2	63.1	36.9	64.1			5.1	6.2	1.8	4.2	4.2
1850	76.1	23.9	54.8	45.2	56.4			5.0	6.4	1.9	4.2	4.2
1860	78.9	21.1	52.9	47.1	54.9			4.7	8.0	2.0	5.4	5.4
1870			52.5	47.5	54.1			6.0	10.1	2.3	7.7	7.7
1880			51.3	48.7	53.1			5.2	11.1	3.1	6.5	6.5
1890			42.7	57.3	44.8			6.5	12.7	3.7	6.8	6.8
1900			40.2	59.8	42.6			5.7	13.7	3.9	6.2	6.2
1910			31.4	68.6	34.4			5.2	14.2	5.4	5.6	5.6
1920			25.9	74.1	28.9			3.0	14.0	5.9	4.0	4.0
1930			21.6	78.4	23.8			4.1	16.6	3.7	4.6	4.6
1940			17.0	83.0	18.8			3.3	16.6	2.3	4.1	4.1
1950			12.0	88.0	13.5			4.6	18.6	2.3	3.0	3.0
1960			8.1	91.9	9.1			4.9	19.0	1.4	3.4	3.4

TABLE 3

U.S. AND U.K. EMPLOYMENT BY INDUSTRY: 1840-1960<sup>a</sup>

	Agriculture		Fishing		Mining		Construction		Cotton Textiles		Ocean Transport		Railway		Trade	
	U.S.	U.K.	U.S.	U.K.	U.S.	U.K.	U.S.	U.K.	U.S.	U.K.	U.S.	U.K.	U.S.	U.K.	U.S.	U.K.
					U.S. Only	(Coal)	A	B	A	B	A	B	U.S.	U.K.	U.S.	A
1840-41	3,570	1,515	24	24	32	n.a.	290	377	72	260	95	76	7	2	350	95
1850-51	4,520	2,017	30	37	102	n.a.	410	497	92	331	135	156	20	29	530	91
1860-61	5,880	1,942	31	40	176	n.a.	520	594	122	450	145	203	80	60	890	132
1870-71	6,790	1,769	28	48	180	351	780	716	135	450	135	192	160	96	1,310	217
1880-81	8,920	1,633	41	61	280	485	900	877	175	485	125	206	420	158	1,930	363
1890-91	9,960	1,502	60	54	440	632	1,510	902	222	529	120	236	750	213	2,960	475
1900-01	11,680	1,425	69	51	637	780	1,665	1,219	303	524	105	264	1,040	320	3,973	673
1910-11	11,770	1,553	68	53	1,068	1,049	1,949	1,145	370	580	150	293	1,855	373	5,320	896
1920-21	10,790	1,449	53	51	1,180	1,248	1,233	899	450	560	205	314	2,236	357	5,845	1,491
1930-31	10,560	1,353	73	40	1,009	931	1,988	987	372	564	160	305	1,659	305	8,122	2,323
1940-41	9,575	n.a.	60	n.a.	925	n.a.	1,876	n.a.	400	n.a.	150	n.a.	1,160	n.a.	9,328	n.a.
1950-51	7,870	1,219	77	26	901	791	3,029	1,282	350	322	130	218	1,373	318	12,152	2,213
1960-61	5,970	n.a.	45	n.a.	709	n.a.	3,640	n.a.	300	n.a.	135	n.a.	883	n.a.	14,051	n.a.

<sup>a</sup> Source: For the U.S., present estimates. For the U.K., B. R. Mitchell and Phyllis Deane, *Abstract of British Historical Statistics, 1962*, pp. 60-61, 118, 188; and United Kingdom, *Annual Abstract of Statistics, 1961*, p. 106. For U.K. vessel transport we use "sea, canal, and docks"; for agriculture, we use agriculture, horticulture, and forestry; for coal, 1940 figure is that for 1938.

<sup>b</sup> Data in column A based on Factory Inspectors returns; in B, for insured employees.

<sup>c</sup> Data in column A are for "commercial occupations"; in B, for "commercial finance and insurance occupations (excluding clerical staff)."

Intimately linked to the advance was the concurrent rise in railroad employment: 300 per cent for the United States, compared with 100 per cent for the United Kingdom.<sup>1</sup> For the United Kingdom, railways offered only a superior means of transport, competitive with existing roads and canals; for the United States, they constituted the very conditions for opening new territory, breaking into areas that had virtually no transport worthy of the name.<sup>2</sup>

Linked to the population advance was the 150 per cent rise in U.S. trade employment, compared with a mere 30 per cent for the U.K. London, Glasgow, Bath, and Barset had long since acquired their complement of drapers, greengrocers, and apothecaries. New London, Chicago, and Etruria had still to develop such a network of shops. Why, one may ask, if extensive development were so characteristic of the U.S., did construction employment in the U.S. gain 80 per cent—not much more than the U.K. 60 per cent? It is likely that the answer lies in the nature of our measures. A substantial amount of construction for the new U.S. population was of the crudest sort, done by farmers themselves with the help of their laborers or slaves. Performed in this way, it created fewer opportunities for full time construction employees than the mere volume of construction would suggest.

Finally, for both fishing and vessel employment, the rate of U.S. rise (50 per cent) was below the U.K. (70 per cent). For both industries, 1860 was a U.S. peak, the war then breaking permanently the U.S. rate of advance in these industries.

### 1860-80

The most decisive contrast for these decades is in agriculture, where U.S. employment increased 100 per cent, while in the U.K. it decreased 15 per cent. The forceful U.S. advance in agriculture did far more than surpass the 1840-60 rate; it was of a different character. American wheat had begun flooding into markets from Wales to Sicily, successfully competing with exports from Devon, Cawnpore, and the Ukraine. The greater 1840-60 rise in U.S. than U.K. farm employment had reflected the extensive development of the U.S. and its home market. The 1860-80 rise now reported the swelling U.S. competitive advantage in world export markets. Concurrent export strength in mining (a 60 per cent employment

<sup>1</sup> For railroads we compute an 1850-60 change as being a more helpful basis for contrasting the two nations than the astronomical 1840-60 change.

<sup>2</sup> We are not designating the railways as a *sine qua non* in development, but simply noting that the first transport network, whether road, rail or canal, had a role in cutting the cost of importing population, as well as of exporting goods, that was so significant as to be different in kind from a merely cheaper means of transport.

gain compared with the U.K. 40 per cent) and cotton textiles (40 per cent compared with the U.K. 10 per cent) was apparent.<sup>3</sup> In the less export-oriented activities for which we show data, the U.K. rise was either greater (fishing: U.S.—30 per cent, U.K.—50 per cent; vessels: U.S.—minus 15 per cent, U.K.—no change), lesser (construction: 80 per cent compared with 60 per cent), or the same (trade: 200 per cent). For railways alone there was substantial growth for each, but the 400 per cent rise for the U.S. was much more dramatic than the 200 per cent for the U.K. And here, of course, it was the interaction between government subsidy, export market possibility, and the attractive powers of mineral wealth and the soil that conjointly brought the growth of agricultural exports and railroads. In Bernard's apt phrase, every mile of railroad in the new nation was "a kind of centrifugal pump furnishing for exportation hundreds of tons of the products of such country."<sup>4</sup>

### 1880-1910

The third of a century from James Garfield to William Howard Taft undoubtedly lacked some of the more florid and grandiose excursions in political life that characterize earlier decades. But for these decades a common character of significant aspect marks the employment changes (shown in Table 3), and presumably the underlying output changes as well. Substantially greater gains by the United States than by the United Kingdom appear in every major group shown, and indeed in every category shown, except vessels.

	<i>U.S.</i>	<i>U.K.</i>
	<i>(per cent)</i>	
Agriculture	30	-5
Fishing	60	-10
Mining	280	120
Construction	115	31
Textiles	100	20
Vessels	20	40
Railway	230	133
Trade	180	144

Let us particularly note the construction rise, nearly four times as great for the United States as for the United Kingdom. This differential reflects the differential stimuli to population growth apparent in each. From 1880 to 1890 alone, over 6 million immigrants entered the United States (on a 50-million population base). Concurrently, the United Kingdom lost 2 million emigrants from a population half our size. Between

<sup>3</sup> For mining we use an 1870 base because of the absence of a U.K. figure for 1860.

<sup>4</sup> Quoted in David A. Wells, *Recent Economic Changes*, New York, 1890, p. 176.

1900 and 1910 the United States gained 8 million immigrants, while the United Kingdom lost 1.5 million emigrants.<sup>5</sup> These contrasting migration flows plus variations in the rate of natural increase generated differing manpower requirements in residential construction. The induced effects on highway and public building construction, on plant for making steel, brick, and lumber can be surmised, although not measured at present.

### 1910-30

We note three generalizations about the employment changes shown for these two decades. (1) Both nations had reached a peak of agricultural employment in 1910—the United States clearly, the United Kingdom somewhat less clearly—and both then began an uninterrupted descent from that peak by a 10 per cent decline. (2) For most other categories shown no significant employment change occurred for the United States, whereas the United Kingdom showed declines for nearly all. The long weakness of the United Kingdom after the effort of World War I is particularly apparent in the declines for cotton textiles, mining, fishing, and railway employment. (3) The one marked increase in labor requirements (Table 3) was for trade, with a 60 per cent gain for the United States and a more than 100 per cent rise for the United Kingdom. (Data for service and government in the United States, and presumably the United Kingdom, would show marked gains.)

### 1930-50

In the two decades from the beginning of the Great Depression to the more durable cold war, declines took place in virtually all industries except those linked to the lively postwar population increase. Marked declines in agriculture for both nations reflect a cut in disguised unemployment, a rise in alternative opportunities. A 20 per cent decline in cotton textiles for the United States and a 30 per cent decline for the United Kingdom indirectly reports the competition of new nations and new fibers. The 10 per cent further declines for mining likewise reflect the fresh availability of alternative jobs, competitive fuels from abroad, productivity advance. International competition also helps explain the decline of vessel employment in both countries (20 per cent and 30 per cent respectively) despite active U.S. subsidy programs, while the decline for U.S. railroad employment (contrasting with stability for the United

<sup>5</sup> Data for the United States from Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1957*, 1960, pp. 8, 56; and for the United Kingdom, from B. R. Mitchell and P. Deane, *Abstract of British Historical Statistics*, 1962, pp. 9, 50.



Kingdom) reflects in no mean measure a livelier U.S. subsidy program for nonrail transport than that in which the United Kingdom indulged.

The intense rise in construction employment (50 per cent for the United States and 30 per cent for the United Kingdom) presumably reflected needs of a growing population, as did the U.S. trade growth of 50 per cent. The absence of any U.K. gain in trade growth contradicts this inference only in part: the remarkable U.K. gain for the trade group in the 1951–61 decade suggests that it was the varied U.K. manpower and investment controls after World War II that limited such expansion as the free market would have generated.<sup>6</sup> The advance of U.S. trade employment, despite such productivity coadjutors as supermarkets and vending machines, suggests that the redistribution of the population (to suburban areas), as well as lack of investment constraints as in the United Kingdom, led to a proliferation of shops, stores and distributive convenience in general.

### *The Role of Education in U.S. Economic Growth*

Publications on the economic effects of education have proliferated in the past decade. Disagreeing on many other issues, their authors all seem in cheerful concert on one point: formal education has made massive contributions to our economic growth. Now education per se, communication, or learning in general are not at issue. Such activities may encompass much that is labeled investment and more that is definable as consumption.<sup>7</sup> But to treat education in so broad a sense is to fashion a tool without a cutting edge. We are then involved with an amorphous totality, encompassing both our cultural values and our economic way of life.

Most of the discussions focus on formal education, but estimates for the count of teachers reach out to include not merely Millard Fillmore and Alfred North Whitehead, but John Sloan, Isadora Duncan, and James Smith IV—plus every errant instructor in art, eurhythmics, or tating. But if we add them all together, higgledly piggedly, they account for no more than 2 per cent of the labor force during the first century and more of our national existence.

<sup>6</sup> Although no comparable Census data are available, we judge from the annual series for distribution trades, insurance, banking, and finance, as presented in the United Kingdom's *Annual Abstract of Statistics*, 1961, p. 108 and 1962, p. 109—which report a rise of 30 per cent for distributive trades in this decade and 21 per cent for finance, insurance, etc.

<sup>7</sup> Cf. Fritz Machlup's stimulating *The Production and Distribution of Knowledge in the United States*, Princeton, 1962.

Can so few candles have cast their beams so far? True, any handful of great souls could have offered Matthew Arnold's "unum porro necessarium." And this noble band might have provided vigor for a swiftly developing economy. But is there a stronger basis than some wishful guild-thinking to suggest this?

What of the quality of the education offered?

a spirit yearning in desire  
To follow knowledge like a sinking star  
Beyond the utmost bound of human thought.

Was this the mighty spirit at work? Contemporary reports do not discover any inordinately high quality pervading the instruction. President Duer, on the New York state school system in 1837, found the "teachers inexperienced and transitory, snatched up for the occasion . . . paid by salaries which hardly exceed the wages of a menial servant; and as a necessary consequence, ignorant and disqualified . . ." <sup>8</sup> James Carter in 1826 reported that "The country schools are everywhere degraded . . . . It is thought a mean thing for a man of competent estate, or for any but the mechanic, the artisan or the laborer, to send their children to them for their education . . . . The teachers of the primary schools have rarely had any education beyond what they have acquired in the very schools where they begin to teach." <sup>9</sup>

It is hardly as though the quantity of education made up for its lack of quality. The South Carolina Legislature appropriated \$40,000 for 840 schools in 1828. <sup>10</sup> Given the usual contemporary ratio of one teacher per school this would mean about \$45 a year. Since teachers would have received somewhat more than the \$7 a month paid for hired slaves, the school year must have averaged less than five months. <sup>11</sup> In 1838 the Superintendent of Schools for Ohio computed that New York funds will "pay for teaching the whole [of the enrolled student body] less than 3 months in the year." <sup>12</sup> His own report leads to an Ohio figure only slightly higher, at under four months. <sup>13</sup> In 1868 it was asserted with some

<sup>8</sup> Quoted in Samuel Lewis, *First Annual Report of the Superintendent of Common Schools of the State of Ohio*, Columbus, 1838, p. 13.

<sup>9</sup> James Carter, *Essays on Popular Education*, 1826, quoted in Newton Edwards and H. G. Richey, *The School in the American Social Order*, Boston, 1947, p. 269.

<sup>10</sup> *An Accompaniment to Mitchell's Reference and Distance Map of the United States*, Philadelphia, 1835, p. 221.

<sup>11</sup> The \$7 figure is from Table A-23 in the writer's *Manpower in Economic Growth*, New York, 1964.

<sup>12</sup> *First Annual Report, Superintendent of Schools, Ohio*.

<sup>13</sup> *Ibid.*, p. 46, comparing his figures for children attending school with "the number of months scholars have been taught" and the "number in usual attendance."

pride to would-be emigrants that "Alabama has made ample provision for the education of her children, the poll-tax of \$1.50 being set aside for this object exclusively," yet this appeal anticipated that the migrant would bring even superior skills: "under your superior knowledge of cultivating the soil, the fields that have been scratched by a lazy nigger and a poor mule will yield abundantly. Go to Alabama."<sup>14</sup> And, in fact, it appears that the Alabama school year for the children enrolled averaged four months, compared to only three in North Carolina.<sup>15</sup>

As late as 1870, when we have our first comprehensive figures on attendance, the average child enrolled in school attended less than four months out of the year, while a reckoning which included the numbers not enrolled would pull the average down close to three months.<sup>16</sup> They are well below figures from the earlier Censuses, which appear to refer to enrollment rather than attendance. But even the three-month average applies only to native students in the northern and midwestern states. Most southern states had only recently instituted public schools. And the bulk of the foreign born and Negro labor force had had no formal schooling whatever. It is a fair inference, therefore, that from 1800 to 1870 formal education per person in the U.S. labor force came to less than two months a year during their years of schooling. Nor could it have risen much above three months prior to 1900. It is scarcely likely, therefore, that the quantity of schooling compensated for the limitations on its quality. Taken together they do not suggest that formal education was anything like a significant factor in raising the quality of the American labor force, or in stimulating economic growth.<sup>17</sup>

### *The Relative Contribution of Agriculture to U.S. Economic Growth*

Obtruding through this motley array of statistics is a single, overwhelming fact about American economic growth. Brilliantly obvious though it may

<sup>14</sup> *To the Emigrant. The Descriptions of the Lands on the South and North Alabama Railroad Are Not Overdrawn*, Louisville, 1878.

<sup>15</sup> North Carolina data on duration and teacher pay from *Report of the Commissioner of Education . . . for the Year 1870, 1870*. Assuming the same rate of pay, the teacher-school income ratios (Ninth Census, Vol. I, p. 452) suggest a third longer duration than for North Carolina.

<sup>16</sup> *Report of the [U.S.] Commissioner of Education*, p. 504, gives data by state on school population, enrollment, attendance, and average duration of school year from which we compute these averages.

<sup>17</sup> By definition the extent of education that a labor force member received at his mother's knee, by consulting his soul while fishing at the brook, or on the job, is not at issue. And the presumably greater contributions for such specialists as doctors or lawyers seem some distance away from basic factors in economic advance.

be, it is nonetheless usually lost sight of in the pursuit of theorems on fascinating, but yet undiscovered, lesser points. That fact is simply the overwhelming importance of agriculture during the many decades when the structure of our present economy and social order was being shaped. Occupying nearly 75 per cent of our labor force in 1800, farming occupied over half the labor force until some time between 1880 and 1890. (It is, of course, no coincidence that it was at the end of the same decade that the Census superintendent found that continuity in the line of settlement could no longer be observed—an event defined more pungently by Turner as “the end of the frontier.”) The Kuznets and Gallman estimates of national income are consistent with this conclusion.

But if this is so we may draw one rather significant inference with respect to the factors that dominated our growth. Recent discussions of backward and forward linkages in economic development have tended to emphasize the contributions made by nonfarm sectors to economic advance. Yet in our own history the gross dominance of agriculture suggests, by mere probability, that it accounted for a greater portion of these effects than all other industries put together. An industry that used from 50 to 90 per cent of the nation's labor input over the first century of our national existence was surely more likely to make greater demands on most supplying industries than one that merely accounted for 5 or 10 per cent.<sup>18</sup>

Yet this proposition is surely not true with respect to every particular supplying industry. Moreover, the difference between input coefficients can be such that the marginal effects of an advance in nonfarm industries could be much more potent than our argument suggests, resting as it does on an assumption of equal average effects.

Can we throw any light on the net results by reference to empirical results? Some interesting data are available for the textile industry, characteristic leader in the industrialization of so many nations. As of 1831, an estimated 3,200 men and 11,000 tons of iron and steel were required to produce machinery at the rate the textile industry was then installing it, according to the reports of the New York Convention.<sup>19</sup> Since the Convention was busily emphasizing the importance of manufacturing industries as markets for native industries, the figure is not

<sup>18</sup> The labor force totals represent a minimum statement of input to agriculture: (1) hours were longer in farming than the average for nonfarm industries after 1830, (2) work by female family workers is incompletely recorded. Offsetting, in part, is the possibly higher quality of some nonfarm labor input. But this fact would be largely irrelevant to the point being made here.

<sup>19</sup> Quoted in *Niles' Weekly Register*, 1832, Vol. 42, Addendum, p. 8. The ratio is consistent with, and probably rests on, data for the Lowell, Concord, and Merrimac River Company.

likely to be an underestimate. A decade later, the Locks and Canal Machine Shop, working for all the Lowell mills, employed between 1,000 and 1,200 hands "directly and indirectly" when actually building mills.<sup>20</sup> Given the ratio of Lowell textile output to that of the United States, it is unlikely that the indirect manpower requirements for the nation as a whole would mount as high as 10,000.

For the woolen industry the figures are so small as to be trivial. In January 1827, Representative Davis, trumpeting the substantial role of the industry, gave figures on its total input of wool, while in July the pro-tariff General Convention estimated iron and steel requirements per 100,000 pounds of wool consumed.<sup>21</sup> Combining these figures leads to a requirement by the entire industry of 160 tons of iron and steel annually—or less than a tenth of 1 per cent of total input.<sup>22</sup>

But if only 10 per cent of iron and steel output went to the major textile industries, where did the bulk of U.S. iron and steel production at this period go? A detailed breakdown for the output of Litchfield, Connecticut, in 1831 may be suggestive:<sup>23</sup>

Total		\$178,000
Scythes	56,000	
Pitchforks	20,000	
Ploughs	3,800	
Hoes	7,150	
Shovels	6,500	
Subtotal		93,450
Axes	26,500	
Rat traps	9,500	
Shoetacks and sparables	40,000	

The share of agricultural items in the total output is clearly overwhelming even if one excludes axes, the bulk of which must have been used in clearing land for farming.

Of the total investment requirement for agriculture, of course, much went into land clearing, much to current agricultural production. The

<sup>20</sup> *Hunt's Merchants Magazine*, Vol. 9, November 1843, p. 426.

<sup>21</sup> Gales and Seaton, *Register of Congressional Debates*, January 31, 1827. *Proceedings of the General Convention of Agriculture and Manufactures*, July, 30 1827, p. 42.

<sup>22</sup> An output of 112,866 tons of bar iron equivalent was reported by the *General Convention of the Friends of Domestic Industry; Report of the Committee on Iron*, New York, 1831, pp. 19, 28.

<sup>23</sup> *Ibid.*, p. 28.

Parker-Primack estimates for the 1850's report 450,000 equivalent persons in land clearing.<sup>24</sup> This "industry" accounts for less than 10 per cent of our total farm labor force average for the decade but undoubtedly required well above that proportion of supporting investment per farm worker. (If one adds in roads, canals and other social overhead capital—more accurately social underfoot capital—the proportion will zoom. However, the growth of such capital reflects broader forces than mere market forces originating in agriculture.)

For farm operations we may at least refer to very recent figures which Leontief has given.<sup>25</sup> These indicate that the direct capital coefficients per million dollars of output ran as follows in recent years:

Agriculture	1.61
Iron ore mining	1.48
Spinning, weaving, dyeing	0.31
Sawmills, planing and veneer mills	0.53
Blast furnaces	0.96
Footwear	0.10

(These coefficients measure not stock of capital but flow of current services.) They suggest that an equivalent dollar volume of farm output requires far more iron and steel output, machinery production, than does an equivalent dollar volume of output generated by (a) the textile and footwear industries that bulked large in our early growth, or (b) by the omnipresent mills that employed the largest single group of manufacturing employees before 1860, or even (c) iron and steel production per se. Technological forces joined with institutional ones to generate significant agricultural demands for output by the metals industries. Even the rudest of techniques required axes to clear the land and breaking ploughs to open the plains, scythes to cut wheat, and hoes to chop cotton. Such demands burgeoned when wage-price trends made advantageous a shift to the more capital-intensive techniques of drill and harvester. A complementary stimulus to nineteenth century growth was the influence of widespread land ownership—widespread, say, as compared with Ireland or Italy at the same time. Such ownership made it possible for cultivators to reap the financial benefits of investment, inducing more farming and educating more farm investment than the volume in which a rational crew of monopolists, hiring employees, might have indulged themselves.

<sup>24</sup> William Parker and Martin Primack, "Land Clearing Under Nineteenth Century Techniques" (unpublished paper), p. 12.

<sup>25</sup> Wassily Leontief, "Factor Proportions and the Structure of American Trade," *Review of Economics and Statistics*, November 1956, Appendix III.

In a world of intensified nationalism, with every new nation seeking immediate advance, it is not surprising that extended attention has been given to a generalization stated by Colin Clark, but described by him as stemming from Petty.<sup>26</sup> That generalization refers to a tendency for the proportion of the labor force in agriculture to decline when an economy develops. Any predictive law is, of course, of interest. One that predicts a more or less irresistible trend of such arrant significance is even more so.

What is of greater interest, however, is the question of what forces work to produce such a trend. To the extent that developing nations refer to our experience as precedent they may, however, find no impelling requirement to shift out of agriculture (or mining) into manufacturing and tertiary industries. Table 2 indicates fairly flatly that the proportion of the labor force in agriculture in this country hardly shifted at all from 1850 until some time after 1880. Growth during this period—and growth there was by a dozen criteria—came from no disembodied force for industrialization.

The engine of advance during these decades was comparative advantage on a global scale; the midwestern states became producers of wheat far superior to Italy, France, and England, while the southern states continued to be the still dominant world suppliers of cotton and tobacco. The central states readily secured labor by immigration. Of her central labor force group (males, age 25–44) in 1880, for example, Kansas had received just under two-thirds by immigration, immigrants flowing from other states and countries as distant as Russia.<sup>27</sup> And with prospects so bright that interest rates of 17 per cent were being paid (in Kansas in the 1870's) capital, too, flowed in from eastern and foreign sources.<sup>28</sup> Indeed, Easterlin estimates that approximately 18 per cent of the total wealth of the six rapidly growing central states in 1880 was owned outside the state.<sup>29</sup>

Another way of looking at the long-term trend is to separate the figures for the North and West from those for the South, treating them as separate nations. Major labor force shifts occurred within each. Those for the North and West were well publicized. But those within the South were just as significant. Of those persons numbered in the 1850 Census,

<sup>26</sup> *Conditions of Economic Progress*, 1940, pp. 6–7. A more recent precursor was Allen Fisher in the *International Labor Review*, January 1920.

<sup>27</sup> Everett Lee, Ann Miller, Carol Brainerd, and Richard Easterlin, *Population Redistribution and Economic Growth, United States, 1870–1950*, 1957, pp. 142–144.

<sup>28</sup> Kansas rates in Allan Bogue, *Money at Interest*, 1955, pp. 116–117, 272.

<sup>29</sup> Lee *et al.*, *Population Redistribution*, p. 729. We combine his data for Minnesota, Iowa, Missouri, Nebraska, Kansas, and the Dakota Territory.

for example, the percentages then living outside the state of their birth were:<sup>30</sup>

South Carolina	42
North Carolina	34
Virginia	31
Alabama	26
Georgia	24
Mississippi	18
Texas	5

We take the 5 per cent for Texas, with its heavy immigration, as a practical minimum. The proportions for the old south ran six to eight times as great as that minimum. For the Gulf states (whose out-migrations in volume began perhaps a decade later) the rates were three to five times as large. We know, too, that between 1800 and 1860 indigo disappeared from the list of the major crops, tobacco had spread its domains, while cotton and cane had risen from almost nothing to a dizzying eminence. But so far as the trend of the farm proportion in the labor force was concerned, none of this is in evidence. The labor force proportions changed as follows:<sup>31</sup>

	<i>Percentage of Labor Force in Farming</i>	
	1800	1860
South	82	84
North and West	68	40

Had the South from 1800 to 1860 been the separate nation it sought to become in 1860 the labor force figures would indeed have reported massive growth during sixty years—but with no taint of decline in the farming share of the labor force.

We take the above data to indicate only one thing: U.S. experience reveals no higher law at work forcing a decline of the share of the labor force in agriculture during economic growth. Our experience suggests, instead, that the optimal alternatives change from time to time, depending on the marginal efficiency of capital among regions, products, and activities, and—just to complicate matters—depending on the incentives and limitations that the social order laid upon one or another set of alternatives. One inference for those of today's underdeveloped nations whose economies are primarily based on one export product is that U.S. experience does not prove that the proliferation of manufacturing employment is prerequisite to growth.

<sup>30</sup> James De Bow, *Compendium*, pp. 116-117.

<sup>31</sup> Estimated in the writer's *Manpower and Economic Growth*.



### *Derivation and Explanation of Estimates*

The present estimates were derived to permit analysis of long-run changes in the structure of the American economy, and to assist in projections of employment and GNP in the years ahead.<sup>32</sup> To facilitate such work it is most desirable that the series developed be made comparable with the major series on the labor force and its distribution currently available. Hence the totals, with exceptions noted below, are generally comparable with the explicit or implicit series compiled by the Bureau of the Census and published by the Bureau of Labor Statistics as part of the *Current Population Survey, Monthly Report on the Labor Force*. Since the CPS figures are not comparable with the Decennial Census results, our series will automatically also differ from the Census results for 1940-60, when both sets of figures are available. Hence, too, they will differ from the figures of Clarence Long, Daniel Carson, Solomon Fabricant, and John Durand—all of whom adopt the Population Census levels for the 1940 labor force, and (in some instances) its components.<sup>33</sup> Since the CPS figures are not comparable with the results of the Census of Agriculture, our figures for agricultural employment will necessarily differ also from those of the U.S. Department of Agriculture, and from series such as those of Kendrick, Knowles, Barger, and Landsberg and others who link to the USDA series.<sup>34</sup>

A basic difference between CPS and USDA series (as between various series for construction, teachers, fishermen) and our own is that we seek to include each person only once, in the industry to which he is primarily attached, rather than to develop industry series that include everyone who may devote some time to a particular industry.

<sup>32</sup> Differences between the present series and the major alternatives for the years 1930 ff. are discussed in some detail in *ibid.*, Part III.

<sup>33</sup> Clarence D. Long, *The Labor Force under Changing Income and Employment*, Princeton University Press for NBER, 1958; Solomon Fabricant, "The Changing Industrial Distribution of Gainful Workers" and Daniel Carson, "Changes in the Industrial Composition of Manpower since the Civil War" in *Studies in Income and Wealth*, 11, New York, NBER, 1949; John Durand, *The Labor Force in the United States, 1890-1960*, 1948, Table A-6. Durand (p. 207), however, gives ratios for converting to CPS levels.

<sup>34</sup> John Kendrick, *Productivity Trends in the United States*, Princeton for NBER, 1961, Table A-VI. Kendrick adjusts his series down to a full-time level by 1940-55 ratios. James Knowles, *The Potential Economic Growth in the United States*, Joint Economic Committee, Washington, 1960, uses the Kendrick estimates. Harold Barger and Hans Landsberg, *American Agriculture, 1899-1939: A Study of Output, Employment and Productivity*, New York, NBER, 1942.

Differences for the years prior to 1940 between our labor force totals and the gainful workers estimates of Kaplan and Casey, Edwards, Whelpton, Carson, and Miller arise for a number of reasons. Most generally we differ for two reasons. (1) We accept the original Census figures for 1900, 1920, and 1930 without adjustments proposed by various writers, and the 1870 and 1890 Censuses only as adjusted in official reports of the Census Bureau. Hence we will differ from Carson, Miller, Long, and Kendrick. (2) We adjust the 1910 Census by procedures differing from those pioneered by Edwards, and hence will differ from Kaplan and Casey and others.

For the major categories of construction, trade, and domestic service, the CPS totals differ from those of the Population Census, and the National Income Division, and our figures will differ correspondingly. These differences for 1930-60 are necessarily associated with differences in level for prior years in order to prevent the series from taking an abrupt and unreasonable path from 1920 to 1930. Hence, we differ from Carson, Kuznets, and others.

For total manufacturing (and railway and ocean vessel employment), we link to the BLS series for employees in nonagricultural establishments, since this is the series used for current analysis of trends in manufacturing, etc. Because that series is adjusted to social security benchmarks, its level will differ from that of the Census of Manufactures and the infinite number of series that depend on the Census of Manufactures for current and/or earlier years—including the well-known series of Kuznets, Fabricant, Easterlin, and others.

For cotton textiles and iron and steel we similarly link to BLS totals except that we have had to make new estimates for cotton textiles in recent years, no official series being available.

For railways also we link to BLS, and hence differ from ICC totals for 1890 and after (which omit switching and terminal companies in some years) and from NID totals for 1929 and after (which differ slightly from BLS). For earlier years we rely on direct ratios of employment per track miles and estimates of trends in such ratios over time, whereas the forthcoming important study by Fishlow applies cross-section relationships between employment and activity measures from one region to others.

For fishing and teachers we accept the Population Census as having the most comprehensive coverage, measuring the numbers of persons who consider each as their primary activity. Hence, we arrive at different results from the estimates, respectively, of the Bureau of Wildlife and Fisheries and the Office of Education, not to mention the many series which use these estimates as benchmarks.

## II

*Methods of Estimate*

## GAINFUL WORKERS: 1800

The size and distribution of the 1800 labor force was estimated in a number of steps. The key steps and assumptions are outlined below.

1. Estimates were made of the total number of free males aged ten and over.<sup>35</sup> It was assumed that the proportion of these males gainfully occupied was 87.2 per cent—the same rate as given by the 1850 Census, the first providing such data, and much the same as that for all subsequent Censuses of the gainfully occupied.<sup>36</sup>

2. The number occupied in navigation and fishing was estimated by procedures described in the section on navigation employment.

3. The number of farmers was estimated primarily on the basis of the number of heads of rural white families:

a. Estimates of the number of white families had been previously made by utilizing Census counts of white families in 1790 and 1850 ff. in a regression relationship against the white population divided by a series for estimated average size of family.<sup>37</sup>

b. The proportion of white families in 1800 that was rural is estimated at 93.8 per cent—the ratio implicit in the U.S. white population data. The number of urban slaves was then deducted from the total slave population—thus, by further subtraction from the total Census figure for rural population—giving the required figure.

Urban slaves were estimated as the sum of slaves living in the major slaveholding cities. The ratio of this group to total slaves can be computed for 1790 at 5 per cent and was assumed the same for 1800. For 1790, the slave population for Henrico County, Virginia, Baltimore County, Maryland, New Hanover County, North Carolina, Jefferson County, Kentucky, and Chatham County, Georgia, was assumed to equal the total urban slave population for those states. For South Carolina, 22

<sup>35</sup> The white population aged ten and over is reported in *Historical Statistics of the United States, 1789-1945*, 1949, p. 28. The ratio of males to total white population aged sixteen and over in 1790 was applied to this figure. Census, *A Century of Population Growth*, 1909, p. 208.

<sup>36</sup> *The Seventh Census of the United States: 1850*, 1853, pp. xlii, lxxx. For the stability over the 1870-1930 period of the rates for all males aged sixteen and over, compare Alba Edwards, *Comparative Occupation Statistics*, Washington, 1943, p. 92.

<sup>37</sup> See the author's "Population Change and the Supply of Labor," in *Demographic and Economic Change in Developed Countries*, Princeton University Press for the National Bureau of Economic Research, 1960, p. 414.

per cent of the Charleston County slave total in that year was assumed to be urban—that being the ratio of city to county slave population in 1840.<sup>38</sup>

c. From this 708,000 total for white rural heads we deduct 70,000 for those engaged in handicrafts and trades in rural areas, leaving 638,000 as the estimate of white heads of families who were farmers and farm laborers.<sup>39</sup>

Data from the 1790 Census on the distribution of the free colored population gives us the basis for estimating 5,000 gainfully occupied in urban areas, and 62,000 in rural—the latter then arbitrarily split into 50,000 farm labor and 12,000 farmers.<sup>40</sup>

4. The number occupied in nonfarm occupations other than navigation and fishing was estimated as the sum of those in urban areas and those outside urban areas.

a. Of all whites aged ten and over in 1790, 50.2 per cent were males according to the 1790 Census.<sup>41</sup> The same ratio was applied for 1800. Of the male group thus computed, it was estimated that 9.1 per cent (or 129,000) were in urban areas—87.2 per cent of whom (using the same gainfully occupied rate as above for the total males) were gainfully occupied, or 112,000.

The proportion of males in urban areas was based in turn on 1790 Census figures for cities that accounted for nearly half the urban population in that year—Baltimore, Boston, Charleston, New York, and Philadelphia. For these cities taken together, the ratio of white males aged sixteen and over to total free population was computed, and applied to the total urban population. Thus we derive a figure for free white males sixteen and over in urban areas. The ratio of this figure to the total U.S. population for this group is the 9.1 per cent noted above. This leaves only a single gap—namely, the total free urban population in 1790. This was estimated by deducting from the reported totals the number of urban slaves, as estimated above in step 3. Reference to the Charleston,

<sup>38</sup> The various county figures for 1790 are from Census, *A Century of Population Growth*, Table 104, while totals for free population and urban population in 1800 are derived from data in *Historical Statistics*, 1949, pp. 25, 29.

<sup>39</sup> In section 4b we estimate 227,000 whites gainfully occupied in rural areas but not in farming. Now, over-all, we have 1,240,000 gainfully occupied whites and 755,000 white families, giving a ratio of 61 per cent. This ratio was cut down to 30 per cent to reflect the fact that among the 227,000 (who were primarily in handicrafts and trades) a larger proportion of secondary workers would appear, the multiplication then giving 70,000.

<sup>40</sup> Census, *A Century of Population Growth*, Table 104, gives city data.

<sup>41</sup> The basic source materials used in the following estimate appear in Census, *A Century of Population Growth*, Table 104, and in *Historical Statistics*, 1949, pp. 25-29. In addition to free males, however, others were employed in urban areas.

Philadelphia, and New York City directories for 1790 and 1800 indicates many listings of female tavern keepers, in addition to which a significant number of domestic servants were employed in urban areas. To the 116,000 white males aged ten and over, therefore, 40,000 was added for female domestic service (estimated below) plus an arbitrary 10,000 addition for other females. This brought the total up to 166,000.<sup>42</sup>

b. For the group outside urban areas but in nonfarm pursuits, we begin from the certainty that the extent of local handicrafts (blacksmiths, saddlemakers, etc.) and traders and learned professions changed at a different rate in different parts of the country from 1800 to 1840—the latter year providing our first occupational data for these groups. For the big cities, however, as for New England with its rising factory system, the 1840 data are certainly irrelevant. On the other hand, for the most populated southern states in 1800 (Virginia, the Carolinas, Georgia, Tennessee, and Kentucky) plus Alabama and Mississippi, this is less true. Exclusive of the towns in these states, it was assumed that the ratio in 1840 of (a) persons in such occupations to (b) total white male rural population aged ten and over applied equally well in 1800. (This amounts to assuming that the supporting service personnel required per 1,000 population in 1840 for such areas was the same as required in 1800. Since we have excluded all towns, and the northern areas of nascent industrialization, the resultant ratio estimate of saddlers, shopkeepers, school teachers should apply reasonably well.<sup>43</sup>) In step 4a the number of free urban males (aged ten and over) was estimated at 129,000, which, by deduction from the total, leaves 1,290,000 free male population in rural areas. Taking 1.41 per cent of these as gainfully occupied in learned professions, 2.76 per cent in commerce, and 13.4 per cent in hand trades and trade gives a total in nonfarm pursuits, but outside urban areas, of 227,000. Allowing for 13,000 free domestic servants of the 694,000 rural families (the South, of course, must be largely excluded from this estimate) gives 240,000.

Combining the 130,000 gainfully occupied in urban areas with the 240,000 in nonfarm pursuits outside urban areas gives a total of 370,000.

5. White farm laborers were estimated as (a) the 210,000 difference

<sup>42</sup> *The New York Directory for 1799*; Jacob Milligin, *The Charleston Directory and Revenue System, 1790*; and *The Philadelphia Directory for 1800* report tavern keepers. For the domestic service estimate, see section on domestic service.

<sup>43</sup> From the 1840 *Census Compendium* (Allen edition) the ratio of persons in the learned professions, in manufacturing and trade, and in commerce to the white male population aged fifteen to seventy was computed for the above states exclusive of the towns reported for each state. Data for the Middlewestern states were not used on the assumption that the density and pattern of settlement was so much different from that of the coastal states in 1800 as to be an irrelevant guide. The 1800 urban data were estimated above and the rural figure is simply the difference from the total.

between all white males gainfully occupied and those in the specified occupations noted above plus (b) an arbitrary 50,000 of the 638,000 farmers and farm laborer family heads estimated above. Since this important group was estimated as a residual it is particularly necessary to assess its reasonableness. Our best test for this purpose is the ratio of all free laborers (260,000 whites plus 50,000 nonwhites, estimated below) to the number of farmers. For 1800 it proves to be 52 per cent of that number, while for 1860 the Population Census data (also for the free population) give a 41 per cent ratio. The decline in the ratio is consistent with the opening of the midwest and the greater consequent rise in self-employed farmers than farm laborers.

6. Added to the above estimates for the white population were those made for slaves and free colored. For both groups the numbers aged ten and over were estimated, and 87.2 per cent were estimated as gainfully occupied.<sup>44</sup> The basis for the latter ratio has been discussed elsewhere, and rests basically on the fact that an examination of 1820 and 1840 Census unpublished schedules for various southern counties reveals that planters commonly reported all their slaves aged ten and over (both men and women) as gainfully occupied.<sup>45</sup>

The allocation of the slaves between those in rural and urban areas has been described above, and that between farm and nonfarm occupations is assumed as identical. The many individual examples of slave blacksmiths, turpentine tappers, carpenters, etc., living in rural areas (and used on the plantation or hired out) suggest some distortion here. But undoubtedly it is a trivial one. The allocation of the free colored population is more in doubt, but fortunately few are involved.<sup>46</sup>

7. For 1805, Samuel Blodget estimated the total active population at 1,866,000, compared with the present estimate of 1,900,000 for 1800.<sup>47</sup> This similarity conceals differences in the components: his figure for slaves is 400,000 compared with the present 530,000. For seamen and fishermen, his 116,000 compares with the present 45,000. (He apparently counts both entrances and clearances of seamen.) The major difference, however, appears in his estimate of artisans (100,000) and professionals

<sup>44</sup> The total population for the groups is from *Historical Statistics*, 1949, p. 27. The ratio aged ten and over for slaves was 65 per cent in 1830, 66 per cent in 1840, and was taken as 65 per cent in 1800. For free colored the ratio was 70 and 72 per cent in 1830 and 1840, respectively, and was assumed at 70 per cent for 1800.

<sup>45</sup> Compare the discussion below in connection with the estimates for 1820 and 1840, and the historical materials in my *Manpower in Economic Growth*.

<sup>46</sup> The 68,000 involved were allocated as follows: 5,000 to urban areas based on the numbers shown for the larger cities; 53,000 of the remainder to farm laborers and 10,000 to farmers.

<sup>47</sup> Samuel Blodget, *Economica, A Statistical Manual for the United States of America*, Washington, 1806, p. 89.

and traders (50,000), compared with the present 300,000 for both groups. The present figure of 137,000 males in urban areas is not far from his 150,000 total. It is likely, therefore, that he made a much smaller allowance for those in the hand trades and in general stores throughout the nation that were *not* in the big cities. Because of the subtraction procedure used, this in turn is a major factor in producing the difference between the present figure of 910,000 free persons in agriculture and Blodget's 1,200,000 for "free planters and agriculturists." The major difficulty with Blodget's estimate lies in precisely this figure. For if one takes the present estimate of 600,000 free farmers, his figure implies some 585,000 free farm laborers—giving a ratio of 98 per cent, which is unreasonably high. (His total in agriculture is, of course, much closer to our 1,400,000.)

One may also mention an *ad hoc* assertion of William Duane to the effect that 17/20 of the free occupied population were "farmers and those who acquire support from labor"—a figure to be compared with the 75 per cent implicit in the present figures.<sup>48</sup> Duane, as a brilliant and bitter journalist and politician of the time, provides a figure that presumably lacked pedestrian accuracy, but does distinguish the orders of magnitude involved.

Since the composition of the labor force did not change greatly over the years, it may be relevant to cite two estimates for slightly later dates. Representative Pearce of Rhode Island stated in January 1827 that "83 in every 100 are engaged in agriculture"—or much the same as Duane's statement.<sup>49</sup>

In 1820, Matthew Carey estimated that there were 5 million agriculturists, 1.5 million artists, mechanics, manufacturers, etc., plus 1.5 million professors of law and physic, gentlemen who live on their income, merchants, tradesmen, seamen, etc.<sup>50</sup>

#### GAINFUL WORKERS: 1810

The 1810 gainful worker total was estimated by procedures similar to those used for 1820–40 estimates. For free males and slaves we apply the same worker rates as in 1820 to the appropriate 1810 population figures.<sup>51</sup>

For slaves, we estimate those ten and over at 31 per cent of the total

<sup>48</sup> William Duane, *Politics for the American Farmer*, Washington, 1807, p. 3. Tench Coxe in 1787 had guessed that nine out of ten persons were engaged in agriculture. Harold Hutcheson, *Tench Coxe*, 1938, p. 79. For a similar assertion (by Franklin)—that "calculations carefully made do not raise the portion of property or the number of men employed in manufactures, fisheries, navigation and trade to one-eighth" of that in agriculture, for New England, see H. C. Adams in *John Hopkins Studies in Historical and Political Science*, 1884, p. 10.

<sup>49</sup> *Annals of Congress*, January 30, 1827, col. 863.

<sup>50</sup> Matthew Carey, *The New Olive Branch*, Philadelphia, 1820, pp. 151–152.

<sup>51</sup> Population data from *Historical Statistics*, 1949, p. 28, for white males ten to fifteen, and sixteen and over.

(as in 1820), that rate in turn being based on the 31.8 per cent for 1850 and the 31.1 per cent for 1860. The 87.2 per cent worker rate for adult males, the 25 per cent for boys, and the 90 per cent for slaves are discussed in connection with the 1840 estimate.

For free females we estimate three components. Domestic servants were estimated at 70,000 on the basis of a regression against the number of white families (as discussed in the section on employment in domestic service). Employment in textiles, including wool, was estimated at 10,000 as outlined in the section on cotton textile employment.

For employment in the clothing trades and all other industries we add an arbitrary sum equal to domestic service. The first year in which we can estimate with some likelihood of reason, 1860, shows this group to be under 300,000, or half the estimate for domestics in that year. In the infancy of the factory system, before "boughten clothing" was at all common, we can hardly estimate the count for this group at greater than the 70,000 in domestic service. One might reasonably dispense with an estimate altogether and get about the same totals, but we follow tradition to show that a moderately rational estimate has been made for this category. We make no allowance for females in agriculture, since examination of the unpublished Census schedules for 1820 and 1840 indicates they were not included in those years, while the county data for 1860, 1870, 1880 show that only nonwhite women in the South were included in the agriculture counts. The latter category, for 1810, is comprehended in our estimate of the slaves gainfully occupied.

#### GAINFUL WORKERS: 1820

The 1820 Census secured data on the occupation of those gainfully employed in agriculture, commerce, and manufactures.<sup>52</sup> Long has pointed out the unreasonably low proportions gainfully occupied in fourteen cities, and Whelpton has adjusted for the inclusion of professional service and other urban occupations that were not in principle included, as well as for the inclusion of navigation, lumbering, etc.<sup>53</sup>

In the present estimates we begin from two premises. The first is that the coverage in the important rural areas of the nation was irregular, and

<sup>52</sup> These data are conveniently summarized, with minor corrections from the original, in 1900 Census, *Occupations*, p. xxx.

<sup>53</sup> Clarence D. Long, *Labor Force*, p. 407. P. K. Whelpton's pioneering and still standard study is "Occupational Groups in the United States, 1820-1920," *Journal of the American Statistical Association*, September 1926. Fabricant has shrewdly noted the relationship between a possible 1820 understatement and the schedule sequence in which occupation questions were asked before the slaves and free colored were enumerated. See Solomon Fabricant in *Studies in Income and Wealth*, 11, p. 31. However, as noted below, examination of the schedules suggests that slaves were rarely omitted en bloc for any family report, though a few such examples do turn up.



in some urban areas it was uncertain. Second, that to adjust for omitted industries directly is the least satisfactory way of arriving at an adjusted total, though eminently desirable for industry information. (That rural census canvassing was irregular can be seen from an examination of a sample of the original 1820 county returns.)<sup>54</sup>

The premise that adjustment for omitted industries should not be made directly if we seek a reliable total simply turns on the difficulty of making such estimates in this volatile growth period. At what rate did the ratio of navigation employment to population, of learned professions to population, etc., actually change? Slight errors in estimating the four or five omitted industry groups can cumulate, in estimating the total.

Since we know that the proportion of adult males working changes less from decade to decade than does the proportion engaged in navigation, lumbering, etc., we prefer to work from the former ratio. Doing so, of course, likewise helps compensate for the irregularity in Census coverage of the industries that it purports to cover. We therefore compute separate estimates of the gainfully occupied among free males sixteen and over, free males ten to fifteen, slaves ten and over, and free females ten and over. We apply rates for other years to the population data for each group. In some instances minor adjustment in the Census totals is needed. For free males sixteen and over—the vast bulk of the labor force in those years—we adopt the 87.2 per cent participation rate derived from 1850 data and the same rate for slaves ten and over. (The applicability of these rates for earlier years is discussed in connection with the section on slaves in agriculture, 1800–60, below.)<sup>55</sup>

<sup>54</sup> The 1820 returns are now in the U.S. National Archives. Some examples follow. Granville County, North Carolina: Chisley Davis family, no occupational entries; Howel Frazier, six in agriculture in family with two white males aged ten and over, and four slaves aged fourteen and over; Halifax, North Carolina: Gideon Allston, thirty in agriculture and thirty slaves aged fourteen and over; Williamsburg, South Carolina: Francis Cordes, eighty in agriculture; Ashe, North Carolina: David Edwards, three in agriculture in a family with two white males, aged sixteen and twenty-six, one aged 45, but eight male slaves over 14; Salisbury, Massachusetts: occupational entries for males but not females; Indiana and Pennsylvania: many occupational entries of one, though females were present. These and other examples show instances where slaves and white adult males in rural areas were omitted, though not commonly. What a sizable random sample would show is another matter.

<sup>55</sup> Population data from *Historical Statistics*, 1949, p. 28. The population of slaves under ten was estimated at 70 per cent of those under fourteen—the ratio prevailing in both 1850 and 1860. For free males, aged ten to fifteen, we assume a 25 per cent rate (see section on 1850 gainfully occupied). For free females, aged ten and over, we estimate 110,000 domestics (see section on domestic service) and an arbitrary 50,000 in other occupations. (A total of 12,000 persons in cotton textiles in 1820, and the 1818–20 decline of all textile hats and clothing industries suggests this as a reasonably generous figure.) Our estimate of 3,135,000 is within 10 per cent of Whelpton's, and those who essentially adopt his figures (i.e., Edwards, Fabricant, and Long).

To allocate omissions between farm and nonfarm pursuits we apply the proportion of farm to total implicit in the reported Census figures.<sup>56</sup>

#### GAINFUL WORKERS: 1830

The procedures used for 1830 were much the same as for 1820. For free males aged fifteen and over the proportion gainfully occupied as reported in the 1850 Census was used, while for slaves aged ten and over a 90 per cent rate was used, both ratios having been discussed above in connection with the 1820 estimates.<sup>57</sup> For free males aged ten to fifteen a 25 per cent rate was used (as in 1840), the rate for native whites ten to fifteen in 1900 being 22.6 per cent. The total for females was estimated as the sum of those engaged in individual industries and occupations. Female domestic service employees were estimated by procedures outlined in the section for employment in that group. An aggregation of establishment reports in a large-scale survey by the U.S. Department of State in 1832 leads to a total of just under 50,000 female factory workers in cotton, wool, shoe, and palm-leaf hat manufacturing, to which we add 25,000 for mantua makers, etc.<sup>58</sup>

#### GAINFUL WORKERS: 1840

The total was estimated as the sum of four major categories.

1. Free males sixteen and over: 4,075,000. It was assumed that 87.2 per cent of these were gainfully occupied, the same rate as shown by the Census data for the free males sixteen and over in 1850.<sup>59</sup>

2. Free males ten to fifteen: 235,000. An arbitrary 25 per cent of this group was taken as gainfully employed, the rate for native whites in 1900 being 22.6 per cent.

3. Slaves: 1,430,000. Following the procedure used for 1850 and 1860 estimates, the proportion of all slaves aged ten and over gainfully occupied was assumed the same as the 87.2 per cent for white males aged sixteen and over.

<sup>56</sup> Any passionate arithmetician will compute a different figure than the one we derive here because we assume that the entire female labor force, as we have estimated it, was omitted, and was, in addition, in domestic service or other nonfarm occupations. Hence the 83 per cent farm ratio applies only to the estimate for males omitted.

<sup>57</sup> Population data from *Historical Statistics*, 1960, pp. 10-11.

<sup>58</sup> Reports presented in *Documents Relative to the Manufactures in the United States*, 22d Congress, 1st Session, House Doc. 308, 1833. For cotton textile manufactures in some states the data used were instead from the New York Convention survey, reprinted in *Niles' Register*, Vol. 41, Addendum, p. 7. See also the writer's "Population Change and the Supply of Labor," *Demographic and Economic Change in Developed Countries*, Special Conference 11, Princeton for NBER, 1960.

<sup>59</sup> De Bow, *Compendium*, pp. 55, 69, 128. The same source was used for other population data below.

4. Free females sixteen and over. The number in industrial pursuits is estimated for 1830 at 75,000 (see note 58), and for 1850 (below) at 220,000. The 1840 figure was estimated by proportionate interpolation, using cotton textile employment 1830-40 and 1830-50.<sup>60</sup> The number in domestic service—240,000—is estimated by procedures described in the section on domestic service.

#### GAINFUL WORKERS: 1850

The total was estimated as the sum of major components outlined below.

1. Free males sixteen and over: 5,330,000. The reported Census total, minus the number of students included therein, is used.<sup>61</sup>

2. Free males aged ten to fifteen: 280,000. The proportion of white males in this age group that were gainfully occupied in the first Census providing such information—that of 1900—was used.<sup>62</sup> The trend for the combined white-nonwhite group from 1870 to 1900 is not such as to suggest that the passage of these decades changed the rate for this group.

3. Free females: 675,000. This group is estimated as the sum of women in a number of specified occupations. This procedure was tested for 1860, and gave results that were close to the sum estimated by the procedure actually used. We therefore have a basis for using it for 1850 beyond its general reasonableness.

a. Domestic servants were estimated at 350,000, by using the relationship to white families, as described in the section on domestic servants.

b. Population Census data for dressmakers, milliners, and tailors are available for 1860 and subsequent decades, and for males (only) in 1850. Taking the total for males in 1850 (52,000) and for 1870 (67,000) we estimate males in 1860 by the trend for males employed in clothing industries as reported by the Censuses of Manufactures.<sup>63</sup> (Virtually all males in these occupations were employed in factories.) Deducting from the reported 1860 Population Census total for both sexes gives us 190,000 for females.

We now compute the ratio of males to total gainfully occupied in these occupations, which proves to be identical in 1860 and 1870. It is therefore assumed the same in 1850, applied to the Census total for males to give 165,000 for females.

<sup>60</sup> See section on cotton textile factory employment.

<sup>61</sup> *The Seventh Census of the United States: 1850*, pp. lxxix, lxxvii.

<sup>62</sup> 1900 Census, *Occupations*, p. cxviii.

<sup>63</sup> Occupation Census data from Edwards, *Comparative Occupation Statistics*, Tables 8-10, and 1890 Census, *Population*, Part II, p. cviii. Manufactures Census data from 1870 Census, *Industry and Wealth*, pp. 394, 400, 406.

c. Mill and factory operatives, not specified. The bulk of female factory operatives, other than those included in the dressmaker, etc. category were returned under this heading. We therefore take the Census of Manufactures trend for the employment of males in factories, deducting clothing factories, to extrapolate the Population Census 1860 total for this occupation to an 1850 level.<sup>64</sup> The resultant figure, minus the males reported in this occupation in 1850, gives a 50,000 estimate for females. Alternatively, we assume that the Population Census enumerators enumerated the same proportion of all male factory operatives in 1850 as they did in 1860. By then taking the Census of Manufactures as a control, we assume that the proportion of male to total employment indicated in the Census of Manufactures data (for all industries but clothing) can apply to the Population Census figure for males, giving a 60,000 figure for females. We arbitrarily average the two figures since no basis exists for preferring one to the other.

d. Teachers. A comprehensive Census enumeration of educational institutions in 1850 gives us the total for that year, the female proportion being taken as the same as that for 1870 (as the ratio changed little in subsequent years).<sup>65</sup> The resultant figure is 80,000.

e. Nurses, boardinghouse keepers. For these small groups, whose numbers changed little over the 1860-80 period, the difference between the 1850 male total and the 1860 male plus female total was assumed to give the correct 1850 figure—of 18,000.

Adding the number in these occupations gives a figure of 662,000. This was rounded to 675,000 to allow for minor omitted occupations.<sup>66</sup> No estimate is made for females in agriculture since the Censuses of 1860, 1870, and 1880 did not include females, except nonwhites in the South—a group which was included under the slave total in 1850.

4. Slaves gainfully occupied: 1,890,000. The number of slaves aged ten and over was derived from Census data for each state in 1850.<sup>67</sup> It was assumed that the worker rates for slaves in 1850 averaged 90 per cent, or above the relatively low rates (of about 80 per cent) for planters and white persons. We rely on Jefferson's statement that numbers of planters

<sup>64</sup> Manufactures and Population Census sources as for dressmakers.

<sup>65</sup> 1850 Census, *Compendium*, pp. 141-143. As can be seen from the similar 1860 enumeration the figures are well above the Population Census counts. They are preferred as being clearly more comprehensive and reliable. The 1870 percentage is based on data from 1870 Census, *Population and Social Statistics*, pp. 676, 638.

<sup>66</sup> One occupation of consequence in later years is laundresses. These are included in the estimate of servants. Another group—clerks, bookkeepers, and saleswomen—included very few women in 1860 and must have had well under 10,000 in 1850.

<sup>67</sup> *The Seventh Census of the United States: 1850*, p. xlv; De Bow, *Compendium*, p. 89.

were not in the labor force, assuming that the same causal factors did not minimize the slave labor force. (Using the adult white male rates by state, however, would only reduce the total by 70,000.)

#### GAINFUL WORKERS: 1860

The 1860 Census secured data on the number of gainfully occupied persons aged sixteen and over. It did not cover slaves, nor did it distinguish between males and females. To expand the Census figures to total, and to provide a basis for linking with the 1850 Census, it was necessary to estimate for 1860 the number of women who were included by the Census as gainful workers, to estimate the number of slaves, and to estimate the number of children ten to fifteen, who were gainful workers but were not included by the Census.

The number of women included in the occupation totals for 1860 was estimated as 895,000 (a check made by a completely different procedure led to an estimate of 950,000). The basic estimating procedure was the following.

1. The ratio of males aged fifteen and over who were gainfully occupied in 1850, 1880, and 1890 was computed for each state.<sup>68</sup>

For 1850 these ratios relate to the free population (which was almost all white). For 1880 and 1890 they relate to the free population, which then included a large number of ex-slaves. It will be seen that the ratios changed little from Census to Census despite this major social change, and appear to have varied as a result of differences in enumerator efficiency rather than because of any discernible trends in labor force rates. The 1850 ratios for free males were therefore assumed to apply equally well to the number of free males in 1860, except for Connecticut and Missouri. For Connecticut the 1880 rate was used instead—the 1850 rate being unreasonably low in the light of rates for other New England states in 1850 and every New England state in 1880 and 1890. The 1850 Louisiana rate was used to raise the Missouri rate so that it was not below that for any other slaveholding state in 1850. While it is possible that even this is not enough of an adjustment, the Louisiana rate was taken as a working indication of the minimum rate under 1850 slaveholding conditions.

If we apply these 1860 rates to the 1860 white male population aged fifteen and over, we get an estimated 7,075,345 white males in this group that were gainfully occupied. Increasing this total by 210,935 for male free colored and free Indians, and deducting from the reported occupations

<sup>68</sup> *The Seventh Census of the United States: 1850*, p. xlii; *1890 Census, Population, Part II*, p. lxxxvii.

count, gives an estimate of 894,697 for gainfully occupied females in 1860, as implied in the Census count for that year.<sup>69</sup>

2. A check estimate of 950,000 was arrived at by an entirely different procedure. The female gainfully occupied total was estimated directly from data on occupations with substantial numbers of females in them in later years. Thus, four occupation groupings accounted for 80 per cent of all female nonfarm employment in 1880. The proportion of females in these occupations in 1880 and 1890 are shown below, together with the total number in 1860 and the estimated proportion of females in the same year.<sup>70</sup>

	<i>Number in Occupation in 1860</i>	<i>Percentage Female</i>			
		<i>1890</i>	<i>1880</i>	<i>1870</i>	<i>Est. 1860</i>
Teachers	112,969	72	68	66	65
Servants and laundresses	627,068	84	81	88	85
Clerks, bookkeepers, and salespersons	185,549	15	7	3	3
Dressmakers, milliners, and seamstresses	151,955	99	97	99	100
Tailors	101,868	34	39	—	36

Estimates were made for these occupations and, in addition, for housekeepers, boot and shoemakers, laborers, mantua makers, nurses and weavers, aggregating a total of 869,000. Total nonfarm females aged fifteen and over and occupied in 1880 were 118 per cent of the aggregate for these or comparable occupations in that year. To allow for the more limited entrance of women into the various occupations in 1860, this percentage was reduced to 110 per cent, and an estimate of 950,000 arrived at.

It was assumed that no women were reported employed in agriculture by the 1860 Census. This assumption was dictated by an examination of the individual state figures for 1880. Only a trivial number of females in agriculture were reported for that year in the great central and northern states—implying that the numbers reported in the southern states reflected primarily Negro women in that year. A fortiori, in 1860, when

<sup>69</sup> Given the small number of free colored and Indians, separate state estimates were not made. Instead, the U.S. number of free colored, aged fifteen and over (1860 Census, p. 595), was assumed to have an 80 per cent worker rate and the free Indians (1860 Census, pp. 596-597) a rate of 60 per cent—a lower rate to reflect Indian family relationships indicated in travelers' tales. But it clearly makes very little difference whether one increases the white male total by 2, 3, or 4 per cent.

<sup>70</sup> Census data from 1890 Census, *Population*, Part II, pp. civ ff.

slaves were not enumerated, the number of white or free colored females reported in agriculture would have been trivial at best.

The number of gainfully occupied slaves in 1860 was estimated at 2,340,000. This estimate was arrived at by applying to the slave population of each state, aged ten and over, the proportion of the free male population (white and colored), aged fifteen and over, that was reported as gainfully occupied in 1850. Several assumptions lying behind this procedure should be noted. First, it is assumed that the proportion of female slaves gainfully occupied was the same as that of males. Examination of a sample of individual Census schedules for 1820 and 1840, the only Censuses when slaveholders did not report on the proportion of their slaves gainfully occupied, showed no distinction of rates resultant from the sex composition of their holdings. Plantation accounts and literature of the time confirm the buying and selling of females and their use for activities productive of market values—the common sufficient indication of gainful occupation.<sup>71</sup> Secondly, the 1860 data could not be used as satisfactorily as the 1850 data for establishing worker rates for this particular group. The 1860 data include not merely men but women gainfully occupied; and while the slave holding states generally had small numbers in this group, some, such as Virginia, Missouri, Maryland, and Delaware, did have a significant number.<sup>72</sup> On the other hand, the 1850 data relate only to males, and we can compute in each state the ratio of the number gainfully occupied to the population base. These proportions generally ran from 84 to 88 per cent in most southern states. Except for the adjustment of the Missouri rate noted above these rates were therefore applied to the slave population aged ten and over in 1860 to estimate gainfully occupied slaves in that year.

Free children aged ten to fifteen were estimated at 535,000. Since virtually all of this group was composed of white children, we take the proportion of white children ten to fifteen gainfully occupied in 1900 as our guide—earlier Censuses being unsatisfactory on various grounds.<sup>73</sup>

<sup>71</sup> Different treatment is not warranted because periods of absence from regular field or house duties for parturition occurred, given the monetary values set on the results of such activity.

<sup>72</sup> We deduce the number of women by applying to the 1860 free male population the worker rate for the same group in 1850, deducting from the reported 1860 total. The result in most slaveholding states is under 10 per cent of the 1860 total in most southern states.

<sup>73</sup> The 1870 Census underenumerated gainfully occupied children; the 1880 Census does not give us the distinction by color; the 1890 Census does not give us that by age. The 1900 Census, *Occupations*, p. cxviii, gives data for deriving rates of 22.1 and 6.4 for boys and girls with native white parents. Those with foreign parents were not included in the weighting, first because the foreign group was much smaller in 1860, and second, as a means of offsetting any slight decline in rates from 1860 to 1900 that may have flowed from rising incomes or the spread of education.

Adding the minor adjustment for the fifteen year olds, we arrive at an estimate for the ten to fifteen group of 535,000.<sup>74</sup>

Adding together the number of free persons sixteen and over reported by the Census as gainfully occupied, the slaves and free children estimated as belonging to this group, and deducting students included in the Census total<sup>75</sup> gives us 11,110,000.

#### GAINFUL WORKERS: 1870-1900

For these years we adopt the figures from the recent Census report by Kaplan and Casey.<sup>76</sup> These figures are essentially the same as the ones given by Edwards who adopted the original 1880 and 1900 Census results which were the official revisions for 1870 and 1890. The only alternative for 1870 is an estimate<sup>77</sup> which adjusts the Edwards figure by one-half of 1 per cent. We prefer to adhere to the official Census results instead of following this relatively minor revision. For 1890 Clarence Long has adjusted the Census on the assumption that school attendance rates in later years applied in 1890, and that labor force rates in 1890 should equal the average of 1900 and 1920 for certain groups.<sup>78</sup> His net adjustment is about 1 per cent of the Census gainful worker total. We prefer to accept the official Census results rather than adopt this speculative and minor adjustment.

#### GAINFUL WORKERS: 1900-60

Estimates for the ten and over group were derived as initial steps in estimating the annual labor force figures 1900-30, and their derivation is outlined in connection with the latter series.

For 1940-1960 we increase our estimates for the labor force as currently defined (including those fourteen and older) by making an allowance for those aged ten to thirteen.

For 1950 we estimate the proportion ten to thirteen in the labor force on the basis of two special Census enumerations of those employed in that

<sup>74</sup> 1860 Census, *Population*, pp. 592-594, gives data for the population aged ten to fifteen. The 1880 Census, *Population*, p. 548, indicates that the ten to fifteen male group is 116 per cent, and the female, 116.5 per cent of the ten to fourteen group.

<sup>75</sup> The Census included precisely 49,993 students, no more, no less (*ibid.*, pp. 676-677).

<sup>76</sup> David L. Kaplan and M. Claire Casey, *Occupational Trends in the United States, 1900 to 1950*, 1958, p. 9.

<sup>77</sup> Simon Kuznets, *Capital in the American Economy: Its Formation and Financing*, Princeton for NBER, 1961.

<sup>78</sup> Long, *Labor Force*, Appendix G.



year.<sup>79</sup> Earlier percentages in the labor force were as follows.<sup>80</sup>

	1920	1930	1940 (March)	1950
Age 10-13	4.4	2.4	n.a.	7.9
Age 14-15	17.5	9.2	5.2	20.8
Percentage ratio	25	26		38

We assume that the relative rise in the rate for the youngest age group from 1930 to 1950 reflects the greater availability of part-time work during the war and postwar years, and hence take a 25 per cent ratio for 1940. Applying that ratio to the 5.2 rate for fourteen to fifteen, and rounding to an annual average rate for the ten to thirteen group, gives 105,000 for 1940, with 35,000 in agriculture.<sup>81</sup> For 1950 we take the data for the fourteen to fifteen year olds as a guide to estimate that half the annual average labor force ten to thirteen was in farming.<sup>82</sup> For 1960 we adopt the same 38 per cent ratio as given by the 1950 data, and this, applied to the 17.5 per cent reported rate for the fourteen to fifteen group, gives us 6.7 per cent for 1960.<sup>83</sup>

#### PREVIOUS GAINFUL WORKER ESTIMATES: 1820-60

Prior gainful worker estimates for these decades are essentially those of P. K. Whelpton. These constitute the primary basis for the estimates made for the Census Bureau by Alba Edwards, as well as the combination

<sup>79</sup> Estimates of 1,095 for August and 719 for October are available. The average of these two was adjusted to an annual average of 718 by the parallel ratio for the fourteen to fifteen year olds. (August data from *Current Population Reports*, Series P-50, No. 83. October data kindly provided by Miss Gertrude Bancroft of the Bureau of Labor Statistics. Data for fourteen to fifteen year olds from Series P-50, No. 31, Tables 3, 8.) Estimates of 132,800 and 201,300 for 1940 and 1950 have been made by Ann Miller (in Simon Kuznets, *Capital in the American Economy*, Table 38). The striking difference in 1950 reflects her use of 1930 ratios for 1950 whereas we rely on the direct special Census enumerations.

<sup>80</sup> 1920 and 1930: 1930 Census, *Occupations*, p. 347. 1940: 1940 Census, *The Labor Force*, Vol. III, Part 1, p. 19. 1950 data: see above.

<sup>81</sup> The resultant rate of 1.3 per cent was rounded to 1.5 to give an annual average rate, and this, applied to the population count (1940 Census, Vol. 4, Part 1, p. 8) gave 104,000, or 105,000 allowing for population growth. The 1940 Census, *Industrial Characteristics*, Table 3, showed that 32 per cent of the fourteen to fifteen year olds were in agriculture and we assume that one-third of the ten to thirteen year olds were.

<sup>82</sup> Some 46 per cent of the fourteen to fifteen year olds employed in October were in farming, compared to 38 per cent for the year. We therefore reduce the October 62 per cent rate for ten to thirteen year olds to 50 per cent for the year, giving 360,000 in farming.

<sup>83</sup> Bureau of Labor Statistics, Special Labor Force Reports, *Monthly Labor Review*, March 1961, P. A-13.

of both series by Solomon Fabricant in a comprehensive and characteristically lucid review of these data.<sup>84</sup>

The gainful worker totals for 1850 and 1860, in either set of estimates, can be viewed simply as the sum of component estimates—white male population times the proportion of that group in the labor force, white female population times the proportion of that group in the labor force, and so on. The present estimates use the actual Population Census counts in each of the four major sex-color groups, and stipulate the proportions of each in the labor force. The alternative estimates stipulate that the proportion of the total population in the labor force in 1850 and 1860 was given by interpolation between 1840 and 1880 rates. This process fails to make use of the actual population counts of the changing numbers of each of these sex-color groups, and fails to use the Population Census records for the proportion of white males gainfully occupied—the largest single group in the labor force. Under the circumstances, interpolation between over-all rates based on the inadequate 1840 Census (when slavery prevailed and manufacturing industries had just begun employing females in significant numbers) and the 1880 Census (when slavery had ceased, a great number of immigrants had entered, and manufacturing was a significant employer of female workers) is hardly a preferred procedure.

A different consideration appears in the 1840 estimates. The procedures used for the present 1840 estimates are similar to those for 1850-60. Whelpton and Edwards, rejecting the improved Censuses of 1850 and 1860, take as the rock on which to rest their estimates that for 1840. Aside from Congressional investigations (exculpations by Webster and Calhoun joining in support of the most incompetent Census superintendent ever in office), we have the internal evidence of the 1840 Census testifying to its limitations. These are discussed in connection with the estimates for the agricultural labor force. These suggest both under- and overenumeration in different portions of the Census. It is impossible from the Census materials themselves to decide just where the net adjustment falls. We therefore reject that Census as a measure of absolute level of the gainfully occupied in the industries it purports to cover, and do not follow Whelpton's procedure of adding about 15 per cent for industries it did not purport to cover. Instead, we return to direct estimating of worker rates

<sup>84</sup> Whelpton, "Occupational Groups"; Edwards, *Comparative Occupation Statistics*, p. 142; Fabricant, "Changing Industrial Distribution." Fabricant adopts Edwards' minor revisions of Whelpton's total gainfully occupied (*ibid.*, p. 43). The Edwards estimates are reproduced, with minor changes, in the important Census monograph by David L. Kaplan and M. Claire Casey (*Occupational Trends*, p. 6). They also appear in Long, *Labor Force*, Appendix A.

based on the somewhat more satisfactory population counts. These, summed as above, suggest that the true total would be about 10 per cent above that estimated by Whelpton. Our difference is largely a result of our adjustment for Census undercoverage in agriculture, Whelpton accepting the Census totals for this group.<sup>85</sup>

#### GAINFUL WORKERS IN AGRICULTURE: 1800-60

Varieties of Census data are available for 1820, 1840, and 1860. The basic procedure adopted was to build upon these data, using relationships to other comprehensive figures to compute the major components of the gainful worker total. The various incomparabilities in coverage and definition make the estimates a laborious matter, and in some instances, quite chancy. But two elements tend to make the 1800-60 figures solidier than might at first appear. One is the pattern of stable relationships for the key components of the labor force, discussed below. The second is the fact that in this period the share of the slave population in the agricultural total, and of the farm population in the U.S. total, is so great that the possibilities of differing estimates are much more limited than would be the case if we had to estimate, in the same fashion, farm employment today. The specific procedures used are outlined below.

#### *Slaves*

Reported Census totals for the slave population in each decade constitute our starting point. For 1830-60 the data also give us the population aged ten and over, while for 1820 we have figures on those aged fourteen and over.<sup>86</sup> The ratio of the under ten group to the under fourteen group was 70 per cent in 1850, and 69.5 per cent in 1860, and was assumed to be 70 per cent in 1820. The 1820 figure for the under ten group as thus derived proves to be 30.5 per cent, compared with 31.8 per cent for the comparable group in 1850 and 31.1 per cent in 1860. We therefore assume 31 per cent for 1800 and 1810. The reported Census figures for 1830-60, and those thus estimated for 1800-20, were then distributed between rural and urban residents. For 1790 we took the slave population of counties which included the five major cities as equivalent to the urban slave population at that early date (even in later decades these counties accounted

<sup>85</sup> The limitations of the 1840 Census figures are discussed by Richard A. Easterlin in "Interregional Differences in per Capita Income, Population, and Total Income, 1840-1950," in *Trends in the American Economy in the Nineteenth Century*, Studies in Income and Wealth 24, pp. 126 ff. He allocates these, as we do, to agriculture.

<sup>86</sup> *Historical Statistics*, 1960, pp. 9, 11.

for an overwhelming proportion of total urban slaves).<sup>87</sup> For 1850<sup>88</sup> and for 1860<sup>89</sup> we added up the slave population of all cities and towns reported in the Censuses of those years. The result of these calculations is that approximately 5 per cent of the slaves were in the urban population in 1790, in 1850, and again in 1860, from which we assume 5 per cent in the intervening years.

For 1850 we do have an estimate by De Bow to the effect that 400,000 slaves were urban—or about 13 per cent.<sup>90</sup> De Bow's figure comprehends "the slaves who are known to be residents of towns, and approximating for those towns that are unknown." However, as noted above, even if one adds up all reported towns in the 1850 Census, exclusive of the unreasonable entries for Missouri, one arrives at perhaps half that number, suggesting that De Bow simply doubled his figure to allow for "the unknown towns." Moreover, one might note a contrary bias—namely, the practice of including with the town population slaves in rural areas owned by those residing in towns. We therefore reject his figure as being less reliable than a direct summation of Census reports.

The proportion of both rural and urban slaves aged ten and over that was gainfully occupied was taken as 87 per cent. The basis for this ratio was discussed at length earlier; essentially it rests on a review of the original 1820 and 1840 Census schedules in which the slave-owners themselves reported on the number of their slaves that were gainfully occupied. Comparison with the numbers of persons (by age) in their families indicated that the slave-owners fairly consistently counted at least those ten and over, and frequently some at younger ages. However, a 100 per cent ratio was not used; we attempted to make a conservative estimate, allowing for sickness and disability. As a guide, the 87 per cent ratio derived for white males fifteen and over in the slave states in 1850 was employed. One may assume that the proportion for slaves ten and over

<sup>87</sup> The counties are those including Richmond (Henrico), Baltimore (Baltimore), Savannah (Chatham), and Louisville (Jefferson). For Charleston County, 22 per cent of the county total was used, that being the city-county ratio for Charleston slaves in 1850. The 1790 data is from Census, *A Century of Population Growth*, Table 104.

<sup>88</sup> *The Seventh Census of the United States, 1850*. Individual city and town totals appear in Table 111 for each state.

<sup>89</sup> 1860 Census, *Census of the Population*, Table 3, gives individual city totals. Since the city total for Augusta was lacking, that for Richmond County was used. The reports for Missouri apparently considered every inhabited area a town in 1850. The 1860 figure of 3,000 for St. Louis was therefore used instead of the summarized figure of 45,000. The population of the twenty-eight major cities plus Richmond County was computed as a check, since it is less subject to the whims of changing definition. This confirmed the essential identity of 1850 and 1860 totals.

<sup>90</sup> De Bow, *Compendium*, p. 94.

would be at least as great.<sup>91</sup> The use of the 87 per cent figure produces a mild underestimate of those employed in agriculture, thus partially compensating for the inclusion of domestic servants, carpenters, etc., employed on the plantations and small slaveholdings.<sup>92</sup>

For 1840 it appears that the Census enumeration must have counted all slaves aged ten and over in rural areas as engaged in agriculture, in contrast to the present estimates that make a 13 per cent reduction for those disabled, ill, or in purely household tasks. This inference rests upon the fact that if the white labor force in agriculture, estimated below, is deducted from the Census count for all in agriculture, the result is 1,550,000—in contrast to the present estimate of 1,563,000 slaves in rural areas (which constitutes the basis for a 1,410,000 estimate of those actually employed in agriculture). While the white labor force may have been estimated incorrectly, the various relationships of that group to the rural white families, of farmers to farm laborers, make it unlikely that a significant error was made. Moreover, the undercoverage of that Census in both northern and southern counties makes it likely that the white estimate, as does the total, errs by being too small rather than too large. On the whole, it seems more likely that the entire slave population in rural areas was classified as engaged in agriculture than that the free farm labor force was underestimated by about 8 per cent.

### *Farmers and Free Farm Laborers*

For 1850 and 1860 we have fairly inclusive data; for 1820 and 1840, somewhat less so. These data were adjusted to a comprehensive coverage, then related to the number of rural white families as the basis for extrapolating to other Census years. Because of this sequence of building from the solid materials of the later Censuses, the estimating procedure will be described in the order actually followed.

The 1860 Census provides a count of farmers and free laborers in agriculture, aged sixteen years and older.<sup>93</sup> The population count for free males aged ten to fourteen was adjusted to include those aged fifteen, and 17 per cent of this ten to fifteen group was taken as the number in

<sup>91</sup> The practice of manumission removed from the slave population some of the oldest slaves and those least likely to be gainfully occupied, again tending to make this a conservative estimate.

<sup>92</sup> For 1860 a test was made of the effect of not using an over-all 87 per cent figure, but ratios were computed for each state from the 1850 data. The result, 2,339,685, was actually used instead of the 2,450,000 to be derived from the 87 per cent figure, but is not significantly different.

<sup>93</sup> 1860 Census, *Population*, p. 592.

agriculture.<sup>94</sup> (No allowance was made for females as is explained below.)

The 1850 Census provides a count of males, sixteen and over, gainfully occupied in agriculture.<sup>95</sup> Males in agriculture, ten to fifteen, were estimated from the reported ten to fourteen population totals, as was done for 1860. No allowance was made for free females engaged in agriculture for 1850, nor for 1800, 1810, or 1830. It is perfectly clear that many farm women did help with the crops, certainly with garden chores, taking care of chickens, etc. The reason why no adjustment was made, when many of lesser consequence were attempted, is simply that there is no evidence that this group was counted in the Censuses of 1820, 1840, or 1860-80 when the Census purported to cover all women, aged ten and over, gainfully occupied. We may make our own judgments as to the meaning of this exclusion. But if we were to include farm women in the agricultural count, it would be necessary to adjust every one of our nineteenth century Censuses.

If one examines the individual state totals for 1870-90, when the published data give a breakdown by sex, and if one examines the unpublished schedules for a random selection of counties in 1820 and 1840, it becomes clear that virtually no women were counted as employed in the midwestern states. The few in the border states of the Middle Atlantic and in New England are readily accounted for as employed in manufacturing, etc. The substantial number of women counted in those Censuses proves to be a phenomenon restricted to the southern states and clearly is a count of Negro females in agriculture—slaves prior to 1860 and free workers afterwards.

As late as 1880, for example (when we do not have the same problem of undercoverage as in 1870, but do purport to include females in agriculture), a grand total of less than 3,000 are reported for Illinois (as compared with 434,000 males). Less than 2,000 each are reported in Massachusetts, Michigan, Minnesota, Ohio, Pennsylvania—as compared with from 100,000 to 400,000 males in farming in each of those states.<sup>96</sup>

<sup>94</sup> From the 1880 Census, *Population*, p. 548, we compute the ratio of white males aged ten to fifteen to those ten to fourteen, and apply it to the 1860 white plus free colored aged ten to fourteen. Edwards (*Comparative Occupation Statistics*, p. 97) summarizes Census data showing about 16 per cent for 1870 and 1910, and about 18 per cent for intervening years. An arbitrary 17 per cent was used, considering all of these as samples of a fairly constant average.

<sup>95</sup> *The Seventh Census of the United States: 1850*, p. lxx.

<sup>96</sup> 1880 Census, *Population*, p. 716. In the 1870 Census we find only 244 females in farm labor compared with 134,000 males (1870 Census, *Population*, Table XXVII); and in 1900, 835 to 79,000 in family farm labor, and 764 to 102,000 for hired (1900 Census, *Occupations*, Table 33). On the other hand, 64,000, 78,000 and 30,000 are reported for Mississippi.

In the 1840 Census, triumphant incompetence succeeded in simultaneously producing an undercoverage as well as an overcoverage of those in agriculture. Our problem is to decide which of these biases was greater, and by how much.

The undercoverage has been noted by careful students, who point to unreasonably low participation rates.<sup>97</sup> Reference to the unpublished schedules now in the National Archives confirms this fact, and suggests that the failure began with the actual enumeration. By making estimates for every county with no, or trivial, agricultural entries, we would increase the free labor total by only 30,000, however.<sup>98</sup> Most of the omissions were made in the slave states, and were therefore assumed not a problem, since the slaves in agriculture were here estimated independently.

But along with undercoverage in some counties was still greater overcoverage in others. Even the proudest Michigander could hardly believe that men, women, and babes in arms in Hillsdale and Livingstone counties were all occupied in farming.<sup>99</sup> And, more substantially, it is impossible to believe that corn production in the midwestern states rose as enormously as it did from 1840 to 1850 while farm employment rose only trivially—as the Census implies.<sup>100</sup> Since the 1850 Census was certainly better than the 1840, this computation suggests that on balance the 1840 Census overenumerated. Such assimilation of entries to the dominant classification group is characteristic of bad enumerative practice.

These limited tests suggest that overenumeration was probably greater than underenumeration. But do we have a more general control? One guide could be the change in the rural population. But unfortunately we have no assurance that the population enumeration of urban areas in 1840 was any better than the occupational check. Hence the estimate of rural population (made by subtraction) would be equally suspect. We may start, however, with certain outside limitations. (a) The ratio of farm laborers to farmers in 1840 cannot have differed greatly from the 1850 ratio. (b) The rate of change in free farm labor, and in free farmers, over

<sup>97</sup> Cf. the analysis of Richard Easterlin, "Interregional Differences."

<sup>98</sup> As a method of estimation, the ratio of agricultural gainful workers to total population in the other counties in the same state was used. (Counties with major cities were, of course, excluded.) The Allen edition was used, and the ratio for most states proved to be near one-third.

<sup>99</sup> 1840 Census, *Compendium*, pp. 94-95.

<sup>100</sup> The Illinois figures show a reasonable proportion of change. Indiana, Iowa, Michigan, and Ohio do not. If one assumes for each of these states that the 1850 ratio of horses and mules to those gainfully occupied in agriculture should have applied in 1840, an adjustment of 70,000 might be made for the four states. If we contend that mechanization would have changed the ratio the adjustment would be still greater.

this decade must not be markedly out of line with the change in prior and subsequent decades. (c) Examination of unpublished schedules shows that all slaves aged ten and over were included as gainfully occupied in many counties. We assume that in rural areas they were all classified in agriculture.

If we assume that the 1,563,000 rural slaves aged ten and over were all allocated to agriculture (instead of merely the 1,410,000 estimated as gainfully occupied), and deduct from the Census total for agriculture, we have a residual of 2,160,000 free persons in farming. The ratio of free persons in farming to farmers was 148 per cent in 1850, 131 per cent in 1860 (and 152 per cent in 1800). If we assume it at 150 per cent for 1840, the number of farmers can then be estimated at 1,440,000. Neither figure is grossly out of line. Any great amount of manipulation is impossible because it distorts one or more relationships, and it is therefore assumed that these are tolerable approximations—including the supposition of a 150,000 overestimate (net) by the Census in its count of slaves in agriculture.<sup>101</sup>

On the other hand, the 1840 data were not adjusted because of the trivial rise in agricultural employment shown, from 1840 to 1850, for Indiana, Iowa, Michigan, and Ohio. It is impossible to believe (a) that enormous gains of corn production occurred in these states, (b) that simultaneously, marked employment gains occurred in Illinois; but (c) that only trivial gains took place for these four states. An adjustment of about 70,000 might be made—but being so dubious, is omitted, though the reader is warned as to this probable bias.<sup>102</sup>

For 1820, the total for those gainfully occupied in farming, as derived in the section on gainful workers in 1820, was used; the estimated slave count was then deducted to obtain free persons in agriculture.<sup>103</sup>

The total of those gainfully occupied in agriculture in 1810 and 1830 was estimated as 150 per cent of farmers in 1810 and in 1830, the ratio to

<sup>101</sup> If the ratio is changed much, the time series for farmers shows an unreasonable hump (or dip) in 1840, particularly in relation to the long-run rural population trends. If one assumes a correct enumeration of the slave population and an error only in the free population—which is unreasonable *per se*—the ratio proves to be 157 per cent.

<sup>102</sup> Production and employment data from the 1840 Census. The adjustment suggested used the ratio of horses and mules to gainfully occupied in agriculture, by state, in 1850 and in 1840; the ratios for most midwestern and northern states changed little, but these changed markedly, and improbably. Assimilation of entries to the dominant classification group being characteristic of bad enumerative practice, it was assumed that the error lay in the well-known inadequacies of the 1840 Census, rather than undercoverage in 1850.

<sup>103</sup> The 1900 Census, *Occupations*, p. xxx, makes minor corrections in the printed 1820 Census figures. We adjust the total there shown for omissions.



be computed from our 1800 estimates being 152 per cent, that for 1850, 148 per cent.

If we look to the rate of admission of immigrants who called themselves farmers or farm laborers, and consider them as the major volatile source of farm labor, the trend is consistent with that of these ratios.<sup>104</sup> Farm labor was then estimated by deducting farmers from the total.

The derivation of the 1800 data is discussed in the section on 1800 labor force.

How do the present estimates compare with the Whelpton-Edwards figures for the same period?<sup>105</sup> For 1820 both are tied to reported Census totals. For 1840 Edwards adopts the Census figure while the present estimates assume that all slaves aged ten and over in rural areas were allocated to agriculture. An adjustment for this (despite a mild compensatory adjustment for counties completely lacking in agricultural entries) produces a total below Census, and therefore below Edwards.

Significant differences arise for 1850 and 1860 largely because Edwards ignored the Census reports for those years. Although this is understandable because these Censuses were limited to free persons (and that of 1850 to free males sixteen and older), we are not well advised to ignore an adequate Census of persons who constitute some 60 per cent of the agriculture total. This is particularly so if our alternative is the Edwards one of interpolating at one fell swoop between a ratio derived from the inadequate 1840 Census and one based on the 1910 Census—after the latter figure had been adjusted by Edwards himself. Edwards implicitly assumes that the trend in the proportion of slaves in rural areas declined as did the U.S. totals, whereas the present estimates, based on totals from reported Census data for cities in 1790, 1850, and 1860, indicate that the proportion of slaves in towns did not rise significantly over the decades.

#### AGRICULTURE: 1870-1900

The bourne from which no traveler has ever returned unscathed is the region where lie the Censuses of 1870-1900, with their indefinite estimation of "laborers." For by a "house that Jack built" process, the inability, and/or unwillingness of respondents, enumerators, and coders to classify laborers with adequate precision left a large group of "laborers, not specified." An unknown portion of these belong in agriculture. The

<sup>104</sup> Immigration data from 1860 Census, *Preliminary Report of the Census*, pp. 12, 17, 18.

<sup>105</sup> Edwards, *Comparative Occupation Statistics*, p. 142, based in large measure on procedures developed by P. K. Whelpton. These figures form the essential basis for those of Solomon Fabricant that appear in *Historical Statistics*, 1960, p. 57.

group is so substantial that we can have no reliable figure for agriculture without estimating them. The proper method of allocating them, however, is difficult to discover. By *force majeure* the laboriously detailed estimates of Alba Edwards have been widely used.<sup>106</sup> But other attempts have not been wanting. We therefore consider the major serious estimates in the field, then describe the present approach.

### *Previous estimates*

Edwards estimates agricultural employment from the trend in the rural population.<sup>107</sup> By heroic interpolation, he estimates agricultural employment for 1850-1900, completely ignoring the Census information for those years. Specifically, he interpolates between the Harrison (1840) and Taft (1910) ratio of gainful workers in agriculture to the rural population, then applies his sixty years of ratios to the rural population totals for these decades to estimate gainful workers in agriculture. To assume a straight-line progression in a set of ratios, moving with relentless precision through years of war, cyclical change, and the spreading factory system, is difficult enough. To use this steady line for interpolating between one ratio based on an unsatisfactory Census (1840) and another based on a Census with an acknowledged substantial overcount of farm workers is an even more troublesome procedure. Edwards was clearly not happy with the procedure but "after much experimentation" adopted it failing any better alternative.

Daniel Carson pointed out, quite properly, the disturbance in the manpower-population ratio that results from wars, from the shifting of worker to nonfarm industries during the depression of the 1870's, and so on.<sup>108</sup> Having pointed to this irregularity, Carson decided to treat agricultural manpower as a function not of rural population, but of improved farm acreage. This procedure displaces the difficulty by an infinitely small amount. Adopting the Census of 1860 count of farm workers, and adjusting the 1920 Census count of farm workers, he interpolates between the two by applying to the improved farm-acreage figures interpolated ratios of workers to acreage.

What does Carson's procedure amount to? The slope of relationship is determined at one end by the extent of his debatable adjustment in the 1920 Census—and at the other, by the level of the 1860 figure, which is adopted from Edwards who adapted it from Whelpton. Whelpton in turn

<sup>106</sup> Edwards, *Comparative Occupation Statistics*, p. 144.

<sup>107</sup> *Ibid.*, p. 142.

<sup>108</sup> Daniel Carson, "Changes in the Industrial Composition of Manpower Since the Civil War," *Studies in Income and Wealth*, 11, New York, NBER, 1949, pp. 128 ff.

created an 1860 figure by interpolating between the 1840 and the 1910 ratio of farm workers to rural population. What matters in all this is the rate of change between 1860 and 1920—the consideration making Carson reject Edwards' detailed study. Having stigmatized Edwards' procedure because it produced unreasonable changes from 1860 to 1870 and 1880, because it disregarded the meaning of the changes in its ratios, Carson goes on to use a ratio that moves with the steady undeviating course of a sleep-walker—being either 3.2 or 3.1 acres per farm worker in any decade, depending on how the rounding falls. While some technological coefficient does relate acreage to farm employment, it is hardly this invariant. Since a large share of farm income derives from livestock (variably related to acreage), and since the men-machinery coefficients also changed over the period (as price-cost relationships changed), we cannot hope for too much from such ratios unless they are derived from some empirical sample or Census data. To derive them merely by assuming undeviating growth over this sixty-year period is unsatisfactory.

A third substantial attempt to estimate agricultural employment was recently made by Ann Miller and Carol Brainerd.<sup>109</sup> These authors, concerned with deriving state estimates, found previous procedures unacceptable, and assumed that "laborers not specified" could be split between farm and nonfarm occupations "in the same proportions as the two industries constituted of the total labor force excluding 'laborers not specified' for each sex."<sup>110</sup> In a helpful analysis they point out that this gives about a fifty-fifty split in 1870 and 1880, and a sixty to forty split in the next two decades. This differs from previous estimates, particularly in allocating a much higher proportion to agriculture in 1900. Their procedure has the considerable merit of simplicity. The major limitation of their treatment is not that the results come from a quite arbitrary assumption, but rather that the reasonableness of their resultant estimates is not tested, checked, or controlled—either by Edwards' method of control (to rural population trends), by Carson's use of farm acreage data, or some *tertium quid*. However, one may note that their figures are not notably distant from those of Edwards' for 1870–90. For 1900, when they are substantially higher than Whelpton's, Edwards', and Carson's, there is some warrant for the point they shrewdly quote Edwards himself as making, that a large rise from 1890 to 1900 appears to have taken place in the southern farm areas—a rise apparent in their estimates but not in Edwards'. We note below further reason for the assumption of a substantial 1890–1900 rise.

<sup>109</sup> In Everett Lee *et al.*, *Population Redistribution and Economic Growth, 1870-1950*, 1957, Part I, pp. 383 ff.

<sup>110</sup> *Ibid.*, p. 384.

*Present Estimate*

Agricultural employment in 1870-1900 is estimated by making fuller use of the direct Census materials for these years than previous estimators have done. We start from the actual reported Census figures for the gainfully occupied in agriculture,<sup>111</sup> instead of by-passing them as do Whelpton, Edwards, Carson, and Miller and Brainerd.

To these figures we add the number of farm laborers who were not tabulated as such but included in the general rubric "laborers not specified." We do not estimate their numbers by first estimating total agricultural gainfully occupied and then subtracting, as do Edwards, Carson, and Whelpton. Instead we tabulate for the cities for which data are available at each Census the ratio of "laborers not specified" to total population in those cities.<sup>112</sup> These cities had roughly half of all the U.S. urban population at each Census. We may therefore consider the ratios of laborers to population that we thus derive to be based on an enormous sample. But while the sample may be great enough to make sampling error no consideration, the possibility of bias does exist. To minimize that bias, the ratios in the different size groups were analyzed, and the three cities of New York, Chicago, and Philadelphia were excluded from the ratio computations. The ratios for 1870-1900 were then 5.13, 4.44, 4.60, and 4.05. Applying these ratios to the total urban population gives us our estimate of urban laborers not specified.<sup>113</sup>

Because we have an estimate of laborers in towns down to 2,500 population, we may have some confidence that we include all laborers, with trivial error, except forestry, mining, and agriculture. Reference to Edwards' analysis indicates that even he allocates a trivial number to forestry, which leaves mining and agriculture. Study of earlier Censuses indicates, as one would expect, that the misallocations in mining were not likely to be between mining and "labor not specified," but rather between mining labor and miners, the relationship to a mine being important and

<sup>111</sup> 1900 Census, *Occupations*, p. lxxxviii. These figures include the official Census revision of the 1890 count to allow for the omission of 582,522 children, aged ten to fifteen, from the total gainful worker count—an adjustment made in the 1900 Census for reasons outlined with considerable precision and persuasiveness (pp. lxvi ff.).

<sup>112</sup> 1900 Census, *Population*, Part I, pp. 430 ff. Laborers, not specified: 1880 Census, *Population*, Table XXXVI. 1890 Census, *Population*, Part II, Table 18. 1900 Census, *Occupations*, Table 42. For 1870 the 30 largest cities are shown; for 1880 and 1890, 58 cities with more than 25,000 population; and for 1900, the 161 cities with 25,000 or more. The estimating procedure computed ratios of laborers not specified to total population in these cities; the count for New York, Chicago, and Philadelphia was added at the end.

<sup>113</sup> The ratios, of course, were applied to the total urban population exclusive of the three cities, with laborers in the latter then added. Urban population from *Historical Statistics*, 1960, p. 14.

apparent to the respondent and enumerator. A fortiori, if mining laborers were thrown into this category on any substantial basis we should expect the ratios to population for Wilkes Barre and Scranton to be unusually high—which is not the case.<sup>114</sup> We conclude, therefore, that within the margin of significant adjustment we may take urban “laborers not specified” as including all those belonging to nonfarm industries, while the balance of “laborers not specified” belong in agriculture.<sup>115</sup>

We now compare the number of laborers not specified which was allocated to agriculture by Edwards, and Miller and Brainerd.<sup>116</sup> The most useful comparison is not one of mere differences but in relationship to a base. The entire laborious discussion of laborers not specified really turns on how many gainfully occupied persons listed by Census enumerators were not classified in agriculture but tossed into the laborers category. For this purpose we take as the base for each estimate the total reported originally by the Census, and add to it the number estimated by each investigator from the labor n.o.s. group.<sup>117</sup>

	1870	1880	1890	1900
	(per cent)			
Present estimates	16	28	24	25
Miller-Brainerd	15	22	21	19
Edwards	18	22	23	13
Carson	6	22	13	9

Aside from the extremely low proportion implicit in Carson's figures for 1870, what is most striking in the table is the signal 1890–1900 decline in the Edwards and Carson ratios. Such a decline is not only unwarranted in the abstract, but in the light of the specific statements made in the 1900 Census by the distinguished scholars, Joseph Hill and W. R. Rossiter. While every attempt had been made, they said, to classify laborers in agricultural districts to farm labor, and others to manufacturing and

<sup>114</sup> Edwards, in fact, does not attempt a direct estimate for laborers in mining. He simply divides a group of laborers that he has been unable to allocate to other industries, as between forestry, mining, manufacturing, and trade, in proportion to employees directly allocated to those industries.

<sup>115</sup> We assume that the small number of farm workers resident in towns that are allocated to nonfarm jobs by this procedure offsets the number of nonfarm workers who, being resident in open country, were assimilated to the prevailing classification and labeled as farm labor by the enumerators.

<sup>116</sup> Edwards, *Comparative Occupation Statistics*, p. 144; Carson, in *Studies in Income and Wealth*, 11, p. 126; Lee et al., *Population Redistribution*, p. 384.

<sup>117</sup> We intentionally exclude the subsequent 1870 and 1890 Census adjustments: our problem here is not that of a correct total but misclassification of persons recognized as gainfully occupied. The gainful worker data are from 1900 Census, *Occupations*, p. 1.

mechanical pursuits wherever the evidence on the schedule warranted it, "this effort did not prevent a very large increase in 1900 in this class of workers over the number reported in 1890."<sup>118</sup> We therefore infer that a reasonable estimate must assume that 1900 enumerators did not signally improve over the performance of their 1890 peers in the precision with which they classified farm laborers between "farm labor" and "labor not specified." We therefore conclude that the Miller-Brainerd and the present estimates have greater consistency with the known characteristics of enumeration. In addition, the present procedure, unlike previous ones, utilizes the information actually available from the Censuses on the geographic location of laborers not specified, to estimate by a systematic method the number in farm and in nonfarm pursuits.

In the most recent comprehensive Census publication on historical occupational data, Kaplan and Casey have made various revisions in Edwards' figures to provide a more precise classification.<sup>119</sup> While the differences from Edwards are small, they are improvements and we adopt these 1870-1900 figures as a starting point. We then adjust them by the difference between the Edwards count of "laborers not specified" in agriculture (which they implicitly adopt) and our present estimates. The results (in thousands) are the following:

	<i>Kaplan and Casey</i>	<i>Present Estimates</i>	<i>Difference</i>
1870	6,849	6,790	-59
1880	8,584	8,920	+336
1890	9,938	9,960	+22
1900	10,888	11,680	+792

#### FARMERS

For 1940-60, the Current Population Survey totals (mildly different from the Decennial Census figures) are accepted as the most carefully reported and classified figures.<sup>120</sup>

For 1900-30, we adopt the reported Census of Population counts for these years, as adjusted by Kaplan and Casey.<sup>121</sup>

The reported figure for 1890 overallocates Negro laborers and other

<sup>118</sup> 1900 Census, *Occupations*, p. xxvi.

<sup>119</sup> Kaplan and Casey, *Occupational Trends*. Edward Atkinson surmised in 1901 that "nearly 50%" of the 17.4 million gainful workers in 1880 were really in agriculture. Cf. 57th Census, 1st Sess. House Doc. 182, *Report of the Industrial Commission*, p. 522.

<sup>120</sup> Bureau of the Census, *Current Population Reports*, Series P-50, No. 2, p. 19, and No. 31, p. 23. Bureau of Labor Statistics, *Special Labor Force Report*, No. 14, p. A-21.

<sup>121</sup> Kaplan and Casey, *Occupational Trends*.

laborers, primarily in the southern states, to this occupation. While the 1900 Census corrected the 1890 figure for laborers, the corresponding correction that must flow for the count of farmers was not made. It is, however, made here.<sup>122</sup>

For 1860–80, Census occupational entries now grouped under the heading “farmers and farm operators” were combined to give total farmers and farm managers.<sup>123</sup>

For 1820–40, farmers were estimated by applying ratios to the total gainful workers in agriculture. The ratio of total to farmers was as follows: 1800, 152 per cent; 1850, 147 per cent; and 1860, 131 per cent. Interpolated values of 150 per cent were used for 1820 and 1840.

A regression of the number of farmers in 1800, 1820, 1840, 1850, and 1860 against the number of rural white families shows a very close relationship. The slope was used for estimating 1810 and 1830 values.

The derivation of the 1800 total for farmers is discussed in the section on 1800 labor force.

#### EMPLOYMENT IN NAVIGATION: 1800–1960

For estimating the trend of employment in navigation back to 1800 we have three bodies of information. Each has its own limitations. Taken as a whole, however, they help indicate the likely trend. The first set of data derives from the reports of the Treasury Department in entrances and clearances of American vessels. A second is the information from the Population Census of 1840, and subsequent years, on employment in certain navigation occupations. A third set of data, easily the most confusing, encompasses a variety of contemporary estimates. Let us review each in turn.

The port entrance and clearance data appear in the annual reports of the Secretary of the Treasury on Commerce and Navigation. We shall attempt to establish the level of employment, at decennial dates 1800–70, for each major type—fishing, whaling, coastal trade, foreign trade.

<sup>122</sup> 1900 Census, *Occupations*, p. lxxiii, discussed the overcount of farmers and, on page lxxi, an adjustment of 491,000 in the count of male laborers is made. If one interpolates between the ratio of farms to farmers in 1880 (107.5 per cent) and 1900 (101 per cent), and uses a ratio of, say, 105 per cent, an adjustment of 523,000 in farmers is indicated. To minimize differences from the Census, however, the 491,000 adjustment is used as the measure both of the required change in laborers and in farmers.

<sup>123</sup> 1900 Census, *Occupations*, pp. xxxiii, liii. These include farmers and planters, overseers, gardeners and florists, stock raisers, apiarists. For 1870 the Census total was increased by 107,000, which is Edwards' estimate of the number of farmers included in the undercount of that year. See Edwards, *Comparative Occupation Statistics*, pp. 104, 141.

*Fishing Employment: 1870-1960 (decennial)*

For 1870-1960 we adopt the Population Census totals for fishermen and oystermen.<sup>124</sup> Two other sources of data were rejected as indications of trend for the group. One is the annual report on documented tonnage in cod, mackerel and whale fisheries. This tonnage total was cut almost in half from 1860 to 1870. Hence, had our procedure for 1800-60 been used for 1870 ff., a substantial decline in employment would have been indicated. The Population Census does show an 1860-70 decline for the northern states, where much of the employment associated with documented tonnage appeared. However, a substantial 1860-70 rise for Virginia, Maryland, and other states with ex-slaves suggests a contrary factor not encompassed in the documented tonnage-employment relation. We, therefore, adopt the occupation Census reports beginning with 1870. (The result is to indicate a slight 1860-70 decline.)

A second possible source is the fishing employment total reported in the Censuses of Transportation beginning with 1906.<sup>125</sup> Their totals, however, include only wage earners working for firms with ships above a minimum tonnage figure—thus, omitting other wage earners as well as the far more substantial group of self-employed. It is, therefore, reasonable that they should be substantially below the more comprehensive total for the entire labor force associated with fishing.

*Fishing*

Benchmark estimates of employment were made for 1800 and 1860, with interpolation by tonnage engaged in the cod and mackerel fishery. For 1800 we have estimates by the House of Representatives, based on a Treasury report, that there were 3,841 men and 25,787 tons of shipping engaged in the fisheries.<sup>126</sup> Seybert's data on the enrolled and licensed tonnage shows that Massachusetts tonnage came to 94 per cent of the U.S. total, from which one can inflate the Treasury employment total to 4,100 (or 4,000 rounded). For 1860, the Census lists 15,579 employed in cod and related fishing as of June 1.<sup>127</sup>

<sup>124</sup> Kaplan and Casey, *Occupational Trends*, p. 14. 1940 Census, *The Labor Force*, Vol. III, p. 180. 1950 Census, Vol. II, Part 1, *Characteristics of the Population*, pp. 1-283. 1960 Census, *Occupations by Industry*, p. 7. In each of these last three Censuses the industry total, used here, is about 7,000 above the occupation total for fishermen. The latter is most directly comparable with the Census data for earlier years. No adjustment is made—*de minimis*.

<sup>125</sup> 1926 Census, *Water Transport*, p. 8.

<sup>126</sup> *American State Papers, Commerce and Navigation*, Vol. I, p. 511. For related estimates, cf. Timothy Pitkin, *Political and Civil History*, 1817, pp. 41, 44.

<sup>127</sup> 1860 Census, *Statistics of the United States . . .*, 1866, p. 550.



We can interpolate between these totals by the documented tonnage in the cod and mackerel fisheries, if there is some basis for believing that the ratio of men to tons changed linearly. It is possible to test this ratio for Barnstable, which had a substantial portion of the Massachusetts total. In 1832 this county averaged 145 men per 1,000 tons in the cod fisheries; in 1845, 152, and in 1855, 135.<sup>128</sup> This stability suggests that we are reasonably safe in interpolating the 1800 and 1860 ratios, and then applying these to the tonnage data.<sup>129</sup>

### Whaling

For whaling we interpolate between the 1860 Census total and an 1800 level of 1,000, by documented tonnage in whaling, given the constancy in both the crew-tonnage cleared ratios for New Bedford in 1835-60 and in various estimates of that ratio apparent in the sources.<sup>130</sup>

The New Bedford trend is an obvious source, to be used with some circumspection since perhaps 10 per cent of tonnage clearing the port was in coasting and foreign trade. More reliable, because more comprehensive, are figures on clearances for the South Seas or the Pacific Ocean—the port classification varying through the years. The trend in tons per man was the following:

<i>Per 1,000 Tons of Shipping in New Bedford</i>			
	Men Entered	Cleared	Cleared for South Seas or Pacific Ocean
1835	71	76	81
1839	75	62	78
1850	78	81	(81)
1860	74	85	90

<sup>128</sup> For 1832 we use data in U.S. Congress, Serial Set 222, *Documents on the Manufactures of the United States*, p. 94; for 1845, John G. Palfrey, *Statistics of . . . Industry in Massachusetts for . . . 1845*, 1846, p. 366; for 1855, *Statistical Information . . . Industry in Massachusetts . . . 1855*, 1856, p. 612. The last two are the state industrial censuses. We compute 1800 and 1860 ratios of employment to documented tonnage (as reported in *Historical Statistics*, 1960, p. 445), interpolate the ratios, and then apply these to the tonnage series.

<sup>129</sup> Tonnage data from *Historical Statistics*, 1960, p. 445. We may compare the implicit ratio of 134 men per 1,000 tons in Adam Seybert, *Statistical Annals*, Phila., 1818, pp. 340, 341, with Jeremy Belknap's estimate (in his *The History of New Hampshire*, Dover, N.H., 1812, Vol. III, p. 158) of six to seven men and one to two boys per twenty- to forty-ton ship, and Samuel Davis's ("Notes on Plymouth, Mass." in *Collections of the Massachusetts Historical Society*, Second Series, Vol. III, 1815, pp. 167, 168) report for Plymouth in 1770 of seven to eight men in ships averaging thirty to forty-five tons.

<sup>130</sup> 1860 Census, *Statistics of the United States*. . . . For 1800 we take an arbitrary minimum of 1,000 in the light of Seybert's estimates (*Statistical Annals*, pp. 338, 341) that only 1,332 were employed in 1818 in New Bedford and Nantucket, and that the total tonnage employed for the U.S. in 1800 was only 651.

Data for whaling reported by the Massachusetts Censuses of 1837 and 1845 lead to similar results, variations between the entering, clearing data and other sources reflecting deaths, desertions, etc.<sup>131</sup>

The absolute level for whalers can be set at 87 men per 1,000 tons on the basis of various reports. For Nantucket in 1807 the ratio was approximately 86.<sup>132</sup> For 1832, Thomas Greene reported that the whalers out of New Bedford aggregated 39,623 tons, and had 3,105 men, giving a ratio of 86; *Niles' Register* indicates similar results.<sup>133</sup> A report by the Committee on Public Lands for 1846 and data on ships cleared for the whale fisheries for 1860 both lead to a figure of 88.<sup>134</sup> It is suggestive that no increase in labor productivity appears in this portion of the industry. At the same time, the increasing theme of all reports on the industry is the development of crimping, the increased hiring of foreigners, and the search for ever lower-cost labor.<sup>135</sup> It is in particularly sharp contrast with the decline that appears to have cut manpower requirements per ton in half from 1794 to 1832.<sup>136</sup> (There is some indication that employment aboard ship actually increased somewhat over the long term.<sup>137</sup>)

<sup>131</sup> John P. Bigelow, *Statistical Tables Exhibiting the Conditions and Products of Certain Branches of Industry in Massachusetts*, 1838, p. 182; John G. Palfrey, *Statistics of . . . Industry in Massachusetts*.

<sup>132</sup> James Freeman, "Notes on Nantucket. August 1st, 1807" in *Collections of the Massachusetts Historical Society*, Second Series, Vol. III, p. 29 reports 46 ships with 10,525 tons belonging to Nantucket on July 27th, 1807, that forty of the forty-six ships were engaged in whaling, the larger ships with twenty-one men, the smaller with sixteen. We assume an average of 18.5 men per ship.

<sup>133</sup> U.S. Congress, Serial Set 222, *Documents on the Manufactures of the United States*, pp. 182-183. *Niles' Register*, Vol. XLI, Nov. 19, 1831, p. 218, gives data indicating 76 for the right whale fisheries and 81 for the sperm fisheries.

<sup>134</sup> 29th Congress, First Sess., Doc. 46, *Report of Committee on Public Lands*, Serial Set 478, p. 44; *Report of the Secretary of the Treasury . . . Commerce and Navigation, 1860*, p. 527. The preceding figures, based on clearances, are comparable indications of full-time equivalent employment requirements. A total employment figure of 12,301 for whaling (as of June 1, 1860) appears in the 1860 Census, *Statistics of the United States*, p. 550. No tonnage data, unfortunately, are given. But comparison of a January 1864 tonnage figure shown in the same source (p. 549) with that in *Historical Statistics, 1960*, p. 445 suggests that the latter's figure of 167,000 tons for 1860 might be reasonably comparable. If so, a ratio of 72 is indicated on a total basis—to be contrasted with a figure of 88 when allowing for the fact that the average vessel made more than one trip. Since whaling voyages averaged 2½ years, however, this reconciliation is hardly adequate.

<sup>135</sup> Cf. Samuel Eliot Morison, *The Maritime History of Massachusetts, 1783-1860*, Boston and New York, 1921, *passim*.

<sup>136</sup> U.S. Congress, *American State Papers, Commerce and Navigation*, I, p. 511, estimates 4,139 tons and 600-700 men for 1794 in a report made by a House Committee in February 1803.

<sup>137</sup> *Annals of Congress*, December 1822, p. 402. Representative Floyd of Virginia gives ship clearances from Nantucket as 18,765 tons and 1,315 seaman—or 70 men per 1,000 tons.

*Coasting Trade*

The trend of employment in coastal shipping cannot be derived directly from the port data, for no such classification is shown. However, as an indication we may take clearances for Canada and for Cuba. Voyages to the former were mostly short lake runs across from New York; the Cuban voyages originated in various ports, tending to be somewhat longer in duration:<sup>138</sup>

	<i>Men Per 1,000 Tons, Clearances for</i>	
	Canada	Cuba
1835	66	50
1839	57	50
1850	43	43
1860	(41)	37

Coastal voyages would have been of somewhat shorter duration than those to Cuba but hardly as short as the brief trips from New York to Canada that dominate the clearances for Canada. The Cuban rates were therefore adopted for coasting voyages, with the 50 rate carried unchanged to earlier decades on the analogy of the very stable data for foreign trade. (See below.) Confirmation of the rate is suggested by one of 48 for coasting voyages out of New York City in 1831.<sup>139</sup>

*Foreign Trade*

As an indication of the trends for foreign trade we have U.S. clearances for foreign countries, which include a heavy volume of shipping to Cuba and Canada (noted above) as well as to other foreign countries:<sup>140</sup>

<i>Men Per 1,000 Tons</i> (clearances for foreign countries from all U.S. ports)	
1830	45
1835	52
1839	48
1850	41
1860	29
1870	29

It must be emphasized that this trend necessarily reflects the varying proportions of shipping headed for the separate ports. The variation depending on destination was marked. Thus for 1839 the 57 for Canada

<sup>138</sup> *Report on Commerce and Navigation*: 1835, pp. 277-278; 1839, pp. 283-284; 1850, pp. 319-320; 1860, p. 557. From *ibid.*, 1960, pp. 526 and 594, one can derive a ratio of 26 for Canada as a whole, and of 41 for Canada excluding an enormous volume of shipments out of Buffalo Creek (which accounted for nearly 17,000 crew members). For extrapolating man-tonnage ratios, the exclusion seemed desirable.

<sup>139</sup> Based on a report of the *New-York American Advocate*, summarized in the *New England Magazine*, 1831, Vol. I, p. 529.

contrasts with 37 for trips to England, while for virtually the same year we have a report by the French attaché in San Francisco indicating a 64 rate for American vessels entering that port.<sup>141</sup>

Given the above figures for coasting and foreign trade we adopt a two-step procedure for estimating employment in these trades. The clearance data, of course, cannot be used directly since a given ship and its crew could make many clearances during the year. We therefore use the documented tonnage data, on the assumption that, by applying the ratios derived above to the tonnage in foreign trade and in coasting, we can compute a series for the trend in ocean navigation employment.<sup>142</sup> We deduct tonnage on western rivers from the total for "coasting plus internal." The ratios for Cuba were used for the years shown (50 for the earlier years), while a similar procedure for foreign trade utilized 45 for 1800-20.

The resultant series yields an 1830 figure within a few percentage points of one estimated for 1834 by Secretary of the Treasury Woodbury, and an 1840 estimate close to that estimated for 1839 by the Chairman of the House Committee on Naval Affairs (see following section). As a result, we adopt the series as the final one for ocean navigation. The results are as follows:

*Employment in Ocean Navigation and Fishing*  
(in thousands)

	Total	Ocean Trade	Fishing and Whaling
1800	50	45	5
1810	69	64	5
1820	68	56	12
1830	87	72	15
1840	114	90	24
1850	153	124	29
1860	191	161	30

<sup>140</sup> *Report on Commerce and Navigation*: 1835, p. 256; 1839, p. 262; 1850, p. 286; 1860, p. 530. 21st Congress, Second Sess., Senate Doc. 76, *Report of the Secretary of the Treasury . . . Commerce and Navigation*, p. 286, shows tons entered, tons departed, and number of seamen employed. I have averaged tonnage entered and departed in computing tons per man. See *Report on Commerce and Navigation*: 1835, p. 278; 1839, p. 268; 1850, p. 284; 1860, p. 527. For 1870, we used U.S. Bureau of Statistics, *Immigration and Navigation Statements, being Parts II and III of the Annual Report . . . on Commerce and Navigation*, 1870, p. 59.

<sup>141</sup> Dufflot de Mafros, *Travels on the Pacific Coast*, 1844 (reprint 1937, p. 266).

<sup>142</sup> Tonnage data from *Historical Statistics*, 1960, pp. 445-446. For 1830 the documented tonnage figures appear too low. An enormous 1828-30 decline is reported, whereas clearances and entrances continued to grow over those years. (Presumably this decline reflects the 1829-30 clearance of ghost tonnage from the totals.) See *ibid.*, p. 439. We therefore use the 1820-30 change shown by the average of entrances and clearances of American vessels to extrapolate the 1820 tonnage rate. This 37 per cent rise is virtually identical with the 1820-28 rise in documented tonnage.

*Comparisons with Census of Population*

A continuing source of data, beginning with 1840, is the decennial Census of Population.

That Census was probably the most inadequate in our history and the navigation figures are peculiarly affected. There are several indications that the employment figure of 89,000 was inadequate. First, the industrial portion of the Census finds fewer people in such industries as fishing, construction, lumbering, etc., than does the population enumeration. Nevertheless, the industrial portion of this Census reports only 36,000 persons employed in fisheries and whaling—compared with a total of 56,000 in navigation of the ocean.<sup>143</sup> This, in turn, implies that well under 20,000 persons were engaged in coastal and foreign trade. However, the 8,312 U.S. ships clearing from the country in the year ending September 30, 1839, had crews of nearly 71,000.<sup>144</sup> It is conceivable, but hardly likely, that the explanation lies in the difference being a measure of the employment of foreign sailors by American ships. However, hospital money deductions are too large for this to be likely.

Another indication of the limitations of the 1840 Census is to be found in comparison of the detailed local data. Barnstable reported more people gainfully occupied in ocean voyages than New York State, while Boston reported twice as many. This is wholly improbable in the light of clearance data, hospital money receipts, and later Censuses. Thus, the 1839 Commerce and Navigation Report shows documented tonnage in Barnstable at a tenth of that for New York. It is characteristic of inadequate Census practice for there to be overallocation to some categories in the midst of general underenumeration. The 1840 Census offers a classic example.

For 1850, the Census was restricted to free males aged fifteen and over. The omission of slaves in this industry would not have affected the totals much. On the other hand, the 1850 Census reports a decrease in navigation employment for the leading states of Massachusetts and Virginia,<sup>145</sup> although their tonnage had increased significantly from 1840 to 1850. Conceivably the institution of the catch-all category for "laborer not agricultural," a doubtful improvement instituted by De Bow, tended to reduce the navigation as well as other industrial categories. In any event the 1840–50 trend of a decline from an incomplete 1840 Census makes the 1850 report dubious.

<sup>143</sup> 1840 Census, *Compendium* pp. 103, 361 (1841, T. Allen edition). That the industrial portion was too low can be seen by examining the data on Boston fishing shipments.

<sup>144</sup> 1839, *Report on Commerce and Navigation*, p. 288.

<sup>145</sup> As can be seen by comparing the 1840 Census with *The Seventh Census of the United States: 1850*, p. lxxx.

The 1860 Census, as the last prewar Census, should be invaluable as a benchmark for 1800-60 trends in navigation employment. It appears unsatisfactory, however, for two main reasons. The 1860 Census actually reports less employment in the major navigation occupations than does the 1850 Census: 96,000 for mariners, fishermen, sailors, and boatmen as against 116,000. Yet the documented tonnage in 1860 was fully 55 per cent greater than in 1850.<sup>146</sup> Tonnage of American vessels cleared was 135 per cent greater, with ships making more passages during the course of the year.<sup>147</sup>

It is quite unlikely, under the circumstances, that employment in 1860 should have been below that in 1850, and in addition lower than that for 1870, when the decline in the merchant marine that began during the war years was well under way. The explanation of the Census count may simply have been that so many voyages were under way in midsummer 1860 that the sailors were not at home to be counted by the enumerators—and, mostly being unmarried, were not reported to the Census enumerators by wives or relatives.

What about the third category of information on employment in navigation—namely, contemporary reports, surmises, and wishful hypotheses? We can begin with the year 1810.

In protesting an increase on import duties in 1824, a committee of Boston merchants—their number including not merely William Gray and Nathaniel Thorndike, but Daniel Webster, Nathan Appleton, and Abbott Lawrence<sup>148</sup>—was clearly concerned with emphasizing the importance of the export trade. We may, therefore, take as a maximum or reasonable estimate their assertion that “one seaman is required on an average, for every twenty tons” of shipping—yielding their figure of more than 71,000 employed in 1810.

In 1815, Josiah Quincy estimated that the nation possessed 120,000 seamen each worth \$500 a year to the country.<sup>149</sup> Study of his language suggests the likelihood that he was speaking of all those competent as fishermen, and of the fishing interest he was then engaged in magnifying and lauding. One must assume that he included the Haverhill cobbler or the Barnstable artisan who fished part of the year. This is the only explanation of a figure far above that for 1850, when our documented tonnage

<sup>146</sup> *Historical Statistics*, 1949, p. 208. The data for 1849 and 1859 were used. The tonnage data was as of December 31, while the Population Census was taken as of June 1, 1860.

<sup>147</sup> *Report on Commerce and Navigation: 1850*, p. 284; 1860, p. 532.

<sup>148</sup> *American State Papers, Finance*, IV, p. 470.

<sup>149</sup> *Speech of Hon. Josiah Quincy in the House, January 25, 1812*, Alexandria, 1812, p. 10. Quincy quotes Congressman Reed as to the valuation of our tonnage, adds his own surmise as to seamen.

was enormously greater. (Of course in 1815 a further factor was at work: the overloading of vessels during wartime in order to provide a crew to handle prizes.<sup>150</sup> But numerically this can hardly have been a major factor.

For 1816, however, we have the much more reasonable estimate of 70,000 men, made by the Secretary of the Treasury. As the officer responsible for the registration of all ships, the publication of our figures on foreign trade, and the collection of hospital money from mariners, he must be considered a preferable source.<sup>151</sup>

For the early 1830's we have a number of estimates. As of 1829, the Secretary of the Treasury reported for each state on the number of vessels and "the seamen usually employed in navigating the same which belonged to each state or territory." His figure for December 31, 1829, was 61,672.<sup>152</sup> As his entries of 22 men for Ohio and 262 for South Carolina indicate, however, it would appear that employment on rivers and canals (and seagoing employment in vessels not large enough to be licensed by the Treasury) was probably omitted. For December 1834, Secretary Woodbury, of the Treasury, made another report, finding "our whole number of seamen of every kind, exclusive of about five thousand in the navy is computed to be seventy-five thousand."<sup>153</sup> It will be noted that unlike the earlier report, whose estimate is tied to the listed vessels, this purports to include all seamen "of every kind"—the difference presumably explaining the difference of 13,000, rather than any marked gain in employment.

For January 1833, we also have an estimate by Chairman Reed of 70,000.<sup>154</sup> A week later, however, another Congressman, Pearce of Rhode Island, found 80,000 seamen working at \$10 a month—the same figures as appear in a memorial from his constituents, published elsewhere.<sup>155</sup>

<sup>150</sup> In 1813 the Grand Turk had a complement of 120 men in a boat half the size of one launched in 1916—for a crew of 7. Cf. Robert R. Peabody, *The Log of the Grand Turk*, 1926, p. 223.

<sup>151</sup> Adam Seybert, *Statistical Annals*, p. 315. Presumably it is this same estimate that is quoted in Franklin D. Scott, editor, *Baron Klinkowstrom's America, 1818-1820*, 1952, p. 169. The Baron (a lieutenant colonel of the Swedish fleet) toured the U.S. in 1818-20, eyes open and pen in hand.

<sup>152</sup> 21st Congress, Second Sess., Sen. Doc. 76, *Report of the Secretary of the Treasury, Commerce and Navigation of the U.S.*, pp. 284-285.

<sup>153</sup> 23rd Congress, Second Sess. Sen. Doc. 7, Serial Set 266, *Report from the Secretary of the Treasury on . . . Marine Hospitals in the United States*, December 8, 1834, p. 2.

<sup>154</sup> Gales and Seaton, *Congressional Globe*, January 22, 1833, p. 1189. Reed estimates more than 300 ships, over 100,000 tons, with an annual fitting out cost of \$1.9 million exclusive of labor, a value of ships and outfits of \$7 million.

<sup>155</sup> *Ibid.*, January 30, 1833, p. 1519. Pearce estimates 2 million tons of registered and enrolled shipping, slightly above the official figure, worth \$30 per ton. The memorial appears in 22nd Congress, Second Sess., 1832-33, Doc. 101, Serial Set 234, p. 4.

For 1839 Chairman Reed estimated the total then at 109,000 men.<sup>156</sup> However, according to the same source, the *New York Herald* of January 1845 estimated 7,000 seamen in the navy, 17,000 on whalers, and 44,000 merchant seamen—or 68,000 exclusive of fishermen.<sup>157</sup>

In the same year, Captain Marryat adopted Henry Carey's figure of  $4\frac{1}{3}$  seamen per 100 tons, and applied this to the documented tonnage estimate of 86,000—or well below Chairman Reed's estimate.<sup>158</sup>

As a final sample of *ad hoc* estimation we may refer to the estimate of a Navy surgeon, who found that "the number of persons employed as seamen and boatmen, including those engaged in the cod, whale, and other fisheries, is not less than 160,000."<sup>159</sup>

The decisive movement in the preceding figures is given by the components for coasting and foreign trade. Our implicit ratios for these categories may be compared with various contemporary reports. As of 1818, Seybert estimated six men per 100 tons in foreign and coasting trade.<sup>160</sup> In 1821, the Committee on Manufactures quoted and accepted a statement of the Mercantile Society of New York, giving ratios of 6.6 in coasting, 5.0 in the West India trade and 4.8 in the European trade.<sup>161</sup> In 1820 and 1824, committees of Boston merchants found five seamen "required on an average" for every hundred tons, both then and in 1810.<sup>162</sup> More than a decade later, in 1836, the same ratio continued to be used.<sup>163</sup> And the Andrews report, as of 1853, also implicitly adopted this ratio.<sup>164</sup> This over-all ratio of fifty men for every 1,000 tons in the early years compares favorably with our over-all foreign trade ratios of forty-five men in 1830 and forty-eight in 1839. Our 1870 ratio of twenty-nine may be compared with the later figure of thirty-five estimated by David A. Wells in 1890 (for sailing vessels of 200-300 tons).<sup>165</sup>

<sup>156</sup> Quoted in *Remarks on the Scarcity of American Seamen and the Remedy, by a Gentleman Connected With the New York Press*, New York, 1845, p. 17. Possibly he was misquoted.

<sup>157</sup> *Ibid.*, p. 24.

<sup>158</sup> Captain Frederick Marryat, *A Diary in America* (New York, 1839), I, p. 183. Marryat estimated the British ratio at 5, from his own knowledge.

<sup>159</sup> William S. W. Ruschenberger, *Remarks on the Condition of the Marine Hospital Fund . . . by a Surgeon U.S. Navy* (Philadelphia, 1848), p. 9.

<sup>160</sup> Adam Seybert, *Statistical Annals*, Philadelphia, 1818, p. 35.

<sup>161</sup> *American State Papers, Finance*, III, Report of the Committee of Manufactures, January 15, 1821, p. 643.

<sup>162</sup> *Report of the Committee of Merchants and Others of Boston on the Tariff*, Boston, 1820, p. 13. *American State Papers, Finance*, IV, p. 470.

<sup>163</sup> Daniel Drake, "Report on Ohio Hospitals," in 24th Congress, First Sess., House Doc. 195, 1836.

<sup>164</sup> 32nd Congress, First Sess., Senate Exec. Doc. 112, *Andrews Report on Trade and Commerce*, 1853, p. 834.

<sup>165</sup> David A. Wells, *Recent Economic Changes*, 1890.



Peering circumspectly into the morass of data noted above, what can we conclude as to the numbers employed in navigation? For 1816 we have a reported figure by the Secretary of the Treasury that is within 2 per cent of the present estimate based on clearance data, as is the 1829 estimate of the then incumbent Secretary. For 1834, Secretary Woodbury's figure falls between that estimated here for 1830 and 1840, as does Chairman Reed's figure. For 1839 Chairman Reed estimated a figure within 5 per cent of the figure given here for 1840. And finally, Navy Surgeon Ruschenberger's figure of 160,000, published in 1848, is within 2 per cent of that estimated here for 1850. We regretfully differ with an unnamed gentleman from the *New York Herald* and with the good Captain Marryat, the latter using much the same procedure as ours, but relying not on clearance data for his ratio but on Henry Carey's figure of 43. We note, finally, that the present figures implicitly assume the equivalent of full time activity in our interpolating series—tending to overstate marine employment. In the other direction, however, we omit employment in nondocumented vessels—whether small fishing vessels, broadhorn arks, or sloops navigated by men whose primary work was farming or cobbling shoes. The assumption that these contrary biases more or less cancelled is hopefully demonstrated by the great similarity between the present estimates, derived from clearance data, and the *ad hoc* estimates noted above.

#### NAVIGATION EMPLOYMENT: 1870–1960

For 1870–90, employment was estimated as the sum of employment aboard sailing vessels, steam vessels, and unrigged vessels.

For sailing vessels the ratio of men per 1,000 tons in 1870, 1880, and 1890 is computed in connection with the productivity estimates and discussed in the section on that subject. These figures applied to the U.S. documented tonnage under sail give sailing vessel employment.

For steam vessels employment in 1880 and 1890 is reported by the Census of Water Transportation. For 1870 we compute a ratio of 57 men per 1,000 tons, interpolating between the 70 figure available for 1851 and the 51 figure implicit in the 1880 Census data. Applying this to the documented tonnage total gives steam vessel employment in 1870.

For unrigged vessels we extrapolate to 1870–90 the 7,129 total employment on such vessels in 1906 by changes in documented tonnage of canal boats and barges.

The resultant 1870 estimate of 137,000 appears consistent with a contemporary estimate by Joseph Nimmo, Chief of the Division of

Tonnage of the Treasury's Register's Office.<sup>166</sup> Nimmo estimated 36,300 men in American vessels engaged in foreign trade—or 36 per cent of the present total, which may be compared with the 35 per cent that foreign trade vessels constituted of total foreign plus coastwise and internal tonnage.<sup>167</sup>

For 1906, 1916, and 1926, we adopt the Census totals, merely adjusting the 1906 Census to include fishing and yacht employment.<sup>168</sup>

For 1900, 1910, 1920, and 1930, we interpolate between the above data by documented tonnage totals, exclusive of canal boats and barges—the exclusion reflecting the trivial amount of employment associated with the fairly substantial tonnage of schooner barges, tugs, etc.

The 1930 total is extrapolated to 1940-60 by the full time employment estimates of the national income accounts.<sup>169</sup>

#### GAINFUL WORKERS IN MINING: 1800-1900

We extrapolate a 1900 benchmark to earlier decades by a series reflecting the trend of employment in coal, iron, precious metals, lead, stone, and salt mining.

1. For the trend of employment in coal mining we adopt the Census of Mining totals for 1840-70, extrapolating to earlier years by the 1840-60 regression of employment against a weighted series for coal production.<sup>170</sup>

2. For iron mining we take the total for the 1850-70 Census of employment in mines, extrapolating back by the trend of pig iron shipments.<sup>171</sup>

3. For precious metals the 1870 Census of Mines is clearly too low and we use instead the Population Census reports for 1850-70, giving the

<sup>166</sup> Nimmo is quoted in 41st Congress, Third Sess., House Executive Document 76, *Letter from the Secretary of the Treasury: Foreign Commerce and the Practical Workings of Maritime Reciprocity*, February 1870, p. 30.

<sup>167</sup> An estimate of 100,000 in coasting and internal navigation for 1870 may be a reasonable figure, but it is not clear from Nimmo's estimate of 36,300 men aboard American vessels, and 45,372 aboard foreign vessels engaged in the U.S. foreign trade, just what the basis or purpose of his estimate was.

<sup>168</sup> 1926 Census, p. 21. The yacht employment total is given on page 5 of the 1906 *Census of Transport*.

<sup>169</sup> U.S. Office of Business Economics, *National Income*, 1954 Edition, Table 26; *U.S. Income and Output*, Table VI-13; and *Survey of Current Business*, July 1962, Table 53.

<sup>170</sup> Employment and coal production, 1840-70: *Historical Statistics*, 1960, pp. 349, 357, 360. We reduce bituminous tonnage by one-third before adding it to anthracite to reflect the difference in tons produced per man for each type as indicated by data in the 1870 Census, *Industry and Wealth*, p. 760.

<sup>171</sup> *Ibid.*, pp. 401, 407, 768. *Historical Statistics*, 1960, p. 366.

total count of miners in California and Colorado.<sup>172</sup> For those years there was no precious metal mining of numerical consequence outside those states, while virtually all mining in the two states was for precious metals. For 1840, gold production figures and the (inadequate) Census of Mines alike suggest a trivial number in mining—under 1,000. For 1830, however, we must reckon with a widely reported, if short-lived, mining boom from 1829 to 1831—when substantial gold deposits were discovered in Georgia and the Carolinas. The major historical consequence is associated with the displacement of the Indians from Georgia, but the discoveries did briefly affect the gainful worker totals. Her Britannic Majesty's attaché in Washington in 1832 reported that men "are flocking to the mines from all parts and find ready employment," and he estimated 20,000 hands so employed.<sup>173</sup> A contemporary Congressional report found 6,000 to 7,000 engaged at times in mining gold in Georgia, but not more than 100 at other times.<sup>174</sup> We take contemporary figures of \$2.50 worth of ore raised per day per hand, divide into the mint receipts for the year to get less than 1,000 full-time employees.<sup>175</sup>

4. For lead mining the 1840–70 Censuses report about 1,000 employees, possibly missing some considered as self-employed contractors.

From contemporary reports we find less than 500 in 1811, about 1,200 in 1819 and about 2,000 persons in all branches—mining, smelting, and transporting—in 1826, though "part of their time is devoted to farming."<sup>176</sup>

5. For stone we sum Census reports on employment in granite, marble, and other stone mining for 1840, 1850, and 1870.<sup>177</sup> For 1860 employment was estimated as 79 per cent of the number employed in granite and marble manufacturing—the same ratio as for 1870.<sup>178</sup> This procedure gives an 1860 total about halfway between 1850 and 1870, or much the same

<sup>172</sup> 1850 Census, *Statistics of Progress*, p. 976, for California. Gold was not discovered in Colorado until later years and we assume 0 in 1850. 1860 Census, *Population*, p. 668. 1870 Census, *Population and Social Statistics*, p. 820.

<sup>173</sup> William G. Ouseley, *Remarks on the Statistics and Political Institutions of United States*, Philadelphia, 1832, p. 172. Ouseley estimates 20,000 hands and \$100,000 weekly value.

<sup>174</sup> U.S. Congress, Serial Set 210, Report 82, *Assay Offices, Gold Districts, North Carolina and Georgia*, p. 26.

<sup>175</sup> Yield per hand from *ibid.*, pp. 24, 29. Mint data from *1850 Report of the Secretary of the Treasury*, p. 138.

<sup>176</sup> For 1811, H. M. Brackenridge, *Views of Louisiana*, Baltimore, 1817, pp. 125, 267. For 1819, Henry Schoolcraft, *A View of the Lead Mines of Missouri*, New York, 1819, p. 127; and *American State Papers, Public Lands*, Vol. III, p. 663. For 1826, *ibid.*, Vol. IV, p. 558. A 1,200 estimate appears in *Steeles Western Guide and Emigrants Directory*, Buffalo, 1836, p. 96, making 3 million pounds annually.

<sup>177</sup> 1840 Census, *Compendium*, p. 359. 1870 Census, *Statistics of Industry and Wealth*, Vol. III, pp. 468, 769.

<sup>178</sup> 1860 Census, *Manufactures*, p. 738. 1870 Census, *Statistics of Industry and Wealth*, pp. 396, 769.

result as if the Population Census count of stone and marble cutters plus quarrymen had been used for interpolation.<sup>179</sup>

6. Rough estimates for the minor category of salt mining were made.<sup>180</sup>

We sum the above six series and use the total to extrapolate our 1870 benchmark for mining employment. We take our 1900 benchmark for employees in mining (derived in connection with the employment estimates for 1900 ff.) and extrapolate to 1870 by the Decennial Census of Population totals for miners and quarrymen.<sup>181</sup> We then extrapolate the 1870 figure by the sum of the six series obtained above. For 1800 we arbitrarily assume 10,000 as compared to the 11,000 in 1810 derived by the above procedure.

#### CONSTRUCTION: 1840-1900 (DECENNIAL)

For 1850-1900, the logical starting point for extrapolating the 1900 construction employment total is the set of Population Census reports on the number of gainful workers in the major construction trades for the decennial years.<sup>182</sup> The important group of construction laborers must be omitted because it was never separately reported by the Census, being mixed in with totals for laborers in manufacturing, service, transportation, etc.<sup>183</sup>

How reasonable is the trend shown by these figures? Since it is possible to rationalize virtually any trend, we must seek an external check on the data. One check we use is the value of construction materials (constant dollars) per construction worker; by using Shaw's estimates we find a reasonable trend in the 1870-1910 data.<sup>184</sup> A second check is indicated

<sup>179</sup> The *Seventh Census*, pp. lxxv, lxxvii. 1860 Census, *Population*, pp. 673, 677. 1870 Census, *Manufactures*, p. 821.

<sup>180</sup> Data for 1840 from the 1840 *Compendium*, p. 359; 1850 *Compendium*, p. 183; 1870 Census, III, p. 622. Running between 2,000 and 3,000 for these years, the total was taken as 2,000 for earlier dates.

<sup>181</sup> 1900 Census, *Occupations*, pp. xlii, xliii, lviii, lix. The Census of Mines and Quarries gives broadly similar results, but its incomplete coverage of precious metal mining and small-scale operations in the earlier years makes the Population source a preferable one.

<sup>182</sup> We use the data for carpenters, masons, plasterers, painters, electricians, plumbers, paper hangers, roofers. For 1870 ff. we use the summary in Edwards, p. 105. For 1850 and 1860, that in the 1900 Census, *Occupations*, p. vii.

<sup>183</sup> Edwards attempts a figure for laborers in the "building, general and not specified category," but even for this broad group his estimates are labeled as "largely estimates" (cf. *Comparative Occupation Statistics*, p. 105, n. 44 and p. 144). "Building contractors" are likewise intermingled with "manufacturers" in the reports. Carson's estimates for laborers in construction have no external basis of support and he apparently does not use them in creating his construction estimate.

<sup>184</sup> William H. Shaw, *Value of Commodity Output since 1869*, 1947, p. 76. These data are essentially summaries of Census of Manufactures reports, with allocation of mixed commodities and deflation by Shaw's price index. The materials per mechanic beginning with 1869 are estimated (in thousand dollars) as follows: 6.0, 8.1, 12.7, 11.4, 12.3.

because of the difficulty of properly deflating the value of product data. For this check we relate employment of carpenters to employment in the factories producing carpentry materials, of masons to that of brick factories, etc.<sup>185</sup> The trend in each set of ratios, while less reliable because such an approach implies parallel productivity trends in both industries, is stable enough to confirm some major shifts of absolute level in the separate gainful worker series that are questionable a priori. Construction employment was therefore estimated by extrapolating 1900 employment by the trend in the specified trades, taken as a group.

For 1840, the relationship between construction employment for 1850–1910 and the number of white families was computed, and the figures proved to have a narrow range.<sup>186</sup> We use the 1850 ratio for estimating 1840 from the figure for white families. The resultant estimate for 1840 is much the same as using an average of 1850–1910 ratios. It is likewise within a few percentage points of an estimate arrived at simply by fitting a least squares trend to the absolute number of construction employees 1850–1910, and extrapolating to 1840.<sup>187</sup>

Since we are dealing with the 1840 figure, irregular trends arising from the construction of railroads are no problem. For roads and turnpikes we assume, in the absence of knowledge, a closeness of trend so that the growth of this volume of social capital is assumed to parallel the growth in white families. The canal frenzy of the 1830's was ended by 1840, nor had the volume involved been great. At the peak of construction in Ohio, Pennsylvania, and Maryland in the early 1830's, less than 30,000 persons were at work—and allowing for the lack of work during the winter months, the full time equivalent would have been substantially less.

Finally we may compare our estimate of 210,000 employed in construction in 1840 with the 85,501 employed in house construction in 1840 according to the Census of that year.<sup>188</sup> The implication that 41 per cent of

<sup>185</sup> Manufacturing employment data are from the 1900 Census of Manufactures, I, pp. 11 and *passim*; 1870 Census, pp. 396, 402, 403, 407.

<sup>186</sup> White families were estimated in connection with the present series for domestic servants. The figures rest ultimately on Population Census count of families, as adjusted. The number of white families per person in the trades used above was as follows for Census years 1850–1910: 11.7, 13.3, 11.4, 12.9, 9.9, 11.2, 10.6.

<sup>187</sup> Since an increasing volume of construction reflected streets and industrial buildings in the cities, the ratio of construction mechanics to urban population was likewise computed, but the results have a wider range over the decades, hence are inferior for extrapolation. Allowances for variations in canal, road, and railroad construction are obviously not worth making. If we had sound data for such activity and building construction, a direct estimate would have been made in the first place. The limited coverage of the building permit series makes their use equally pointless.

<sup>188</sup> *Compendium of the Enumeration of the Inhabitants and Statistics of the United States*, Thomas Allen, ed., 1841, p. 364.

all construction employees were engaged in house construction may be compared with the 37 per cent ratio of nonfarm residential to gross construction in the 1869-78 period, the earliest shown by the Kuznets estimates.<sup>189</sup> The encouraging similarity simply tells us that the basic Kuznets data for this later period do not suggest any obvious inadequacy in our estimate.

The pathbreaking work by Daniel Carson for 1870 and after constitutes the major previous estimate for this industry, his figures having been used with almost no change by Fabricant, and his trend having been used with little change by John Kendrick.<sup>190</sup> Carson uses much the same group of mechanics' occupations for interpolations and secures similar results for trend.<sup>191</sup> (His absolute figures differ markedly, because he relies on Population Census levels, which are drastically different from those in the establishment-benchmarked series of the BLS beginning in 1929, as well as those in the National Income Division estimates for 1929 and after.)<sup>192</sup> Since the present estimates were tested against Shaw's materials output, they will also be reasonably consistent with Kuznets' output figures for the period, the movement of the latter series being essentially that of materials output.<sup>193</sup>

#### MANUFACTURING EMPLOYMENT

##### *Wage Earners*

Estimates of manufacturing employment presented below are intended to reflect trends in factory employment. The growth of the factory system as an employer of manpower can be seen in its most useful single dimension by such a measurement. We do not, therefore, rely on the Population Census materials, which comprehend, at all times, employment in small

<sup>189</sup> Kuznets, *Capital in the American Economy*, Part C. We use gross construction in 1929 prices from his Table 15 and nonfarm residential data for 1871-78, averaging the latter 5-year moving averages.

<sup>190</sup> Carson, p. 47, and Fabricant, p. 42, in *Studies in Income and Wealth*, 11; John W. Kendrick, *Productivity Trends in the United States*, Appendix A, Table A-VII and Appendix E. Kendrick relied on an earlier version of the present estimates for deriving his intercensal figures for 1900 ff. and for a revised 1920 benchmark, but uses Carson for 1870-1910 decennial trends.

<sup>191</sup> Carson, in *Studies in Income and Wealth*, 11, pp. 115, 117. He also includes "builders and contractors," but since Census reports confused that group with "manufacturers" there is no basis for making a reliable estimate of their number, nor for using it to give added illumination here.

<sup>192</sup> His 1930 figure of 3.0 million compares with an NID figure of 2.2. Hence, all his figures are much above the present ones.

<sup>193</sup> Kuznets' data in his *Capital in the American Economy* move largely as do the construction figures in his *National Product Since 1869*, New York, NBER, 1946. These reflect a constant percentage margin added on to Shaw's output data, plus minor inventory adjustment.

handicraft shops. While there is certainly distinct value in a really comprehensive measurement, it is difficult to separate out of the Population Census materials a moderately clean-cut category, so that we can say—this is the definition of manufacturing employment, or factory employment, or productive activity that is comprehended under the category for which we present figures.

Even in the measurement of factory employment that derives from a factory Census we have serious limitations. In the early decades the Gallatin report, or the early Censuses, intermingled factory employment with employment in homes under the putting out system and under contract. This, of course, was the way the factory system did develop. But it is difficult to see how one could usefully add up employment of persons working twelve hours a day in a factory with that of women binding shoes at home for a few hours each day. In any event, the course we attempt here is simply to measure employment in factories exclusive of hand trade activities, such as saddlers, photographers, mechanical dentists, blacksmiths, and others included at various times. The resultant series will show a sharper transition from handicraft to factory activity than would be measured if we had some means of measuring hours of input and units of output under home and factory conditions.

1840. The Census sought to measure comprehensively all factory production, as well as output in fishing and other industries that would now be considered under other headings. We estimate employment under two headings: that reported by the Census and that not reported.

Employment is reported by the Census for about 80 per cent of total factory production. We sum employment as reported for cotton, wool, iron, tanneries, furniture, mills, breweries, and many lesser industries.<sup>194</sup> For some 221,000 employees thus covered (excluding the 72,000 in cotton textiles), the average value of product per employee is approximately \$1,000. Dividing this \$1,000 average into the value of product for which no employment data are given, we derive employment in this category.<sup>195</sup> The combination of both categories gives an employment total of 471,000. We round to 500,000 as a means of allowing for remaining omissions—primarily of small proprietors—and to emphasize by the even half million the arbitrariness of any figure for this industry at this period.

1810. We estimate employment in this year as the total of the six major components. (1) Cotton textiles and (2) iron manufacturing are both

<sup>194</sup> 1840 Census, *Compendium*, pp. 358 ff. By including all iron employment we undoubtedly include some iron mining and woodcutting employment. We exclude, however, employment in house construction, though shown under manufacturing.

<sup>195</sup> The value of product data are taken from the *Report of the Secretary of the Treasury on Finances for the Year Ending 1855*, p. 93.

estimated as described in the sections below. (3) For the largest single employment category—mills—we make separate estimates for grain mills and other. For grain mills we compute the number of mills and bushels of grain ground in both 1810 and 1840, the result suggesting approximately 5,000 bushels ground per mill per year at both dates.<sup>196</sup> From the estimates of the consumption of wheat at both dates, as made by Towne and Rasmussen,<sup>197</sup> we then derive the number of mills in 1810 more accurately than the incomplete 1810 Census would indicate. We then extrapolate the 1840 Census count of mill employment by the percentage change in mills between the two Censuses. We then apply the same percentage change to the 1840 employment in saw and oil mills, implicitly making the same assumption for these products as Towne and Rasmussen did for wheat, i.e., that population change accounts for change in final takings. (4) For breweries the 1810 product total is somewhat above that for the 1840 Census, but the price index of spirits was also greater, so that we take the trivial change in production to reflect a constant employment total.<sup>198</sup> (5) For woolens even Gallatin could state no more enthusiastic an evaluation of woolen manufacturing in 1810 than that “there are yet but few establishments for the manufacture of woolen cloths.”<sup>199</sup> Taking the partial data listed, and allowing for various incompletenesses in reporting, one can estimate 400 factory employees, approximately 1,000, when home workers are included.<sup>200</sup> (6) The product in the balance of manufacturing in 1810 is estimated at \$62 million.<sup>201</sup> For this group we assume the same value of product per person engaged as that for mills, the two being similar in 1840.<sup>202</sup> The summation of the above groups comes to 61,000, which we round to 65,000 to include

<sup>196</sup> For 1810 data appear in *American State Papers, Finance*, II, p. 761. The fullest reports are those for the counties of Pennsylvania and we take those where both number of mills and bushels and barrels are reported. (We convert one barrel as equivalent to 3.4 bushels.) For 1840 we use Pennsylvania figures from the *Census Compendium*, pp. 140, 152.

<sup>197</sup> *Trends in the American Economy in the Nineteenth Century*, p. 294. Their data reflect primarily the change in the population.

<sup>198</sup> Output data from 1900 Census of Manufactures, Part 1, pp. li, lii. Price data from *Historical Statistics*, 1960, p. 115.

<sup>199</sup> *American State Papers, Finance*, II, p. 427.

<sup>200</sup> From the data Gallatin gives on page 434 one can compute yards made per worker and per establishment. Expanding the more comprehensive reports from the final Digest (p. 691) one can estimate total production of 240,000 yards. A later, but authoritative, reading of this source finds “nearly 200,000 yards produced.” 50th Congress, First Session, H.D. 550, *Wool*, 1888.

<sup>201</sup> 1900 Census, *Manufactures*, I, p. li. The total for manufactures in this source is between the preliminary and final figures given in *American State Papers*, pp. 712, 713.

<sup>202</sup> The relevant 1840 groups are leather and tanning, which average \$1,270 in 1840 compared with \$1,250 in mills, and smaller amounts for building materials and furniture.



proprietors in minor omitted categories (prices for which changed little according to Warren and Pearson); building materials (prices for which were likewise much the same); and furniture (for which it was also assumed that prices were stable). We therefore adapt the 1840 product per employee figures and apply to 1810 product totals. Summing these categories gives us 75,000 employment.

1850-60. The Census of Manufactures provides totals that require an infinity of adjustments in principle, but little adjustment in practice. As the factory system developed, the shading between hand trades, service, and manufacturing became progressively more difficult to discern. The Census included an unknown number of shoe repairers together with shoe factory operatives, for example. Moreover, the definition of manufacturing was broad enough to encompass iron mining, fisheries, plumbing, and mechanical dentistry. Three adjustments can be singled out for notice.

1. Inclusion of nonmanufacturing categories such as iron mining, fishing, etc., can be handled by deducting these from Census totals.<sup>203</sup>

2. For major hand-trade categories, such as boot and shoe, bakery, blacksmith, wheelwrights, tobacconist, examination of the ratio of male to female operatives in these and later years, and comparison with the Population Census totals (for 1850-70) for related occupation titles suggests that the Census covered few except bona fide factory operatives. A considerable number of males were reported for these industries in the Population Census, but not in the Census of Manufactures. Yet the ratio of shoemakers to population must, after all, have an upper limit.

3. It is well known that enumeration in recent years of industries with characteristically small establishments—e.g., sawmills—is a peculiarly difficult business. Even with vast improvements in roads, means of enumeration, lists, and skills, we still fail to enumerate such categories at all well. How much less comprehensively the Censuses of a century ago must have covered such categories as small shoe repair shops. This consideration gains particular force from the practice of excluding all establishments with under \$500 in manufacturing activity—an exclusion that would have kept out a far greater proportion of these essentially service activities than one assumes at first blush. To the extent that there was coverage of such establishments, it helps to compensate for the undoubted failure of the *ad hoc* Census organizations of the time to do an adequate job of covering what they purported to cover.

<sup>203</sup> The following categories are subtracted in one or more of the years under review: carpentering, coal mining, fishing, gold mining, stone quarrying, copper mining, iron ore, millinery, dentistry, masonry, painting, photography, plastering, plumbing. Totals, and all adjustment items, from 1870 Census, *The Statistics of the Wealth and Industry of the United States*, III, Table VIII B.

We therefore accept the Census reports, excluding only categories clearly to be omitted from the purview of manufacturing, and assume that the small amount of overcoverage of cobblers and hand trades helped offset the failure to get a comprehensive coverage of those properly included.

*1870-1900.* A recent very careful study by Richard Easterlin provides the basis of the wage-earner estimates.<sup>204</sup> We adjust his results only for 1880.<sup>205</sup>

The estimates made above for 1850-1900 were all adjusted in the same ratio as the 1900-29 figures were (in the manner described in the section on annual estimates of employment, 1900 and following). Essentially this adjustment is one for undercoverage in the Census of Manufactures enumerations. It reflects the percentage difference between total employment as enumerated by the Census of Manufactures and that reported by the Social Security system in the late 1930's and 1940's before the Census utilized the Social Security lists of employers in checking the completeness of its coverage. We have little basis for varying the ratio to earlier years. On the one hand, Census enumerators were less well trained than nowadays. On the other hand, factories were then much more noteworthy phenomena, particularly since the Census of Population and Manufactures enumerations were then combined.

### *Persons Engaged*

The wage-earner totals for 1810 and 1840 having already been rounded upward no separate addition is made for proprietors or salaried workers in 1810-40.

For 1850-90, persons engaged were estimated by adding to the wage-earner totals 150 per cent of the count of establishments for the same industries. This ratio is that prevailing in 1890. Since it is somewhat below that for 1900-10, it is more appropriate for use in earlier years,

<sup>204</sup> In Lee *et al.*, *Population Redistribution*, p. 636. Data on page 623 of this study will differ from ours, being derived from the Population Census. The totals, presumably inclusive of self-employed and salaried workers, are nonetheless below the wage-earner count of the Manufactures Census as adjusted by Easterlin.

<sup>205</sup> For 1880 we increase the total to allow for employment in the periodical press, omitted by the Census in that year. The reported newspaper employee group as a per cent of all printing employees ran to about 44 per cent in 1870, and to 65 per cent in both 1890 and 1900. (Computed from data in 1870 Census, III, p. 397; 1890 Census, VI, Part 1, p. 105; 1900 Census, VII, Part 1, p. 368.) We assume 50 per cent in 1880, so that the omitted category was assumed equal to the reported printing group of 58,506 (1900 Census, VII, Part 1, p. 13). The 1870 Census explicitly covered the press, reporting 13,130 employees. We make no adjustment for the still smaller group prior to that date. Adjustments for 1850-80 are made by Robert E. Gallman in *Trends in the American Economy*, 1960, p. 58.

when most other persons were proprietors, and the salaried group was of limited size.

For 1900, the ratio of proprietors and firm members to establishments was extrapolated from 1909 and 1904, while the count of salaried personnel was available from the Census.<sup>206</sup>

The 1850–1900 data thus derived were increased in the same percentage for undercoverage as the wage-earner data for these decades—on the assumption that the percentage undercoverage of establishments in the days of smaller establishments was similar to that for wage earners.

#### COTTON TEXTILE FACTORY EMPLOYMENT

We estimate cotton textile employment for 1800 at 1,000, for the convenience of having a round number—although the total in the industry was almost certainly less than this sum. The estimate was arrived at by using data for later years, as follows.<sup>207</sup>

	<i>Operatives Per</i>		<i>Spindles</i>
	<i>1,000 Spindles</i>	<i>Bale of Cotton</i>	<i>Per Bale of Cotton</i>
1805	—	—	5
1815	100	1	4.5
1831	48	3	4.8
1860	23	12	—

We have an estimate by John Whipple (owner of the Hope Textile Mill in Providence) of 5,000 spindles in the industry in 1806.<sup>208</sup> His total is much the same as the 4,000 estimated for 1807 by Zechariah Allen (and quoted by Samuel Batchelder, one of the earliest manufacturers in the industry), and the 4,500 for 1805 as estimated by Secretary of the Treasury Woodbury.<sup>209</sup>

For 1805 we then compute spindles per bale of cotton using Whipple's 5,000 spindle figure and the 1,000-bale cotton consumption estimate made by the Committee on Commerce and Manufactures.<sup>210</sup> This gives a ratio much the same as that for 1831. Applying the ratio to the 500 bales consumed in 1800 gives 2,500 spindles. This figure is confirmed by Clark's itemization of the eight operating mills in 1800, working—he

<sup>206</sup> Proprietors equaled 103 per cent of establishments in 1909, 105.5 per cent in 1904, and were taken as 105 per cent in 1899.

<sup>207</sup> Computed from sources noted below in connection with estimates for each year.

<sup>208</sup> Gales and Seaton, *Register of Congressional Debates*, January 30, 1833, col. 1511.

<sup>209</sup> Samuel Batchelder, *Introduction and Early Progress of the Cotton Manufacture in the United States*, 1863, p. 53. Woodbury Report, 24th Congress, 1st Session, House Doc. No. 146, *Cotton*, p. 51.

<sup>210</sup> Quoted in *Addresses of the Philadelphia Society for the Preservation of National Industry*, Philadelphia, 1819, p. 165. Also, *Niles' Register*, Vol. 9, p. 448.

guesses—"less than 2,000 spindles."<sup>211</sup> Assuming that the 1805-15 constancy in the spindle-bale ratio suggests that technological change during this preliminary period of the industry was limited, we may use the 1815 ratio of operatives to spindles to estimate 500 operatives in 1800. For convenience, and to emphasize the limitations of our knowledge, the figure is rounded to an even 1,000.

For 1810, Gallatin's summary of the 1810 Census gives a total for mills of 80,000 spindles and 4,000 employees.<sup>212</sup> We double that figure to include home weavers, giving a full-time equivalent figure of 100 employees in cotton textile production per 1,000 spindles for 1810 and earlier years—half in the factories and half weaving at home. This addition is computed as follows: (1) Coxe's *Digest* has an implicit ratio of 50 factory workers per 1,000 spindles, plus 80 additional women engaged in home weaving at an average of half a day each.<sup>213</sup> (2) Data for one Providence factory in Gallatin's report imply 53 factory employees and 178 total employees, including neighborhood workers.<sup>214</sup> (3) One of the most advanced of the early factories, and apparently the first to do any substantial amount of weaving in the factory, averaged 100 employees (inclusive of weavers) some five years after the Census.<sup>215</sup> On the other hand, one of the most modern factories in 1815, but one without power looms, averaged 55 operatives per spindle in December 1815.<sup>216</sup>

For 1815, a memorial presented to the Congress in that year by cotton manufacturers stated that within thirty miles of Providence, then the center of the textile industry, there were 130,000 spindles at work,

<sup>211</sup> Victor S. Clark, *History of Manufactures in the United States*, 1929, Vol. 1, p. 535.

<sup>212</sup> *American State Papers, Finance*, II, p. 427. A comparison of the state spindle detail given on page 432 with Tench Coxe's *Digest* (printed in *ibid.*, p. 694) shows unbelievable increases in spindles for New Jersey, Maryland, South Carolina, etc., with only small increases in quantities spun in mills (p. 692). Coxe obviously included home spindles. Gallatin's data also appear in *Annals of Congress*, 11th Congress, Part 2, Appendix, col. 2227, 2228, distinguishing the actual 31,000 spindles in operation at the end of 1809 from the 80,000 projected for 1810. His figures are repeated in the Woodbury Report, p. 51.

<sup>213</sup> *American State Papers, Finance*, II, p. 669. Coxe asserts that 1,160,000 spindles and 58,000 persons would suffice to work up into yarn all the cotton produced in the United States, the weaving of which would take "100,000 women with the fly shuttle during one-half of each working day in the year. . ."

<sup>214</sup> *Ibid.*, p. 434.

<sup>215</sup> Samuel Ripley, "A Topographical and Historical Description of Waltham . . . 1815" in *Collections of the Massachusetts Historical Society*, 2d Series, Vol. III, 1815 (reprinted 1896), pp. 263-264.

<sup>216</sup> Data for the Fall River Manufacturing Company appear in William R. Bagnall, "Sketches of Manufacturing and Textile Establishments" (edited by V. S. Clark; typescript in the Baker Library of the Harvard Business School), 1908, pp. 1915-1916.

consuming 29,000 bales of cotton, with 26,000 persons steadily employed.<sup>217</sup>

Because of the urgent nature of the request for tariff protection we may assume that the largest possible total for persons affected by such protection would be reported. Was there significant employment beyond the thirty-mile radius? At this point none of the Lowell mills had yet been erected, and only limited production took place in Massachusetts. For the important textile center of Philadelphia, employment was about 2,000, according to estimates of a protectionist group similarly desirous of maximizing the count.<sup>218</sup> For the dominant production center in New York State, no more than 2,000 could be estimated.<sup>219</sup> We can thus hardly estimate more than 30,000 to 35,000 for the United States. This figure is a third of that estimated in 1816 by the Committee on Commerce and Manufactures which estimated the U.S. consumption of cotton in manufacturing at three times that of the area around Providence, and the employment at nearly four times as much.<sup>220</sup> The Committee's estimate of 100,000 is almost double the number counted fifteen years later, after the rise of Lowell, by a vigorous and alert protectionist group.<sup>221</sup> We are therefore unable to rely on these figures, either for employment or cotton consumption, as a basis for setting the 1815 level. We take 30,000 as the U.S. total in that year, adding to the 26,000 for the Providence area, an arbitrary 2,000 each for Pennsylvania and New York.

For 1820, we estimate 12,000 employed, the remarkable decline reflecting not an absence of growth in the industry but the aftermath of the

<sup>217</sup> *American State Papers, Finance*, Vol. III, p. 52. *Niles' Register*, IX, p. 190. Cf. the *Transactions of the Rhode Island Society for the Encouragement of Domestic Industry, in the Year 1863*, pp. 21 and 73, for a list of mills and spindle count in November 1815. Batchelder, *Cotton Manufacture*, p. 59, gives a slightly smaller count.

<sup>218</sup> *Circular and Address of the National Institution for Promoting Industry in the United States, to Their Fellow Citizens*, New York, 1820, p. 21. In this circular an estimate is made for 1814, 1816, and for 1819. The intent being to show the great decline to 1819, the earlier figures would, if anything, be biased upwards. Data on page 27 show that Rhode Island employment in 1816 was 15,253—hence 11,000 of the above 26,000 were outside that state.

<sup>219</sup> *Ibid.*, p. 25, gives spindles for Oneida County, which were assumed to require manpower at 200 per 1,000 spindles.

For the area around Wilmington, a promanufacturing group implicitly estimated 600 children (for less than a full year) in cotton and wool manufacturing (*Niles' Register*, Vol. 9, p. 96).

<sup>220</sup> *American State Papers, Finance*, Vol. III, p. 82. Also, quoted in *Addresses of the Philadelphia Society*, p. 166. See also, Isaac Briggs in *Niles' Register*, Vol. 9, p. 391. Niles himself takes the same figures as the Committee uses but rates the 66,000 women and children at equal to "16,000 hands fit for agricultural services." From his adjusted components one then derives a total of 54,000. *Niles' Register*, Vol. 9, p. 277.

<sup>221</sup> *General Convention of the Friends of Domestic Industry*, New York, 1831.

1819 recession. A total of 11,423 employees is reported in the 1820 *Digest of Manufactures*, to which we add an additional complement (for firms omitted by the first Census report), yielding a total of 12,000.<sup>222</sup> Despite the variety of doubts cast on the 1820 Census, its results are not unreasonable. One arrives at an 1819 figure of 5,000 in the major production centers of Rhode Island, Pennsylvania, and New York by using data from the key protectionist group that attacked the Census results.<sup>223</sup> Hence, allowing for omitted areas, a revival in 1820 would hardly bring the total above the amended *Digest* figure of 12,000.<sup>224</sup>

For 1831, a comprehensive listing of mills, output, and employment made for the New York Convention of the Friends of the Manufacturing Interest provides us with total employment.<sup>225</sup> Our only adjustment in these totals is to exclude hand-loom weavers, as not being part of the factory employment.<sup>226</sup>

For 1840-1940, the regular U.S. Census reports were used after minor adjustment.<sup>227</sup>

<sup>222</sup> *American State Papers, Finance*, IV, pp. 28 ff. These data are summarized by Edith Abbott, "The History of Industrial Employment of Women in the United States," *Journal of Political Economy*, October 1906, p. 482. We add to Miss Abbott's total, individual figures from Adams' *Letter*, 17th Congress, 2d Session, Exec. Doc. 90.

<sup>223</sup> *Circular and Address of the National Institution for Promoting Industry in the United States, to Their Fellow Citizens*, pp. 21, 25, 27, enables us to make an 1819 estimate of 5,000 for the main production centers.

<sup>224</sup> As an indication of the extreme order of magnitude that might have been involved in the 1820 Census, we can take a statement by Niles in 1823, when recovery from 1818-20 was well advanced. He states that the 250,572 spindles reported in the Census reflect "an imperfect return" but that even if the Census were not imperfect there has since been a marked rise to "not less than 330,000" (*Niles' Register*, Vol. 24, p. 34). Computing the implicit ratio for Rhode Island, from the Census, of employees per 1,000 spindles gives a figure just under 50—implying less than 13,000 employees as late as 1823.

<sup>225</sup> Printed in *Niles' Register*, Addendum to Vol. 42, March-August 1832, p. 7. These data are reprinted in a number of sources indicating their authoritative character. See, for example, Gales and Seaton, *Register of Congressional Debates*, January 23, 1833, col. 1327; 1860 Census, *Manufactures*, p. xix; 1880 Census, II, *Manufactures*, pp. 10-11. Presumably the same source lies behind figures quoted by Carroll Wright in the 1880 Census, *Manufactures* (pp. 542 ff.) although minor differences appear.

<sup>226</sup> Hand-loom weavers in Pennsylvania and New Jersey, the major remaining centers of such work, are reported by the New York *General Convention of the Friends of Domestic Industry*.

<sup>227</sup> 1840-90 data: 1890 Census, *Manufactures*, Part III, p. 186. 1919 Census, *Manufactures*, X, p. 177. 1929 Census of *Manufactures*, Part II, pp. 247, 261. 1939 Census of *Manufactures*, Vol. II, Part 1, p. 287. The 1909 Census figure was adjusted to a 1910 level by using data on the 1909-10 reduction in cotton consumption and the decline in finished textile production. Production data were from Shaw, *Value of Commodity Output*, p. 72. For 1920 and 1930 we use Kuznets' adaptation of BLS data (Kuznets, *National Income and Its Composition*, p. 598). For 1940 we extrapolate the Census total for cotton textiles by the 1939-40 change for textile mill employment (Office of Business Economics, *Business Statistics*, 1951, p. 57).

By 1950, different raw materials were used in textile production, and the same mill would work on cotton at one time, synthetics at another. As a result, the Census gives us no separate figures for cotton textile employment. We make a rough estimate, however, in order to complete the long time series, by relating (a) adjusted bales of cotton consumed in manufacturing to (b) cotton textile employment in 1909, 1919, 1929, and 1937—the regression relationship implying 350,000 employed in 1950, and 300,000 in 1960.<sup>228</sup> We divide bales consumed by an index of output per person employed in the production of textile mill products.<sup>229</sup> The adjusted figures thus derived provide for productivity trends and yield a very simple and close relationship between bales and employment.

#### IRON MANUFACTURING: WAGE EARNERS

For 1830 we have the results of a comprehensive survey by a convention of iron manufacturers.<sup>230</sup> The general reasonableness of their findings may perhaps be validated by their acceptance by Henry Clay.<sup>231</sup> But somewhat reminiscent of Russian statistics, though they appear to purvey the truth, it is not the truth we assume them to offer. Their level, 29,524, is virtually the same as that of the 1840 Census figure of 30,497.<sup>232</sup> Now the 1840 figure may reflect the doldrums of that period, but is it likely to have shown no advance in employment? We suggest that the Convention figure included, as was more or less commonly done at the time in protariff statements, all employment connected with iron production, inclusive not merely of iron mining, but also coal mining, woodcutting, carting, etc.<sup>233</sup>

As one basis for adjustment we take detailed 1832 data for 100 New

<sup>228</sup> Consumption data from *Historical Statistics*, 1960, pp. 414–415, extrapolated to 1960 by *Business Statistics*, 1961 edition, p. 189.

<sup>229</sup> The output-per-person index is from Kendrick, *Productivity Trends*, Table D-IV.

<sup>230</sup> *General Convention of the Friends of Domestic Industry*, assembled at New York, October 26, 1831, *Reports of Committees, on the Product and Manufacture of Iron and Steel*, pp. 20, 32.

<sup>231</sup> Gales and Seaton, *Register of Debates*, February 2, 1832, col. 260.

<sup>232</sup> 1840 Census, *Compendium*, p. 358.

<sup>233</sup> The convention report rests on an implicit figure of five tons of bar iron and castings produced per man in Center and Huntingdon Counties, an extremely low figure for the most efficient area in the United States if only forgers were included, but quite reasonable if all personnel were in.

In 1837 a New York State report noted that iron ore furnaces near Amenia made 10,000 tons of iron a year and employed 1,000 men as “ore diggers, coal men, teamsters, smelters, limestone diggers, etc.” This implies the same ratio of ten tons per man. New York State, Geological Survey, *Annual Report, 1837*, p. 181, State of New York, in Assembly, February 20, 1838.

Manufacturers' reports in the McLane Report, the Harrisburgh Convention in 1827, and the Iron Masters Convention in 1849 similarly appear to include nonfactory employees; and the line between manufacturing and mining continues to be difficult to distinguish even in our own day.

Jersey furnaces, from which we can estimate that 30 per cent of all wage payments per ton of bar iron went for work in the forge.<sup>234</sup>

We compute an alternative ratio from the 1880 Census. In that Census the reports included mining employees as well as those in iron manufacture, while they did not in 1890.<sup>235</sup> We take the data for furnaces working with charcoal, as most comparable with the 1840 data, and find that in Tennessee and Virginia, where the charcoal iron industry was most important, the tons of ore per hand in 1850, 1860, 1870, and 1880 were much the same.<sup>236</sup> Rising from this level (of about 60) at all four Censuses, it suddenly jumped to 368 in 1890—suggesting that this was the first Census to exclude mining employees. We make three estimates of the overcount in 1880, i.e., of the number of mining and related employees other than manufacturing workers. (a) If we assume that employees per establishment, reported at 144 in 1880 and 43 in 1890, should have been the same at both dates (and one could make an even stronger argument, since the Census reported that the 1890 establishments were larger and better equipped),<sup>237</sup> we derive a figure of 4,988 employees. (b) If we assume that capital per employee in charcoal furnaces in 1880 was 20 per cent below that in 1890—for mineral furnaces it was 24 per cent lower—the figure comes to 4,812. (c) If we assume that the employment per ton of pig iron produced was cut in half from 1880 to 1890 in charcoal furnaces as in mineral (instead of the reported 80 per cent charcoal decline), we estimate 5,224. All three procedures suggest that manufacturing employment was perhaps one-third of the reported 16,670 in the 1880 charcoal iron industry. Given the New Jersey ratio of 30 per cent and the 1880 Census one of 33 per cent, we stipulate a 30 per cent ratio for adjusting the 1831 Convention total down to a round 20,000 employment in 1830.

The Census for 1840 reports under iron, “number of men employed including mining operations,” at 30,497.<sup>238</sup> Contemporary evidence indicates that the only nonmanufacturing activities included in that total were those of iron mining.<sup>239</sup> We adjust the Census total down by the detailed New Jersey data used above.

<sup>234</sup> U.S. Congress, Serial Set 223, *Documents Relative to the Manufactures in the United States*, 1833, p. 183. A ton finished at the forge was valued at \$59.25, \$18.00 of which was for making the iron at the forge and repairs of the forge—the rest for mining and carting ore and coal, plus woodcutting.

<sup>235</sup> 1890 Census, *Manufactures*, VI, Part 3, p. 385.

<sup>236</sup> 1880, 1890: 1890 Census, *Manufactures*, VI, Part 3, pp. 407-09. Charcoal iron industry only. 1850-70: 1870 Census, *Wealth and Industry*, pp. 602-603, all iron manufacturing in specified states.

<sup>237</sup> 1890 Census, *Report on Manufacturing Industries, Part III*, p. 406.

<sup>238</sup> 1840 Census, *Compendium* (Allen edition, 1841), p. 358.

<sup>239</sup> Okeley's 1842 report, reprinted in 62d Congress, 1st Session, Senate Doc. 21, p. 499.



Pig iron production in 1810 is estimated at 20 per cent of that in 1840, and bar iron output at about 23 per cent.<sup>240</sup> With little change in the locus of the industry, or the sources of fuel and ore, in this period, we arbitrarily assume only a modest productivity gain, and stipulate 1810 employment as 25 per cent of that in 1831.

For 1800–20, we estimate, from the 5,000 level in 1810, an arbitrary 1,000 in 1800. The 1810 level is kept for 1820; although the industry did grow significantly over the decade, production fell by over one-half to the recession year of 1820.

For 1850–1900, we use Census data, with an adjustment for the Census overcount in 1880 based on considerations discussed above with respect to 1840.<sup>241</sup>

For 1910–60, because the coverage of the Census shifts over this period, and because most Census enumerations relate to the last year of the decade (e.g., 1909 rather than 1910), we have to make a number of adjustments in reported Census data. We utilize Fabricant's presentation of the Census materials for 1910–39, plus data from BLS and Census to arrive at a final series most comparable with the Census iron and steel figures for the nineteenth century.<sup>242</sup>

#### TRADE: 1840–1900

For 1870–1900, we extrapolate the 1900 employment total by the number reported in selected occupations in the Census of Population.<sup>243</sup> The

<sup>240</sup> Pig iron: *Historical Statistics*, 1960, p. 366. Bar iron: data from *General Convention of the Friends of Domestic Industry*, p. 2.

<sup>241</sup> 1850 and 1860: 1870 Census, *Wealth and Industry*, III, pp. 407, 401. 1870: 1890 Census, *Manufactures*, VI, Part 3, p. 383. This last source adjusts the 1870 Census for the duplicate inclusion of establishments under more than one detailed industry. 1890: 1900 Census, VII, Part 1, p. 9. This source adjusts the 1890 Census, presumably because it reported peak rather than average employment. 1880: We use data from the last source, but exclude an estimated 12,000 overcount. (For this estimate, see the above discussion with respect to the 1840 estimate.)

<sup>242</sup> Solomon Fabricant (*Employment in Manufacturing, 1899-1939: An Analysis of Its Relation to the Volume of Production*, New York, NBER, 1942, p. 199) gives an 1899 figure for blast furnaces and steel mill products that is identical with the 1900 Census total for "iron and steel." We therefore use his comparable 1909, 1919, 1929, and 1939 figures. These are moved forward one year by, respectively: 1909-10 production of steel ingots, rails, shapes (*Historical Statistics*, 1960, p. 416); 1919-20, monthly FRB indexes of employment in the industry (*Federal Reserve Bulletin*, December 1923, p. 273); 1929-30, BLS indexes (Lewis Talbert and Alic Olenin, *Revised Indexes of Factory Payrolls*, BLS Bul. 610, 1935, p. 27); and 1939-40, 1950 and 1960 employment in SIC 331 (BLS, *Employment and Earnings Statistics, 1909-1960*, Bul. 1312, p. 95).

<sup>243</sup> We use Edwards' summary for trade (*Comparative Occupation Statistics*, p. 110) exclusive of his "all other occupations" category. We find his estimates for this latter group dubious because they imply a ratio of laborers to dealers 1870–1900 that is wholly inconsistent with the level from 1910 on, where we do have direct data. It is also necessary to exclude bankers, brokers, real estate agents, and others in the group that were not in trade.

procedure is similar to that of Carson and the trend is therefore similar to his. (Because they are consistent with the figures for 1929 and after, however, our figures are at a much different level than is his Population Census-benchmarked series.)<sup>244</sup>

For 1850-60, we extrapolate our 1870 figure by the trend in selected trade occupations.<sup>245</sup>

For 1840, the Population Census reported the number of persons engaged in commerce, as they did for 1820. We find it necessary to ignore these totals for four main reasons.

1. The procedures used in the 1840 Census of Manufactures clearly include persons engaged in transportation under the heading of "commerce," and we assume the same procedures were used for the enumeration of the population, both activities being under the charge of William Weaver and his small staff.<sup>246</sup>

2. The distinction between manufactures and trade was particularly difficult to make in a period when the "hand trades" were as important as they were in 1820 and 1840. The allocation between the two published categories cannot, therefore, be assumed a priori to be a reliable one. The cobbler made and sold his product, as did the wheelwright, candle-maker, carriage maker, etc. Hence, there was equal warrant for including any given person either under the hand trade group (assigned for many decades to "manufactures") or commerce.

3. For three states (with nearly half of trade employment in these years) we compute the number of persons served per person engaged in trade:<sup>247</sup>

	1820	1840	1850	1860	1870	1880	1890	1900
Massachusetts	38.8	90.4	42.5	36.5	43.7			
New York	146.1	83.5	45.5	39.0	26.4			
Pennsylvania	143.5	109.2	53.7	59.9	40.7			
U.S.	108.5	120.7	34.3	30.3	25.7	22.5	18.6	16.4

<sup>244</sup> Kendrick adopts Carson's benchmarks, except for using the present writer's preliminary 1920 benchmark, and interpolates by an early version of the present series. His figures differ from Carson not merely in level but in trend, particularly 1870-1900, possibly because he "adjusted to an employment basis" (*Productivity Trends*, p. F-7).

<sup>245</sup> Data on agents, clerks, livery stable operators, peddlers, merchants, and dealers as shown in the 1900 Census, *Occupations*, pp. lv-lvi. Because female clerks were not enumerated in 1850, we extrapolate our 1860 estimate to 1850 by the above group exclusive of clerks.

<sup>246</sup> 1840 *Compendium*, p. 360, shows "internal transportation" as part of commerce.

<sup>247</sup> We use published Census state trade totals, U.S. totals for 1820 and 1840, and our U.S. estimates for 1850 ff., and relate these to the count of the white population. Purchasing by and for nonwhites prior to 1863 required almost no added distribution network, while their money income level afterwards was so low as to make it more useful to exclude them from the ratio computation. For 1850 we sum figures for thirteen occupations—e.g., clerks, dealers, etc.; for 1860 the itemized dealer and clerk figures; and for 1870, the trade and transport total minus transport occupations, to give trade totals.

Is it possible to accept that, in Massachusetts, for example, 1820, 1850, and 1860 are at similar levels, but 1840 is so much higher? Or should we simply assume underenumeration of trade employment in 1840? Can we believe that the distribution network in New York and Pennsylvania expanded so rapidly from 1820 to 1850 and so little from 1850 to 1860?

4. The internal relationships in the 1840 Census reports suggest gross undercoverage—leading to the high ratios noted above. For example, two countries with almost identical population in Vermont respectively reported 4 and 136 persons in commerce. Other pairs, in New York, reported 51 and 238, 3 and 376; in Virginia, 0 and 70; in North Carolina, 7 and 245; in South Carolina, 7 and 121. The Census also reported no persons in commerce in various New England towns, in Jersey City, Raleigh, Macon, Fredericktown, Portsmouth—and only one person for the nine thousand inhabitants of Detroit.<sup>248</sup>

A state Census of Michigan in 1837 reported 795 merchants, whereas the 1840 U.S. Census reported only 728 in commerce, including merchants and employees.<sup>249</sup>

Our procedure for 1840 was to extrapolate the trend in ratios of white population to trade employment shown in the table above. By doing so we assume that the growth of cities, the development of the distribution system in new areas and the proliferation in old ones, the changing productivity in distribution were all subsumed in a trend closely correlated with the trend in ratios of white population to trade employment.

Without some absolute benchmark on the figures for an earlier date, this is hardly a very satisfactory method; a great deal turns on the question of the inflection of the curve of ratios. In this respect our estimates for this category, and construction, differ significantly from our other early figures which do, in general, have some absolute control. (The link to the population series does, of course, provide one constraint.) It may be helpful, however, to note that a linear extrapolation—surely the outside estimate, since it implies no improvement in the distribution system—will increase our 1840 figures by less than 10 per cent. The result of the foregoing adjustment is a more than doubling of the 1840 Census figure. Hence the level, albeit more consistent with later figures (the population data and so on), is well above that of previous writers who have adopted the Census results.<sup>250</sup>

<sup>248</sup> All data from the 1840 *Compendium*. Vermont: Caledonia, Chittenden; New York: Orleans and Cortland, Greene and Suffolk; Virginia: Augusta and Harrison; North Carolina: Ashe and Bladen; South Carolina: Pickens and Richmond.

<sup>249</sup> James H. Lanman, *History of Michigan*, New York, 1839, p. 294.

<sup>250</sup> In *Trends in the American Economy*, Theodore Marburg adjusted the Census upward to a level of 135,000 (p. 319). Other estimates, relying on Seaman's figures for

## RAILROADS

Our estimates for railroads are the sum of ones made for each of the six individual regions into which the 1880 Census divided the country (Table 4).

*Region I: New England*

We estimate the trend of employment for two categories—Massachusetts railroads, and all others in the region. Data on the Massachusetts roads are readily available for 1870 and 1880.<sup>251</sup> For 1850, stockholder investigating committee reports give us figures for seven major roads,

TABLE 4  
RAILROAD EMPLOYMENT, 1840-80

	U. S.	Region <sup>a</sup>					
		I	II	III	IV	V	VI
1840							
Mileage	2,265	356	1,399	488		21	
Empl. per mile	(3.24)						
Employment	7,000						
1850							
Mileage	7,310	2,256	3,207	1,706	97	46	
Empl. per mile	(2.88)	3.5	2.22	3.3	3.43	2.74	
Employment	21,080	7,900	7,120	5,600	330	130	
1860							
Mileage	27,420	3,639	11,687	7,130	4,700	147	115
Empl. per mile	(2.98)	3.7	2.42	3.3	3.43	2.74	2.74
Employment	81,790	13,460	28,300	23,200	16,120	400	310
1870							
Mileage	43,510	4,115	16,552	10,007	9,110	331	3,394
Empl. per mile	(3.66)	5.12	3.95	3.3	3.61	2.74	1.72
Employment	159,120	21,070	65,400	33,000	32,900	910	5,840
1880							
Mileage	87,070	5,894	28,647	13,869	23,586	897	14,174
Empl. per mile	(4.78)	5.37	7.33	3.1	4.06	2.49	2.36
Employment	415,967	31,634	209,725	43,154	95,776	2,238	33,440

<sup>a</sup>

I: New England; II: Middle Atlantic, Michigan, and Ohio; III: Southeast; IV: Illinois, Iowa, Minnesota, Missouri, Wisconsin; V: Louisiana, Arkansas; VI: Mountain and Pacific.

income produced (*Essays on the Progress of Nations*, 1868, p. 459) will reflect either his adoption of the Census employment figures or his 10 per cent increase in reported Census capital totals for trade.

<sup>251</sup> Massachusetts, Board of Railroad Commissioners, *Fourth Annual Report*, January 1873, pp. 178, 188, gives data for 1872, which we use for the 1870 ratio. *Ibid.*, January 1881, pp. 111 ff., gives data for 1880.

which account for a third of all employment in 1872.<sup>252</sup> For 1860, selected annual reports for 1856–61 plus the findings of a Congressional committee are available.<sup>253</sup> However, the ratio of 7.6 men per mile, to which the 1860 data lead, comes to well above a reasonable 1860 figure, being at just about the 1870 level of 8.0 for all roads. Presumably this is so because they were primarily the larger roads. For 1860, therefore, we compute instead the ratio of the Connecticut rates for 1860 to 1870, and apply that ratio to the Massachusetts 1870 ratio.<sup>254</sup> Connecticut rates for 1860, 1870, and 1880 are readily computed from the reports of the Railroad Commissioners.<sup>255</sup>

We then weight the Connecticut and Massachusetts rates together for 1860 and 1870. Extrapolating the region's 1880 average gives a regional figure for 1870.<sup>256</sup> For 1860 we assume the weighted ratio represents that for the region. The resultant average of 3.7 for the region in 1860 seems consistent with the 1850 Massachusetts average of 3.72. We therefore adopt the latter (rounded down to 3.5), for the region's average in 1850.

#### *Region II: Middle Atlantic, Michigan, and Ohio*

Because of the diversity of experience in this region, estimates of employee per mile in each of the major states in the region were made. The summation of the employment figures thus derived were then used to extrapolate the region's 1880 total to earlier years.

<sup>252</sup> Onslow Stearns, Superintendent of the Northern Railroad, provides data for the Boston and Maine, Boston and Providence, Old Colony, Fitchburg, and Northern (of New Hampshire) in *Report of the Committee of Investigation of the Northern Railroad, to the Stockholders, May 1850*, Concord, Appendix. *Report of the Committee of Investigations of the Nashua and Lowell Railroad. . . May 29, 1850*, Boston, 1851, pp. 77, 89, gives data for this railroad. Boston and Concord data are in *Annual Report, 1850*, pp. 14, 32.

We adopt the weighted average for these roads as being representative for the state in 1850. By later years, of course, more marginal roads had entered, with lighter traffic, hence employment, per mile. Therefore, one cannot use the seven road-state relationship in these later years to adjust the 1850 data.

<sup>253</sup> Annual reports, and averages: Boston and Maine, 1858 (6.5); Boston, Concord and Montreal, September 1859 (1.1); Western, January 1861 (9.2). For 1856, data on the Boston and Worcester (8.0), Boston and Maine (8.0), and Western (9.0) appear in 34th Congress, 1st Session, House Report 358, *Pacific Railroads and Telegraphs*, pp. 48, 60.

<sup>254</sup> The Connecticut rate, 54 per cent, is virtually identical with that for the Boston and Maine.

<sup>255</sup> Connecticut, General Railroad Commissioners, *Seventh Report*, 1861, pp. 28, 33; *Seventeenth Report*, 1870, pp. 54, 58; *Twenty-Eighth Report*, 1881, pp. 80, 95. Employment data were not used for a few small roads that did not report mileage data.

<sup>256</sup> 1880 regional data from: 1880 Census, *Report on the Agencies of Transportation*, 1883, pp. 259, 377. For weights we use mileage as of 1880 from the 1880 Census (*ibid.*, p. 507) and as of 1860 and 1870 from H. V. Poor, *Manual of the Railroads of the United States for 1872-73*, 1872, p. xxxiii.

For New York State the *Annual Report* of the State Engineer provides us with data on miles laid in the state.<sup>257</sup> For 1880 we derive a state employment total from 1880 Census data for individual roads.<sup>258</sup> For 1860 we begin from employment as reported for the New York and Erie, the Hudson River, and the New York Central railroads in 1856.<sup>259</sup> For these same roads, and for all other New York State roads in 1857, we then computed total expenditures on the major employment activities (conductors and baggagemen, engineers and firemen, freight labor, porters, watchmen, and switchmen).<sup>260</sup> The three roads mentioned above accounted for 68.1 per cent of expenditures in the sum of these categories—and about 70 per cent of freight cars as well. We concluded that their employment accounted for 68 per cent of all state employment in 1856 as well, thus implicitly assuming that the average expenditure per employee was the same for all roads as for the average of these three. For 1860 we then interpolate between the 1856 and 1870 employee-per-mile estimates.<sup>261</sup> For 1850 and 1870 we utilize the State Engineer's count of N.Y. freight cars, as follows. Ratios of employees per freight car were computed for all state roads in 1860 and 1880; they averaged 1.23 and 1.22 respectively.<sup>262</sup> Given this stability we therefore assumed a 1.23 ratio for 1850.<sup>263</sup>

As for New York, so for Pennsylvania we have comprehensive figures on freight cars and miles of main line.<sup>264</sup> We estimate employees per

<sup>257</sup> *Annual Report of the New York State Engineer and Surveyor, January 1851, Table A; September 1860, Table C; 1870, p. 211, and 1880, pp. 97-98.*

<sup>258</sup> 1880 Census, *Report on the Agencies of Transportation*, Tables 6 and 9, using the reports for the New York Central, Erie, Syracuse and Binghamton, New York and Ontario, Rome and Watertown, Albany and Susquehanna.

<sup>259</sup> Erie: Edward H. Mott, *Between the Ocean and the Lakes, The Story of the Erie*, 1899, p. 483; Hudson River, NYC: 34th Congress, 1st Session, H.R. 274, *Pacific Railroads and Telegraphs*, pp. 47, 48, 64.

<sup>260</sup> *Report of the State Engineer and Surveyor on the Railroads of the State of New York for . . . 1857, 1858*, pp. 295 ff. We exclude the 3rd, 6th and 8th Avenue railroads.

<sup>261</sup> The rate of gain appears reasonable in the light of tonnage increases for the Erie and New York Central, as reported in 52d Congress, 2d Session, Senate Report No. 1394, Part I, p. 618, and the stability in mileage as shown in Poor, *Manual of the Railroads*.

<sup>262</sup> *Report of the State Engineer and Surveyor, 1857.*

<sup>263</sup> Data for employment on a few individual roads are available for 1850, but appear inconsistent with these results, possibly because construction employees were included in the early reports. The *Annual Report* of the Albany and Schenectady Railroad, January 31, 1852 (p. 13) leads to an average of 9.5; that of the Syracuse and Utica for 1848 (pp. 1, 9) to an average of 10.0. For the Erie (Mott, *Between the Ocean and the Lakes*) an average of 2.9 per mile operated is indicated, much closer to the state average we use.

<sup>264</sup> Pennsylvania, *Reports of the Several Railroad Companies of Pennsylvania Communicated by the Auditor, 1863*, pp. 328, 331; *Annual Report of the Auditor General of State of Pennsylvania . . . Railroad, Canal and Telegraph Companies, 1871*, pp. xxv, xxix; *Annual Report of the Secretary of Internal Affairs, Part IV for 1880*, pp. xxiii.

freight car on the Pennsylvania Railroad in 1856, 1866, and 1880;<sup>265</sup> then use these ratios to extrapolate the 1880 state ratio of employees per freight car.<sup>266</sup>

Employment data are available for Ohio in 1870 and 1880, while for 1860, the unsatisfactory expedient of applying the average employees-per-mile figure for 1868 to the 1860 mileage total was adopted.<sup>267</sup> For Maryland, data on employment and freight cars in 1856 and 1880 are available, with interpolated ratios then computed for 1860 and 1870.<sup>268</sup> Since the B & O and Maryland ratios in 1880 were very similar—30.0 and 33.6—the interpolated ratios were then applied to mileage totals computed for the state.<sup>269</sup>

The regional employment total for 1880 was then extrapolated to 1870 and 1860 by the summation of the above state employment estimates.<sup>270</sup> The 1850 data available for a few roads in the region, and computed above, are hardly a very satisfactory basis for a direct estimate. We have something of an upper limit in the form of the 2.9 employees per mile on the Erie Railroad, one of the two largest in New York and one of the four or five largest in the region. With lighter loads on the other roads, the ratios for them should be still smaller. We assumed instead that the New England ratio was a solid reference point, and estimated the Region II ratio as much below the New England 1850 ratios as the two were apart in 1850, thus giving an 1850 estimate of 2.22.

### *Region III: Southeast*

We estimate that employment per mile of railroad for the entire 1850–70 period averaged 3.3, as compared with an 1880 Census ratio of 3.1. Our

<sup>265</sup> 1880: 1880 Census, *Transportation*, pp. 266–267. 1866: *Guide for the Pennsylvania Railroad, with an extensive map . . . and information useful to travellers*, Philadelphia, 1866, p. 40, indicates that the road when completed will have “not less than 4,050 employees” and 4,800 eight-wheel cars. The booklet originated in the Pennsylvania Railroad offices. Data in *Pacific Railroad and Telegraph* (34th Congress, pp. 48, 62) lead to an average of 2.79 as compared with our 2.89 figure for New York State.

<sup>266</sup> The 1880 ratio for the state was computed from the 1880 Census, *Transportation*, Table VI, using data for the Allegheny, Delaware and Hudson, Lehigh, New York and Pennsylvania PRR, Philadelphia and Reading, Pittsburgh and Titusville.

<sup>267</sup> 1870, 1880: Ohio, *Annual Report of the Commissioner of Railroads and Telegraphs, 1880*, pp. 45, 67. 1868: *Ohio Annual Report . . . 1868*, p. 228. 1860: mileage estimated by subtracting from the 1868 total the 1860–67 construction on all lines listed as having mileage in Ohio. 1880 Census, *Transportation*, Table VIII p. 228.

<sup>268</sup> 1856: U.S. Congress, *Pacific Railroads and Telegraphs*; 1880 Census, *Transportation*, p. 261.

<sup>269</sup> For 1880 the Maryland total was computed by totaling employment and mileage for ten major roads in the state, then applying the average to the state mileage total. Data from 1880 Census, *Transportation*, pp. 260 ff. and 509 ff. Mileage for earlier years computed from *ibid.*, pp. 321 ff., using data for selected roads.

<sup>270</sup> 1880 Census, *Transportation*, p. 257, gives the regional total.

rate is the average of rates computed from twenty-one reports for various southern railroads in the years from 1840 through 1867.<sup>271</sup> These roads were scattered throughout the old South, from the Central of Georgia to the Richmond and Danville, Louisville and Nashville, etc. No temporal trend is obvious in the ratios; hence, the superior estimate based on a pooling of all the averages was used for all dates.

*Region IV: Illinois, Iowa, Minnesota, Missouri, and Wisconsin*

For employment in 1870 we (1) estimate employees per mile of road built in the region by 1870, 1874, and 1880; (2) apply these averages to the Census data on miles built. For ten individual roads we have data on employment in 1874 as given in a special Treasury study.<sup>272</sup> From the 1880 Census we can compile data for employment on these same roads in 1880, as well as mileage built as of both dates.<sup>273</sup> The ratio of one average to the other, when applied to the implicit 1880 region average (of 4.26 employees per mile built), gives a 3.79 figure for 1874. This figure was then extrapolated to an 1870 level (of 3.70) on the basis of data for seven major roads showing tons (of freight carried one mile) per mile of road built.<sup>274</sup> These roads account for most of the mileage in the region.

<sup>271</sup> Annual reports with year and computed men per mile indicated as follows: 1840, Charleston and South Carolina, 3.9; 1842, Central of Georgia, 0.8; 1848, Charleston and S.C., 3.0; 1848, Louisa, 7.0; 1853, Richmond and Petersburg, 4.1; 1854, R and P, 8.5; 1855, R and P, 4.7; 1854, Virginia and Tennessee, 3.3; 1856, Virginia and Tennessee, 2.8; 1857, Virginia and Tennessee, 2.5; 1857, Memphis and Charleston, 2.4; 1855, Richmond and Danville, 3.5; 1856, Richmond and Danville, 4.5; 1857, Richmond and Danville, 3.2; 1858, Richmond and Danville, 3.2; 1859, Richmond and Danville, 3.5; 1857, North Carolina, 1.7; 1858, North Carolina, 1.9; 1859, Norfolk and Petersburg, 1.7; 1861, Louisville and Nashville, 2.2; 1862, Louisville and Nashville, 3.4; 1867, Louisville, Cincinnati, and Lexington, 3.2. Reports for these railroads for other years, and for other railroads, in the collection of the Bureau of Railway Economics were examined. Out of several hundred reports, however, these and half a dozen reports for railroads in Massachusetts and New York were the only ones with employment figures. The sample is unquestionably not a random one; fortunately its variability is not great.

<sup>272</sup> Data for employment on individual roads appear in Edward Young, *Labor in Europe and America*, 1875, pp. 787-788. Young was Chief of the Treasury's Bureau of Statistics.

<sup>273</sup> 1880 Census, *Transportation*. Employment data from Table VI, mileage data from Table VIII. The roads were: Cairo and St. Louis, Cairo and Vincennes, Chicago and Alton, Chicago and Iowa, Chicago and Pekin, Chicago and Rock Island, Indiana and Bloomington, Quincy and Alton, St. Louis and Alton, Evansville and Terre Haute, Indianapolis and St. Louis.

<sup>274</sup> Data on tons carried one mile by the Chicago and Milwaukee, Chicago and Northwestern, C B and Q, Chicago and Rock Island, Illinois Central, Pittsburgh and Fort Wayne, Ohio and Mississippi were taken to reflect trends in Region IV. (A few, however, were actually classed in Region II.) Data from 52d Congress, 2d Session, Senate Report 1394, Part I, *Wholesale Prices, Wages and Transportation*, 1893, pp. 618 ff. Mileage data from 1880 Census, *Transportation*.



	1870	1874	1880
Employment per mile built (ten-road sample)		5.27	5.92
Index of employment in Region IV (based on ten-road sample)		38	100
Index of tons of freight (one mile equivalent) per mile built (seven-road sample)	45	52	100

It will be seen that the tonnage data suggest only a mild change in the ratio from 1870 to 1874, and it is likely that the rise in employment per mile built was even milder.

As a rough indication of a check on this estimate, the following may be helpful. We know that the number of freight cars in the region in 1880—and indeed in all regions but the South—approximately equaled the number of employees. For three major roads (C B and Q; Milwaukee and St. Paul; Chicago and Northwestern), which together had about a third of all mileage in the region in 1870, we have data from annual reports.<sup>275</sup> These can be condensed to indicate that freight cars per mile in 1860 were 89.3 per cent of their 1870 average. This compares quite favorably with our implicit estimate that employees per mile in 1860 averaged 87 per cent of the figure for 1870.

We estimate that employment per mile built changed in 1860–70 in the same proportion that freight (tons carried one mile) per mile built did over this decade. The 1860 Census reports total freight tonnage and mileage for nine major roads in the region.<sup>276</sup> We infer the number of tons carried per mile from the tonnage total by applying a ratio computed from data in the Aldrich report. That report provides (for the C B and Q, the Chicago and Rock Island, the Illinois Central, and the Pittsburgh and Fort Wayne) figures on both total tonnage and tonnage carried one mile.<sup>277</sup> The 12.4 per cent ratio thus derived is virtually identical with the 11.8 per cent one can compute for the same year for all railroads in New York State.<sup>278</sup>

#### *Region V: Louisiana and Arkansas*

For the numerically trivial mileage in Census Region V, we assume that the 1850–70 averages per mile were 10 per cent above that implicit in the 1880 Census—as the averages were for Region III.

<sup>275</sup> Chicago, Burlington and Quincy, *Annual Report, 1870*, pp. 13, 16, 45; 1880, p. 15. Milwaukee and St. Paul, *Annual Report, 1870*, pp. 34–35; 1880, pp. 50, 272. Chicago and Northwestern, *Annual Report, 1870*, pp. 15, 34, 36; 1880, pp. 50, 272–73.

<sup>276</sup> 1860 Census, *Population*, p. 324.

<sup>277</sup> Senate Report 1394, Part I, *Wholesale Prices*, 1893. For some roads the ratio was computed from data for 1863 rather than 1860.

<sup>278</sup> *Annual Report of the New York State Engineer and Surveyor*, September 30, 1860, p. 362, and 1860 Census, *Population*.

*Region VI: Mountain and Pacific*

Employment in this region was nonexistent in 1850. In 1860 the bulk of mileage was in two roads, the Houston and the Texas. We assume the same ratio as that estimated for Region V, a region of similar physical and traffic density conditions.

As of 1870 the bulk of the mileage operated was in the Central Pacific and Union Pacific. For each road we estimate freight cars per mile operated, assume a constant 1870-80 employment per freight car, and compute employment.<sup>279</sup>

*U.S. Total: 1840*

For 1840, we estimate U.S. railroad employment at 9,000 by one procedure, and give some rough checks by others. Our basic estimate begins from an 1838 Treasury Department survey which reports 350 locomotives in use in the United States.<sup>280</sup> Given the limited number of roads at the time, and publication of figures for individual locomotives, the result should be reasonably solid. For 1840 the number of locomotives as estimated in Hunts (bringing up to date figures from Von Gerstner) is consistent with growth from this Census count, at 465.<sup>281</sup> We estimate twenty employees per locomotive at this date. The average for the Erie railroad in 1841 is somewhat greater, that for five New England roads in 1850 somewhat lower.<sup>282</sup> The average for the New York Central, Erie, Pennsylvania, B & O, Boston and Worcester in 1856 was twenty-one.<sup>283</sup>

If we take the independent data on mileage operated and apply estimates of men employed per mile in the same roads noted above, we derive estimates of from 6,700 to 9,500.<sup>284</sup> Because railroad mileage was

<sup>279</sup> 1880 Census, *Transportation*, pp. 276, 278, 413, gives data for 1880. For 1869: 44th Congress, 1st Session, House Report 440, *Pacific Railroads*, pp. 248, 136. Tons of freight carried one mile rose sixfold on the Union Pacific whereas freight cars increased only 50 per cent. Tonnage data from Senate Report 1394, Part I, *Wholesale Prices, 1893*, p. 620. The increase in freight handled per freight car is not unreasonable.

<sup>280</sup> 25th Congress, 3d Session, House Doc. 21, U.S. Treasury Department, *Steam Engines*, December 13, 1838.

<sup>281</sup> *Hunts' Merchants' Magazine*, Vol. IV, p. 481.

<sup>282</sup> Erie Official report data in Mott (*Between the Ocean and the Lakes*, p. 483). New England Roads: *Report of the Committee of Investigation of the Northern Railroad to the Stockholders*, May 1850, Concord, Appendix. Data from the 1880 Census, *Transportation*, Part IV, p. 257, also indicate about twenty men per locomotive in the Northeast, where 1840 railroads were concentrated, and twenty to twenty-five in other regions.

<sup>283</sup> All data from House Report 358, *Pacific Railroads and Telegraphs*, 1856, pp. 47, 48, 60, 62, except Erie employment from Mott, *Between the Ocean and the Lakes*.

<sup>284</sup> Mileage data from *Historical Statistics*, 1960, p. 427. Employees per mile on the Erie averaged 2.4. The mean for seven New England roads in 1851 (see 1850 estimates below) was 3.4.

concentrated in the Northeast the bounding of our 9,000 estimate by these figures is some support. Since roads with low traffic tended to have relatively high employment per mile, it is useful confirmation that the average for the Charleston and South Carolina in 1840 ran no greater than 3.9 men per mile.<sup>285</sup>

### *Other Estimates*

The Population Census count of "railroad employees" is well below the official ICC and BLS figures for 1890 and after, and is therefore below our estimates, linked as they are to the BLS level.<sup>286</sup> This is so because the large number of trackmen, carpenters, clerks, and others employed by railroads in occupations not peculiar to railroading, are included in other Census occupation rubrics.

The above estimates are similar to the results in the impressive study by Fishlow in the present volume, except for the year 1870.

Two factors account for the latter difference. His estimate was derived by multiplying the total earnings for that year (of \$385 million) by .592, the pooled coefficient relating employment to earnings on Massachusetts and Ohio railroads.

His total earnings for 1870 appear to be too low because the sample of five railroads he used to extrapolate the 1880 ton-mile total back to 1870 reflects the smaller gain in Census Region II than actually characterized the U.S. in general.<sup>287</sup>

Using data for individual railroads in Massachusetts and Ohio, Fishlow computes a regression coefficient to link earnings and employment. When he used this procedure in the check year of 1880 it led to an underestimate of the actual U.S. total by 12 per cent.

If one combines a 10 per cent overestimate (as for the 1870 earnings figure) and a 12 per cent error in the regression coefficient (as for 1880), Fishlow's procedure could yield an 1870 total at about the level of the present estimates.

The above discussion has all rested on the assumption that the 1860 level of railroad earnings, from which Fishlow departs to estimate the

<sup>285</sup> *Annual Report* for 1840. The 1842 *Report* for the Central of Georgia reported 126 employees and 147 miles of road, but did not report any agents. For 1848 the Charleston and South Carolina average was 3.0.

<sup>286</sup> Population Census data appear in Edwards, *Comparative Occupation Statistics*, p. 109, and 1890 Census, *Population*, Part I, p. cvii.

<sup>287</sup> Fishlow indicates his source as the Aldrich report. Ninety per cent of his ton-mile total was activity on four railroads in Census Region II. Frickey's data—used by Fishlow for estimating passenger miles—indicate, however, that the ton-mile gain for Region II was about 10 per cent less than that for the U.S. See Edwin Frickey, *Production Trends*, 1947, pp. 84, 87.

1870 level, is satisfactory. However the 1860 figure itself was no reliable total. It derives from Fishlow's adjustment of an 1855-56 Treasury survey riddled with errors. Substantial corrections of the survey results were properly made by Fishlow, but it is doubtful if at this remove one could be confident of estimating within, say, 10 per cent accuracy.

The use of Fishlow's regression procedure is, as he puts it, acceptable on the assumption that the product of the operating ratio, the share of wages in expenses, and the reciprocal of the wage rate are constant throughout the country. It would be a happy conclusion if the average of the cross product of three such ratios in Massachusetts and Ohio yielded a U.S. average that was accurate within 10 per cent.

Although Fishlow makes no regional estimates, by comparing 1860 and 1880 regional data we can consider where the additional 68,000 employment in Fishlow's 1870 U.S. estimate might be. Surely not in Regions I, III, and V, given the 1880 total and assuming some growth from 1860 to 1880. For Region VI our 1870 estimate is based on data both for the Union Pacific and the Central Pacific (plus allowance for minor roads)—which account for virtually all mileage in the region at this date. Hence Regions II and IV account for most of the difference.

For Region II our component estimates for Pennsylvania rest on the data for the entire state showing that freight cars were almost five times as numerous in 1880 as 1870; New York and Maryland data showing roughly a tripling in each; and Ohio, less than doubling of employees. The combination of weighting, allowance for other states, and adjustments to an employment level leads to our tripling for the region. For Region IV our component estimates rest on data for employment of ten major roads in the region in both 1874 and 1880. We extrapolated from 1874 to 1870, using the ton-mile data for all railroads in the region as reported in the same Aldrich report from which Fishlow drew the five-road sample he used to extrapolate total U.S. ton miles. With these fairly specific, localized, and comprehensive indications we find it difficult to believe that the rise for these two regions was only two-thirds of what we estimate. It seems preferable to leave open the question of the validity of extrapolating for the U.S. from ton mileage on five railroads, and the accuracy of an implicit cross product of three ratios, to yield results—via extrapolation from two states to the U.S.—that are precise within 10 per cent.

Daniel Carson, working from the Population Census data, provides a higher estimate for 1870, and Fishlow derives a similar figure in confirmation of his estimate for that year.<sup>288</sup> Implicitly both analysts assume that

<sup>288</sup> Daniel Carson, "Changes in the Industrial Composition of Manpower since the Civil War," in *Studies in Income and Wealth*, 11, 1949, p. 127. See also Fishlow in this volume.

the ratio of all railroad employees, classified as such, to the number not so classified was virtually identical in 1880 and 1870.

But a look at the details of the Census indicates that the undercoverage of this group by the Census "railroad men" category was not in fact constant. Thus, the Census reports a 36 per cent decline of "employees of railroad companies" in Connecticut from 1870 to 1880 (despite statewide data showing a marked rise in tonnage hauled), and about the same decline in Alabama; and though it reports a U.S. gain of 70 per cent from 1870 to 1880, that gain is net of a substantial (and unreasonable) decline in the absolute number of railroad employees of Irish origin.<sup>289</sup> It would appear that variations in the rate of railroad construction affected the reported series on employees, making them useless as a basis for estimating operating employment, or checking such estimates at all precisely.<sup>290</sup> If we exclude natives of Ireland from the total count of railroad men in both 1870 and 1880, on the assumption that the count for this group was distorted by the inclusion of construction activity, we arrive at a Population Census figure that rises 140 per cent from 1870 to 1880. This gain compares with 160 per cent implicit in the present estimates and 80 per cent in Fishlow's (see Table 4).

#### TEACHERS: 1830-1960

For 1900-60 we adopt the Population Census count of teachers, in preference to the figures reported to the Office of Education by cities, county boards of education, and other units.<sup>291</sup> The Office of Education is concerned with public education, providing data on private education only at intervals. Moreover, the usual possibilities of duplication in an establishment source (for example, an art teacher working in two different schools during the payroll period and being reported by each) are further complicated by the inevitable difficulty in securing reports from the host of private schools. Both factors make it desirable to rely on an unduplicated source.

<sup>289</sup> 1870 Census, *Population*, pp. 676, 707. 1880 Census, *Population*, pp. 762, 763.

<sup>290</sup> In Georgia, for example, substantial construction work in 1869 was done on the Marietta and North Georgia, on the Chester and Lenoir, Savannah, Florida and Western. Instead of 196 miles completed in 1869, the state had only 24 miles completed for these roads in 1879. For Alabama, the Alabama Great Southern, Montgomery and Eufalfa, Selma, Rome and Dalton completed 159 miles in the earlier year and none in the later. (1880 Census, *Railroads*, p. 349.) The decline in the natives of Ireland clearly suggests a decline in construction employees, not in operating ones.

<sup>291</sup> 1900 to 1950: Population Census data are summarized in Kaplan and Casey (*Occupational Trends*, p. 22). 1960: U.S. Census of Population, 1960, Report PC(1)1 C, pp. 1-216, Table 87. Office of Education, *Biennial Survey of Education in the United States*, 1954-56, Chapter 1, Table 13.

For the years prior to 1890 the Population Census totals, though including employment in many small, private schools, prove to be smaller than those from the early Censuses of educational institutions.<sup>292</sup> This gap reflects the greater tendency in those early decades for teaching to have been a part-time job. A fair number of teachers presumably reported another occupation in the population count, because they spent more time in it than teaching, because they were engaged in it at the time of the Census, etc. (For 1860, 1880, and 1890 the Population Census total runs about 80 per cent of the establishment Census count.<sup>293</sup> For 1870 the ratio is down to 57 per cent, but this discrepancy apparently reflects an inadequate Population Census: it gained by a mere 10 per cent over 1860, as compared with 30 per cent and greater gains in other decades, and a near 50 per cent gain in the school Census.<sup>294</sup>) We, therefore, use the 75 per cent ratio prevailing in 1860 as a basis for extrapolating the 1860 Population Census count back to 1850.<sup>295</sup> We have a rough confirmation of this figure from the count of male teachers reported by the Census of that year.<sup>296</sup>

The Census for 1840 reported the number of scholars and schools, but not the number of teachers.<sup>297</sup> We approximate the number of teachers by the close relationship between the number of schools and teachers in 1850 and 1860, extrapolating that ratio.<sup>298</sup> The implicit size of class per teacher—thirty-five—is slightly above the 1850 figure of thirty-three. As such it compares quite favorably with what contemporary sources indicate. The school returns for Massachusetts in 1836 have an implicit average of 29.5 students per teacher.<sup>299</sup> In the late 1830's James Hall described

<sup>292</sup> For example, 1870 Census, *The Statistics of the Population of the United States*, Vol. I, p. 458.

<sup>293</sup> Population Census count: 1880 Census, *Population*, pp. 760, 792; 1870 Census, *Population*, I, pp. 676, 688; 1860 Census, *Population*, pp. 673, 677. 1890 Census, *Population*, II, pp. 354–355. Establishment count: 1870 Census, *Population*, I, p. 458; 1880 Census, *Population*, p. 918; 1890 Census, *Population*, II, *Report on Education*, p. 51.

<sup>294</sup> The school Census data gain itself may be understated: for example, it reports teachers in New York and Illinois decreasing markedly from 1870 to 1880, whereas the Population Census data more reasonably show a marked rise. The 1880 school Census specified "whole number employed at one time," whereas the 1870 Census makes no such qualification, and apparently thus arrived at a high, duplicated, count.

<sup>295</sup> 1850 teachers count from *The Seventh Census of the United States: 1850*, p. lx.

<sup>296</sup> Our estimate of 79,300 teachers times the 66 per cent ratio of female teachers to all teachers (shown in 1870) implies 27,000 male teachers and professors. The reported number was 30,530.

<sup>297</sup> Summarized in *The Seventh Census of the United States: 1850*, p. lxi.

<sup>298</sup> 1850: *ibid.*, p. lx, lxi. 1860: *Statistics of the United States (including mortality, property, etc.)*, 1866, pp. 505–506. The ratio (130 per cent in 1860 and 122 per cent in 1850) was taken as 115 per cent in 1840.

<sup>299</sup> Summarized in *North American Review*, Vol. 44, April 1837, p. 503. The data cover reports from 289 towns and cities.

a typical Midwestern "school of 30 scholars."<sup>300</sup> (Moreover, the report of the New York State superintendent of common schools has an implicit average for 1840 that is virtually identical with that for the state in the 1850 Census.)<sup>301</sup>

For 1830 we compute the number of teachers from the ratio to pupils. A survey by the U.S. Secretary of State provides figures on the number of pupils in free schools in Connecticut, Maine, Rhode Island, and Indiana in 1830.<sup>302</sup> To this number we can add that for New York State, from the superintendent's reports.<sup>303</sup> These data are then used to estimate the ratio of pupils to total white population in the five states in 1830. They are then compared with a ratio similarly computed for 1840.<sup>304</sup> The lack of change in the ratio for these states is taken to indicate that the U.S. 1840 ratio of pupils to white population also was unchanged from the 1830 ratio.

Applying the 1840 ratio, therefore, to the 1830 white population gives a figure of 1,503,000 pupils. Dividing this by a class of thirty-eight pupils per average teacher, we obtain 40,000 teachers associated with the school system.<sup>305</sup> Adjusting this to the Population Census level, we then get a figure of 30,000 for persons whose primary activity was teaching, whether in public or private schools.<sup>306</sup>

For 1790 information collected with the Census for Philadelphia gives the number of professors and teachers in middle and south Philadelphia and in Southwark.<sup>307</sup> Applying the ratio of teachers to population in middle and south Philadelphia (then including the bulk of the city's population) to the urban population total in 1790, we obtain a total of 570. (Philadelphia then had about 12 per cent of that group.<sup>308</sup>) For the rural population we rely on the evidence of the 1840 Census, which reported

<sup>300</sup> James Hall, *Notes on the Western States*, 1838, p. 204.

<sup>301</sup> S. S. Randall, *A Digest of the Common School System of the State of New York*, Albany, 1844, p. 83. *The Seventh Census of the United States: 1850*.

<sup>302</sup> 23d Congress, 1st Session, *Statistical View of the Population of the United States from 1790 to 1830 Inclusive*, 1835, pp. 190, 209, 214.

<sup>303</sup> New York State data for 1830 and 1840 from Randall, *Digest of Common School System*.

<sup>304</sup> Data for the first four states from 1850 Census, p. lxi. For New York we use Randall, *Digest of Common School System*, for both dates, in order to obtain maximum comparability.

<sup>305</sup> The ratio of 27.4 pupils per teacher in 1860, 30.6 in 1850, and 35.6 in 1840 was assumed at 38.0 in 1830.

<sup>306</sup> In 1860 the Population Census count of teachers was 75 per cent of the total derived from the school Census, and that ratio was adopted for earlier years as well. (The ratio for 1870 was 57 per cent; for 1880, 81 per cent; and for 1890, 82 per cent.)

<sup>307</sup> Census, *A Century of Population Growth*, p. 142

<sup>308</sup> Population data from *Historical Statistics*, 1960, p. 9.

very few "scholars" outside the states with major cities. A fortiori, there would have been still fewer in 1790. We therefore increase our urban teacher total of 570 to an arbitrary 1,000 to give a national total for 1790.

For 1800, 1810, 1820, we apply ratios of teachers to the white population. Ratios were computed from the above data for 1790, 1830, 1840, 1850, and 1860. The curvilinear trend, fitting these figures rather easily, was used to interpolate the 1800-20 ratios.

#### EMPLOYEES IN DOMESTIC SERVICE

Procedures used for 1900-60 are described elsewhere.<sup>309</sup> This series related to all persons in the domestic service industry—a group that includes a small number of the servant aristocracy (coachmen, private policemen, and so on) in addition to servants *per se*, and will therefore exceed the Census counts for domestic servants.

For 1870-90, the 1900 total was extrapolated by the Census total for servants and laundresses (except laundry) as adjusted by Edwards for these years.<sup>310</sup>

For 1860, the Census of Population count for servants and allied occupations was used, with minor adjustment.<sup>311</sup>

The Census count of male domestic servants in 1850 was inflated on the assumption that the ratio of female domestics to total domestics showed a mild trend over time, declining to the 87 per cent in the reported Census figures for 1870, and the 84 per cent in 1880, 1890, and 1900.<sup>312</sup>

For 1790 we estimate one servant per family in northern and Middle Atlantic cities, to give just under 25,000.<sup>313</sup> This ratio is based on an 1830 statement by a Philadelphia society for placing domestic servants to the effect that there were "at least the same number of domestics as houses in the city."<sup>314</sup> (Note that our series applies to free servants

<sup>309</sup> Cf. the author's *Manpower in Economic Growth*.

<sup>310</sup> Edwards, *Comparative Occupation Statistics*, p. 112.

<sup>311</sup> 1860 Census, *Population*, pp. 662 ff. Total for servants, domestics, housekeepers, laundresses, matrons, cooks and stewards, porters. This 634,000 total was reduced 34,000 on the assumption that the 40,000 hotelkeepers, restaurant and saloon keepers, and bartenders in that year had that many employees.

<sup>312</sup> The proportion for 1850 was estimated at 93.9 per cent, and for 1860 at 90.6 per cent, on the assumption of a 3.3 per cent change from one decade to the next—the same as that occurring between 1870 and 1880.

The resultant 365,000 was reduced to 350,000 to allow for servants in hotels, saloons, etc.

<sup>313</sup> All cities of any consequence in 1790 are listed in Census, *A Century of Population Growth*, pp. 11, 78. We exclude southern cities since the bulk of servants in private households were slaves. Dividing this population total by the average size of free family (*ibid.*, p. 96) gives an estimate of 22,000 families in the cities having free servants.

<sup>314</sup> Address to the Public of the Society for the Encouragement of Faithful Domestic, Philadelphia, July 20, 1830, p. 1.



only, hence excludes the bulk of those in the South, and does not include servants in taverns, hotels, etc., who are classified under trade.)

As an approximate check we can make an estimate from data for 1860. The 1860 ratios of servants per family in each region applied to the number of free families in 1790 gives a figure of about 50,000.<sup>315</sup> This figure is clearly on the high side, reflecting (1) the considerable advance in the supply of domestic servants (indicated by the stability and weakness of wage rates for the group after the 1847-50 migrations), and (2) the general increase in the standard of living. Both forces would tend to increase the number in domestic service, the former much more strongly.

For 1800-40, if we chart the relationship between servants as estimated above for 1790 and 1850-1950 against the number of white families at those twelve decadal dates, a simple curvilinear relationship appears.<sup>316</sup>

This relationship was interpolated for the 1800-40 period to give servant-family ratios which, applied to estimates of families, gives an interpolating series.<sup>317</sup>

<sup>315</sup> 1860 data from Census, *Population in the United States in 1860*, 1864, pp. 674-675. 1870 data from 1870 Census, *Population*, 1872, I, p. 595. We compute ratios for New York, the New England States, New Jersey, Pennsylvania, and Delaware as a group.

<sup>316</sup> Simple for purposes of extrapolation. The 1870 figure is above trend, reflecting the results of abolition and the tremendous increment to the free labor force. 1920 and 1950 are below trend, reflecting the effects of prosperity attached to both wars. These years were excluded in determining the trend line.

<sup>317</sup> Estimates of white families were derived by the writer in *Demographic and Economic Change in Developed Countries*, Special Conference 11, Princeton for NBER, 1960, pp. 413-414.