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IRREGULAR PRODUCTION AND
TIME-OUT-OF-WORK IN AMERICAN
MANUFACTURING INDUSTRY IN 1870 AND
1880: SOME PRELIMINARY ESTIMATES

Jeremy Atack
Fred Bateman

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ABSTRACT

This paper makes use of hitherto untabulated data from the censuses of manufacturing for 1870 and 1880 to investigate the extent to which firms operated at less than their full capacity year round in these census years and thus provides some evidence of the extent to which workers may have faced temporary or permanent lay-off. We conclude that firms nationwide operated for the equivalent of 254 days (out of, perhaps, 309 working days) during the 1870 census year from the end of May, 1869 to the beginning of June, 1870 and 261 days during the 1880 census year from the beginning of June 1879 to the end of May, 1880. Workers put in the equivalent of slightly more days of work in each of these years in their customary industrial employment because larger firms were more likely to operate for more days per year. There were, however, significant regional and industry differences.

Although our estimates are broadly consistent with independent estimates and are generally in accord with expectations, they raise important questions about economic performance in the late nineteenth century which remain unanswered here.

Jeremy Atack
Department of Economics
Box 1819, Station B
Vanderbilt University
Nashville, TN 37235
and NBER

Fred Bateman
Department of Economics
Brooks Hall
University of Georgia
Athens, GA 30602

IRREGULAR PRODUCTION AND TIME-OUT-OF- WORK IN AMERICAN MANUFACTURING INDUSTRY IN 1870 AND 1880: Some Preliminary Estimates*

Jeremy Atack

Vanderbilt University

and

National Bureau of Economic Research

Fred Bateman

University of Georgia

This paper approaches the problem of seasonal and irregular production and employment in American manufacturing industry during the late nineteenth century using new data from the Censuses of Manufactures for 1870 and 1880.¹ These data on the number of months of full-time operation worked by each manufacturing establishment during the 1870 and 1880 census years were never tabulated by the Census Office because funding expired before the task was completed. The Massachusetts Bureau of Labor Statistics, however, did summarize the 1870 data for Massachusetts in its *Fourth Annual Report*.²

These data, while not perfect, offer the earliest comprehensive picture of the extent of production downtime and less than full-time year-long employment for industrial workers in America. These are separate but related issues: Industrial workers were put out of work because firms

*Research assistance was provided by Mary Beth Thesing.

¹The data from the 1870 Census of Manufactures were collected by Fred Bateman, James D. Foust and Thomas J. Weiss under grants from the NSF: GS-2450, GS-2456, SOC 75-18917 and SOC 75-20034. Collection of the 1880 data was funded by NSF grants SES 86-05637 to Jeremy Atack and SES 86-09392 to Fred Bateman. We are grateful to the National Science Foundation for their generous and continuing support for this research.

²Massachusetts. Bureau of Labor Statistics, *Fourth Annual Report of the Bureau of Labor Statistics, House Document 173*, (Boston: 1873), pp. 76-85.

reduced or suspended production either as a result of demand fluctuations or supply constraints. However, since producers employed different numbers of workers there is not a 1:1 equivalence between firms working full-time for fewer than twelve months annually and the fraction of time that workers were out of work at their usual jobs. We estimate that American businesses, on average, operated for the equivalent of 254 days of full time work per year in 1870 (out of a possible 309 days) while in 1880 they averaged 261 days of full time work. Workers, on the other hand, averaged 262 days of full time employment in manufacturing in 1870 and 272 days in 1880 as larger firms worked more days each year. Assuming that 309 working days represent a year's employment, these data imply that individuals might have been out of work 15.3 percent of the time in 1870 and 12.0 percent of the time in 1880 if no alternative work were available.

Massachusetts was the first state to officially recognize the problem of "involuntary idleness" among industrial workers. Data on unemployed workers in that state have been exhaustively reviewed by Alexander Keyssar.³ However, Keyssar's focus differed from that in this paper. He paid scant attention to the scraps of data on the irregularity of industrial work contained in the early Massachusetts Bureau of Labor Statistics Reports, focusing instead upon state population census data and other information from 1885 onwards.

Others have investigated the seasonality of work in America but, lacking the kind of evidence we present here, they have focused primarily upon seasonality in agriculture.⁴ Agriculture, which employed about two-thirds of the labor force in 1850, still occupied almost half as late as 1880.⁵

³Alexander Keyssar, *Out of Work: The First Century of Unemployment in Massachusetts*, (Cambridge, 1986).

⁴For example, Stanley Engerman and Claudia Goldin, "Seasonality in Nineteenth Century Labor Markets," NBER Working Paper Series on Historical Factors in Long Run Growth No. 20, January 1991.

⁵See Thomas J. Weiss, "Economic Growth before 1860: Revised Conjectures," NBER Working Paper Series on Historical Factors in Long Run Growth No. 7, October 1989 and U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970*, (Washington DC: GPO, 1975) Series D75-77 and D152 and 153.

Agricultural seasonality was hardly unexpected. It still characterizes non-livestock farm activities today. Moreover, many of the seasonally "unemployed" farm workers were probably family members for whom work could always be found clearing land, digging ditches, repairing walls and fences and other capital formation activities. Those who were not family often moved on, following the seasonal harvests. Not all rural inhabitants, however, depended upon agriculture for their livelihood even in the mid-nineteenth century. Much of early manufacturing was rural rather than urban but the rural unemployed did not represent the same concentrated political interest group or pose quite the same potential threat to civil order as the urban unemployed. The authorities could not afford to ignore the social or political threat of the urban unemployed, especially as industry itself became increasingly urban during the nineteenth century.

Indeed, such concerns prompted Massachusetts to make the first formal inquiries of the extent to which workers were employed for less than the full year in their customary occupation.⁶ The initial steps in this direction came as a part of the 1870 Census of Manufactures when enumerators were directed to determine "the number of months of active operation, reducing part time to full time" during the census year.⁷ The Census, however, provided no guidance in the instructions as to how this was to be done.⁸ At the time, this was not crucial since the results were never tabulated. We believe that the Census intended enumerators to treat two months at half time as the equivalent of one month at full time. This is also the way in which the Massachusetts Bureau of Labor Statistics interpreted the data for Massachusetts in their *Fourth Annual Report*.⁹ They used a procedure

⁶Massachusetts. Bureau of Labor Statistics. *Seventh Annual Report*, (Boston: Wright & Potter, 1876)

⁷See Carroll D. Wright, *History and Growth of the United States Census*, (Washington DC: GPO, 1900), p. 314.

⁸ Indeed, the census instructions fail to mention any of the questions pertaining to labor. See Department of the Interior. Census Office, *Ninth Census, United States. 1870. Instructions to Assistant Marshals* (Washington, DC: GPO, 1870), especially pp. 20-26.

⁹Massachusetts. BLS, *Fourth Annual Report*, *op. cit.*.

similar to ours except that they assumed a 308-day working year and only reported what we have called "downtime." They cautioned those using the data that:

"It must be understood, that this number of days, is not the number that a completed establishment *may* run in each year, though in some occupations, as in Brick, Carpentering, Charcoal, Chocolate, etc., it is the actual average time that these occupations are carried on each year, while in the case of Carpets and Cars, though these establishments are in operation twelve months of the year, two or three of those enumerated were in operation but six months, bringing the average time down ..."¹⁰

Similar questions were asked as a part of the 1880 Census. Again, no detailed instructions were given to enumerators but the intention was made much clearer. Enumerators were directed to account for all twelve months and report the number of months in operation on "full time," "on three-fourths time only," "on two-thirds time only," "on one-half time only" and "idle."¹¹ Again, these results were never tabulated by the Census. Note that we assume unit elasticity, that is to say, "three-fourths time" means that the firm used only three quarters as much labor (leaving aside the question of whether this meant working only three-quarters as many hours with the full complement of workers or working full time with only three-quarters of that number) to produce three-quarters of the output that could have been produced with a full complement of full time workers.

We have used these data in samples drawn from the 1870 and 1880 Censuses of Manufactures to estimate the number of days of full-time operation that samples of manufacturing plants worked during the two census years.¹² The 1870 data were collected as state-level samples and are currently not easily aggregated to the regional or national level. We only

¹⁰*Ibid.*, p. 72.

¹¹Wright, *History and Growth*, *op. cit.*, p. 315.

¹²The data from the 1870 Census of Manufactures were collected by Fred Bateman, James D. Foust and Thomas J. Weiss under grants from the NSF: GS-2450, GS-2456, SOC 75-18917 and SOC 75-20034. Collection of the 1880 data was funded by NSF grants SES 86-05637 to Jeremy Atack and SES 86-09392 to Fred Bateman.

report those data for 1870 where we have been able to correctly weight the samples. We expect in the coming months to develop statistically valid samples of firms for 1870 at the regional and national level that will not require the current elaborate post-sampling weighting schemes. The 1880 database is a national sample, with regional and state industry represented in their correct proportions. Because they do not require post-sampling correction we report a full set of estimates based upon these data. Months were converted to days by multiplying by 25.75. This assumes that there were 309 working days during the year composed of 52 six-day work weeks per year minus Christmas Day, Good Friday and Independence Day. Months at three-quarter time were converted to full-time equivalents by multiplying by 0.75. Months at two-thirds time and half-time were similarly converted by using the appropriate multiplier. These data are reported by region and by two-digit SIC industry group.¹³

Two distinct concepts underlie our measures. First, we estimate the equivalent number of days of full-time operation worked by manufacturing establishments during the census year. This is the simple average of the data reported by the census enumerators, converted to days using the multiplier, 25.75: That is, the average number of days of full-time equivalent operation during the census year in industry j ,

$$D_j = \left(\frac{\sum_{i=1}^n m_{ij}}{n_j} \right) \cdot 25.75,$$

where m_{ij} is the number of months of equivalent full time operation by the i -th establishment in industry j .

We refer to the difference between this figure and the 309 working days which we assume constitutes a full year's work as "downtime." Downtime

¹³The data are also reported by state in Appendix A.

encompasses both seasonal and cyclical components but, unlike the information collected as a part of the 1900 Census, the 1870 and 1880 data do not allow us to identify the particular months or seasons when production fell short. Nor do we know whether short or idle time was the result of supply or demand constraints or whether it was planned or unplanned. Certainly some industries such as construction or canning were—and still are—seasonal while other industries, such as textiles, are less so except to the extent that bad weather interrupted power or disrupted shipments.

Second, we have weighted the number of months of full time equivalent operation by establishment employment:

$$E_j = \left(\frac{\sum_{i=1}^n m_{ij} \cdot e_{ij}}{\sum_i e_{ij}} \right)$$

where e_{ij} is the number of employees working in the i -th establishment in industry j .

The result, E_j , is an estimate of the number of months that an industrial laborer might have worked. We have again converted these estimates to days. The difference between this and 309 days is our best estimate of the time that a worker might have been out-of-work which we have defined as not being employed in their customary principal activity. This differs from our best estimate of the number of months of equivalent full time operation by the i -th establishment in industry j because firms employed different numbers of workers. In particular, we find that larger firms (measured by the number of employees) typically worked more days per year than smaller ones. These estimates also differ from those used by Keyssar and those reported in the Seventh Annual Report of the Massachusetts Bureau of Labor Statistics which pertain to the period of work in occupations by individual workers averaged across firms and sometimes across industries.

Workers at this time were not necessarily unemployed in the sense of being out of work and actively engaged in a job search at the prevailing market wage. They may have taken the free time as "vacation." Or, they may have switched to another part-time occupation—traditionally farming, particularly at harvest time. Certainly, most of the industry and regional monthly manufacturing employment indexes reported by Engerman and Goldin from the 1900 Census exhibit a sharp dip in early to mid-summer, coinciding with the small grain harvest.¹⁴ Moreover, this dip seems relatively more pronounced in those areas specializing in small grains. However, as the industrial labor force became increasingly concentrated in major urban areas it seems less likely that temporary local farm employment at harvest time could have asserted so large and pervasive an effect.

Although workers may have had temporary jobs during slack periods, we do not view them as a transient work force, constantly switching jobs in response to marginal, perhaps short-lived, incentives. Certainly as the century wore on, it seems increasingly likely that employees acquired firm-specific human capital, periodic layoffs (expected or unexpected) notwithstanding. As a result they might have formed long-term attachments to the firm which valued their specific skills, preferring temporary layoffs compensated with higher wages to the alternative job search for less remunerative but more secure, full-year employment. This view of the late nineteenth century labor market is consistent with that documented by Susan Carter and Elizabeth Savoca for California in 1893.¹⁵

Our best estimate of the number of days of full time equivalent operation and the percent of downtime by region in 1870 and 1880 are shown in Table

¹⁴Engerman and Goldin, "Seasonality," *op. cit.*, especially Figure 3.

¹⁵Susan Carter and Elizabeth Savoca, "Labor Mobility and Lengthy Jobs in Nineteenth Century America," *Journal of Economic History*, 50, (March 1990), pp. 1-16. Note, however, that Jacoby and Sharma dispute the representativeness of the 1893 California data and questions Carter and Savoca's measure of duration. See Sanford M. Jacoby and Sunil Sharma, "Employment Duration and Industrial Labor Mobility in the United States, 1880-1980," *Journal of Economic History*, 52, (March 1992), pp. 161-80.

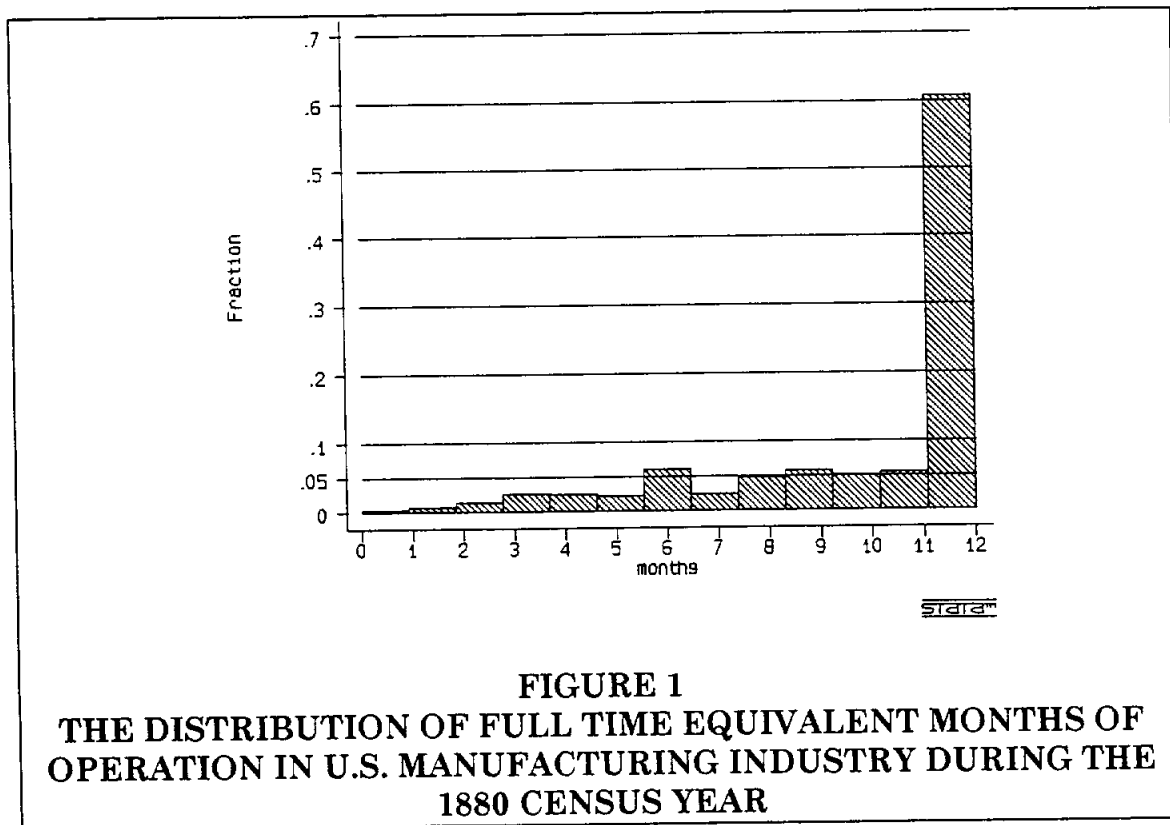
1. Nationwide, firms averaged 254 days of full-time work in 1870 and 261 in 1880. Firms in the Northeast operated more days; firms in the South, fewer. In part, this reflects regional differences in the industry mix, but even within the same industry, southern firms worked fewer days of equivalent full-time operation than northeastern firms. For example, southern food processing firms in 1880 averaged 233 days compared with 257 days for firms in this industry in the Northeast; southern textile mills worked 263 days while northeastern mills averaged 265 days.

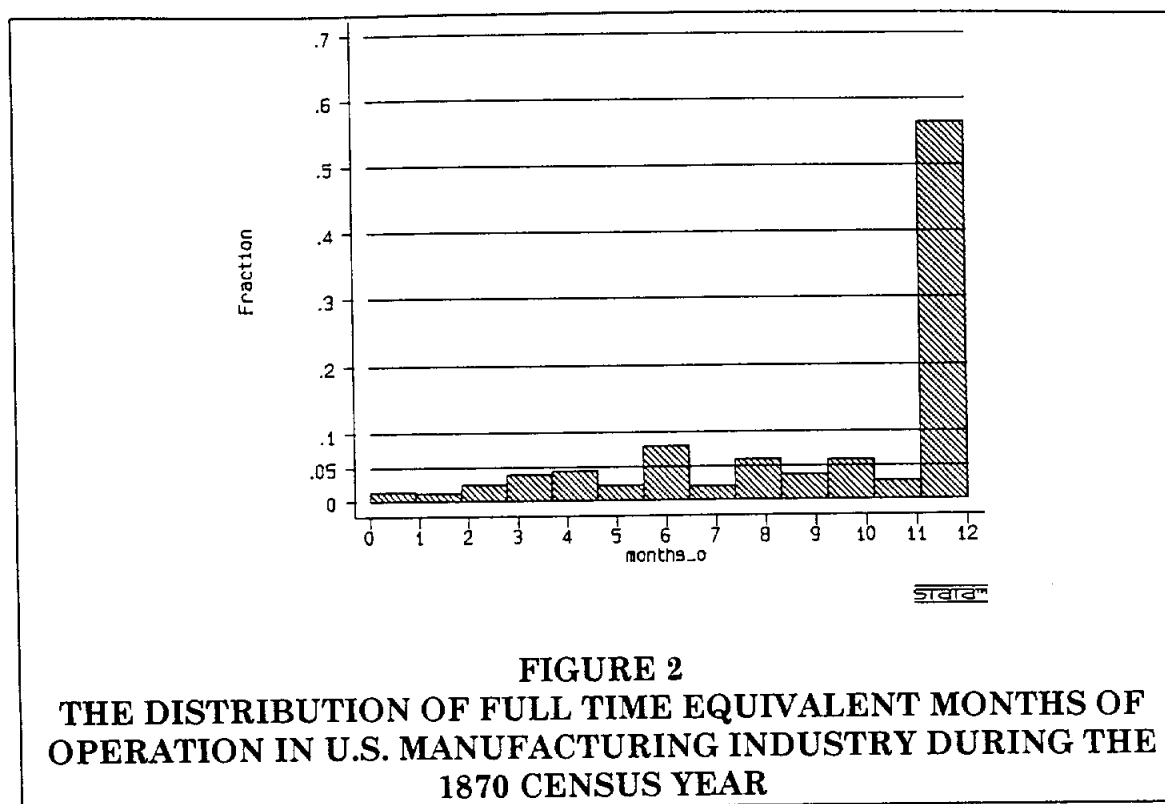
Region	1870 Census Year		1880 Census Year	
	Equivalent Full Time Days of Operation	Percent of Downtime ^a	Equivalent Full Time Days of Operation	Percent of Downtime ^a
Midwest	254	17.8	262	15.2
Northeast	260	15.9	268	13.3
South	240	22.3	241	22.0
West	258	16.5	261	15.5
United States	254	17.8	261	15.5

^a $(1 - \{\text{days of full-time equivalent operation}/309\}) * 100$
 Source: 1870—Bateman-Weiss samples from the manuscript censuses of manufactures for 1870; 1880—Atack-Bateman national sample from the manuscript censuses of manufactures for 1880

Behind these simple averages, however, lie the distributions of months of full time equivalent work that we actually observe. The distribution in 1880 is highly skewed towards full time work, throughout the year (Figure 1). Almost 60 percent of the firms reported working fulltime throughout the 1880 census year. Fifteen percent worked six months or less and a quarter worked fewer than nine months. Thus the median firm operated 12 months of the year in 1879/80. The modal number of months of operation was also 12 per year even though the average is just a little over 10 months of full time work. The distribution of months of full time operation during the 1870 census year is similar (Figure 2) although we again caution that the 1870 data in their present form cannot be aggregated without biasing the results

because of the over-representation of certain states, particularly southern and the frontier midwestern ones. This almost certainly biases the results towards too many establishments operating fewer than 12 months during the 1870 census year. However, with this *caveat* in mind, the distribution of months of operation by each establishment in all the 1870 samples (see Appendix A for a list of the states included), we believe that the shape of the overall distribution is approximately correct even though the individual cell proportions may be wrong. More than half of the sampled firms (56%) worked 12 months during the 1870 census year. Almost a quarter worked just six months or less (23%), compared with 15 percent during the 1880 census year.





By industry, agricultural services (SIC 7) and brick and tile manufacturers (SIC 32) averaged the fewest days of full-time work during the year (Table 2). Agricultural services in the South, principally cotton presses, typically operated only 100 days of full time work during the 1880 census year, while firms in this industry in the Midwest, which primarily rendered threshing services, averaged 229 days of full-time work annually. Lumber mills (SIC 24) also experienced considerable downtime, being out of production approximately one-third of the time. At the opposite extreme, tobacco product firms (SIC 21), furniture manufacturers (SIC 25), printers (SIC 27), leather products firms (SIC 31), primary metals producers (SIC 33), machinery manufacturers (SIC 35), oil and gas producers (SIC 49) and blacksmiths (SIC 76) averaged the equivalent of 275 days or more of full-time operation during the 1880 census year. Disaggregated by industry, the data reveal an important pattern: southern firms generally worked fewer days than those elsewhere. Since drought and winter freeze were less problematic in the South, does this reflect relatively more constrained product demand in

the South or more seasonal labor opportunities outside of manufacturing in the South? Northeastern firms also generally worked more days than those in the Midwest. In 1880, manufacturing in the Northeast offered more regular employment than that elsewhere.

2-digit SIC	Industry	Days of Full Time Equivalent Operation				
		South	Midwest	Northeast	West	U.S.
7	Agricultural Services	100	229			111
17	Construction	249	247	264	262	256
20	Food Processing	233	245	257	250	247
21	Tobacco Products	243	284	286	300	278
22	Textile Mill Products	263	236	265		255
23	Clothing	260	282	276	308	278
24	Lumber	208	222	220	177	217
25	Furniture	297	289	286	287	289
26	Paper	290	266	275		274
27	Printing and Publishing	306	303	291	309	297
28	Chemicals	238	269	256	252	254
31	Leather Products	278	293	284	273	286
32	Brick and Tile	175	178	224		192
33	Primary Metals	283	285	285	285	285
34	Fabricated Metals	258	255	295		277
35	Machinery	281	289	284	289	285
37	Transportation Equip.	180	279	256		250
49	Gas and Oil	309	294	265		279
76	Blacksmithing	283	292	296	277	291

Source: Atack-Bateman national sample from the manuscript censuses of manufactures for 1880

Data by industry for 1870 reveal the same general pattern but any estimates that we were to report at this time would be biased by the over-representation of particular states or regions. The potential impact of such over- and under-representation might be judged by inspection of the variation across regions in the number of days of full-time equivalent operation of firms in 1880 in particular industries (Table 2) or from the state to state variations (Appendix A).

Weighting annual work time by employment confirms the pattern revealed in Tables 1 and 2. Employees in northeastern manufacturing were out of work for about 8.4 percent of the 1880 census year while those in southern establishments were out more than twice as long (Table 3). Workers in the Northeast averaged 283 work days in 1880, compared with only 250 for those in the South. The widening of the downtime gap between northeastern and southern manufacturing when the data are weighted by employment indicates that large northeastern firms were more likely to work year around than large southern producers. This result holds true at the industry level too (Table 4).

Region	Days of Full-time Work in Manufacturing	Percent of Time Out of Work ^a
Midwest	262	15.2
Northeast	283	8.4
South	250	19.1
West	264	14.6
United States	272	12.0

^a $(1 - \{\text{days of full-time equivalent operation}/309\}) * 100$ weighted by employment.
Source: Atack-Bateman national sample from the manuscript censuses of manufactures for 1880

Our best estimates of the number of days that industrial laborers worked during the 1880 census year are shown in Tables 3 and 4. The data in Table 4, weighted by industry employment, reveal an even wider range of variation across industries than the firm averages shown in Table 2. Those working in the agricultural services industry (SIC 7) were out of work almost two-thirds of the year in 1879/80 and workers throughout the nation in food processing, lumber, chemicals and brick and tile were out of work more than a quarter of the time. Employees in the clothing industry, printing and publishing, fabricated metals, machinery, transportation equipment, gas and oil, and blacksmithing lost less than 5 percent of the available work time during the year. These figures suggest quite strongly that industrial work in these industries had become a full time occupation. As the aggregate data suggest, in most industries laborers in the South were out of work for more time than

those in the Midwest and especially in the Northeast. Only in furniture manufacture did southern workers enjoy substantially greater employment security during the year than their counterparts elsewhere.

2-digit SIC	Industry	Percent of Time Spent Out of Work				
		South	Midwest	Northeast	West	U.S.
7	Agricultural Services	67.4	28.6			65.8
17	Construction	22.3	17.1	11.8	8.6	14.4
20	Food Processing	31.5	24.6	20.9	24.0	24.4
21	Tobacco Products	9.4	6.2	1.6	1.5	5.7
22	Textile Mill Products		33.1	5.9		18.3
23	Clothing	25.9	5.8	3.6	0.9	4.3
24	Lumber	26.3	26.7	25.7	29.9	26.6
25	Furniture	1.4	6.2	8.6	6.3	7.0
26	Paper		12.2	8.7		8.6
27	Printing and Publishing	0.1	1.9	2.4	0.0	1.9
28	Chemicals	30.5	11.8	24.5	32.4	25.7
31	Leather Products	8.2	6.1	9.1	14.0	8.5
32	Brick and Tile	41.9	28.4	27.5		30.5
33	Primary Metals	14.7	23.8	4.4	1.4	10.4
34	Fabricated Metals		13.9	0.9	14.4	2.4
35	Machinery	4.2	6.4	3.5	6.5	4.7
37	Transportation Equip.		0.7	3.3		2.9
49	Gas and Oil		1.2	5.5		3.8
76	Blacksmithing	7.6	5.0	4.0	10.6	5.3

Source: Atack-Bateman national sample from the manuscript censuses of manufactures for 1880

Our estimates are broadly consistent with other scattered independent observations of the number of days that businesses operated in the late nineteenth century and the number of days that workers were employed. The Massachusetts Bureau of Labor Statistics, for example, independently tabulated the data on months of operation collected by the 1870 Census and used them to estimate the number of days that businesses operated.¹⁶ Across all industries in the state, businesses averaged the equivalent of 280 days of

¹⁶Massachusetts Bureau of Labor Statistics, *Fourth Annual Report, op. cit.*, pp. 76-85

full-time operation, ranging from 308 days in some industries such as locksmithing, paints, saws, and silverware to 156 days in the fish packing and 157 days in brickmaking. The cotton textile industry was just average in terms of days of production lost, reporting 280 days of full-time work. This industrial pattern mirrors that in the Bateman-Weiss data for 1870 although firms in Massachusetts spent only one month out of production during the 1870 census year whereas we estimate that businesses nationwide averaged more than two months of downtime. The 1870 census data as reported by the Massachusetts Bureau of Labor Statistics, however, do not allow us to estimate how many days the average industrial worker lost as a result of production cut-backs or suspensions.¹⁷

Other data were collected as a part of the Massachusetts state census of 1875 that enable us address exactly this question and compare the estimates with those in Tables 3 and 4.¹⁸ Although 61,778 persons provided state census enumerators with information on the "number of days employed in your occupation during the year," these data, for reasons unknown, are ignored by Keyssar. We have summarized the information for some of the more important occupations (Table 5). These are ordered by the percent of time out-of-work, assuming a 309-working day year. Outdoor jobs such as mason or carpenter, generally involved more time out-of-work than factory jobs, though there were factory laborers such as female finishers in the cotton mills who worked fewer days. Indeed, the data reveal a remarkably wide variation in length of annual employment during the year across occupations. Female pressers in the straw industry, for example, averaged only 80 days of work in 1875; oilers in cotton factories reported 101 days; and doffers, 110 days. Other occupations were more or less all year: card

¹⁷Nor are we currently able to report independent estimates of the average number of days of full-time work that industrial workers in Massachusetts worked during the 1870 census year because of some obvious coding errors in our Massachusetts data that we are in the process of correcting.our best estimate is that is that they worked between 280 and 290 days based upon the experience of the cotton textile industry which was the largest single employer of industrial workers in Massachusetts.

¹⁸Massachusetts. Bureau of Labor Statistics. *Seventh Annual Report*, (Boston: Wright & Potter, 1876), pp. 20-1, 84-5, 192-202.

strippers, folders and press operatives averaged 300 days; spoolers put in almost 306 days and leather buffers worked 310 days.

Occupation	Average Number of Days Employed During Year	Percent of Time Out-of-Work
Mason	185	40.1
Laster (female)	197	36.2
Laster	199	35.6
Eyeleter (female)	201	35.0
Paper Finisher (female)	204	34.0
Painter	210	32.0
Shoe Heeler	216	30.1
Carpenter	219	29.1
Common Laborer	225	27.2
Farm Laborer	237	23.3
Weaver	239	22.7
Weaver (female)	239	22.7
Cabinet Maker	242	21.7
Carder (female)	252	18.4
Spinner (female)	252	18.4
Spinner	256	17.2
Machinist	256	17.2
Blacksmith	257	16.8
Carder	258	16.5
Warper (female)	258	16.5
Shoe Heeler (female)	263	14.9
Paper Finisher	277	10.4
Leather Buffer	310	0
All Occupations (male)	242	21.7
All Occupations (female)	259	16.2

Source: Massachusetts Bureau of Labor Statistics, *Seventh Annual Report (Public Document No. 31)*, (Boston: Wright & Potter, 1876).

In most occupations where both men and women were employed, women worked fewer days per year than men. Male finishers in the cotton mills, for example, worked 255 days in 1875 while women holding the same job averaged only 175 days of work. Quite possibly this reflects a tendency to fire women first to preserve the earnings and jobs of the "bread-winner." However, the 14,000 women in our sample reported working an average of 259 days in the year whereas the 48,000 men spent an average of only 242 days on the job, reflecting both the relative concentration of women workers

in the textile mills where employment was fairly regular and the male-dominance in some of the least regular jobs such as construction.

The inclusion of farm workers in this data set provides a benchmark against which to compare industrial work. Although workers in many occupations worked more days in 1875 than farm laborers, some occupations—including some factory occupations such as paper-making and a number of activities in the boot and shoe industry—engaged the workers for fewer days per year than farm work. Indeed, farm laborers managed more days of work during the year than common laborers.

We can also compare our 1880 estimates of time out of work by industry in Massachusetts with Keyssar's estimates of time out of work by occupation in 1885, equating the industry average with that of the principal occupation in a particular industry. The results are often quite similar. For example, according to our estimates, brick industry workers in the Northeast were out of work about 27.5 percent of the year while Keyssar quotes an unemployment rate among brickmakers in Massachusetts in 1885 of 27.8 percent.¹⁹ Similarly, Keyssar quotes a rate of 6.5 percent among blacksmiths which compares with our estimate that blacksmiths in the Northeast were out of work about 4 percent of the time.²⁰

Our estimates for 1880 are more nearly comparable with two other surveys: one from Massachusetts, the other from Ohio. The Massachusetts survey taken in 1882 reported 293 working days on average, or very close to full time, all year compared with our estimate of 280 days for some two years earlier.²¹ In 1882, the brick industry had the most downtime—the equivalent of 109 days of production lost—while the textile industry lost virtually none.

¹⁹Keyssar, *Out of Work*, *op. cit.*, Appendix A.1, pp. 308-11.

²⁰*Ibid.*

²¹Massachusetts Bureau of Labor Statistics. *Fourteenth Annual Report*, (Boston: Wright & Potter, 1883), pp. 238-41

In 1878, barely a year before the 1880 census year began, the Ohio Commissioner of Labor noted "there are a large number of idle men in the State, men able to work and anxious to secure employment."²² He found that "of the number reported as employed, a large proportion have not employment fifty weeks in the year."²³ Of the 22,650 employees surveyed, barely half, 11,442, were employed for fifty weeks or longer and almost 2,500 worked less than 30 weeks.

Interpreting the data on shutdowns and layoffs over time as we do, however, also requires knowledge of the state of the business cycle which compounded any periodic, seasonal layoffs and shutdowns. Studies of the business cycle classify layoffs as a leading economic indicator, peaking or reaching a nadir perhaps six months or so ahead of the business cycle, while unemployment and production are classified as coincident indicators, with peaks and troughs within six months of the business cycle peak or trough.²⁴ Not all branches of industry, however, are equally coincident with the cycle. Raw materials and semi-manufactures tend to lead, consumer goods coincide, while producer goods lag, the business cycle although the differences are small.

These considerations, however, are important given the timing of the reference cycles relative to the 1870 and the 1880 census years. The 1870 census year ran from May 31, 1869 to June 1, 1870 while the business cycle peak is dated as June 1869, reaching a trough in December 1870.²⁵ The 1880 census year ran from June 1, 1879 to May 31, 1880, while the business cycle reached a trough in March 1879 but did not peak until March of 1882.²⁶ The

²²Ohio. Bureau of Labor Statistics. *Second Annual Report* (Columbus, Nevins & Myers, 1879), pp. 10-1.

²³*Ibid.*

²⁴See Geoffrey H. Moore (ed), *Business Cycle Indicators*, Studies in Business Cycles, Vol. 10, (Princeton: NBER, 1961), especially pp. 672-86.

²⁵Arthur F. Burns and Wesley C. Mitchell, *Measuring Business Cycles*, Studies in Business Cycles, Vol. 2, (NBER, 1946), Table 16, p. 78.

²⁶*Ibid.*

1870 Census thus coincides with a short-lived downturn while the 1880 census was taken during the early phases of a relatively long upswing. We might thus expect unemployment to be relatively high in 1870 and production schedules attenuated. However, the downturn in 1869 seems to have been relatively mild: Frickey's index of industrial production was essentially stagnant during this period.²⁷ In contrast, the upswing that began in 1879 was quite pronounced, with the term "boom" as a description of economic conditions entering the language at this time.²⁸ In light of the prolonged and deep recession that had preceded the 1880 census, it is unclear how quickly employment would have recovered. Still, allowing for some "slop" our estimates seem both plausible and consistent, both internally and with the scattered external evidence. Employment levels in 1870, as an example, were higher than in the mid- and late-1870s and higher in the early and mid-1880s than earlier.

Lastly, we briefly report the results from a TOBIT regression to see if we can estimate the number of days that a firm operated based upon the firm's characteristics. The results reported in Table 6 simply use characteristics of the firm and the industry as predictors of the number of days of operation in 1880. Limits of zero days and 365 days per year were established for the dependent variable, DAYS, in this TOBIT. Industry characteristics (proxied by SIC industry dummies) explain much of the firm-to-firm variation; so too do regional effects. As might be expected from Table 1 and Table 2, firms in the South operated significantly fewer days per year than firms in the Northeast, but those in the Midwest and West also produced for fewer days per year. Again, as might be expected from a comparison of Tables 1 and 2

²⁷Edwin Frickey, *Production in the United States, 1860-1914*, (Cambridge, 1947); See also Rendigs Fels, *American Business Cycles, 1865-1897*, (Chapel Hill, 1959), pp. 96-98.

²⁸Fels, *op. cit.*.

TABLE 6 TOBIT Regression to Explain the Number of Days that Firms Operated in 1880						
Variable	Regression Coefficient	Standard Error	t-statistic	P> t	95% Confidence Interval	
					Lower	Upper
Capital	.0801	.0194	4.112	0.000	.0419195	.1182912
% female	-28.3376	5.8206	-4.868	0.000	-39.74774	-16.92745
water	-10.08045	2.5417	-3.966	0.000	-15.06305	-5.097857
SIC 7	-131.7817	9.4157	-13.996	0.000	-150.2391	-113.3242
SIC 17	3.7034	3.3389	1.109	0.267	-2.841734	10.24864
SIC 21	27.3180	4.8649	5.615	0.000	17.78141	36.85476
SIC 22	8.0288	10.161	0.790	0.429	-11.89109	27.94871
SIC 23	37.4128	5.1345	7.287	0.000	27.34779	47.47795
SIC 24	-32.49484	2.687	-12.092	0.000	-37.76258	-27.2271
SIC 25	36.8718	5.1055	7.222	0.000	26.86364	46.88012
SIC 26	27.7029	8.059	3.437	0.000	11.90341	43.50242
SIC 27	47.0890	6.1390	7.670	0.000	35.05494	59.12319
SIC 28	3.033	5.5315	0.548	0.583	-7.810179	13.87652
SIC 31	35.3266	2.9672	11.905	0.000	29.51003	41.14332
SIC 32	-58.13257	5.0900	-11.421	0.000	-68.11045	-48.15469
SIC 33	33.0556	4.3927	7.525	0.000	24.44477	41.66661
SIC 34	23.5948	7.842	3.009	0.003	8.222238	38.96751
SIC 35	32.970	3.7965	8.684	0.000	25.52814	40.41286
SIC 36	-14.72045	48.2782	-0.305	0.760	-109.359	79.91807
SIC 37	-4.38477	10.2698	-0.427	0.669	-24.51646	15.74692
SIC 38	43.4737	24.1957	1.797	0.072	-3.95656	90.90413
SIC 39	27.3922	4.9765	5.504	0.000	17.6368	37.14769
SIC 49	19.1047	13.3627	1.430	0.153	-7.089851	45.29941
SIC 76	40.3637	3.1913	12.648	0.000	34.10781	46.61978
South	-14.98521	2.2603	-6.630	0.000	-19.41602	-10.5544
Midwest	-4.39437	1.7958	-2.447	0.014	-7.914693	-8.740536
West	-11.54992	4.8720	-2.371	0.018	-21.10055	-1.999302
constant	255.8562	2.3412	109.281	0.000	251.2667	260.4458

28 observations left-censored at zero
7681 uncensored observations
Psuedo R² = 0.0175

with Tables 3 and 4, larger firms, measured here by the capital invested in the firm (in thousands of dollars) instead of total employment, typically operated for more days per year than smaller firms. The coefficient indicates that days of operation increased by about one day per year for each \$12,500 increase in firm capital. Firms relying more heavily on female workers operated for significantly fewer days per year than firms relying more heavily on male workers. This is consistent with our suggestion that in most late nineteenth century firms women were viewed as the marginal workers

whenever production was being reduced. The magnitude of this coefficient is more than sufficient to offset the industry effect in female-dominated industries such as textiles (SIC 22). Firms that depended upon water power operated fewer days per year as one might have expected. Lastly, note that while most of the regression coefficients are statistically significant and relatively large, the regression equation does a poor job of explaining firm-to-firm variations in days of fulltime employment.

CONCLUSION

Our estimates of the irregularity of manufacturing operations and of less than year-round employment of the industrial labor force have a number of important implications for our understanding and interpretation of economic performance in nineteenth century America. First, full time, year around employment of industrial workers in 1880 might have raised national income by perhaps 10 percent or so.²⁹ Second, if firms in fact averaged the equivalent of only nine or ten months of full time operation a year, this reinforces claims by Fred Bateman and Thomas Weiss that their estimates of mid-nineteenth century industrial profits are biased downwards by several percentage points since wages account for approximately half of industry value-added. Third, adjusting for part-time work will accentuate the regional differences in profit rates.³⁰ Fourth, industry differences in the extent of part-time operation may help explain some of the variability in Kenneth Sokoloff's estimates of labor and total factor productivity.³¹ Fifth, to the extent that there was an underlying trend towards more regular employment as transportation improved, as peak labor demands were reduced through mechanization and

²⁹ Assuming that industrial productivity was about double that elsewhere in the economy and depending upon what value one assumes for the elasticity of output with respect to labor.

³⁰ See, for example, Fred Bateman, James D. Foust and Thomas J. Weiss, "Profitability in Southern Manufacturing: Estimates for 1860," *Explorations in Economic History*, 12, 3 (1975) and Fred Bateman and Thomas Weiss, *Deplorable Scarcity: The Failure of Industrialization in the Slave Economy*, (Chapel Hill: UNC Press, 1981)

³¹ Kenneth L. Sokoloff, "Productivity Growth in Manufacturing During Early Industrialization: Evidence from the American Northeast, 1820-1860," in Stanley L. Engerman and Robert E. Gallman, *Long-Term Factors in American Economic Growth, Studies in Income and Wealth Volume 51*, (NBER, 1986), pp. 679-736.

diversification, and as reliance upon waterpower diminished, these data suggest some need to reconsider our story of the pace and pattern of economic growth during the nineteenth century. The labor input (measured by aggregate worker hours) is probably overstated earlier in the century. Correcting for this would increase early labor and total factor productivity and reduce the rate of growth in labor (and total factor) productivity early in the century relative to that later. Such a change is consistent with revisions proposed by Weiss and by Robert Gallman regarding nineteenth century growth.³²

³²See Weiss, "Economic Growth before 1860," *op. cit.*, and Robert E. Gallman, "The Agricultural Sector and the Pace of Economic Growth: U.S. Experience in the 19th Century," in David Klingaman and Richard Vedder (eds.) *Essays in 19th Century History* (Athens OH: Ohio University Press, 1975).

APPENDIX A
DAYS OF FULL-TIME EQUIVALENT OPERATION DURING THE
CENSUS YEAR BY STATE

1870	
State	Days of Full-time Equivalent Operation During Year
South	
Alabama	251
Arkansas	235
District of Columbia	298
Florida	203
Kentucky	253
Mississippi	225
North Carolina	213
Tennessee	221
Texas	234
Virginia	259
West Virginia	247
Midwest	
Illinois	265
Indiana	236
Kansas	236
Minnesota	261
Missouri	258
Ohio	258
Wisconsin	264
Northeast	
Connecticut	260
Maine	253
Massachusetts	280
New Hampshire	195
New Jersey	274
New York	264
Vermont	266
West	
California	258
Oregon	255
Missing states either have yet to be sampled or contain obvious errors requiring verification	
Source: Bateman-Weiss samples from the manuscript censuses of manufactures for 1870.	

1880	
State	Days of Full-time Equivalent Operation During Year
South	
Alabama	219
Arkansas	230
District of Columbia	286
Florida	247
Georgia	233
Kentucky	246
Louisiana	224
Maryland	271
Mississippi	198
North Carolina	250
South Carolina	206
Tennessee	227
Texas	229
Virginia	248
West Virginia	233
Midwest	
Illinois	269
Indiana	249
Iowa	272
Kansas	258
Michigan	266
Minnesota	255
Missouri	255
Nebraska	261
Ohio	265
Wisconsin	255
Northeast	
Connecticut	274
Delaware	259
Maine	245
Massachusetts	268
New Hampshire	250
New Jersey	270
New York	270
Pennsylvania	268
Vermont	268
West	
California	270
Oregon	213
Washington	256
Source: Atack-Bateman national sample from the manuscript censuses of manufactures for 1880	

APPENDIX B
PERCENT OF TIME SPENT OUT-OF-WORK DURING THE CENSUS
YEAR BY STATE

1870		
State		Percent of Time Spent Out-of-Work
	South	
Alabama		17.4
Arkansas		30.0
District of Columbia		10.3
Florida		30.8
Kentucky		12.3
Mississippi		23.8
North Carolina		30.7
Tennessee		28.4
Texas		32.7
Virginia		18.4
West Virginia		19.8
	Midwest	
Illinois		39.2
Indiana		16.8
Kansas		12.4
Minnesota		24.1
Missouri		12.1
Ohio		6.5
Wisconsin		15.5
	Northeast	
Connecticut		6.3
Maine		8.9
New Hampshire		4.7
New Jersey		8.3
New York		10.9
Vermont		18.5
	West	
California		19.4
Oregon		14.3
Missing states either have yet to be sampled or contain obvious errors requiring verification		
Source: Bateman-Weiss samples from the manuscript censuses of manufactures for 1870		

APPENDIX B (continued)
PERCENT OF TIME SPENT OUT-OF-WORK DURING THE CENSUS
YEAR BY STATE

1880		
State		Percent of Time Spent Out-of-Work
	South	
Alabama		22.3
Arkansas		29.6
District of Columbia		6.3
Florida		16.1
Georgia		15.0
Kentucky		18.1
Louisiana		40.7
Maryland		20.7
Mississippi		32.1
North Carolina		16.4
South Carolina		22.8
Tennessee		16.2
Texas		26.9
Virginia		13.2
West Virginia		19.7
	Midwest	
Illinois		11.6
Indiana		19.5
Iowa		18.4
Kansas		21.2
Michigan		13.8
Minnesota		22.7
Missouri		12.8
Nebraska		22.3
Ohio		14.7
Wisconsin		22.7
	Northeast	
Connecticut		6.9
Delaware		41.7
Maine		24.3
Massachusetts		9.4
New Hampshire		10.7
New Jersey		8.4
New York		7.1
Pennsylvania		7.4
Vermont		17.0
	West	
California		11.8
Oregon		19.6
Washington		22.0
Source: Atack-Bateman national sample from the manuscript censuses of manufactures for 1880		