The Economic Impact of the American Civil War on Northern Textile Towns*

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January 2026

Abstract

I examine the effects of the American Civil War on Northern manufacturing by considering the massive supply shock to the female-dominated cotton textiles industry in Massachusetts. Using newly digitized 19th-century manufacturing censuses and a differences-in-differences identification strategy, I find that the war did not hinder long-run growth. Although wartime female employment dropped substantially in textile-producing towns, it recovered within ten years along with the cotton textiles industry. Male employment and manufacturing output were unaffected. A lack of wartime outmigration partially explains the immediate recovery, which contrasts with the British experience of the same shock.

*I thank James Feigenbaum, Robert Margo, and Martin Fiszbein for invaluable feedback and guidance as well seminar participants at Harvard, BU, and the 2025 Cliometrics Conference. I have also benefited from conversations with Jiwon Choi, Grant Goehring, Danielle Graves Williamson, Emma Knight, Catherine O'Donnell, Vasudha Ramakrishna, and Hong Wang. All remaining errors are my own.

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1 Introduction

The Union's victory in the American Civil War dismantled the Confederacy, destroyed large pockets of the South, and abolished slavery. How, then, did a war that the North decisively won affect its burgeoning industrial economy?

To answer this question, I consider the massive, temporary, and negative shock to the supply of raw cotton for textile production in Massachusetts during the war. Cotton textiles was the country's biggest antebellum manufacturing industry, and with a majority female workforce, it was the largest market employer of women (U.S. Census Bureau, 1865). Prior to the Civil War, production concentrated in mill towns such as Lowell, MA, which relied on the increasing flow of cotton from southern plantations. The war's outbreak in 1861 and concomitant collapse of raw cotton production shattered this supply chain, temporarily shuttering most cotton textile factories and leaving the workers in mill towns—especially young women—without work. The shock proved to be short-lived, however, as despite the abolition of slavery, the South's cotton output quickly returned to its prewar levels by the mid 1870s.

In this paper, I estimate the cotton supply shock's immediate and postwar effects on manufacturing activity in Massachusetts mill towns. To do so, I construct a novel panel dataset of town-level manufacturing outcomes between 1837-1895 that combines newly-digitized state censuses with Massachusetts's establishment-level returns from the complete-count federal censuses of manufactures (Hornbeck et al., 2025). Using an event study design, I compare manufacturing outcomes during and after the Civil War between cotton mill towns—those with more than 20% of antebellum employment in cotton goods—and non-mill towns.

I find that the shock's effects were gendered and temporary. Due to the composition of the cotton textiles workforce, the wartime supply shortage caused female employment to drop by 82% in cotton towns while leaving male employment untouched. The effect on female employment dissipated within 10 years of the war's end, and the postbellum effects on male and total employment were large and positive. The value of manufacturing output followed this latter pattern as well, but the estimates are noisy and not statistically significant.

I then turn to investigating the effects on the cotton textiles industry across the state. It is possible, for instance, that postwar industry diversification could explain the immediate recovery but mask lingering effects on the industry experiencing the supply shock. To do so, I use town-industry-year data from the manufacturing censuses and a differences-in-differences approach where

I compare outcomes between the cotton goods industry and the other industries in the state. I again find temporary effects on output and employment, which both declined during the Civil War but recovered by 1875.

I end by juxtaposing the Massachusetts experience with Britain's, which saw persistent negative effects from the same shock. Although British textile mills shifted their suppliers from the American South to India during the Civil War (Hanlon, 2015), population growth in British cotton towns remained lower through the beginning of the 20th century (Hanlon, 2017) and families working in cotton textiles in the 1860s had higher mortality rates postwar (Arthi et al., 2022). To compare the two settings directly, I use the same town-level differences-in-differences design to investigate whether the supply shock caused population size to decrease in Massachusetts cotton towns. Instead, I find no effect on wartime total, male, or female populations, while all three grew relative to non-cotton towns in the postbellum period. This suggests that a lack of wartime net outmigration kept labor supply relatively steady such that female employment and the cotton textiles industry could rebound quickly postwar.

This paper is the first to causally estimate the effect of the American Civil War on the North's economy. Previous observational work has examined how broad macroeconomic outcomes evolved during and following the war (Cochran, 1961; Engerman, 1966; Goldin and Lewis, 1975), concluding that the "the Civil War resulted in a brief pause in the [North's] long-run growth and development" (Atack and Passell, 1994, p. 376). Goldin and Lewis (1975) in particular infer that per capita consumption returned to its prewar growth path by the end of the 1870s. My causally identified findings corroborate this conclusion for towns specializing in cotton textiles production.

I also advance two strands of the historical literature on women's role in industrialization. The first broadly concerns trends in female labor force participation, employment, and occupational sorting originating in the nineteenth-century (Goldin, 1980; Goldin and Sokoloff, 1982; Costa, 2000). The second investigates the effects of large gender-biased economic shocks. Recently, Ager et al. (2026) and Feigenbaum and Gross (2024) have examined the consequences of automation shocks in heavily-female industries (cow-milking in Norway and telephone operation in the United States, respectively). Goehring (2025), in work most similar to the present study, concludes that the Civil War cotton famine increased the supply of sex work in British cotton textile counties during the war, but the effect dissipated by 1868. In line with these findings, I uncover a lack of negative persistence.

2 Historical Background

2.1 Manufacturing in Antebellum Massachusetts

Massachusetts was at the forefront of American industrialization in the 19th century, especially in cotton textiles. While the first American cotton mill opened in Beverly, Massachusetts in 1788, the industry took off in the 1820s when production moved from the putting out system into the factory "where the processes of manufacture were all carried on under the same roof, the first instance of the kind in the United States" (Massachusetts Bureau of Statistics of Labor 1899, p. 219-221; Dublin 1994, p. 29-30, 33). The factory system brought gains from both mechanization and the organization of production, as a Dedham, MA historian noted in 1827 that "good machinery" and "labor...directed by a single experienced agent" had brought the price for weaving common cotton cloth from a range of five to 14 cents per yard in 1814 down to nine-tenth of a cent per yard and cotton shirting from 50 cents to 16 cents (Worthington, 1827, p. 131).

Data from early state industrial censuses highlight the expansion of textiles in antebellum Massachusetts (Commonwealth of Massachusetts, 1838, 1846, 1856).[1] In the 18-year period between 1837 and 1855, capital investment[2] grew by 166%. The number of cotton spindles in use, the amount of raw cotton consumed in production, and the number of yards of cotton cloth manufactured all more than doubled, with the bulk of the increase coming between 1845 and 1855. Labor productivity–measured as the number of yards of cotton cloth produced per worker–rose by 41.6%. There was no expansion geographically or in the number of establishments; 99 municipalities produced cotton goods in 1837, which decreased to 94 in 1845 before returning to 98 in 1855, while the number of establishments increased only marginally from 283 in 1837 to 296 in 1855. Nevertheless, by the Civil War, Massachusetts alone consumed just under 1/3 of all cotton used in American textiles production (U.S. Census Bureau, 1865).

Cotton textiles' expansion required ever more operatives, and mills turned to the young women of New England to meet the need. In 1837, 18,788 mill hands worked in the manufacture of cotton goods, which increased by 90% to 35,703 in 1855. Around 2/3 of these workers in cotton textiles were female, which was unique to the industry as women were the minority in the other areas where they tended to find employment (see figure 1). While children as young as ten worked in the mills (Robinson, 1898, p. 40), the representative "mill girl" prior to the 1850s was unmarried, between the

[1] See Section 3 for a thorough treatment and description of these data.

[2] Adjusted to 1860 dollars using consumer price indices from Lindert and Sutch (2006), Table Cc1-2.

ages of 15-19, recruited from the countryside, and sought to make some additional income to send to her family before marriage (Dublin, 1994, p. 88-89, 109-110, 112). In contrast to the family-centered English mills or Samuel Slater's in Rhode Island, Massachusetts mill operatives worked for wages and roomed in boarding houses with other young women (Layer, 1955, p. 2). The composition of the labor force evolved in the 1850s due to the large influx of Irish famine immigrants to the cotton producing-towns, and the recruitment of young women from the countryside continued but became less important (Dublin 1993, p. 147; Dublin 1994).

[Figure 1 about here]

2.2 King Cotton: Southern Agriculture

The industrial revolution taking place in Massachusetts would not have been possible without the South's increasing supply of raw cotton. Figure 2 plots the South's cotton output by year for the period 1790 to 1905. Between 1800 and 1860, cotton production increased by over 51 times, with an annual growth rate of 6.83%. For the specific period from 1837 to 1855 during which cotton consumed in production increased by 184% in Massachusetts, the South's output rose annually by 4.62% for 126% overall growth. Productivity gains in cotton planting came from the dispersion of the gang system of labor (Fogel and Engerman, 1974) as well as yield and quality improvements from the introduction of Mexican hybrid cotton varieties (Olmstead and Rhode, 2008). As a result, Olmstead and Rhode (2008) note that the cotton picked per enslaved person per day increased 2.3% annually from 1801 to 1862, for an overall increase of 4.1 times. Furthermore, such efficiency gains incentivized westward expansion of cotton cultivation, which compounded with the productivity increases to create the massive growth in output.

2.3 The Civil War Cotton Shock

The Civil War caused a major, temporary supply shock to the cotton textiles industry. The principal cause was the steep decline in Southern cotton production. Figure 2 shows the massive drop-off in output immediately following the war's beginning in 1861, and by 1864 cotton production had reached its lowest level since 1818, which was only 6.7% of the 1861 figure. Additional contributing factors include the Union Navy's blockade of Southern ports (Surdam, 1999) and that Southern planters purposefully destroyed around 50% of the remaining cotton bales "to prevent its falling into the hands of the enemy" (Lebergott, 1981).

[Figure 2 about here]

The wartime effects of the cotton famine were evident in Massachusetts. Between 1855 and 1865, cotton cloth production dropped by almost 50% while the industry lost 32% of its employment (Commonwealth of Massachusetts, 1856, 1866). In Layer (1955, p. 31, 33)'s sample of prominent Massachusetts cotton textile companies, none operated continuously during the war, while employment reached its lowest in 1863. Mills in Lawrence almost completely ceased operations, and the Hamilton Company in Lowell began producing woolen goods and continued to do so until the early 1870s (Layer, 1955, p. 31).

Following the Confederacy's surrender, Southern cotton production rebounded quickly. Due to the particular skill-set of former slaves, planters still mainly demanded their labor in the production of staple crops (Jaynes, 1986, p. 63-64), and sharecropping—a coercive land tenancy arrangement with post-harvest payment by share of the crop—developed. While there was a decline in productivity with the abandonment of the gang system of labor under sharecropping (Fogel and Engerman, 1974; Jaynes, 1986; Moen, 1992; Margo, 2002), figure 2 shows that cotton production returned to its pre-war level in the 1870s and continued to grow through the beginning of the 20th century. The cotton textiles industry in Massachusetts appeared to rebound quickly in tandem. By 1875, the gross value of output in cotton goods was 31% above its 1855 level, while capital invested rose by 57%. Employment was 73% higher, with male employment doubling (Massachusetts Bureau of Statistics of Labor, 1877).

3 Massachusetts Censuses of Manufacturing

To investigate the effect of the Civil War cotton shock on Massachusetts's economy, I gather town and town-industry manufacturing data from 19th century state and federal censuses.

Massachusetts was the first state to undertake its own manufacturing census in 1837, and it repeated this effort every decade 1845-1895 (Commonwealth of Massachusetts, 1838, 1846, 1856, 1866; Massachusetts Bureau of Statistics of Labor, 1877, 1888, 1898). The censuses began as a broad effort to document all economic activity across the state, and through 1865 the publications reported production statistics by town for an expanding list of goods that encompassed all sectors of the economy: manufacturing, artisanal crafts, agriculture, fishing, and livestock (see figure A1). The establishment of Massachusetts's Bureau of Statistics of Labor in 1869 systemized the collection and dissemination of the decennial state censuses into extensive multi-volume publications with vol-

umes dedicated to population and social statistics, manufactures and occupations, and agriculture, property, and trade. Instead of listing statistics for every good produced in each town, the later census volumes contained summary tables that aggregated data by town and town-industry.

I use these data to construct town-year and town-industry-year panels of manufacturing outcomes. I have digitized the first four censuses in their entirety and summary tables in the post-Bureau censuses, which I augment with Massachusetts's returns from three federal manufacturing censuses (1850, 1860, 1880). For 1850 and 1860, I aggregate the Hornbeck et al. (2025) complete establishment-level returns by town, whereas for 1880, I have digitized outcomes from the tables in the state's abstract to the federal census (Massachusetts Bureau of Statistics of Labor, 1883).[3] Across the data sources, I consistently observe the value of manufacturing output, total manufacturing employment, and manufacturing employment by sex.[4]

Given the unprecedented nature of collecting extensive manufacturing information in the first half of the 19th century, the data are imperfect for several reasons. Most notable is that all antebellum measures are undercounts. Since the earliest four state censuses reported statistics for a specific list of goods, some important industries were either missing or insufficient. While industry coverage improved over time, and some census enumerators often "[took] pains, in addition to their answers, to gather and present the statistics of other branches of industry" (Commonwealth of Massachusetts, 1838), one notable deficiency is the lack of data on the clothing industry outside of hats and caps. Concerning the federal censuses, enumerators were instructed to record only establishments with an annual value of production output exceeding $500 (US Census Office, 1860). This minimum requirement not only led to undercounts of town totals, but also the complete omission of any town with only small establishments; over 10% of all Massachusetts towns are missing entirely from the 1860 federal census. For this reason, I do not include the 1850 and 1860 censuses in the town-industry panels. With that level of granularity, it is too difficult to distinguish true zeroes and town-industry cells with small establishments.

Between the two sources, measurement error will present a concern if undercounting is endogenous to a town's exposure to the cotton economy. While there is no particular reason to believe this is the case, by having two different antebellum data sources with different forms of measurement

[3]While Hornbeck et al. (2025) have digitized all four 1850-1880 manufacturing censuses, I use only 1850 and 1860 because most counties in 1870 are missing from the Massachusetts state archives and I have separately digitized the 1880 data from the Bureau of Statistics of Labor abstract, so there was no need to duplicate that effort. Furthermore, I do not include these two censuses in the town-industry panel due to the $500 minimum issue mentioned below. For more detail, see section 4.2.

[4]All employment counts include children, since it is not possible to disentangle adult from child employment in years when they were not reported separately.

error, a lack of pretrends would rule out any concerns since it is quite unlikely that prewar estimates from both sources would be systematically biased by similar amounts in the same direction. However, there is one particular case where a large measurement error appears to threaten identification (clothing in 1855 Boston), which I discuss further in section 5.1.

3.1 Defining Cotton Towns

I use the 1855 Massachusetts manufacturing census to classify cotton towns. Similar to Hanlon (2017), I define a cotton town as a municipality with greater than 20% of total employment in 1855 in the production of cotton textiles or printed cloths such as calicoes. This definition of treatment is ideal for two important reasons. First, although I have collected town-level employment figures from the 1860 federal census of manufactures, the 1855 state census has better coverage than the federal censuses that only include establishments producing more than $500 in output. Second, while there are still some issues with the 1855 data, I mitigate many of these concerns by adopting a binary measure because it is more robust to measurement and data quality errors than continuous alternatives (e.g., the labor share in cotton textiles).

[Table 1 about here]

Table 1 contains summary statistics for cotton and non-cotton towns in Massachusetts. There is substantial variation both within and across towns by treatment status. Broadly, cotton towns tended to have greater immigrant and female populations as well as more manufacturing activity. Differences in means for manufacturing outcomes, however, are not statistically significant once weighting by antebellum employment, which I do when estimating my main specification (see section 4.1). Importantly, the manufacturing workforce was majority female in cotton towns and overwhelmingly not so in non-cotton towns (regardless of weighting), and this difference is statistically significant.

3.2 Border Standardization

Finally, I gather a series of historical maps of Massachusetts to standardize data across census years. Between 1837 and 1895, over 50 new municipalities were incorporated in Massachusetts, while five were absorbed into existing ones, and borders between adjacent towns changed quite frequently (Massachusetts Bureau of Statistics of Labor, 1908). Since Massachusetts municipality boundaries from the 19th century have not been previously digitized, I collect historical maps from the Digital

Commonwealth archives database and digitize town boundaries in census years using ArcGIS. I then follow Hornbeck (2010)'s intersection procedure to standardize data to 1855 town borders. More detail is provided in Appendix A.2.

4 Empirical Strategy

To estimate the causal effect of the cotton supply shock on Massachusetts's manufacturing economy, I begin by comparing manufacturing outcomes before, during, and after the Civil War between cotton and non-cotton towns using a differences-in-differences identification strategy. I then turn to investigating how the cotton textiles industry fared relative to other manufacturing industries across the state.

4.1 Cotton Town Event Study

I start with town-level manufacturing data from the Massachusetts and federal censuses between 1837-1895. Since my goal is to identify the effect of the wartime shock on bellum and postbellum manufacturing outcomes in cotton towns, my target causal parameters are average treatment effects on the treated (ATTs) during and after the Civil War. Letting $Y_{\ell t}$ be an outcome in town ℓ in year t and $Y_{\ell t}(0)$ be that town-year's untreated potential outcome, i.e., if the Civil War had never happened, then my parameters of interest are:

$$\tau_t = \mathbb{E}[Y_{\ell t} - Y_{\ell t}(0) | CotTown_\ell = 1] \tag{1}$$

for $t \geq 1865$. It is a well-known result that under the canonical parallel trends assumption these ATTs are equal to differences-in-differences which can be estimated with a dynamic two-way fixed effects regression.[5]

Instead of two-way fixed effects, I estimate the ATTs using Sant'Anna and Zhao (2020)'s doubly-robust differences-in-differences method, which Roth et al. (2023) recommended when parallel trends only holds conditional on a set of pre-treatment covariates. Sant'Anna and Zhao (2020)'s estimator augments the standard differences-in-differences formulation by combining inverse probability weighting (IPW; accounting for each town's conditional probability of receiving treatment using

[5]That is: $\tau_t = \mathbb{E}[Y_{\ell t} - Y_{\ell,1860} | CotTown_\ell = 1] - \mathbb{E}[Y_{\ell t} - Y_{\ell,1860} | CotTown_\ell = 0]$ and τ_t's can be recovered by OLS estimation of $Y_{\ell t} = \sum_{s \neq 1860} \tau_s \times \mathbf{1}\{s = t\} \times CotTown_\ell + \alpha_\ell + \alpha_t + u_{\ell t}$ where α_ℓ, α_t are town and time fixed effects, respectively.

propensity scores, $p(X_\ell) = \mathbb{P}(CotTown_\ell = 1|X_\ell)$) and regression adjustment (RA; accommodating how outcomes would evolve absent treatment across the distribution of covariates). The ATTs are thus identified as:

$$\tau_t = \mathbb{E}\Bigg[\underbrace{\left(\frac{CotTown_\ell}{\mathbb{E}(CotTown_\ell)} - \frac{\frac{(1-CotTown_\ell)p(X_\ell)}{1-p(X_\ell)}}{\mathbb{E}[\frac{(1-CotTown_\ell)p(X_\ell)}{1-p(X_\ell)}]}\right)}_{IPW}(Y_{\ell t} - Y_{\ell,1860} - \underbrace{\mathbb{E}[Y_{\ell t} - Y_{\ell,1860}|CotTown_\ell = 0, X_\ell]}_{RA})\Bigg] \tag{2}$$

and can be estimated by taking sample expectations and plugging in $\widehat{p(X_\ell)}$ and $\widehat{\mathbb{E}}(Y_{\ell t} - Y_{\ell,1860}|CotTown_\ell = 0, X_\ell)$ appropriately.[6]

A key element of this specification is thus the inclusion of antebellum town controls. These include each town's percent foreign born in 1855 to account for the surge of Irish famine and German "forty-eighter" immigrants who tended to settle in cities and manufacturing and mill towns (Ferrie, 1997; Alsan et al., 2020), as well as an indicator for whether the town was urban (population > 2500) in 1855.

Finally, I weight estimations by 1855 manufacturing employment to account for heterogeneity in manufacturing involvement across towns prior to the Civil War. Specifically, this means that I upweight places with heavy manufacturing activity and downweight those with little in order to focus on the effects to places where cotton textiles production centered, like Lowell and Lawrence.

4.2 Cotton Textiles Industry Effects

I investigate effects specific to cotton textiles using town-industry manufacturing data between 1837-1880. My parameters of interest are again ATTs of the form:

$$\tau_t^{cot} = \mathbb{E}[Y_{\ell it} - Y_{\ell it}(0)|i = Cotton\ textiles] \tag{3}$$

where i indexes industry. I estimate τ_t^{cot}'s with the following dynamic fixed effects specification:

$$Y_{\ell it} = \sum_{s \neq 1855} \tau_s^{cot} \times \mathbf{1}\{s = t\} \times \mathbf{1}\{i = Cotton\ textiles\} + \alpha_\ell + \alpha_i + \alpha_t + u_{\ell it} \tag{4}$$

[6]There are multiple parametric and semi-/non-parametric methods for these two estimators. In practice, the propensity score is usually estimated by logistic regression, and the regression adjustment portion is estimated by fitting the conditional expectation function on untreated units with OLS and then plugging in X_ℓ for treated units. See Sant'Anna and Zhao (2020) for a complete treatment and Roth et al. (2023) for an overview.

where α_ℓ, α_i, α_t are town, industry, and year fixed effects, respectively. In the baseline specification, I do not include any controls or weight observations; however, I also present results with weighting and controls for comparison with the specification in section 4.1.

Due to data quality concerns, I omit several censuses from these analysis. First, I do not include the 1850 and 1860 federal censuses because of the instruction that an establishment must have had greater than $500 in output to be enumerated (see section 3). If the data contain no establishments in a town-industry cell, it is impossible to know whether this reflects zero manufacturing activity or any number of small establishments. Second, I remove the 1885 and 1895 state censuses for a similar reason: the Bureau of Statistics of Labor began to censor data for any town-industry cell with fewer than three establishments. Hence, I also do not know whether missing data reflects zero, one, or two establishments. Even when excluding these four censuses, I still have data across six years between 1837-1880.

5 Results

Using the specification from the previous section, I demonstrate that the Civil War was a temporary adverse shock to women in manufacturing that did not affect the long-run development of Northern cotton towns. I then address potential threats to identification and show robustness to strengthen the causal interpretation of the results. I end by highlighting that this pattern of effects on cotton towns is consistent with the trajectory of the cotton textiles industry in Massachusetts, which suffered during the Civil War but rebounded quickly.

5.1 Large, Temporary Effects on Women

The Civil War shock caused a massive, but short-lived, contraction in female employment within cotton towns. Table 2 and figure 3 show the results of the doubly-robust differences-in-differences estimation (equation 2).

[Table 2 about here]

Female employment dropped by 82% during the war (see column (4)), while there was no statistically significant effect on any other available manufacturing outcome. Figure 3 particularly highlights the stark divergence in wartime employment by gender, as well as the immediate postwar recovery.

[Figure 3 about here]

Within ten years of the Union's victory, women's employment had more than rebounded as the estimated event study coefficient in 1875 is positive and economically large (0.49 log points), though not statistically significant. In fact, estimates for all four outcomes are positive in every postbellum year of available data and statistically significant for male employment in 1875, 1885, and 1895 and total employment in 1875 and 1895. While these positive and significant coefficients should not be interpreted as direct effects of the Civil War cotton shock since they appear once Southern cotton production had returned to prewar levels, they still highlight that the wartime cotton scarcity did not impede cotton towns' long-term ability to flourish.

Examining event study coefficients in antebellum years allows me to rule out that differential underlying trend between cotton and non-cotton towns drive the results. All prewar estimates are close to zero in magnitude and statistically insignificant, except for female employment in 1855. While this may suggest a parallel trends violation, I contend that my main conclusion is well-identified for two reasons. First, I show in figure 4 that the supply shock caused the female share of manufacturing employment to decline by just over 20 percentage points relative to non-cotton towns during the Civil War.[7] Since I find no effect on wartime total employment and a positive, though insignificant, effect on male employment (table 2), this negative estimate on the female employment share strengthens the conclusion that women suffered the brunt of the cotton shock. Second, the large and statistically significant coefficient on log female employment in 1855 is due to measurement error and not unparallel trends. Specifically, Boston's female employment was severely undercounted since that year's census enumeration instructions omitted most articles of clothing.[8] As Boston was the largest non-cotton town in the state and my specification weights by antebellum manufacturing employment, a substantial decline in Boston's female employment from 1860 to 1855 absent a parallel decline within cotton towns can explain the large positive estimate in 1855. To confirm, I perform a data correction[9] and re-estimate the main results in table A1, which shows that the 1855 coefficient becomes much smaller in magnitude and statistically insignificant.

[Figure 4 about here]

Finally, I demonstrate robustness in a couple ways. First, the main result is not sensitive to the chosen cutoff of 20% employed in cotton goods in the treatment definition. Figure 5 shows the

[7] Although one of the prewar estimates is statistically significant, it is much smaller in magnitude than the estimated wartime effect and thus does not threaten the parallel trends assumption.

[8] Section 3 contains further detail on the imperfections of the early state censuses. Massachusetts's antebellum clothing industry employed mostly women and centered in Boston, which is why it in particular would suffer from this measurement error.

[9] See Appendix B.1 for details.

estimated effect on log female employment in 1865 using different percentage cutoffs, and the estimates are all negative and statistically significant when going from 10% to 30%. Second, I conduct a randomization test to strengthen the conclusion that the wartime effect on female employment was specific to places specializing in cotton textiles production. Since there were 50 "true" cotton towns in Massachusetts, I perform 1,000 iterations of randomly assigning 50 towns to treatment and calculating the associated t-statistics for the ATT on log female employment in 1865. This is equivalent to drawing a sample of size 1,000 from the distribution of the t-statistic under the null hypothesis that there was no effect of the Civil War on female employment in cotton towns, and it is plotted in figure 6. The t-statistic associated with the true set of cotton towns—given by the dashed vertical line—is larger in magnitude than 97.8% of those generated by random assignment, providing strong support for rejecting the null hypothesis in favor of a negative wartime effect on female employment.

[Figures 5 and 6 about here]

5.2 Immediate Rebound of Cotton Textiles

Using the industry differences-in-differences specification from section 4.2, I show that the wartime supply shock depressed activity in cotton textiles, but it recovered within a decade. Table 3 contains the results of estimating equation 4. In the main specification, both output and employment declined in the Massachusetts cotton goods industry during the Civil War (32% and 17%, respectively, in columns (1) and (3)),[10] while postwar estimates are statistically insignificant for both outcomes. Furthermore, although the joint significance of prewar estimates on output warrants some caution, for employment, the lack of pretrends (joint p-value of 0.733, column (3)) and small postwar estimates strengthen the causal interpretation that the supply shock caused a brief decline in cotton textiles before a quick rebound. These results, when considered with the lack of persistent effects on cotton towns, suggest that women returned specifically to cotton textiles employment postwar and not other industries.

[Table 3 about here]

[10] See Bellemare and Wichman (2020) for the calculation of semi-elasticities when applying the inverse hyperbolic transformation to outcomes. While there are known issues with using this transformation (Chen and Roth, 2023; Thakral and Tô, 2025), table A2 shows that the result on employment is robust to adopting various recommended functional forms for dealing with outcomes containing zeros.

6 Temporary Shocks and Temporary Effects: Comparison with the Lancashire Cotton Famine

Across the Atlantic, Britain also experienced a wartime cotton shortage during the "Lancashire cotton famine." Similar to Massachusetts during the first half of the 19th century, British cotton textile production centered in cities throughout Lancashire and Cheshire counties in Northwest England that relied on ever increasing raw cotton imports from the Southern US (Arthi et al., 2022). The wartime shock was large and temporary as British raw cotton imports dropped steeply during the Civil War while cotton's price exploded before both returned to prewar levels almost immediately (Hanlon, 2015).

Comparing the experience of the same shock on both sides of the Atlantic provides insight into why the effects were temporary in Massachusetts. While there has been no study considering the cotton famine's effects on manufacturing outcomes[11], the shock did produce some lasting consequences—along with temporary ones—in Britain. Specifically, there were temporary wartime increases in the density of sex work establishments and the number of workers seeking relief from local Poor Law Boards in cotton textile producing areas of the country, but there was also sustained outmigration and long-run mortality increases among households working in cotton textiles (Hanlon, 2017; Arthi et al., 2022; Goehring, 2025).

Since this persistence contrasts with my findings for manufacturing in Massachusetts, I investigate the effects of the wartime supply shock on population in Massachusetts cotton towns to facilitate a more direct comparison across the Atlantic. To do so, I gather town-level population counts from each available state (Haines, 2022) and federal (Ruggles et al., 2024) census between 1850-1900[12]. I construct the town counts from federal censuses by geolocating individuals in the IPUMS complete-count data to their town of residence with the Census Place Project (Berkes et al., 2023) and aggregating. To estimate the effect of the cotton shock on cotton towns, I adopt the same doubly-robust differences-in-differences specification described in section 4.1, with demographic replacing manufacturing outcomes.

[Table 4 about here]

[11] Hanlon (2015) does document growth in inventions to specifically accommodate lower-quality Indian cotton, but no research has examined overall manufacturing activity by town, industry, town-industry, etc.

[12] State censuses were every decade for years ending in five starting in 1855, while the federal decennial censuses were in years ending with zero. The original returns from the 1890 census were lost in a fire.

I find no temporary or persistent negative effects on population in Massachusetts cotton towns, which helps explain the immediate rebound of cotton towns and the cotton textiles industry. Table 4 shows the results. The wartime effects of the cotton shock on total population and population by gender are all close to zero and none are statistically significant. In stark contrast to Britain, all postwar estimates are large and positive; overall, postbellum total population compared to 1860 grew by 48% in cotton towns relative to non-cotton towns, but the estimate is only statistically significant at 10%. Effects on men were larger than on women; however, the estimated coefficient on female population share is small in magnitude and statistically insignificant. While the postbellum estimates are noisy, it is clear that the lack of any wartime net outmigration precluded persistent negative effects on population. Furthermore, this null effect on population during the war—particularly for women—helps explain the temporary effects of the shock and why female employment and the cotton textiles industry rebounded immediately: there remained sufficient labor supply to restart once the raw cotton supply began flowing again.

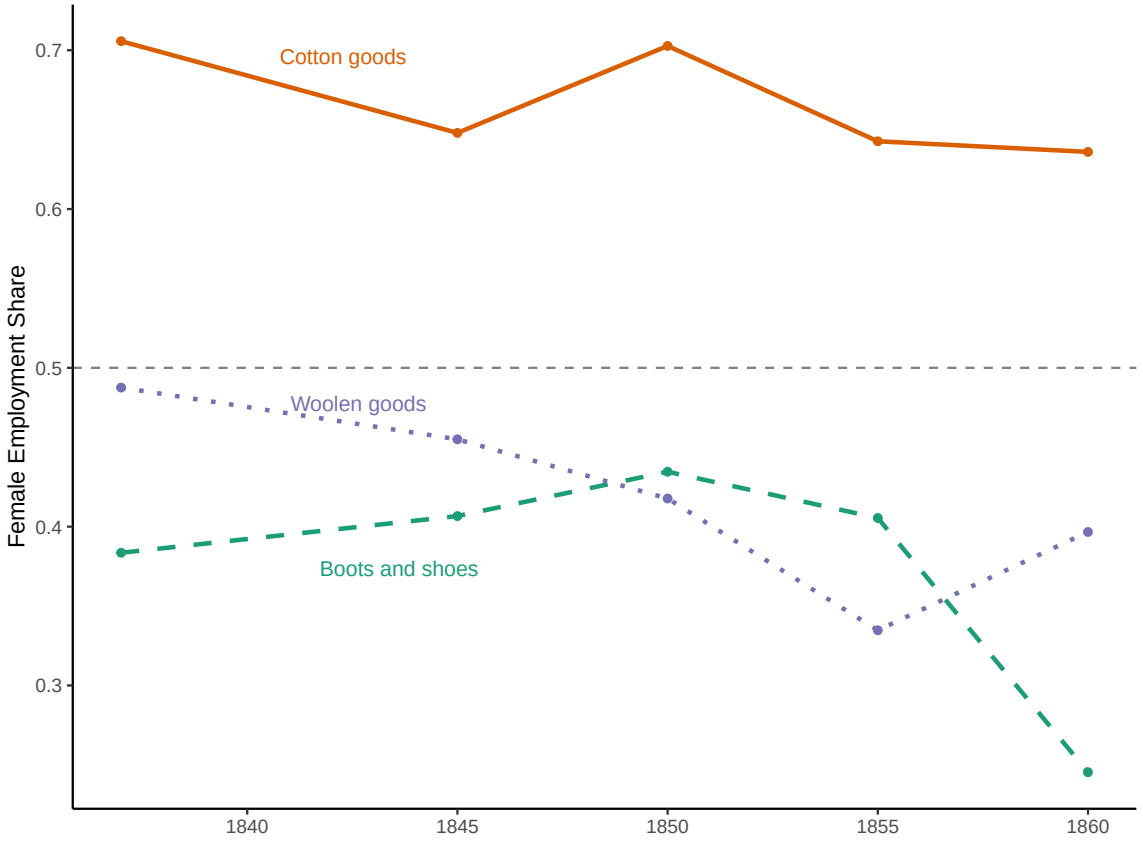
7 Conclusion

This paper studies the effects of the cotton supply shock during the American Civil War on manufacturing in Massachusetts. I find that towns in Massachusetts dependent on the cotton economy saw a large contraction in wartime female employment while men and output were unaffected. Women's employment rebounded by 1875 and postwar effects for men were positive. The cotton textiles industry as a whole followed a very similar path to female employment.

These results provide causal identification to support the prevailing wisdom that Civil War did not hinder long-run manufacturing growth in the North and also contrast with the experience in Britain (Hanlon, 2017; Arthi et al., 2022). A lack of wartime net outmigration from cotton towns in Massachusetts helps explain this disparity in persistence across the Atlantic. With no decline in population, cotton towns had sufficient workers available such that these towns and the cotton textiles industry itself could return to prewar growth once the flow of raw cotton from the South resumed. Why there was outmigration in Britain and not in Massachusetts, however, remains an open question. Exploring how the migratory effects of large shocks differ across varied geographic, cultural, and institutional landscapes more generally is a fruitful avenue for future research.

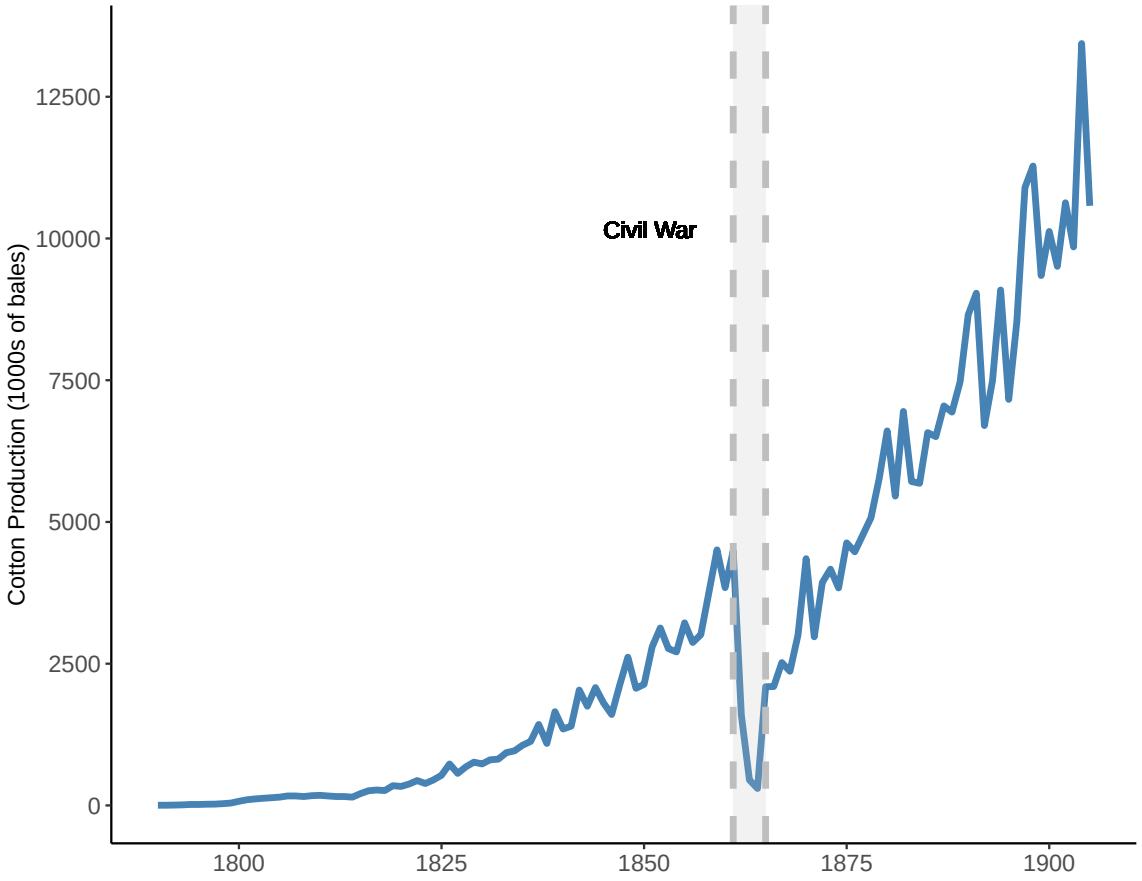
Figures and Tables

Figure 1: Women's Work in Antebellum Massachusetts



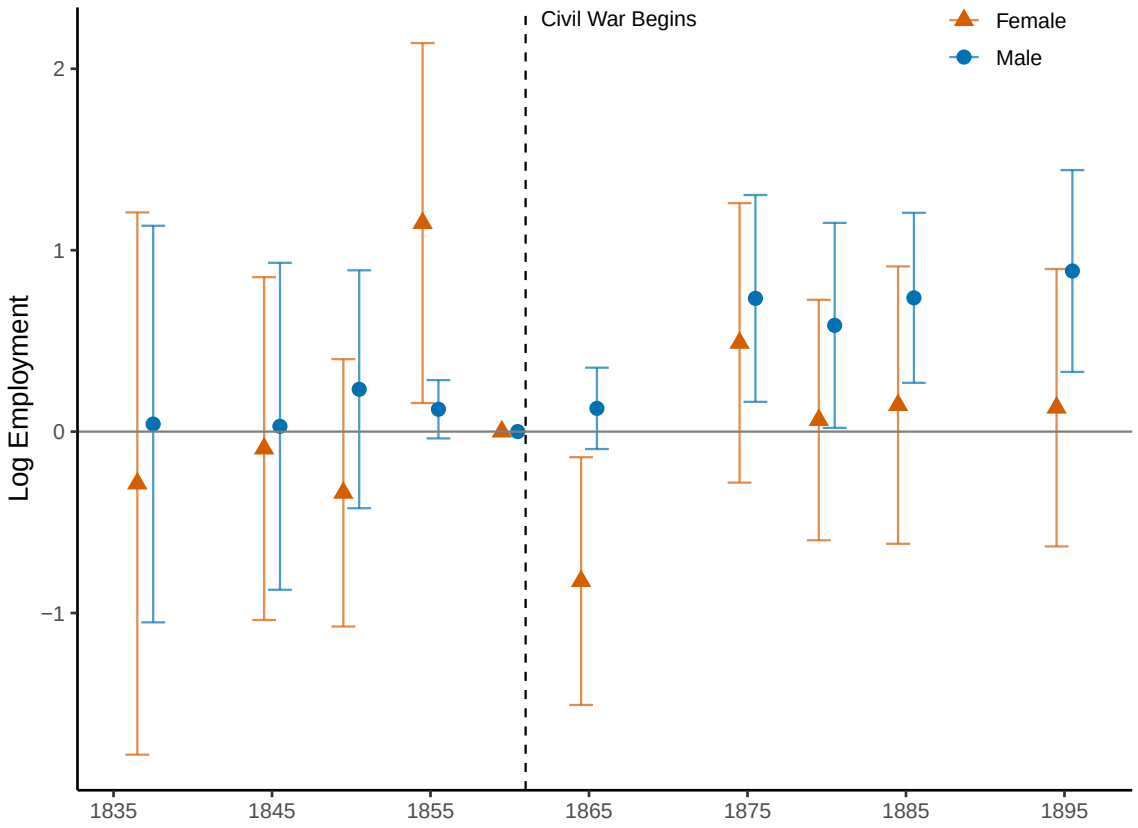
Notes: Female Employment Share$_i$ = $(\sum_\ell \text{Female Employment}_{i\ell})/(\sum_\ell \text{Employment}_{i\ell})$ where $i \in$ {Boots and shoes, cotton goods, woolen goods} and ℓ indexes towns. These three industries are included because they have consistent data coverage and together accounted for at least 2/3 of female manufacturing employment in Massachusetts. *Sources:* State (1837, 1845, 1855) and federal (1850, 1860) censuses of manufacturing. See section 3 for further information on data sources.

Figure 2: The Civil War Cotton Shock



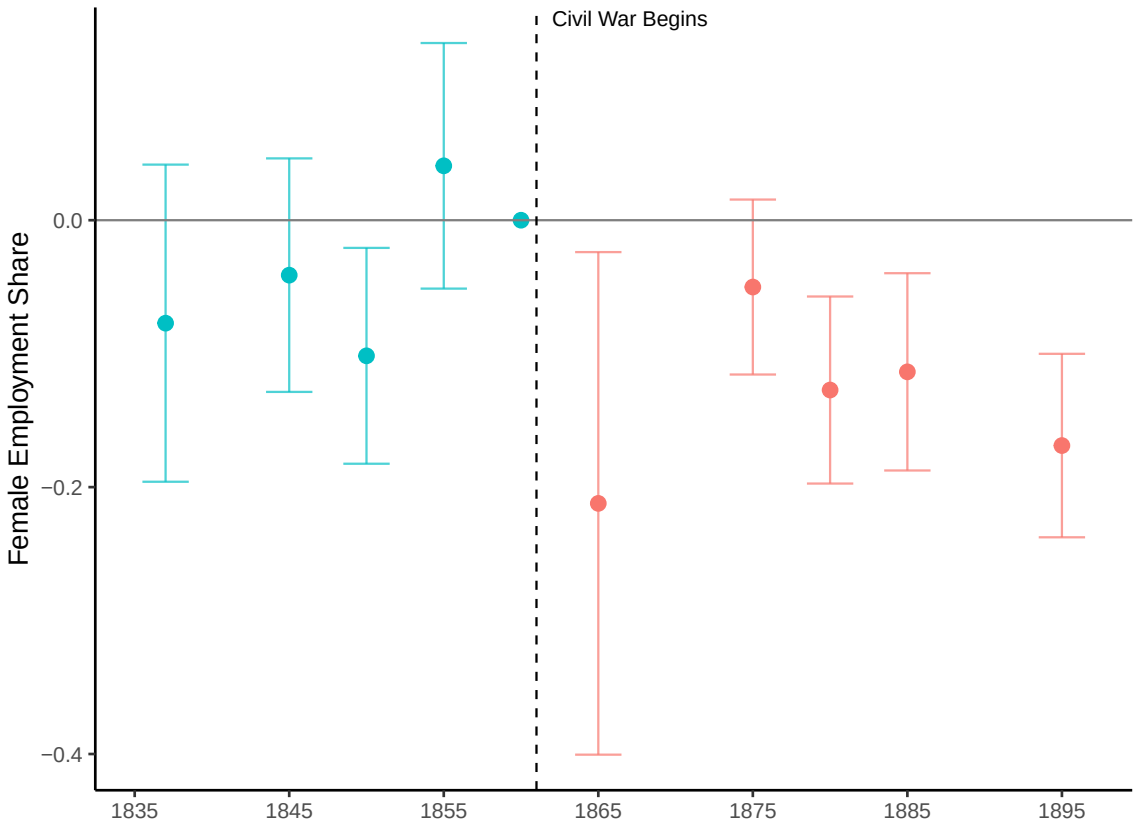
Source: Southern cotton output from Olmstead and Rhode (2006), Table Da755-765.

Figure 3: Gendered Effects of the Civil War Shock on Employment in Cotton Towns



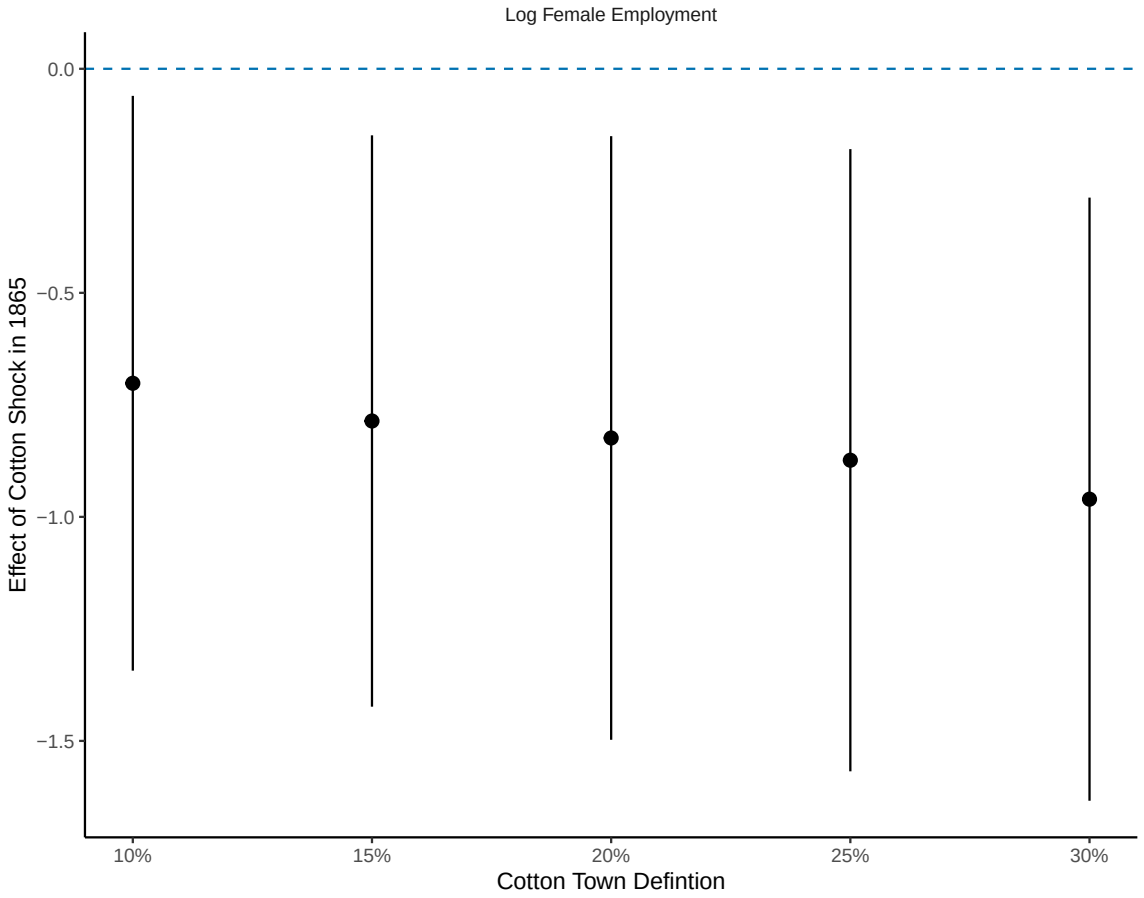
Notes: Event studies estimated using doubly-robust differences-in-differences (Sant'Anna and Zhao, 2020) with the did R package (Callaway and Sant'Anna, 2021). Treatment assigned at the town-level, where "cotton towns" are those with $>$ 20% of 1855 employment in cotton goods. All estimations control for the town's percent foreign born and an urban indicator (population $>$ 2500) in 1855, and observations are weighted by 1855 manufacturing employment. Bars reflect bootstrapped 95% simultaneous confidence bands with clustering by town.
Sources: Massachusetts town employment data are from state (1837, 1845, 1855, 1865, 1875, 1885, 1895) and federal (1850, 1860, 1880) manufacturing censuses. Control variables come from the 1855 Massachusetts state population census (Haines, 2022).

Figure 4: Negative Effect on Female Employment Share



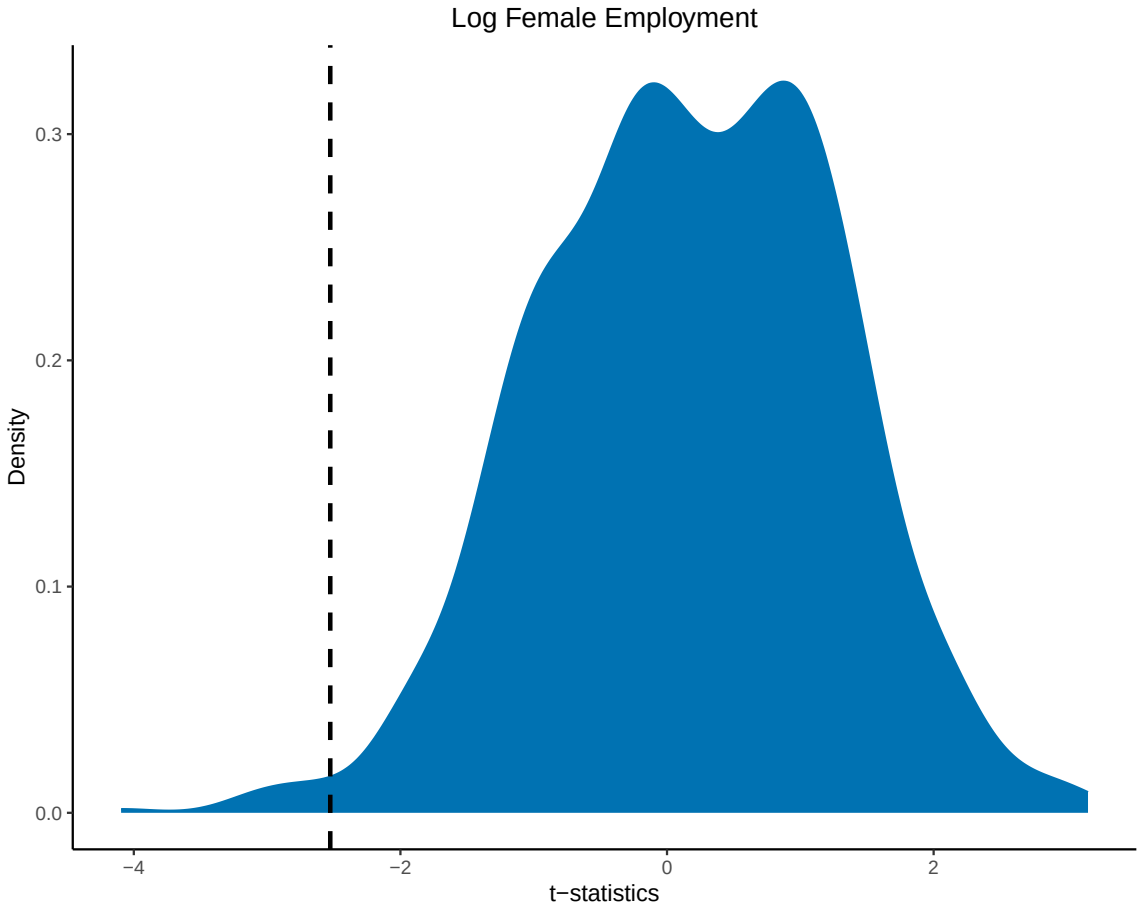
Notes: Event study estimated using doubly-robust differences-in-differences (Sant'Anna and Zhao, 2020) with the did R package (Callaway and Sant'Anna, 2021). Treatment assigned at the town-level, where "cotton towns" are those with $>$ 20% of 1855 employment in cotton goods. The estimation controls for the town's percent foreign born and an urban indicator (population $>$ 2500) in 1855, and observations are weighted by 1855 manufacturing employment. Bars reflect bootstrapped 95% simultaneous confidence bands with clustering by town.
Sources: Massachusetts town employment data are from state (1837, 1845, 1855, 1865, 1875, 1885, 1895) and federal (1850, 1860, 1880) manufacturing censuses. Control variables come from the 1855 Massachusetts state population census (Haines, 2022).

Figure 5: Robustness to Different Cotton Town Definitions



Notes: Estimated effect of the Civil War cotton shock on 1865 female employment across different treatment definitions. Values on the horizontal axis correspond with cutoffs for percent of manufacturing employment in cotton goods to assign towns as cotton towns. Doubly-robust differences-in-differences (Sant'Anna and Zhao, 2020) performed with the did R package (Callaway and Sant'Anna, 2021). Each estimation controls for the town's percent foreign born and an urban indicator (population $>$ 2500) in 1855, and observations are weighted by 1855 manufacturing employment. Bars reflect bootstrapped 95% simultaneous confidence bands with clustering by town.
Sources: Massachusetts town employment data are from state (1837, 1845, 1855, 1865, 1875, 1885, 1895) and federal (1850, 1860, 1880) manufacturing censuses. Control variables come from the 1855 Massachusetts state population census (Haines, 2022).

Figure 6: Randomization Inference



Notes: Randomization test for the effect of the Civil War shock on log female employment in 1865. Distribution of 1,000 t-statistics generated by randomly assigning 50 cotton towns and estimating the main specification for each iteration. The vertical dashed lined reflects the true t-statistic from the estimate in table 2, which is greater in magnitude than 97.8% of the t-statistics generated.
Sources: Massachusetts town employment data are from state (1837, 1845, 1855, 1865, 1875, 1885, 1895) and federal (1850, 1860, 1880) manufacturing censuses. Control variables come from the 1855 Massachusetts state population census (Haines, 2022).

Table 1: Cotton Town Characteristics

	Town Means			Weighted Town Means		
	Cotton Towns	Non-Cotton Towns	Difference	Cotton Towns	Non-Cotton Towns	Difference
Demographics						
Population (1000s)	4.67	3.54	1.13	15.23	20.05	-4.82
	(6.18)	(10.74)	(1.11)	(13.81)	(42.46)	(12.97)
Share Foreign Born	0.21	0.12	0.09***	0.31	0.18	0.13***
	(0.12)	(0.09)	(0.02)	(0.10)	(0.10)	(0.03)
Female Share of Population	0.52	0.50	0.02***	0.55	0.51	0.04***
	(0.02)	(0.02)	(0.00)	(0.03)	(0.02)	(0.01)
Urban (pop $>$ 2500)	0.56	0.36	0.20**	0.90	0.79	0.12**
	(0.50)	(0.48)	(0.08)	(0.30)	(0.41)	(0.06)
Manufacturing						
Value of Manufacturing Output ($M)	1.56	0.76	0.80	7.79	5.31	2.48
	(3.42)	(2.60)	(0.51)	(8.84)	(9.62)	(4.55)
Total Manufacturing Employment (100s)	11.36	6.15	5.21*	49.91	41.53	8.39
	(20.95)	(16.37)	(3.13)	(50.72)	(52.47)	(24.73)
Female Share of Manufacturing Employment	0.41	0.22	0.19***	0.51	0.26	0.24***
	(0.15)	(0.19)	(0.02)	(0.14)	(0.18)	(0.05)
Share of Employment in Cotton Goods	0.44	0.02	0.43***	0.52	0.02	0.49***
	(0.19)	(0.04)	(0.03)	(0.18)	(0.04)	(0.04)
Observations	50	239	289	50	239	289

Notes: Columns 1 and 2 report unweighted town means of characteristics in cotton and non-cotton towns; columns 4 and 5 report town means weighted by 1855 manufacturing employment. Standard deviations are in parentheses below. Columns 3 and 6 contain differences in town means with and without weighting, respectively, with standard errors in parentheses below. Demographic variables come from the 1855 Massachusetts census of population (Haines, 2022). Manufacturing variables (output, male, female, and total employment) come from the 1860 federal census of manufactures (Hornbeck et al., 2025), and the 1855 state census of manufacturing (share of employment in cotton goods).
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Event Study Estimates on Manufacturing Outcomes

	Log(Output ($))	Log(Employment)	Log(Male Employment)	Log(Female Employment)
	(1)	(2)	(3)	(4)
Cotton Town x 1837	-0.05	-0.04	0.04	-0.29
	(0.51)	(0.56)	(0.50)	(0.73)
Cotton Town x 1845	-0.06	-0.07	0.03	-0.09
	(0.45)	(0.41)	(0.41)	(0.45)
Cotton Town x 1850	0.09	0.08	0.23	-0.34
	(0.27)	(0.32)	(0.30)	(0.35)
Cotton Town x 1855	-0.15	0.10	0.12	1.15***
	(0.08)	(0.09)	(0.07)	(0.48)
Cotton Town x 1865	0.13	-0.28	0.13	-0.82***
	(0.22)	(0.17)	(0.10)	(0.33)
Cotton Town x 1875	0.39	0.62**	0.73***	0.49
	(0.30)	(0.28)	(0.26)	(0.37)
Cotton Town x 1880	0.27	0.46	0.59**	0.06
	(0.33)	(0.27)	(0.26)	(0.32)
Cotton Town x 1885	0.27	0.52*	0.74***	0.15
	(0.30)	(0.25)	(0.22)	(0.36)
Cotton Town x 1895	0.40	0.70***	0.89***	0.13
	(0.33)	(0.28)	(0.24)	(0.36)
Overall ATT	0.29	0.41*	0.61***	0
	(0.27)	(0.22)	(0.21)	(0.27)
Pretrend test (p-value)	0.136	0.537	0.127	0.001
Dep. Var. Mean	12.399	5.345	5.050	4.430
Observations	2,853	2,864	2,864	2,146
Towns	289	289	289	237
Controls	✓	✓	✓	✓

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Event study using doubly-robust differences-in-differences (Sant'Anna and Zhao, 2020) with the did R package (Callaway and Sant'Anna, 2021). Treatment assigned at the town-level, where "cotton towns" are those with $> 20\%$ of 1855 employment in cotton goods. All estimations control for the town's percent foreign born and an urban indicator (population > 2500) in 1855, and observations are weighted by 1855 manufacturing employment. Bars reflect bootstrapped 95% simultaneous confidence bands with clustering by town.
Sources: Massachusetts town employment data are from state (1837, 1845, 1855, 1865, 1875, 1885, 1895) and federal (1850, 1860, 1880) manufacturing censuses. Control variables come from the 1855 Massachusetts state population census (Haines, 2022).

Table 3: Effect of the Civil War Shock on the Cotton Textiles Industry in Massachusetts

	Value of Output (IHS)		Employment (IHS)	
	(1)	(2)	(3)	(4)
Cotton Industry x 1837	-0.42*	-0.48	-0.06	-0.31
	(0.25)	(0.83)	(0.11)	(0.32)
Cotton Industry x 1845	0.10	0.76	0.00	-0.01
	(0.22)	(0.97)	(0.09)	(0.40)
Cotton Industry x 1865	-0.38**	0.25	-0.19***	-0.12
	(0.19)	(0.59)	(0.07)	(0.20)
Cotton Industry x 1875	0.23	1.33	-0.06	0.29
	(0.23)	(0.88)	(0.09)	(0.30)
Cotton Industry x 1880	-0.37	0.26	-0.06	0.28
	(0.23)	(0.83)	(0.09)	(0.34)
Year FE	✓	✓	✓	✓
Town FE	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓
Controls x Year		✓		✓
Weights		✓		✓
Pretrend test (p-value)	0.019	0.275	0.733	0.379
Dep. Var. Mean	2.045	2.051	0.647	0.653
Observations	57,444	57,269	57,566	56,430
Towns	330	329	330	329

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimation of town-industry-year regressions of the given manufacutirng outcome on a cotton textiles industry indicator interacted with a full set of year indicators, along with the noted fixed effects, controls, and weights (equation 4). Controls are the town's percent foreign born and an urban dummy (population > 2500); weights are 1855 town manufacturing employment. Standard errors are clustered by town.
Sources: Outcomes and weights from state (1837, 1845, 1855, 1865, 1875) and federal (1880) manufacturing censuses. Control variables come from the 1855 Massachusetts state population census (Haines, 2022)

Table 4: Event Study Estimates on Population Outcomes

	Log(Population) (1)	Log(Male Population) (2)	Log(Female Population) (3)	Female Share of Population (4)
Cotton Town x 1850	0.08	0.07	0.10	0.01
	(0.21)	(0.21)	(0.22)	(0.01)
Cotton Town x 1855	-0.03	-0.04	-0.02	0.01
	(0.11)	(0.11)	(0.11)	(0.01)
Cotton Town x 1865	0.00	0.04	-0.03	-0.02
	(0.13)	(0.13)	(0.14)	(0.02)
Cotton Town x 1870	0.36	0.38	0.35	-0.01
	(0.26)	(0.26)	(0.26)	(0.01)
Cotton Town x 1875	0.59	0.63*	0.56	-0.02
	(0.30)	(0.30)	(0.29)	(0.01)
Cotton Town x 1880	0.47	0.52	0.44	-0.02
	(0.30)	(0.29)	(0.31)	(0.02)
Cotton Town x 1885	0.47	0.51	0.44	-0.02
	(0.29)	(0.29)	(0.30)	(0.01)
Cotton Town x 1895	0.50	0.56	0.45	-0.03*
	(0.29)	(0.29)	(0.30)	(0.02)
Cotton Town x 1900	0.51	0.56	0.47	-0.02
	(0.30)	(0.29)	(0.31)	(0.02)
Overall ATT (1870-1900)	0.48*	0.53*	0.45	-0.02
	(0.28)	(0.28)	(0.28)	(0.01)
Pretrend test (p-value)	0.526	0.522	0.547	0.597
Dep. Var. Mean	7.707	7.004	7.021	0.504
Observations	3,182	3,182	3,182	3,182
Towns	326	326	326	326
Controls	✓	✓	✓	✓

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Event study using doubly-robust differences-in-differences (Sant'Anna and Zhao, 2020) with the did R package (Callaway and Sant'Anna, 2021). Treatment assigned at the town-level, where "cotton towns" are those with $> 20\%$ of 1855 employment in cotton goods. All estimations control for the town's percent foreign born and an urban indicator (population > 2500) in 1855, and observations are weighted by 1855 manufacturing employment. Bars reflect bootstrapped 95% simultaneous confidence bands with clustering by town.
Sources: Massachusetts (1855, 1865, 1875, 1885, 1895) and federal (1850, 1860, 1870, 1880, 1900) population censuses. Treatment defined using 1855 Massachusetts Census of Manufactures.

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Appendices

A Data

A.1 Digitization of the Massachusetts Censuses

A reprisal of some background information on these censuses is first warranted. Each census was authorized by an act of the Massachusetts legislature to collect statistics related to industry within the state. The first two, 1837 and 1845, were standalone while starting in 1855 a decennial census of population accompanied each industrial census. For the first four–1837, 1845, 1855, and 1865– the legislative act specified a list of goods and corresponding statistics relating to industry to be gathered. Town assessors were provided with blank schedules in which to fill the requested information under penalty of a fine. The number of goods detailed in the respective legislative acts expanded quite dramatically, going from less than 40 in 1837 to over 200 in 1865. The goods included livestock and agriculture, and in 1865 even extended to assessing the value of all land. Starting in 1875, the goods were no longer specified in the act authorizing the census, and instructions were provided to enumerators in manufacturing schedules which have not survived. Town-by-industry and town-level aggregations of the statistics were then published.

I began with PDF scans of all eight documents from the Massachusetts State Archives. Two different procedures were used to digitize the censuses since the Massachusetts Bureau of Labor Statistics changed the way it presented information in its publications. As mentioned above, prior to 1875, the bureau's census reports included for each town a *list of goods* produced and the accompanying statistics, as can be seen in the example in Figure A1. Starting in 1875, the publications contain tabular reports at the town level. For the latter, the data from these PDF scans was entered manually into spreadsheets. Accuracy was verified by confirming published county totals equaled the sum of respective manually entered town values when possible; otherwise, I used double entry. I describe the process for digitizing the former in the following paragraphs.

First, I performed Optimal Character Recognition (OCR) of the PDFs using AbbyyFinereader. For each census, I then fed the text from the OCR into Anthropic's Claude 3.5 Sonnet Large Language Model[13] with an accompanying prompt requesting that a .csv file containing a row for each good-town pair with the relevant statistics extracted from the text be outputted. As an

[13]By now Claude 3.5 Sonnet is outdated, but it was the most advanced available model when digitization was performed in the summer of 2024.

example, Figure A2 shows the prompt and response for digitizing the page from the 1855 census in the left panel of Figure A1. Once this process was completed for each census, I cleaned up the outputs to get rid of consistent errors that the LLM tended to make, such as putting the wrong number of commas in a row, assigning total employment to the female employment column, and assigning the quantity of output to the number of establishments column.

The final step was a verification procedure to ensure a high degree of confidence in data accuracy. Due to LLMs' propensity to hallucinate, I developed a process to check the digitized .csv files against the OCRs of the original census using API querying with Claude. For a given census, I looped through each row of the .csv, extracted the associated portion of the OCR-ed text, and prompted Claude to determine whether the information from both sources was identical (see Figure A3). Once every row had been processed, I manually checked all reported discrepancies with the original census document. Though I instructed the LLM to be overly cautious, leading to a substantial fraction of false positives, the procedure still reduced the number of good-town pairs to be manually verified from over 41,000 to around 3,800. I then aggregated the data to the town and town-industry level. For the latter, I first assigned each good based on to one of the 63 manufacturing industries defined in detail by the Commonwealth of Massachusetts in 1875 and 1880. This crosswalk is included in the supplementary materials.

A.2 Border Standardization

Border standardization required digitizing census year municipality boundaries using historical maps and GIS software. A history of all municipality incorporations and border changes was provided in the 1905 Massachusetts Census of Population (Massachusetts Bureau of Statistics of Labor, 1908), which served as a useful reference throughout this procedure. Digitization and generation of boundary shapefiles were performed using Esri's ArcMap 10.8.1 and ArcGIS Pro 3.3. I began with an 1857 map of Massachusetts (Walling, 1857) to create the base year (1855) boundary shapefile. I georeferenced Walling (1857) to the state boundaries provided by MassGIS (2024), then used the editor tool to trace over the municipality boundaries on the historical map. Since the boundaries between Stoneham and South Reading and Braintree and Quincy changed in 1856, these were traced using an 1852 map of the commonwealth[14] (Walker, 1852), while several towns in the Boston area

[14]While the Massachusetts Bureau of Statistics of Labor (1908) notes boundary changes between Cambridge and Somerville and Beverly and Danvers in 1856, these were not discernible on the maps.

were traced from Walling (1858) due to the poor quality of this region in the 1857 state-wide map[15].

To create boundary shapefiles in other census years, I use the municipality history provided in the 1905 census to make note of which towns had borders different from their 1855 borders in a given census year. Then, starting with the 1855 boundary shapefile, I delete the relevant polygons, use a historical map with the correct boundaries for that census year, georeference it to the state borders of the 1855 shapefile, and trace the town boundaries. After producing each census year town boundary shapefile, I standardize to 1855 boundaries using Hornbeck (2010)'s procedure.

[15]These towns are Boston, Brighton, Brookline, Cambridge, Charlestown, Chelsea, Dorchester, Malden, Medford, North Chelsea, Quincy, Roxbury, Somerville, Watertown, West Cambridge, West Roxbury, and Winthrop.

B Results Appendix

B.1 Data Correction

In this Appendix, I describe the data correction mentioned in section 5.1. I perform this correction as the undercounting of female employment in 1855 Boston explains the anomalously large and statistically significant pre-Civil War coefficient on log female employment that may raise concern of a parallel trends violation. The abstract to the 1855 census of manufactures notes "the evident haste with which [it] was prepared" as "many important interests, such as printing and publishing, in all their various departments, engraving, building, coasting, the manufacture of clothing...were entirely overlooked" (Commonwealth of Massachusetts, 1856, p. xi-xii). From this list, clothing is the relevant glaring omission because it disproportionately employed women and centered in the state's biggest non-cotton town: Boston. Reported female employment in 1855 totaled only 275, which is a massive undercount when considering that over 4,000 Bostonian women worked in manufacturing just five years later in 1860. Hence, with estimations weighted by prewar manufacturing employment, such a substantial decline in Boston's reported female employment from 1860 to 1855 absent a parallel decline in cotton towns explains the large positive estimate in 1855.

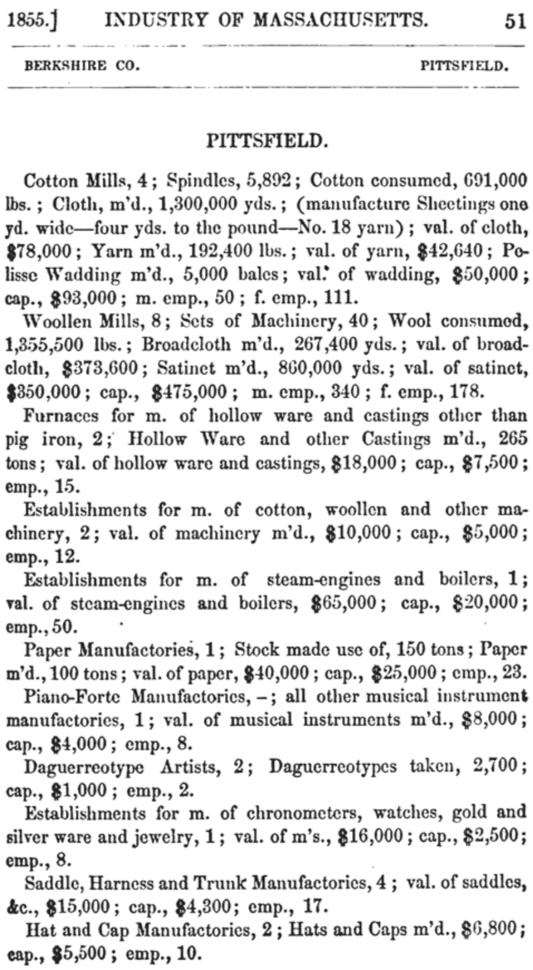
I perform the correction by adjusting employment counts for 1855 Boston using estimates of the clothing industry. Fortunately, in an attempt to rectify the issues with the 1855 census, assessors for the city of Boston provided a figure for the value of clothing produced but not employment. I first calculate the average ratio of clothing's share of Boston's employment to its share of output from 1850 and 1860, which is roughly 1.8.[16] Then, taking clothing's share of output in 1855 (around 23%) and this ratio, I obtain an estimate of employment in clothing (approximately 8,400). I use the average gender composition of Boston's clothing employment in 1850 and 1860 ($\sim$ 70% female), to get final estimates of 1855 male and female employment.

Table A1 contains the results of the data corrected estimation. As column (4) shows, the 1855 estimate on log female employment is close to zero in magnitude and not statistically significant. Thus, with a far more accurate figure for female employment (and accordingly adjusted total and male employment) in 1855 Boston, there is no evidence of a pre-Civil War trend for any outcome.

[16] For instance, if clothing were 10% of the value of manufactured goods in Boston, then on average 18% of all manufacturing employment would be in the clothing industry.

C Additional Tables and Figures

C.1 Data and Digitization



1855.] INDUSTRY OF MASSACHUSETTS. 51

BERKSHIRE CO. PITTSFIELD.

PITTSFIELD.

Cotton Mills, 4; Spindles, 5,892; Cotton consumed, 691,000 lbs.; Cloth, m'd., 1,300,000 yds.; (manufacture Sheetings one yd. wide—four yds. to the pound—No. 18 yarn); val. of cloth, $78,000; Yarn m'd., 192,400 lbs.; val. of yarn, $42,640; Polisse Wadding m'd., 5,000 bales; val. of wadding, $50,000; cap., $93,000; m. emp., 50; f. emp., 111.

Woollen Mills, 8; Sets of Machinery, 40; Wool consumed, 1,355,500 lbs.; Broadcloth m'd., 267,400 yds.; val. of broadcloth, $373,600; Satinet m'd., 860,000 yds.; val. of satinet, $350,000; cap., $475,000; m. emp., 340; f. emp., 178.

Furnaces for m. of hollow ware and castings other than pig iron, 2; Hollow Ware and other Castings m'd., 265 tons; val. of hollow ware and castings, $18,000; cap., $7,500; emp., 15.

Establishments for m. of cotton, woollen and other machinery, 2; val. of machinery m'd., $10,000; cap., $5,000; emp., 12.

Establishments for m. of steam-engines and boilers, 1; val. of steam-engines and boilers, $65,000; cap., $20,000; emp., 50.

Paper Manufactories, 1; Stock made use of, 150 tons; Paper m'd., 100 tons; val. of paper, $40,000; cap., $25,000; emp., 23.

Piano-Forte Manufactories, –; all other musical instrument manufactories, 1; val. of musical instruments m'd., $8,000; cap., $4,000; emp., 8.

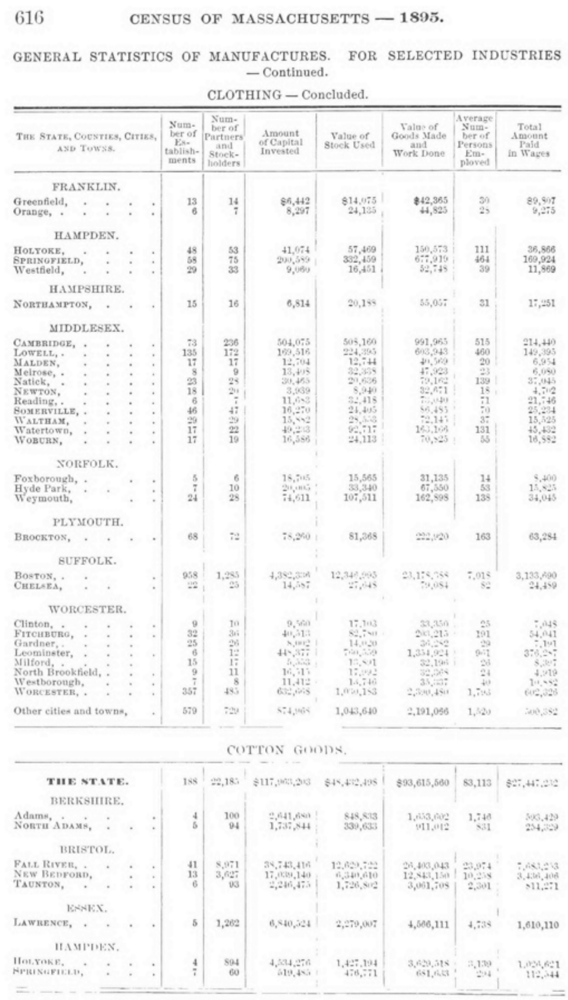
Daguerreotype Artists, 2; Daguerreotypes taken, 2,700; cap., $1,000; emp., 2.

Establishments for m. of chronometers, watches, gold and silver ware and jewelry, 1; val. of m's., $16,000; cap., $2,500; emp., 8.

Saddle, Harness and Trunk Manufactories, 4; val. of saddles, &c., $15,000; cap., $4,300; emp., 17.

Hat and Cap Manufactories, 2; Hats and Caps m'd., $6,800; cap., $5,500; emp., 10.

1855



616 CENSUS OF MASSACHUSETTS — 1895.

GENERAL STATISTICS OF MANUFACTURES. FOR SELECTED INDUSTRIES — Continued.

CLOTHING — Concluded.

The State, Counties, Cities, and Towns.	Number of Establishments	Number of Partners and Stockholders	Amount of Capital Invested	Value of Stock Used	Value of Goods Made and Work Done	Average Number of Persons Employed	Total Amount Paid in Wages
FRANKLIN.							
Greenfield,	13	14	$6,442	$14,075	$42,365	30	$9,907
Orange,	6	7	8,297	24,135	44,825	28	9,275
HAMPDEN.							
Holyoke,	48	53	41,074	57,469	150,573	111	36,866
Springfield,	58	75	200,589	332,459	677,919	464	169,924
Westfield,	29	33	9,060	16,451	52,748	39	11,869
HAMPSHIRE.							
Northampton,	15	16	6,814	20,188	55,057	31	17,251
MIDDLESEX.							
Cambridge,	73	236	504,075	508,160	991,965	515	214,440
Lowell,	135	172	169,516	224,395	603,943	460	149,395
Malden,	17	17	12,704	12,744	40,569	20	6,954
Melrose,	8	9	13,408	32,338	47,923	23	6,080
Natick,	23	28	30,465	29,636	79,162	139	37,045
Newton,	18	20	3,939	8,940	32,671	18	4,702
Reading,	6	7	11,683	32,418	73,040	71	21,746
Somerville,	46	47	16,270	24,405	86,485	70	25,234
Waltham,	29	29	15,882	28,553	72,145	37	15,525
Watertown,	17	22	49,233	92,717	163,166	131	45,432
Woburn,	17	19	16,586	24,113	70,825	55	16,882
NORFOLK.							
Foxborough,	5	6	18,705	15,565	31,135	14	8,400
Hyde Park,	7	10	20,005	33,340	67,550	53	15,825
Weymouth,	24	28	74,611	107,511	162,898	138	34,045
PLYMOUTH.							
Brockton,	68	72	78,260	81,368	222,920	163	63,284
SUFFOLK.							
Boston,	958	1,285	4,382,336	12,346,995	23,178,788	7,018	3,133,690
Chelsea,	22	25	14,587	27,648	79,084	82	24,489
WORCESTER.							
Clinton,	9	10	9,560	17,103	33,350	25	7,048
Fitchburg,	32	36	40,513	82,780	203,215	191	54,041
Gardner,	25	26	8,002	14,020	36,282	29	7,191
Leominster,	6	12	448,377	760,559	1,354,924	961	376,287
Milford,	15	17	5,553	13,891	32,196	26	8,397
North Brookfield,	9	11	16,515	17,992	32,368	24	4,919
Westborough,	7	8	11,412	13,746	35,337	40	10,882
Worcester,	357	485	632,668	1,050,183	2,390,480	1,793	602,326
Other cities and towns,	579	729	874,968	1,043,640	2,191,066	1,520	500,382

COTTON GOODS.

The State, Counties, Cities, and Towns.	Number of Establishments	Number of Partners and Stockholders	Amount of Capital Invested	Value of Stock Used	Value of Goods Made and Work Done	Average Number of Persons Employed	Total Amount Paid in Wages
THE STATE.	188	22,185	$117,963,203	$48,432,498	$93,615,560	83,113	$27,447,232
BERKSHIRE.							
Adams,	4	100	2,641,680	848,833	1,653,602	1,746	593,429
North Adams,	5	94	1,737,844	339,633	911,012	831	254,329
BRISTOL.							
Fall River,	41	8,971	38,743,416	12,629,722	26,403,043	23,974	7,683,253
New Bedford,	13	3,627	17,039,140	6,340,610	12,843,150	10,258	3,436,406
Taunton,	6	93	2,246,475	1,726,802	3,061,708	2,301	811,271
ESSEX.							
Lawrence,	5	1,262	6,840,524	2,279,007	4,566,111	4,738	1,610,110
HAMPDEN.							
Holyoke,	4	894	4,534,276	1,427,194	3,629,518	3,139	1,028,621
Springfield,	7	60	519,485	476,771	681,633	294	112,544

1895

Figure A1: Example Pages from 1855 and 1895 Massachusetts Industrial Censuses

A

<<output_csv_file>>
<documents>
[Paste document]
</documents>
In the text file, there is information on production in Massachusetts in 1855. In each line there is a town, a good, and information on that good. Note that there are some mistakes so that some lines contain more than one good. Please create a CSV file containing data for every town mentioned in the text file with the following columns: Town, Good, Number of Establishments, Value of Output, capital invested (if provided), quantity of output, quantity of raw materials used in production (especially for cotton and woollen goods), male employment (if provided), female employment (if provided), and employment. Do not omit livestock and agricultural goods. Proceed in order of the towns as presented in the text document (e.g. Adams, then Alford, then Becket etc.). Include all towns. If the output is too long for a single message, please continue in subsequent messages without prompting, indicating clearly where you left off and where you're resuming. After you've finished listing all towns, please state 'End of town list.'
Some other instructions:
1. if m. or f. emp. is not specified for a good, then put the number emp. in the total employment column. Leave male employment and female employment blank for that row.
2. there should be exactly exactly 9 commas in every row of the csv. Make sure to check that each row has 9 commas before printing
3. Make sure that value of output and capital invested are in the correct columns. Do not put value of output in the capital invested column if cap. is not provided in the document.
<<output_csv_file>>

A Continue

Certainly, I'll continue with the next town, Pittsfield:

Town,Good,Number of Establishments,Value of Output,Capital Invested,Quantity of Output,Quantity of Raw Materials,Male Employment,Female Employment,Total Employment
Pittsfield,Cotton Mills,4,170640,93000,1300000 yds cloth; 192400 lbs yarn; 5000 bales wadding,691000 lbs,50,111,
Pittsfield,Woollen Mills,8,723600,475000,267400 yds broadcloth; 860000 yds satinet,1355500 lbs,340,178,
Pittsfield,Hollow Ware Furnaces,2,18000,7500,265 tons,,,,15
Pittsfield,Machinery Manufactories,2,10000,5000,,,,,,12
Pittsfield,Steam Engine Manufactories,1,65000,20000,,,,,,50
Pittsfield,Paper Manufactories,1,40000,25000,100 tons,150 tons,,,23
Pittsfield,Musical Instrument Manufactories,1,8000,4000,,,,,,8
Pittsfield,Daguerreotype Artists,2,,1000,2700,,,,2
Pittsfield,Watch and Jewelry Manufactories,1,16000,2500,,,,,,8
Pittsfield,Saddle Manufactories,4,15000,4300,,,,,,17
Pittsfield,Hat and Cap Manufactories,2,6800,5500,,,,,,10

Figure A2: Example Claude Prompt and Response from Digitization Procedure

```
Carefully verify this CSV row against the OCR entries, paying special
    attention to numerical values:

CSV Row: \%s

OCR Entries: \%s

Verification Instructions:

1. Compare EACH numerical field EXACTLY

2. Check for:

   - Matching values (excluding currency symbols)

   - Correct decimal places

3. Identify ANY discrepancies, even minor ones

4. If values differ, explain the specific difference

5. Provide a corrected value

6. If NO discrepancies exist, respond with 'NO DISCREPANCIES'

Respond in strict JSON format
```

Figure A3: Verification Prompt

C.2 Results

Table A1: Event Study Estimates on Manufacturing Outcomes with Data Correction

	Log(Output ($)) (1)	Log(Employment) (2)	Log(Male Employment) (3)	Log(Female Employment) (4)
Cotton Town x 1837	-0.15	-0.15	-0.04	-0.44
	(0.47)	(0.50)	(0.46)	(0.64)
Cotton Town x 1845	-0.09	-0.08	0.01	-0.07
	(0.45)	(0.42)	(0.40)	(0.44)
Cotton Town x 1850	0.02	-0.01	0.15	-0.44
	(0.22)	(0.27)	(0.25)	(0.30)
Cotton Town x 1855	-0.15	-0.10	0.05	-0.25
	(0.08)	(0.05)	(0.07)	(0.17)
Cotton Town x 1865	0.15	-0.29	0.15	-0.87***
	(0.23)	(0.17)	(0.10)	(0.33)
Cotton Town x 1875	0.47	0.70***	0.80***	0.59
	(0.26)	(0.25)	(0.23)	(0.33)
Cotton Town x 1880	0.35	0.53*	0.65***	0.14
	(0.31)	(0.25)	(0.24)	(0.29)
Cotton Town x 1885	0.33	0.58**	0.79***	0.24
	(0.29)	(0.23)	(0.20)	(0.32)
Cotton Town x 1895	0.46	0.77***	0.94***	0.22
	(0.32)	(0.26)	(0.23)	(0.33)
Overall ATT	0.35	0.46**	0.67***	0.06
	(0.26)	(0.2)	(0.19)	(0.24)
Pretrend test (p-value)	0.133	0.318	0.462	0.178
Dep. Var. Mean	12.399	5.345	5.050	4.431
Observations	2,853	2,864	2,864	2,146
Towns	289	289	289	237
Controls	✓	✓	✓	✓

Notes: * p < 0.1, ** p < 0.05, *** p < 0.01. Event study using doubly-robust differences-in-differences (Sant'Anna and Zhao, 2020) with the did R package (Callaway and Sant'Anna, 2021). Treatment assigned at the town-level, where "cotton towns" are those with > 20% of 1855 employment in cotton goods. All estimations control for the town's percent foreign born and an urban indicator (population > 2500) in 1855, and observations are weighted by 1855 manufacturing employment. Bars reflect bootstrapped 95% simultaneous confidence bands with clustering by town.
Sources: Massachusetts town employment data are from state (1837, 1845, 1855, 1865, 1875, 1885, 1895) and federal (1850, 1860, 1880) manufacturing censuses. Control variables come from the 1855 Massachusetts state population census (Haines, 2022).

Table A2: Effect of the Civil War Shock on the Cotton Textiles Industry - Robustness to Functional Forms

			Separating Margins (Chen and Roth, 2023)			Power Functions (Thakral and Tô, 2025)		
	(1) $\mathbf{1}\{y>0\}$	(2) $\log(1+y)$	(3) m(y): x = 0	(4) m(y): x = 1	(5) m(y): x = 3	(6) x = 1/6	(7) x = 1/5	(8) x = 1/4
Cotton Industry x 1837	-0.02	-0.05	-0.02	-0.05	-0.09	-0.04	-0.05	-0.07
	(0.02)	(0.09)	(0.09)	(0.11)	(0.16)	(0.05)	(0.05)	(0.07)
Cotton Industry x 1845	0.03	-0.01	-0.03	0.01	0.07	0.01	-0.00	-0.03
	(0.02)	(0.08)	(0.08)	(0.09)	(0.13)	(0.04)	(0.04)	(0.06)
Cotton Industry x 1865	-0.04**	-0.17***	-0.17***	-0.21***	-0.29***	-0.09***	-0.10***	-0.13***
	(0.02)	(0.06)	(0.06)	(0.07)	(0.10)	(0.03)	(0.03)	(0.04)
Cotton Industry x 1875	0.01	-0.05	-0.06	-0.05	-0.04	0.00	0.00	0.02
	(0.02)	(0.07)	(0.08)	(0.09)	(0.13)	(0.04)	(0.04)	(0.06)
Cotton Industry x 1880	-0.03	-0.04	-0.04	-0.06	-0.12	-0.02	-0.01	0.02
	(0.02)	(0.08)	(0.08)	(0.10)	(0.13)	(0.04)	(0.05)	(0.06)
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Town FE	✓	✓	✓	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓
Pretrend test (p-value)	0.013	0.826	0.947	0.796	0.335	0.308	0.444	0.584
Dep. Var. Mean	0.193	0.544	0.493	-0.315	-1.930	0.313	0.350	0.418
Observations	57,566	57,566	57,566	57,566	57,566	57,566	57,566	57,566
Towns	330	330	330	330	330	330	330	330

Notes: * p < 0.1, ** p < 0.05, *** p < 0.01. Each column estimates equation 4 where the outcome is a different function form of total manufacturing employment in a given town-industry-year in order to show robustness to the use of the inverse hyperbolic sine transformation in the main result. Column (1) estimates the effect along the extensive margin, while column (2) applies the $\log(1+y)$ transformation. Columns (3)-(5) perform "explicit calibration of the extensive margin" (Chen and Roth, 2023), which applies the transformation $m(y) = \begin{cases} \log(y) & y > 0 \\ -x & y = 0 \end{cases}$ for the given values of x in order to estimate the ATT by making the tradeoff along the extensive and intensive margins explicit. Columns (6)-(8) apply power function transformations with the given exponent as recommended by Thakral and Tô (2025). Standard errors are clustered by town.
Sources: State (1837, 1845, 1855, 1865, 1875) and federal (1880) manufacturing censuses.