Liberation Technology?

The Impact of the Sewing Machine on Women [*]

Philipp Ager[†] Davide M. Coluccia[‡]

This version: May, 2026

Latest Version

Abstract

This paper provides novel evidence on how technological change shaped women's labor market participation, fertility, and marriage in 19th-century Massachusetts. We distinguish between the sewing machine's dual role as a manufacturing technology and as a household appliance. Using rich town- and individual-level longitudinal data, we show that this innovation induced divergent responses across the wealth distribution. Women from lower-wealth households increased labor supply, delaying marriage and reducing fertility. In contrast, for wealthier women, the sewing machine functioned as a domestic efficiency tool, enabling earlier family formation and greater civic engagement while reducing market work. Our findings demonstrate how household constraints and social norms mediate the effects of labor-saving technologies, suggesting that technological progress can reinforce inequality by influencing women's economic and social roles.

Keywords: Technology, Gender, Female Labor Force Participation, Fertility.

JEL Classification: J13, J16, N31, N61, O33.

[*] We are grateful to Ran Abramitzky, Lukas Althoff, Leah Boustan, Lou Cain, Alexander Donges, Jose Espín-Sánchez, James Feigenbaum, Martin Fiszbein, Oded Galor, Paola Giuliano, Claudia Goldin, Eleonora Guarnieri, Walker Hanlon, Bob Margo, Jesse McDevitt-Irwin, Chris Meissner, Steve Nafziger, Santiago Peréz, Martin Peitz, Mara Squicciarini, Jochen Streb, Clemence Tricaud, Daniela Vidart, Nico Voigtländer, Romain Wacziarg, Melanie Wasserman, Gavin Wright, and seminar audiences at Brown, Cambridge, Harvard, Gothenburg, MLU Halle-Wittenberg, Northwestern, Stanford, UC Davis, UCLA Anderson, Hohenheim, Mannheim, Siena, Southern Denmark, Uppsala, and Yale, the IOS Summer Academy, and at the 1st CEPR Applied Micro-Economic History Workshop for comments and discussions. Katherine Eriksson kindly shared data with us. We thank Barend Ruesink Bueno and Adrià Mateu I Romero for their excellent research assistance. Support by the German Research Foundation (DFG) through CRC TR 224 (Project A02) is also gratefully acknowledged.

[†]University of Mannheim and CEPR. Email: philipp.ager@uni-mannheim.de. Website: philippager.com.

[‡]University of Bristol. E-mail: davide.coluccia@bristol.ac.uk. Website: dcoluccia.github.io.

1 Introduction

Low participation of women in formal labor markets has persisted across countries and over time. One key driver is a deeply entrenched gendered division of labor that assigns a disproportionate share of housework and child-rearing time to women (Boserup, 1970; Alesina et al., 2013; Bau and Fernández, 2023). Even as industrialization and technological progress have reshaped women's socioeconomic roles over the past 150 years (Goldin, 1990, 2024; Costa, 2000; Olivetti and Petrongolo, 2016; Ager et al., 2026b), it remains unclear whether labor-saving innovations weaken traditional gender norms or reinforce them. This paper studies how the introduction of the sewing machine—a pivotal 19th-century innovation—transformed women's work and affected fertility and marriage decisions.

We study the sewing machine's impact on women in the late 19th-century United States. Following Elias Howe's patent of the first commercial sewing machine in 1846, the United States became the leading producer and one of the earliest adopters of sewing machines for industrial and household use (Cooper, 1976; Hounshell, 1984; Lampe and Moser, 2013). Contemporary observers viewed the invention as a *"social revolution"* driven by unprecedented time savings in needlework.[1] On January 2, 1860, the *New York Times* wrote:

> *"No one invention has brought with it so great a relief for our mothers and daughters as these iron needle-women. Indeed, it is the only invention that can be claimed chiefly for women's benefit."*

The potential of saving valuable time triggered the sewing machine's rapid commercial expansion: as Figure I illustrates, annual sales rose from 45,000 to 570,000 units between 1865 and 1879, and by the end of the 19th century, the sewing machine was widely used in households and across multiple industries (Rosenberg, 1963; Godley, 2001, 2023).

As a dual-purpose technology, the sewing machine had ambiguous effects on women's labor supply, fertility, and marriage. On one hand, expanded employment opportunities in clothing and related industries could raise women's relative wages and increase the opportunity cost of children, thereby reducing fertility (Galor and Weil, 1996). On the other hand, if prevailing gender norms constrained labor market participation, time savings from needlework could instead be reallocated to child-rearing, lowering the cost of additional children (Greenwood et al., 2017). These opposing forces likely generated heterogeneous effects across socioeconomic groups. As a manufacturing technology, the sewing machines expanded labor market opportunities primarily for poorer women, as women from affluent households rarely entered factory employment. As a household technology, the sewing machine reduced the time required for domestic production: poorer women could reallocate these time savings toward market work and reduce fertility, whereas more affluent women could devote their freed time to increased childbearing.

We find that sewing machine adoption had significant effects on women's labor supply, marriage, and fertility decisions, though the direction and magnitude of these effects varied sharply by socioeconomic groups and adoption context. Adoption in both home and workplace settings increased female

[1]The sewing machine was a forerunner of the household-appliance revolution that reduced the time devoted to housework and profoundly shaped women's lives and family formation in the twentieth century (Greenwood et al., 2005a,b).

labor force participation, but only among poorer women. For this group, adoption was also associated with lower marriage rates and reduced fertility. In contrast, wealthier women responded exclusively to the adoption of the sewing machine within their households. Women in this group exhibit higher fertility and a greater likelihood of marriage, at the expense of lower labor force participation rates.

Identifying the effects of sewing machines is challenging, as it requires measures of adoption that can separate the potentially distinct impacts of factory versus household use. We therefore focus on Massachusetts, a leading state in early U.S. industrialization and a center of textile and clothing production (Leblanc, 1969), where such granular data are available. We digitize novel data from Massachusetts business directories listing retailers that sold sewing machines as household appliances, and construct an industry-level exposure measure using employment data from complete-count U.S. Census records, which we supplement with detailed data from the Massachusetts Censuses of Manufacturing. Aggregated at the town level, these measures allow us to empirically distinguish between exposure to the sewing machine as a manufacturing technology and as a household appliance. Massachusetts also produced detailed and reliable town-level vital statistics, which we use to quantify the impact of sewing machine adoption on fertility and marriage.

Our empirical strategy exploits town-level variation in exposure to sewing machines along both dimensions within a difference-in-differences (DiD) framework. This approach compares towns with differing levels of exposure to each type of sewing machine use, allowing us to disentangle the distinct effects of adoption in factories versus households on women's labor supply, fertility, and marriage. We measure town-level exposure to sewing machines as a manufacturing technology using the employment share of industries that would subsequently adopt sewing machines in 1860, before sewing machines were employed at scale. Exposure to sewing machines as household appliances is measured by the year in which the first sewing machine retailer was established in a town.

We provide several pieces of evidence supporting the validity of our exposure measures and estimation strategy. First, we find that treated and untreated towns were observationally similar prior to treatment. Second, our event-study estimates support the key identifying assumption of parallel trends in a DiD framework. Our results are also robust to (i) alternative definitions of sewing machine exposure, (ii) adjustments for spatial correlation, (iii) controls for potential confounders such as immigration and general retailer activity, and (iv) to large deviations from parallel trends, following Rambachan and Roth (2023).

The first part of the empirical analysis examines the local dynamics of female labor force participation, fertility, and marriage before and after the widespread adoption of sewing machines in the second half of the 19th century. The results are based on a panel dataset covering 302 towns in Massachusetts. We first examine how women responded in towns more exposed to the industrial use of the sewing machine and then consider its effects as a household technology.

In towns with higher industry exposure to the sewing machine, the share of women employed in sewing-machine-using industries increased substantially after 1860. A one-standard-deviation increase in industry exposure to the sewing machine yields a 27% standard-deviation increase in female employment in those sectors. To assess whether industry exposure also increased overall female labor force participation, we estimate a triple-difference specification that exploits variation across industries. This approach is motivated by the concentration of employment gains in sewing-machine-using industries and allows us to net out unobserved town-specific economic trends that could otherwise confound the estimates. We find that female employment rose substantially in more exposed towns in industries exposed to the sewing machine, whereas no comparable employment effects are observed for men. These gains extend across major textile, apparel, and leather-related industries, suggesting that productivity improvements and reinstatement effects offset the displacement of women from manual sewing occupations, such as dressmakers and seamstresses.

Moreover, beginning in 1860 and accelerating during the 1870s, we observe a significant decline in the crude birth rate in towns with greater industrial exposure to sewing machines. This decline was primarily driven by a reduction in the number of children per woman (the intensive margin), though we also find a statistically significant reduction in the share of women with at least one child (the extensive margin). Specifically, in response to a one-standard-deviation increase in industry exposure to the sewing machine, the share of women with at least one child fell by approximately 3% of a standard deviation, while the share of married women in these towns declined by 10% of a standard deviation. These patterns align with the hypothesis that improved labor-market opportunities for women raise the opportunity cost of childbearing and delay marriage (Schultz, 1985; Galor and Weil, 1996). In these towns, the fertility decline was further reinforced by a decrease in the value of child labor during the 1870s—consistent with the evidence that factories recruited young women rather than children as sewing-machine operators (Dublin, 1994). A decline in the value of child labor increases the direct cost of having children and reduces the opportunity cost of schooling, thereby incentivizing parents to substitute quality for quantity of children (Doepke, 2004; Galor, 2011; Ager et al., 2020).[2] However, the quantitative contribution of this specific mechanism appears relatively modest compared to the opportunity cost channel. Finally, we show that these shifts are unlikely to be driven by changes in the mortality environment, as child mortality rates did not respond differentially in towns with higher industrial exposure.

In towns exposed to sewing machine retailers, we also observe a substantial increase in female labor force participation. This effect is largely driven by expanding employment opportunities for women in sewing-machine-using industries. We find little evidence of displacement effects from sewing machine retailers, as most industries exhibit positive female employment responses. We also find no evidence of displacement among women employed in private households, such as servants. Overall, we estimate that female labor force participation rose by approximately 26% of a standard deviation in response to the establishment of a sewing machine retailer. Higher female labor force participation is accompanied by a reduction in the extensive margin of fertility (a 9.6% decline of a standard deviation in the share of women with at least one child) and no change in the number of children per woman.

[2] More generally, the quantity-quality tradeoff of fertility has found support in empirical studies of the historical U.S. fertility transition linking fertility declines to improvements in human capital investment and child health (Bleakley and Lange, 2009; Aaronson et al., 2014; Ager and Cinnirella, forthcoming).

These town-level results, however, may mask important heterogeneity, which we examine further in the second part of the empirical analysis using individual-level longitudinal data. The individual-level analysis draws on the Census Tree crosswalks, which provide reliable longitudinal links for women across historical Census records (Price et al., 2021; Buckles et al., 2025).[3] We construct a sample of approximately 100,000 women who can be linked between the 1860, the 1870, and the 1880 Censuses. These longitudinal data enable us to examine heterogeneous effects of sewing machine use across the wealth distribution and help mitigate potential aggregation and compositional biases inherent in the town-level analysis. For example, some women may have relocated to towns with expanding employment opportunities following the adoption of sewing machines by local industries. To address this concern, our individual-level analysis focuses on young-adult women who resided in Massachusetts in 1860, prior to the large-scale diffusion of sewing machines. This focus is guided by historical evidence that women's labor force participation was concentrated among the young and unmarried (Goldin, 1980; Goldin and Sokoloff, 1982).

We show that in towns with greater industry exposure, women from poorer households who were between ages 5 and 15 in 1860—and thus 15 to 25 by 1870—were significantly more likely to participate in the labor force, particularly in sewing-machine-intensive industries. They also exhibited higher occupational income scores in 1870.[4] Consistent with the hypothesis that improved labor market opportunities raise the opportunity cost of childbearing, we document that in towns with higher industrial exposure to sewing machines, women in the lower tail of the household wealth distribution experienced sizable declines in fertility and a lower likelihood of marriage–effects that persist through 1900. By contrast, the diffusion of sewing machines in manufacturing had virtually no effect on women from wealthier households.

Access to sewing machine retailers also increased labor force participation among women from poorer households who were children (ages 5-15) when the first retailer opened, whereas women from the upper part of the income distribution exhibited reduced labor supply. Fertility responses similarly diverged across household groups. While women from poorer households reduced fertility in response to increased labor market opportunities, those from wealthier households increased fertility and were more likely to be married. This is consistent with the substantial social stigma surrounding women's work prior to the 1920s (Goldin, 2006), suggesting that wealthier women reallocated the time saved from needlework and formal employment toward family formation.

Did wealthier women use the time saved from hand sewing for other social activities? While systematic time-use data are not available, participation in community and charitable organizations expanded steadily during the Gilded Age as upper-class women's leisure increased (Scott, 1992; Skocpol, 1995). Using newly digitized data on women's associations in Massachusetts, we examine the relationship between sewing machine diffusion and the emergence of the women's club move-

[3] Because women typically adopted their husband's surname upon marriage, systematically linking them across historical censuses is challenging (Abramitzky et al., 2021). The use of genealogical data in the Census Tree Project helps overcome this issue; see (Price et al., 2021; Buckles et al., 2025) for further details.

[4] Individual wages are not reported in the U.S. Census prior to 1940. The occupational income score (`OCCSCORE`) from IPUMS is widely used in historical labor market research as a proxy for earnings (Saavedra and Twinam, 2020).

ment. We find a positive and significant correlation between the presence of sewing machine retailers and both the number and size of women's clubs, particularly in towns with a larger share of relatively affluent women. By contrast, exposure to sewing machines in manufacturing is not associated with the prevalence of women's associations. While suggestive, these results indicate that the time freed by the sewing machine may have contributed to the rise of women's clubs and civic engagement. Overall, our findings suggest that women from poorer and more affluent households allocated the time savings generated by the sewing machine in markedly different ways.

Contributions to the Literature. This paper contributes to a large literature on the evolution of female labor force participation since the late 19th century (e.g., Goldin, 1990, 2006; Costa, 2000; Fernández, 2013; Olivetti and Petrongolo, 2016). Existing work has proposed multiple causal mechanisms for women's rising economic participation, including structural change, technological and medical advances, World War II, and shifts in cultural and social norms (see, e.g., Rotella, 1981; Bailey, 2006; Goldin and Olivetti, 2013; Albanesi and Olivetti, 2016; Vidart, 2024). Our study focuses on the onset of this transformation, showing that the widespread diffusion of the sewing machine in the late 19th century pushed poor women from home production into the labor market. The resulting increase in female labor supply echoes the insights of Greenwood et al. (2005b) and Cavalcanti and Tavares (2008), who emphasize how labor-saving household technologies can facilitate women's participation in market work. At the same time, although the sewing machine reduced the time devoted to housework, the strong social stigma surrounding work outside the home and the scarcity of socially acceptable white-collar occupations constrained labor market participation among middle- and upper-class women. This result aligns with a broader literature showing that entrenched gender norms and social stigma can remain powerful barriers to women's economic and social advancement (e.g., Fernández and Fogli, 2009; Alesina et al., 2013; Giuliano, 2020; Bursztyn et al., 2023).

Our focus on the consequences of sewing machine adoption for women contributes to the growing literature on the economic effects of task automation.[5] Closest to our study are recent papers on the historical effects of automation (Atack et al., 2019; Caprettini and Voth, 2020), particularly those examining labor-saving technologies that shaped women's work (Feigenbaum and Gross, 2024; Rashid, 2025; Vipond, 2025; Ager et al., 2026b). Vipond (2025) studies the mechanization of the boot and shoe industry in Victorian Britain and finds displacement effects among incumbent women. Similarly, Feigenbaum and Gross (2024) shows that the automation of telephone operations between 1920 and 1940 adversely affected incumbent operators. In contrast, Ager et al. (2026b) find that the diffusion of milking machines after World War II improved the long-term earning prospects of young rural women. Rashid (2025) shows that the widespread adoption of the typewriter in offices from the 1880s created female-friendly white-collar jobs—such as typists and secretaries—raising female employment while lowering fertility and marriage rates.

Compared with these studies, we evaluate how the sewing machine—a gender-biased labor-saving technology utilized both in factories and at home—affected female opportunities at the onset of the

[5] Recent contributions include Acemoglu and Restrepo (2018), Acemoglu and Restrepo (2020), and Bessen et al. (2025). For a recent survey, see Restrepo (2023).

rise in female labor force participation in the late 19th century. To capture these effects, we combine town-level analysis (place-based effects) with individual-level analysis (person-based effects) to investigate how expanded labor market opportunities and savings in housework time affected women's labor supply, fertility, and marriage decisions across the wealth distribution.[6] Our results provide a nuanced view of automation.[7] We show that the adoption of sewing machines in factories generated positive net employment effects, suggesting that productivity gains and the reinstatement of labor into new tasks, such as sewing machine operation, outweighed initial displacement. In parallel, the use of sewing machines in households shifted female labor supply by freeing up time from domestic work. These results suggest that the sewing machine reinforced the importance of female labor as an integral part of the industrialization process of the American Northeast (Goldin and Sokoloff, 1982, 1984; Sokoloff, 1984; Dublin, 1994), and relate more broadly to a prominent debate in economic history on the factors that contributed to the rise of American manufacturing during the 19th century.[8]

Our findings reveal that sewing-machine-induced changes in the opportunity cost of female time fundamentally altered fertility and marriage patterns, contributing to the literature on the historical fertility transition and the economics of fertility more broadly (Guinnane, 2011; Galor, 2012; Doepke et al., 2023; Gobbi et al., 2026). A large body of work emphasizes the opportunity cost of women's time as a central determinant of fertility choices (Schultz, 1985; Jensen, 2012; Wanamaker, 2012). For richer women, our findings are consistent with economic theory predicting that fertility rises when household technologies reduce the time cost of child-rearing by lowering the "price" of children in terms of parental time (Greenwood et al., 2005a, 2017).[9] At the same time, for poor women, among whom the sewing machine operated as a "liberation technology," we document declines in fertility, consistent with the theoretical arguments indicating that technological progress during the second phase of the Industrial Revolution increased female labor supply and the opportunity cost of child-rearing (Galor and Weil, 1996).[10] More broadly, our results underscore the importance of social norms in shaping fertility decisions (e.g., Munshi and Myaux, 2006; Fernández and Fogli, 2009; Kleven et al., 2019; Boelmann et al., 2025). Throughout most of the 19th century, social norms that discouraged women's work outside the home prevented the opportunity cost of children for wealthier women from rising, thereby constraining the sewing machine's impact on the historical fertility transition.

[6] Our empirical analysis and recent work by Arenas-Arroyo (2025) represent the first quantitative efforts to document the large-scale impact of sewing machines. The papers were conceived and developed independently. Arenas-Arroyo (2025) examines how the rollout of Singer sewing machine agents affected women's work as dressmakers and its implications for children at the individual level.

[7] A substantial body of research documents that automation can generate negative displacement effects (Acemoglu and Autor, 2011; Cortes, 2016; Bessen et al., 2025). Whether such displacement effects occur depends, among other factors, on workers' mobility and the scope for occupational upgrading, including the extent to which new technologies reinstate labor into new tasks (Acemoglu and Restrepo, 2019).

[8] Prominent explanations range from improvements in transportation and market integration (Fogel, 1964; Atack et al., 2011; Donaldson and Hornbeck, 2016), specific factor endowments and labor scarcity (Habakkuk, 1962; Cain and Paterson, 1986; Wright, 1990), and the transition from artisanal shops to mechanized factories and the associated rise of the American system of manufacturing and the modern managerial corporation (Chandler, 1977; Hounshell, 1984; Sokoloff, 1984).

[9] There is ongoing debate over whether the household-appliance revolution contributed to the "baby boom" between 1940 and 1960 (Greenwood et al., 2005a; Bailey and Collins, 2011; Lewis, 2018).

[10] Relatedly, Vidart (2026) finds that the expansion of electricity in the early 20th century yielded only a modest fertility decline in the United States, as the time-saving and opportunity-cost channels partially offset each other.

Outline of the Paper. The paper proceeds as follows. In Section 2, we present the historical background on the impact of the sewing machine in the United States and provide a—necessarily—concise history of women's work in the late 19th-century United States. Section 3 describes the data used in the analysis. We present the empirical strategy in Section 4. In Section 5 and Section 6, we examine the effects of the sewing machine at the town and individual levels, respectively. Section 7 presents suggestive evidence on whether the sewing machine contributed to the women's club movement. We conclude in Section 8.

2 Historical Background

In this section, we provide a brief overview of the evolution and diffusion of the sewing machine from its invention in 1846 to its eventual market saturation in the United States. We also highlight the importance of needlework in women's daily lives and analyze how the introduction of the sewing machine shaped the development of female employment. Finally, we motivate our focus on Massachusetts by discussing its role as a key industrial center within the broader national context.

2.1 Sewing Machines in the United States

The sewing machine was a revolutionary labor-saving technology that reduced stitching time by 80 percent. It was widely adopted in factories during the 1860s and in households in later decades (Cooper, 1976; Godley, 2023). The first commercially viable sewing machine was developed in the United States. On September 10, 1846, Elias Howe, Jr. received the first patent (US patent 4750) for a practical lock-stitch sewing machine.[11] The lockstitch, a mechanical sewing method in which two separate threads are interlocked, is the most common mechanical stitch in sewing machines and remains standard today. Before 1860, sales remained limited, as most models were heavy, expensive, and suitable primarily for larger garment factories or professional tailors. The early sewing machines represented a significant capital investment for American families and functioned as status symbols, frequently displayed in the parlors of middle- and upper-class households (Barm and Klepp, 1984; Connolly, 1999).[12]

The transition from handcrafted production to factory-based mass production using interchangeable parts in the late 1850s, together with the formation of the Sewing Machine "Combination" (1856–1877)—a patent pool established by Howe and the leading producers Singer, Wheeler & Wilson, and Grover & Baker—contributed to the diffusion of the invention and its commercial success (Hounshell, 1984; Lampe and Moser, 2013; Godley, 2023). The potential for savings in labor cost in manufacturing was already evident in 1860, as shown in Cooper (1976, p.58): *"Oliver F. Winchester, a shirt manufacturer of New Haven, Connecticut, stated that its factory turned out 800 dozen shirts per week, using 400 sewing ma-*

[11] Charles Frederick Wiesenthal, a German-born physician and inventor based in London, received the first recorded patent related to a mechanical sewing device in 1755 (British Patent No. 701). It was not until nearly a decade later that Howe developed a practical lock-stitch sewing machine (Cooper, 1976).

[12] Singer sold its first machine for domestic use, the so-called Turtle Back, in 1856. In 1859, the more successful "Letter A" model was introduced at a price of $75—a substantial sum at a time when the average household income was around $500 (Barm and Klepp, 1984; Cooper, 1976; Singer Sewing Machine Company, 1914).

chines and operators to do the work of 2,000 hand sewers. The price for hand sewing was then $3 per week, which made labor costs $6,000 per week. The 400 machine operators received $4 per week, making the labor cost $1,600 per week. Allowing $150 as the cost of each machine, the sewing machines more than paid for themselves in less than 14 weeks, increased the operators' pay by $1 a week, and lowered the retail cost of the item."

The shift toward a broader consumer market occurred with the introduction of Singer's "New Family" model in 1865.[13] More than four million units were sold over the following two decades. As Figure I shows, total annual sales of sewing machines in the United States increased more than tenfold between 1865 and 1879. Sales peaked in 1872 and then slowed in the late 1870s, suggesting partial market saturation. In the late 1870s, when the Sewing Machine "Combination" dissolved, sewing machine prices dropped, making them easily accessible for households. Nearly 600,000 sewing machines were sold annually, and it is estimated that more than half of all U.S. households owned a sewing machine (Godley, 2023).[14] By the end of the 19th century, the sewing machine had become a ubiquitous household appliance and an essential industrial tool, used in the production of boots and shoes, clothing, saddlery and harnesses, and bookbinding, as well as in home garment production (Rosenberg, 1963; Hounshell, 1984; Connolly, 1999).[15]

2.2 Sewing Machines and the Reorganization of Women's Work

Throughout the 19th century, sewing was an integral part of a woman's activity. Girls learned how to sew from their mothers or from older female relatives. Once they acquired the skill, they were expected to sew as a regular part of their household duties. The tasks included "plain sewing"—the production and repair of clothing and other household items—and "fancy sewing", such as embroidery, usually reserved for wealthier women. There is ample anecdotal evidence, for example, from women's diaries, that sewing was an everyday activity performed across all social strata, including rich, poor, young, and old women on farms and in cities (Osaki, 1988; Connolly, 1999; Kelly, 1999).[16] More importantly, it provided an opportunity for women in both cities and the countryside to supplement household income, often through the outwork system, which allowed them to earn money while staying within the home (Blewett, 1983; Dublin, 1994).

Nevertheless, a strong social stigma surrounded women's work outside the home, and female labor force participation in the 19th century was generally low. In the 1860 census, the share of employed white women was around 15% and remained relatively stable until 1900.[17] With few exceptions (e.g.,

[13] The increase in sewing machine usage outside factories is also evident in Boston's dressmaking establishments: none used a sewing machine in 1860, but 95% had adopted them by 1870 (Gamber, 1997).

[14] A survey conducted by of the Massachusetts Bureau of Statistics of Labor in 1875 found that about 55% of 216 surveyed skilled workingmen's families owned a sewing machine (Mass. Bureau of Statistics of Labor, 1875, Table III, p.436).

[15] A special Census report on sewing machines in 1900 recorded 55,000 machines in factories and nearly 750,000 in households. American manufacturers also dominated the global market: the Singer Sewing Machine Company, the leading producer at the time, held an estimated 90% market share outside the United States on the eve of the First World War (Godley, 2006).

[16] Sewing activities helped to strengthen family and community networks. For example, sewing circles formed the backbone of benevolent and missionary work and provided the opportunity for wealthier women to meet with other community members in the early 19th century (Kelly, 1999).

[17] It is important to note that the U.S. Census first collected information on women's gainful employment in 1860. Enumerators typically did not account for family workers, who often provided informal and unrecorded labor in support of family-based market production. An augmented index of the female labor force participation that includes women potentially employed

teaching), white-collar occupations were largely unavailable to women. Those who worked often did so out of necessity and were typically employed as pieceworkers in manufacturing, laundresses, or domestic servants. These women were disproportionately poor, young, and unmarried, and most exited the labor force upon marriage. The majority of married women who worked did so to support their families because their husbands were absent, sick, drunkards, or "unable to work" for other reasons (Boustan and Collins, 2014). Goldin (1980, 2006) describes the period between 1870 and 1920 as the era of single women, since three out of four white working women were single. They started working at a young age, often when living with their parents and contributing to the household income until they married, which they did at a relatively late age.

Regarded as "women's work," and thus socially respectable, sewing was one of the few professions in which women could earn a living (Barm and Klepp, 1984). Women worked in the needle trades primarily as dressmakers, tailoresses, milliners, and seamstresses. Dressmakers and milliners were skilled artisans who produced custom clothing and accessories, often running small businesses. Most women in the needle trades, however, worked as seamstresses—a semi-skilled occupation without formal apprenticeships—doing piecework in factories, outside shops, or at home. Tailoresses occupied an intermediate skill level between seamstresses and dressmakers, with wages reflecting these differences. Before the widespread adoption of the sewing machine and the rise of the ready-made garment industry in the late 19th century, dressmakers and milliners earned substantially higher wages than seamstresses (Gamber, 1997; Barm and Klepp, 1984; Dublin, 1994).[18]

The sewing machine transformed the garment industry by dramatically reducing the time required to assemble standardized clothing, such as shirts and trousers. Seamstresses were among the first to see their traditional tasks displaced with the spread of sewing machines in factories beginning in the late 1850s.[19] However, the resulting expansion of the garment industry largely absorbed this labor force as sewing machine operators or pieceworkers. Anecdotal evidence suggests that wages for these operators were higher than those for seamstresses, although factory working conditions were often poor. Wages remained substantially lower than those for men and were typically based on piece rates or a "task" system, which was often subject to exploitation by factory owners. Tailoresses experienced a notable downgrading in occupational status, frequently becoming machine operatives in factories or working in small workshops managed by contractors, since few of them could afford their own sewing machine and instead rented or leased them out from contractors or sewing machine retailers (Cooper, 1976; Barm and Klepp, 1984; Dublin, 1994).[20]

The situation was different for dressmakers, at least initially. While sewing machines became an integral part of the dressmaker shop, increasing productivity in finishing seams, they did not sub-

in informal occupations yields a participation rate of 56%, comparable to today's (Chiswick and Robinson, 2021).

[18]By 1880, avg. weekly wages for a women worker in Massachusetts outside (inside) Boston was \$12.50 (\$7.97) for a milliner, \$10.22 (\$7.42) for a dressmaker, \$6.50 (\$6.58) for a tailoress, and \$5.50 (\$6.18) for a seamstress, with smaller wage differences between skilled and unskilled within the needle trades in Boston than elsewhere in Massachusetts (Wright, 1889, pp.76-81).

[19]At the beginning of this transformation, smaller items such as men's underwear or ties continued to be produced by hand sewers; over the following decades, however, the sewing machine displaced these tasks as well (Barm and Klepp, 1984).

[20]Installment plans and monthly rental systems became increasingly common in the late 1870s when sewing machines became substantially cheaper (Barm and Klepp, 1984).

stantially reduce the time required for high-skill tasks such as custom cutting and fitting. Instead, the professional landscape for dressmakers and milliners was transformed by the introduction of graded practical sewing patterns, the rise of ready-to-wear "pattern hats" (standardized prototypes), and the standardization of sizing in the late 19th century. Together, these innovations effectively deskilled the garment-making process by transferring technical knowledge from artisans to mass-produced templates. They enabled large-scale production of high-quality garments using sewing machines and reduced reliance on skilled artisanal labor (Barm and Klepp, 1984; Gamber, 1997; Connolly, 1999).

While the transformative impact of the sewing machine was most evident in the garment industry, it also fundamentally restructured the "putting-out" system, particularly within the footwear industry. During the antebellum period, women participated in shoemaking primarily as shoe-binders, stitching "uppers"—the top sections of shoes—in their homes. The sewing machine centralized this labor into factories, where women were rehired as machine stitchers and shoe fitters. Beyond garments and footwear, the sewing machine also influenced female employment in related sectors such as saddlery, domestic furnishings, and canvas goods. It might even have spurred growth in the paper box industry, which expanded its use of female machine-stitchers to provide the standardized packaging essential for these new mass-produced goods. Moreover, seamstresses, milliners, and dressmakers found new employment opportunities in the workrooms of general merchandise stores, accommodating the rise the rise of ready-made apparel (McBride, 1978; Blewett, 1983; Dublin, 1994).

Overall, the sewing machine fundamentally transformed women's work in the mid-19th century, with the most pronounced effects in the industrializing American Northeast. The following section examines Massachusetts—one of the leading industrial states—within the broader national context to assess the scale and characteristics of these transformations.

2.3 Industrialization and Female Employment: Massachusetts in the National Context

The American Northeast experienced a substantial structural transformation during the first half of the 19th century (Sokoloff, 1982; Temin, 1999; Atack et al., 2022). Manufacturing production expanded rapidly, a process that was accompanied by increased urbanization. The Northeast led the rest of the country in this transformation: between 1820 and 1850, the share of the Northeastern labor force employed in agriculture declined from 74% to 34%, while the share of the population living in urban areas increased from approximately 10% to 30%. Massachusetts was the pioneer state in the industrialization of the United States. Boston served as the largest manufacturing city in New England, while Lowell and Lynn emerged as prominent centers for textile and shoe production, respectively, alongside several small- to medium-sized, booming manufacturing towns (Leblanc, 1969).

Besides the availability of water power, transportation improvements, and the introduction of the factory system, one salient feature in the early industrialization in the region—and in Massachusetts in particular—was the high employment rate of women and children in manufacturing. Goldin and Sokoloff (1982, 1984) demonstrates that the relatively low productivity of both groups compared to men in the grain, dairy, and hay-based Northeastern agriculture facilitated their transition into manufacturing employment in the early 19th century. Estimates from Goldin and Sokoloff (1982) indicate that by 1832, close to one-third of manufacturing workers in the Northeast were women. Initially, female workers were utilized intensively in the growing cotton and wool textiles, but their industrial distribution diversified as other sectors gained importance. By 1850, roughly one-third of the females manufacturing workers in the Northeast worked in textiles, another third in clothing, and the remainder in other industries, such as shoes and papers—a pattern of industrial distribution similar to United States as a whole (Goldin and Sokoloff, 1982, Table 2).[21]

During this period, industrial outwork was a vital form of employment for women in the Northeast, particularly in New England. In this system, women performed tasks such as weaving cloth, braiding palm-leaf hats, or binding shoes in their homes (Blewett, 1983; Dublin, 1994).[22] Outwork relied heavily on young unmarried daughters, but it also provided a crucial source of income for married women and widows. The adoption of the power loom in cotton textile mills and the use of the sewing machine in shoe production led to a substantial decline in outwork, shifting female labor into factories. In these factories, most hired women were typically native-born, young, and unmarried (Dublin, 1979, 1994; Sokoloff, 1982). These young women were an integral part of the manufacturing labor force in the industrializing Northeast before the Civil War. The estimated manufacturing labor force participation rate of women aged 10-29 suggests an overall increase in their labor supply between 1832 and 1860.[23] As a leader in the production of textiles and shoes, Massachusetts had relatively high levels of labor force participation among young women and a significantly higher share of female workers in manufacturing compared to the national average (Goldin and Sokoloff, 1982).

Sewing as a means of employment likely increased in importance in Massachusetts and elsewhere in the Northeast over the first half of the 19th century, as the share of female manufacturing workers in the clothing industry rose from 7.8% in 1837 to 18.3% in 1850 (Goldin and Sokoloff, 1982). By 1865, around 25% of working women in Massachusetts were engaged in machine or hand sewing.[24] The manufacturing labor force participation rate of females aged 10-29 years in Massachusetts increased between 1860 (28.4%) and 1880 (32.8%) following the widespread adoption of the sewing machine (Goldin and Sokoloff, 1982, Table 8, p.768). As a leading industrial state with well-developed textile, garment, and footwear industries that depended heavily on female labor, Massachusetts—with its unusually detailed and granular data—provides a unique opportunity and ideal laboratory to evaluate the impact of the sewing machine on female employment

Detailed census records make it possible to evaluate the importance of employment in industries that adopted the sewing machine at a large scale after 1860.[25] In Table I, we report census-based

[21] Technical changes, the growth of male-intensive industries, and competition from unskilled male immigration into cotton mill towns also led to a gradual relative decline of females employed in manufacturing in the two decades before the Civil War (Sokoloff, 1982; Dublin, 1979).

[22] Outwork employment typically took place in rural areas, but it was also a common practice in cities like Boston for the needle trades (Dublin, 1994).

[23] The estimates for four New England states where data were available range from 12% (CT) to 27% (MA) in 1832 and from 22% (NH) to 33% (RI) in 1860 (Goldin and Sokoloff, 1982, Table 8, p.768).

[24] Out of the 83,314 employed women in 1865, 4,381 worked as seamstresses, 4,410 as shoe workers, 3,855 as tailoresses, 3,487 as dressmakers, and 2,388 as milliners, and it was assumed that a portion of the 20,152 operatives worked as sewing-machine operators (Massachusetts. Secretary of the Commonwealth, 1867, pp. 142-43, 306).

[25] Starting in 1860, the U.S. Census also collected information on female employment across all gainful occupations. See

evidence for the United States (Panel A) and Massachusetts (Panel B). Columns (1-4) compare employment shares across industries by their use of sewing machines and by gender. In 1860, prior to the widespread diffusion of the sewing machine, women in Massachusetts were not overrepresented in industries that would later adopt the technology: 3,079 out of 38,483 (8%) were employed in such industries, compared to 73,489 out of 351,312 (21%) in all other sectors. By 1880—and especially by 1900—this gap had closed. In 1900, 20,599 out of 69,373 (28%) of women were employed in sewing-machine-using industries, compared to 310,867 out of 1,103,622 (28%) in all other sectors.[26]

These patterns suggest that employment growth in sewing-machine-using industries was not mechanically driven by an initial overrepresentation of women in those sectors. Nevertheless, the aggregate evidence indicates that the expansion of employment opportunities associated with the diffusion of the sewing machine accrued disproportionately to women. While the United States as a whole exhibits similar trends, the share of women employed in sewing-machine-using industries is substantially higher in Massachusetts, consistent with the state's specialization in clothing and related industries. To assess the overall impact of the sewing machine on female employment, one must also evaluate the trends outside manufacturing. The overall female labor force participation increased modestly at the national level, from approximately 15% in 1860 to just over 22% in 1900, while in Massachusetts, it rose from 18% in 1860 to nearly 33% in 1900. In the following empirical analysis, we explore these dynamics in greater detail using disaggregated data at the town and individual level.

3 Data

This section introduces the town-level data we compile from federal and state population censuses, as well as the individual-level linked data constructed from disaggregated federal census records. We also describe our two measures of exposure to sewing machines. Additional technical details on data construction are provided in Section A.

3.1 Census-Based Data: Town-Level Analysis

We rely on historical individual-level complete-count decennial data from the US censuses, available via IPUMS (Ruggles et al., 2024). Our sample covers the entire population of Massachusetts from 1850 to 1900, excluding 1890 due to the loss of census records in a fire. Individuals are assigned to their town of residence–our baseline unit of analysis–using the geo-referenced dataset developed by Berkes et al. (2023).[27] Towns represented the lowest administrative unit in 19th-century Massachusetts. We harmonize town boundaries over the sample period, yielding 302 consistent towns, following the procedure described in Section A.1.

The census provides detailed individual-level information. For the working-age population (ages 1560), we extract data on gender, race, birthplace, employment, occupation, literacy, number of chil-

Section 3.3 for details on the industries that widely adopted sewing machines by 1900.

[26]We find similar patterns when focusing on the population of women between 15 and 30 years old (see Panel B.2).

[27]Berkes et al. (2023) provide latitude and longitude coordinates for roughly 90% of the US population; in Massachusetts, coverage exceeds 95% in each census year.

dren, marital status, and the occupational income score as a proxy for income. We aggregate these variables at the town-decade level to construct a balanced panel in which each town is observed five times. Women's employment status cannot be determined in the 1850 Census, as enumerators did not record women's occupations. Throughout the paper, we focus on female employment in the market economy, abstracting from informal employment and unreported labor for market production, such as unpaid work in family-operated businesses (Chiswick and Robinson, 2021).

We supplement the census data with historical statistics from Massachusetts. We digitize the 1837 and 1845 *Manufacturing Statistics* and incorporate information from the decennial State Population Census waves between 1865 and 1915, compiled by Haines (2022). Combining these sources with the federal census increases the temporal frequency of town-level observations. Unlike the US census, however, the Massachusetts data are only available in town-level tabulations, so we do not use them in analyses that require individual-level data. footnoteThe 1855 State Census is not suitable for our analysis, as it lacks information on non-manufacturing female employment as well as gender-disaggregated data on fertility and marriage.

Table II lists selected descriptive statistics computed on the final panel dataset that combines the federal and the state censuses. On average, towns have 11,000 inhabitants and about 2,100 employed workers. Manufacturing accounts for approximately half of total employment, while agriculture is relatively marginal. As evidenced in the literature, the employment rate among women is considerably lower than in the rest of the population (21%, compared to 60% among men). About 45% of working-age women have at least one child, and 56% married. Children constitute approximately 34% of the overall population.

3.2 Linked Data: Individual-Level Analysis

To investigate the mechanisms underlying the town-level patterns and address potential aggregation and compositional biases, we conduct an individual-level panel analysis that requires tracking individuals across censuses. We use crosswalks from the Census Tree Project (CTP) developed by Price et al. (2021) and Buckles et al. (2025), which leverages genealogical data and advances in machine learning methods to link women across censuses.[28] The CTP links are of high quality and have been independently verified.[29]

Our main individual-level analysis is based on two linked datasets. The first sample, which we employ to examine how industrial exposure to sewing machines affected occupational choices and related outcomes, consists of women linked between the 1860 and 1870 censuses. To study the effects of exposure to sewing-machine retailers, we shift the endpoint and construct a second sample linking women between the 1860 and 1880 censuses. This shift is necessary because sewing-machine retailers were largely established about a decade after the diffusion of sewing machines in manufacturing.

[28] Standard census-linking algorithms cannot reliably follow women over time, as they typically change their surname upon marriage (Abramitzky et al., 2021).

[29] In the robustness analyses reported in Section 6.3, we show that the baseline results are robust to using an alternative linking strategy developed by Ruggles et al. (2025), as well as to reweighting individuals to ensure that the linked sample is representative of the population. Moreover, we show that in this context, the CTP sample is more representative of the population than the linked sample obtained using the recent Althoff et al. (2025) methodology.

Outcomes are measured in 1870 or 1880, respectively. Finally, we use a sample of women linked between the 1860 and 1900 censuses to measure completed fertility and other outcomes that may still have evolved over a longer horizon, with all outcomes observed in 1900.

3.3 Two Measures of Exposure to Sewing Machines

We develop two distinct approaches to disentangle the sewing machine's impact as a manufacturing tool from its role as a household technology.

First, our measure of town-level exposure to sewing machines as manufacturing tools is the 1860 employment share of industries that subsequently adopted the sewing machine. Using 1860 data allows us to capture the industry distribution prior to the technology's widespread commercialization. Formally, let S denote the set of industries that widely adopted sewing machines by 1900.[30] We define the town-level exposure to sewing machines in manufacturing as

$$\text{Industry Exposure to SM}_d \equiv \frac{\sum_{s \in S} \text{Employment}_{d,s,1860}}{\text{Employment}_{d,1860}}, \tag{1}$$

where $\text{Employment}_{d,s,1860}$ is the number of workers employed in sector s in town d in 1860. This measure captures the idea that a town is more exposed to the sewing machine as a manufacturing technology if the employment share of industries that would later adopt sewing machines was relatively higher before the machine became widespread. We use 1860 as the baseline to minimize endogeneity concerns, as very few sewing machines were in commercial or household use at that time. Our results are robust to using 1850 as the baseline year (which does not report female employment) and to applying a broader classification of sewing machine-adopting industries (see Section B for details).

Second, we measure exposure to sewing machines as household appliances using newly digitized information from historical business directories covering the universe of sewing machine retailers in Massachusetts between 1850 and 1900. The directories are drawn from the *Massachusetts Register* and its successor, *The New England Business Directory*, which spans the later part of the sample period. We digitized the directories for the years 1859, 1867, 1869, 1872, 1874, 1877, 1878, 1883, 1887, 1889, and 1893, collecting information on the number and location of each sewing machine retailer.

We use proximity to sewing machine retailers as a measure of exposure to household appliances. Specifically, for each town, we record the first year in which at least one retailer is listed in the directories and examine the evolution of outcome variables before and after this date. As a robustness check, we also use proximity to the nearest retailer at various distance thresholds as alternative treatment measures (see Section B). This approach ensures that our results are not sensitive to the baseline assumption that individuals could purchase sewing machines only from retailers in their own town.

Figure II illustrates the spatial variation of our treatment measures. Figure IIa shows substantial

[30] The Census Bureau in 1900 listed the following industries as using sewing machines "extensively": "Awnings, tents, and sails," "Bags, other than paper," "Bookbinding and blank bookmaking," "Boots and shoes, factory product," "Clothing's men, factory product," "Clothing's men, factory product, buttonholes," "Clothing's women, dressmaking," "Clothing's women, factory product," "Corsets," "Flags and banners," "Gloves and mittens," "Hats and caps," "Pocketbooks," "Saddlery and harness," "Shirts," and "Trunks and valises." We map these categories to the following 1950-IPUMS industry codes: "Apparel and accessories," "Miscellaneous fabricated textile products," "Paperboard containers and boxes," "Leather: tanned, curried, and finished," "Footwear, except rubber," and "Leather products, except footwear." The results are robust to less conservative definitions of sewing machine-using industries.

variation in industry exposure to sewing machines across towns, with values ranging from zero to over 50 percent. Exposure is highest in Massachusetts' manufacturing hubs, such as Lynn, Lawrence, Lowell, and Worcester, but there is considerable variation across other towns as well. Figure IIb reports the year in which sewing machine retailers first appeared in each town, highlighting sizable variation in the timing of their establishment. The first retailers appeared early, in 1859, in Boston, and subsequently spread across the state into the 1870s. Overall, roughly one-third of towns had a retailer during the sample period.

4 Empirical Framework

In this section, we first present the difference-in-differences (DiD) research design used to estimate the impact of sewing machines at the town level. We then discuss the key identification assumption required for causal interpretation of the results. Finally, we outline the empirical strategy for the individual-level analysis.

4.1 Difference-in-Differences Regressions

To estimate the impact of the adoption of sewing machines in manufacturing at the town level, we adopt the following DiD intensity-to-treat design:

$$y_{dt} = \alpha_d + \alpha_t + \sum_{\substack{k=-a \\ k \neq 0}}^{b} \beta_k \times \mathbb{I}\left(t - 1860 = k\right) \times \text{Industry Exposure to SM}_d + \varepsilon_{dt}, \tag{2}$$

where d and t index town and census year, respectively. The terms α_d and α_t denote town and time fixed effects. The terms $\mathbb{I}(\cdot)$ represent relative time periods categorical variables, which are interacted with the town-level measure of exposure to sewing machines, *Industry Exposure to* SM_d, defined in Equation (1). We omit 1860 as the baseline year—the last pre-treatment period—since the diffusion of the sewing machine accelerated in the mid-1860s. The outcome variable y_{dt} is expressed as a percentage of the relevant population. For example, female labor force participation is defined as the share of working women relative to the total female population aged 15 and above.

Analogously, to assess the impact of access to sewing machine retailers, we estimate the following staggered difference-in-differences specification using the methodology developed by de Chaisemartin and d'Haultfœuille (2024):

$$y_{dt} = \alpha_d + \alpha_t + \sum_{\substack{k=-a \\ k \neq 0}}^{b} \beta_k \times \mathbb{I}\left(t - \text{First SM Retailer}_d = k\right) + \varepsilon_{dt}, \tag{3}$$

where *First SM Retailer*$_d$ denotes the year in which the first sewing machine retailer enters town d. Unlike Equation (2), where treatment timing is common across towns, this specification exploits variation in treatment timing across locations. The staggered rollout enables us to identify the dynamic effects of retailer entry on the outcome variable y_{dt}. Standard errors in Equations (2) and (3) are clustered at the town level. To address potential spatial autocorrelation, we also report estimates using Conley (1999) standard errors, as explained in Section 5.3.

Under the parallel trends assumption, the estimated coefficients $\{\hat{\beta}_k\}_{k\geq 0}$ capture the dynamic treatment effects of exposure to sewing machines. In addition, as part of the robustness exercises described in Section B, we estimate static versions of both specifications that collapse the pre- and post-treatment periods. These estimates facilitate comparisons across specifications and outcomes.[31]

4.2 Discussion of the Identification Assumption

The key identification assumption underlying Equations (2)–(3) is the parallel trends assumption. In Equation (2), this requires that, in the absence of the sewing machine, towns with a higher concentration of sewing-machine-using industries in 1860 would not have followed different trajectories from towns with a lower concentration of such industries. In Equation (3), the assumption implies that, absent the establishment of sewing machine retailers, towns that would eventually have at least one retailer would not have exhibited different trajectories from towns that never did.

Although the parallel trends assumption is ultimately untestable, we present several exercises to support our identification strategy. First, in Table III, we report correlations between a set of observable characteristics and the two treatment measures in the 1850 and 1860 cross-sections. Columns (1–2) show the correlation between industry exposure to sewing machines and each variable in levels in 1850 and 1860. Columns (4–5) report analogous correlations for the presence of sewing machine retailers, measured before and after retailer entry. Importantly, the parallel trends assumption pertains to pre-treatment *trends* rather than levels. Accordingly, columns (3) and (6) report correlations between the growth rates of each variable and the two treatment measures, controlling for town and year fixed effects.

We find that exposure to sewing-machine-using industries is positively correlated with manufacturing employment (columns 1–2), which is unsurprising given that these industries are part of the manufacturing sector. However, manufacturing employment in these areas was declining prior to the invention of the sewing machine (column 3). Exposure is otherwise largely uncorrelated with other variables, except for agricultural employment and the share of women with at least one child. Sewing machine retailers tended to locate in areas with growing populations (column 6), but towns with and without retailers appear broadly similar along other observable dimensions.

In addition to these balance tests, we estimate flexible versions of Equations (2) and (3) and report the pre-treatment coefficients $\{\hat{\beta}_k\}_{k<0}$. Most coefficients are statistically indistinguishable from zero, and all are small in magnitude, providing further support for the parallel trends assumption. Finally, we apply the approach developed by Rambachan and Roth (2023) to assess the sensitivity of our results to potential violations of parallel trends. Results indicate that our baseline estimates are robust to sizable deviations from this assumption in the post-treatment period, as described in more detail in Section 5.3.

[31]In the case of (3), we report the average total effect cumulated over the estimation period, as described in de Chaisemartin and d'Haultfœuille (2024). This estimand captures the overall impact of the treatment by aggregating all post-treatment effects across periods, thereby reflecting the full dynamic response to the establishment of sewing machine retailers.

4.3 Individual-Level Framework

Our individual-level analysis utilizes the linked samples of women described in Section 3.2. These allow us to examine heterogeneous responses to the diffusion of sewing machines across wealth and age groups. To measure variation across the wealth distribution, we assign each woman the total wealth of her household in 1860.[32] We then group women into quartiles based on their household wealth, and assign households reporting no wealth to a separate category. Our analysis focuses on women from households with positive wealth using the first wealth quartile as the reference group.

As noted in Section 2, working women were disproportionately young, unmarried, and poor, often leaving the labor force upon marriage. Our estimation strategy, therefore, exploits variation in exposure to sewing machines across age cohorts and the 1860 wealth distribution. Treatment exposure is assigned based on a woman's location in 1860—the census year immediately preceding the primary take-off of the sewing machine. Accordingly, the analysis focuses on women already residing in Massachusetts in 1860. This approach mitigates potential selection bias arising if women moved in response to treatment exposure. To estimate the impact of industrial exposure to sewing machines, we employ the following cross-sectional difference-in-differences specification:

$$\begin{aligned} y_i =& \alpha_{d(i)} + \alpha_{t(i)} + \alpha_{\xi(i)} + X_i'\Gamma + \beta \times \left(\text{Young}_i \times \text{Industry Exposure to SM}_{d(i)}\right) + \\ &+ \sum_{\substack{q=0 \\ q\neq 1}}^{4} \delta_q \times \text{Young}_i \times \text{Industry Exposure to SM}_{d(i)} \times \mathbb{I}\left(\xi(i) = q\right) + \varepsilon_i, \end{aligned} \tag{4}$$

where i denotes an individual residing in town $d(i)$, born in year $t(i)$, and belonging to household wealth quartile $\xi(i)$. The terms $\alpha_{d(i)}$, $\alpha_{t(i)}$, and $\alpha_{\xi(i)}$ denote town, cohort, and wealth-quartile fixed effects, respectively. The vector X_i includes individual-level controls for race and birthplace. The indicator $Young_i$ equals one for women younger than 15 in 1860, and zero otherwise. *Industry Exposure to* SM_d measures town-level exposure to sewing machines in 1860, as defined in Equation (1).[33] The first quartile serves as the omitted reference category. The estimation sample consists of women born between 1835 and 1855. This ten-year window centered around 1845 captures the first cohorts exposed to the sewing machine as they entered the labor market.

Analogously, we estimate the following specification to assess the impact of the establishment of sewing machine retailers:

$$\begin{aligned} y_i =& \alpha_{d(i)} + \alpha_{t(i)} + \alpha_{\xi(i)} + X_i'\Gamma + \beta \times \left(\text{Retailer}_{d(i)} \times \text{Young}_i\right) + \\ &+ \sum_{\substack{q=0 \\ q\neq 1}}^{4} \delta_q \times \text{Retailer}_{d(i)} \times \text{Young}_i \times \mathbb{I}\left(\xi(i) = q\right) + \varepsilon_i, \end{aligned} \tag{5}$$

where $Retailer_{d(i)}$ is an indicator equal to one if at least one sewing machine retailer is present in district $d(i)$. The variable $Young_i$ equals one if individual i was younger than 15 when retailers entered, and

[32] Household wealth in 1860 is calculated by summing real and personal estate values, including all real estate, stocks, bonds, mortgages, notes, livestock, silverware, jewelry, and furniture owned by household members.

[33] In the main results, we omit households with no reported wealth because we cannot disentangle missing entries from zero-income ones. In robustness checks, we report treatment effects separately for this category under $q = 0$.

zero otherwise. As in Equation (4), we include town, cohort, and wealth-quartile fixed effects, as well as the same individual controls X_i. The estimation sample includes women aged 5 to 25 at the time the first sewing machine retailer opened in their town. In towns that never received a retailer during the sample period, we include cohorts born between 1840 and 1860, reflecting the typical birth-cohort window observed across treated towns.

As described in Section 3, we use outcomes from 1870 to capture the impact of industrial exposure to sewing machines and from 1880 to assess the influence of sewing machine retailers.[34] We consider six outcome variables. First, we construct an indicator for whether a woman is employed in a sewing-machine-using industry. Second, we include a dummy for whether a woman is employed in manufacturing. Third, we look at women in formal employment, regardless of industry. Fourth, we use the log of the occupational score as a proxy for income. To capture fertility, we consider both the number of children and an indicator for whether a woman has any children. Finally, we examine marital status at the time of the census. In 1880, we further observe whether the woman has ever married. In both Equations (4) and (5), standard errors are clustered at the town level.

5 Town-Level Analysis

In this section, we examine the impact of the sewing machine on women at the town level. Section 5.1 discusses the labor market effects following the large-scale diffusion of sewing machines. Section 5.2 presents the corresponding effects on fertility and explores the potential underlying mechanisms. Section 5.3 assesses the robustness of these results.

5.1 The Labor Market Effects of the Sewing Machine

Figure III summarizes the effects of sewing machines on female employment by type of treatment exposure. The top row presents results for exposure to sewing machines as a manufacturing tool, while the bottom row reports the corresponding effects for home use.

Figure IIIa shows a substantial increase in female employment in industries that adopted sewing machines. The estimated $\widehat{\beta}_k$ coefficients display a clear pattern: in more exposed towns, the share of women employed in these sectors rose gradually throughout the 1870s and 1880s, before stabilizing thereafter. These effects are statistically significant at the 1% level. Quantitatively, a one-standard-deviation increase in industry exposure to the sewing machine yields a 0.274-standard-deviation increase in the share of women employed in sewing-machine-using industries over the period 1860–1900. In Figure IIIb, we examine the aggregate effect of industrial sewing machine exposure on total female labor force participation. While the estimates are less precise than the sector-specific results, we find a statistically significant effect at the 10-percent level in 1885 and 1895. Quantitatively, a one-standard-deviation increase in exposure to the sewing machine in manufacturing leads to a 5% standard-deviation increase in female labor force participation after the sewing machine is adopted in manufacturing. The estimated coefficient attenuates and is no longer statistically distinguishable from zero by 1900.

[34] Implicitly, we thus restrict the attention to retailers established before 1880.

Importantly, we find no statistically significant correlation between towns with a larger exposure to the sewing machine as a manufacturing tool and the share of women working in sewing-machine-using industries (Figure IIIa) before 1860. This pattern suggests that female labor force participation in sewing-machine-exposed industries in towns with greater exposure to sewing machines was not already on a differential trend before the widespread adoption of sewing machines in manufacturing. In Section 5.3, we provide further evidence in support of our identification strategy. We cannot replicate this exercise for overall female employment because women's participation in formal non-manufacturing labor markets was first recorded in 1860.

We now turn to examine how exposure to sewing machine retailers impacted women's employment. Sewing machine retailer presence capture the local access to sewing machines as household appliances. In Figure IIIc and Figure IIId, we show that the employment rate in sewing-machine-using industries and the overall female labor force participation rate increased after the establishment of a sewing machine retailer. Quantitatively, the employment rate in sewing-machine-using industries increases by approximately 0.54 standard deviations after the establishment of a sewing-machine retailer. Overall female employment exhibits a 0.26-standard-deviation increase over the same period.[35] The pre-treatment coefficients are small and insignificant, indicating no evidence of violations of the parallel trends assumption in the pre-treatment period.

A plausible concern is that our estimates capture broader town-specific trends in economic activity rather than the effect of the diffusion of the sewing machine. To explore this possibility, we exploit the fact that the employment effect of sewing machines is concentrated in sewing-machine-using industries. We thus leverage between-industry variation in a triple differences setting to control for town-specific time-varying factors. Formally, we estimate the following specification for industry exposure to the sewing machine:

$$y_{idt} = \alpha_{i\times d} + \alpha_{i\times t} + \alpha_{d\times t} + \\ + \sum_{\substack{k=-a \\ k\neq 0}}^{b} \beta_k \times \mathbb{I}(t - 1860 = k) \times \text{Industry Exposure to SM}_d \times \mathbb{I}(\text{SM Industry}_i) + \varepsilon_{idt}\,, \quad (6)$$

and the following regression for exposure to sewing-machine retailers:

$$y_{idt} = \alpha_{i\times d} + \alpha_{i\times t} + \alpha_{d\times t} + \\ + \sum_{\substack{k=-a \\ k\neq 0}}^{b} \beta_k \times \mathbb{I}(t - \text{First SM Retailer}_d = k) \times \mathbb{I}(\text{SM Industry}_i) + \varepsilon_{idt}\,, \quad (7)$$

where i, d, and t denote an industry, town, and census year with corresponding fixed effects by industry-by-town $\alpha_{i\times d}$, industry-by-year $\alpha_{i\times t}$, and town-by-year $\alpha_{d\times t}$. The term $\mathbb{I}(\text{SM Industry}_i)$ is an indicator equal to one if industry i is exposed to the sewing machine and zero otherwise. The triple difference estimator thus compares towns and industries by exposure to the sewing machine. Compared with the DiD estimator, this approach allows us to include town-by-year fixed effects to

[35] These effects are driven by the fact that female employment is, on average, low. In Massachusetts, in 1860, only 18% of women between 15 and 60 years old worked (25% for those between 15 and 30 years old), as reported in Table I.

control for time-varying unobserved heterogeneity at the town level. As in (3), we estimate (7) using the estimator developed by de Chaisemartin and d'Haultfœuille (2024).

Figure IV displays the results. We find that the log-employment in sewing-machine-using industries increases in towns with higher exposure to sewing machines (Figure IVa) and after the establishment of sewing machine retailers (Figure IVb). Both patterns are entirely driven by women.[36] Since the triple differences specifications control for time-varying city-level factors, the positive treatment effects on female employment indicate that our results plausibly reflect the labor-market impact of the sewing machine rather than broader unobserved trends. Overall, despite being a labor-saving innovation, our estimates suggest that sewing machines increased overall female employment. In towns with higher industrial exposure to sewing machines, the estimates indicate that productivity and reinstatement effects outweighed the displacement effect associated with the automation of hand sewing (Acemoglu and Restrepo, 2019). Our findings further indicate that the sewing machine enhanced the efficiency of homework, thereby inducing a positive shift in female labor supply.

To examine the heterogeneous impact of the sewing machine across industries, we analyze employment effects in the sectors that most prominently employed women during the period.[37] In Figure V, we report treatment effects from a set of DiD specifications, following Equations (4)-(5). The dependent variable is the industry-specific share of employed women relative to the total female working-age population.

Figure Va illustrates the net employment effects following the widespread diffusion of sewing machines in factories. We find positive net employment effects in footwear factories, general merchandise stores and business services. The increase in employment in footwear, for example, provides suggestive evidence of a reinstatement effect. As Dublin (1994, p. 17) notes, *the application of sewing machines to the stitching of shoe uppers created a new class of female factory workers termed "shoe fitters" or "stitchers".* General merchandise stores absorbed seamstresses and dressmakers, while business services increasingly employed women in clerical roles, pointing to broader occupational spillovers beyond manufacturing. For several industries, such as textile mills, the net employment effects are quantitatively small. By contrast, we find negative employment effects in dressmaking shops, suggesting that sewing machine adoption in factories displaced independent seamstresses and dressmakers. Moreover, the negative employment effect in agriculture—a sector already in decline in Massachusetts during this period—underscores the expanding industrial and service-sector opportunities that sewing machines facilitated for women.

Figure Vb shows the net employment effects after towns gained access to a sewing machine retailer. We similarly find sizable positive net employment effects in footwear, general merchandise stores, and business services, alongside expansions in printing, textile mills, and retail trade. Notably, access to sewing machine retailers did not lead to negative employment effects in dressmaking shops,

[36] Table C.1 replicates the triple DD results when we collapse the pre- and post-treatment periods into two windows.

[37] We identify the top 15 sectors with the highest female employment in Massachusetts using the IPUMS variable `IND1950`, which is based on the 1950 Census Bureau's industrial classification system. For years prior to 1910, industry was inferred from the occupational responses. For instance, the category "dressmaking shops" (`IND1950` = 847) includes most milliners, dressmakers, and seamstresses.

though it did in agriculture and for certain manufacturing industries that primarily hired women as operatives. In both cases, we do not find evidence that the sewing machine displaced service workers in private households.

Figure D.7 replicates this analysis, focusing on major textile-, apparel-, and leather-related industries. Within these sectors, we find moderate negative employment responses in dressmaking and shoe-repair shops following the widespread adoption of sewing machines in factories, suggesting the displacement of seamstresses, dressmakers, and shoe-binders. By contrast, employment in the footwear and paper box industries exhibits large increases, reflecting a structural shift toward factory-based production (Figure D.7a). The effect of sewing-machine retailers is generally positive for most industries, with the notable exception of shoe-repair shops where the estimates are negative but statistically insignificant (Figure D.7b).

5.2 The Sewing Machine and Fertility Choices

Having established that the widespread adoption of the sewing machine—both as a manufacturing tool and in the home—increased female employment, we now turn to its effects on fertility and the potential mechanisms driving these patterns. As a first step, we utilize detailed annual vital statistics from Massachusetts covering the period 1850–1900. These reports provide aggregated town-level data on births, which allow us to construct the crude birth rate, defined as the number of births divided by population, which we express in per-thousand units.[38]

Figure VIa presents the estimated β_k coefficients over biannual time windows for sewing machines as a manufacturing technology, using the 1860-61 cohort as the reference group. Beginning in the 1860s, towns with greater industrial exposure to sewing machines exhibit a clear decline in fertility—a trend that strengthens over time, leaving the most exposed areas with substantially lower crude birth rate by the end of the 19th century. While these coefficients are statistically significant, the magnitude of the decline is modest (standardized $\beta = -0.100$).[39] Figure VIb displays the crude birth rate response to the presence of sewing machine retailers. The estimates indicate a statistically significant decline in fertility starting eight to ten years after a retailer's establishment. The effect is quantitatively similar to the response to industry adoption of the sewing machine (standardized $\beta = -0.150$), although it exhibits mean reversion by the end of the estimation period.

As a second step, we use data from the U.S. Census and the Massachusetts State Census to further examine which margins drove the fertility decline in towns with higher industrial exposure. Specifically, we construct the share of mothers and the number of children per woman to capture fertility adjustments along the extensive and intensive margins, respectively. Figure VIIa and Figure VIIb reveal a significant decline in fertility in towns with higher industrial exposure, consistent with the patterns shown in Figure VI. Following the increased diffusion of sewing machines in the

[38] Massachusetts began the statewide collection of vital statistics in 1841/42. The data are generally considered reliable and of high quality, with accuracy improving and underreporting declining as the system matured (Gutman, 1956). Katherine Eriksson shared with us the birth and death records for the years 1858–1887 and 1893–1900. We digitized the birth records for the years 1850–1857 and 1888–1892.

[39] Table C.2 presents the corresponding estimates in tabular form.

1860s and 1870s, the estimated β_k-coefficients are consistently negative and statistically significant. Quantitatively, a one-standard-deviation increase in industry exposure to the sewing machine yields a 0.026-standard-deviation decrease in the share of women with at least one child, and a 0.1-standard-deviation decrease in the number of children per woman.[40] Exposure to sewing machine retailers yields a decline in fertility along the extensive margin (Figure VIIc). Quantitatively, the establishment of a retailer yields a 0.09-standard-deviation decrease in the share of women with at least one child. By contrast, we find a very small (0.05 of a standard deviation) and marginally significant positive effect of sewing machine retailers along the intensive margin of fertility (Figure VIId).

What mechanisms explain the fertility decline in towns with greater industrial exposure to sewing machine use? In the late 19th century, it was common for women to leave the labor force after marriage to have children. Improved labor-market opportunities may have led women to delay or even forgo marriage, thereby reducing fertility. As shown in Figure VIII, towns with higher industry exposure experienced a significant decline in the share of married women starting in the 1870s, with the effect intensifying over the sample period. The estimated β_k-coefficients in the post-sewing machine period are always negative and statistically significant, but not statistically different from zero in the pre-sewing machine era. Quantitatively, a one-standard-deviation increase in industry exposure to the sewing machine decreases the share of married women in the post-sewing-machine period by approximately 9% of a standard deviation. In contrast, we find no systematic response in the share of married women to exposure to sewing machine retailers.

Changes in the mortality environment in manufacturing towns could represent an alternative explanation for the observed decline in fertility. Public health interventions—such as the expansion of clean water systems, sewerage infrastructure, and the free distribution of antitoxins to combat diphtheria—substantially improved child health in Massachusetts toward the end of the nineteenth century (Alsan and Goldin, 2019; Ager et al., 2026a). To assess this channel, we construct the crude mortality rate for ages 0–5 based on the Massachusetts vital statistics for the period 1858-1888. We find, however, that shifts in the mortality environment are unlikely to account for these patterns. As shown in Figure D.1, child mortality trends do not explain the systematic fertility decline observed in towns with greater industrial exposure to sewing machines beginning in the mid-1860s.

Another potential explanation for the observed fertility decline is the rising demand for human capital and the growing opposition to child labor during the second phase of the Industrial Revolution (Doepke, 2004; Doepke and Zilibotti, 2005; Galor, 2011). Although Massachusetts had mandated school attendance since 1852 and, by 1837, restricted the employment of children under 15 who had not attended school for at least three months in the previous year, compliance remained imperfect. During our period, school attendance hovered around 80%, while child labor rates still averaged about 6%, largely reflecting the limited enforcement provisions in Massachusetts child labor laws prior to 1880 (Moehling, 1999). Nevertheless, anecdotal evidence suggests that factories primarily recruited adolescent girls and young women, rather than young children, as sewing-machine operators

[40]There is some indication of deviations from parallel trends in the pre-treatment period in Figure VIIa, which we address in the robustness section below.

or stitchers (Goldin and Sokoloff, 1982; Dublin, 1994). Towns with a high concentration of clothing and related industries, where child labor was historically common, may therefore have experienced a shift away from child labor and a corresponding increase in school enrollment, potentially contributing to a decline in fertility.

To assess this mechanism, we analyze U.S. Census and the Massachusetts State Census data on school attendance among children aged 5-14 and labor force participation among children aged 10-14 who reported a gainful occupation. Our results indicate that towns with greater industrial exposure to the sewing machine experienced both an increase in school attendance and a significant decline in child labor during the 1870s (see Figure D.2a and Figure D.2c). Quantitatively, however, these effects are modest. Notably, the differential decline in child labor in high-exposure towns dissipates after 1880, possibly reflecting the equalizing effect of stricter enforcement of child labor and compulsory schooling laws. Exposure to sewing-machine retailers similarly increased school attendance (Figure D.2b), with a negative, albeit small and statistically insignificant, effect on child labor (Figure D.2d).

Overall, our town-level results indicate that greater industrial exposure to sewing machines increased female employment, an effect accompanied by a corresponding decline in fertility. We also document a significant reduction in the share of married women in towns with higher industrial exposure, consistent with expanded labor-market opportunities for young women. In Section 6, we use individual-level data to show that the aggregate patterns mask important compositional dynamics, as employment, fertility and marriage responses to retailer access and industry exposure to the sewing machine vary considerably across the wealth distribution.

5.3 Robustness Analysis

We conduct a series of robustness checks for our town-level analysis. These are detailed in Section B, along with their underlying motivations and a brief summary of the corresponding results.

First, we verify the stability of our baseline estimates. Figure D.8–Figure D.9 report the main coefficients when augmenting the baseline specification—which includes city and year fixed effects—with additional controls measured in 1850 and interacted with period dummies. These controls include total, child, female, Black, and foreign-born population; employment in manufacturing, agriculture, services, and retail; and the literate population. All controls are expressed as shares of the population. Each figure also presents estimates from a specification that includes all controls simultaneously, as well as a model incorporating county-by-year fixed effects. Across all specifications, the estimates remain quantitatively consistent with the baseline results. These findings further suggest that towns' access to sewing machine retailers is not simply capturing broader employment growth in retail occupations or differential access to general retail establishments.

Second, we show in Table C.3 that more exposed towns did not experience a differential inflow of migrants from other towns and, if anything, saw lower levels of out-of-state immigration. This mitigates concerns that our results may be driven by selective migration into towns with greater exposure to sewing machines.[41] To further address potential selection concerns, in Section 6, we restrict the analysis to women who were already residing in Massachusetts prior to the widespread adoption of sewing machines.

Third, we examine the robustness of our estimates to potential violations of the parallel trends assumption and provide additional sensitivity checks to support our identification strategy. In Figure D.3 and Figure D.4, we estimate bounds that are robust to deviations from parallel trends following Rambachan and Roth (2023). Across all outcomes, the baseline estimates remain stable even under sizable departures from parallel trends in the post-treatment periods. In Figure D.14, we report a randomization inference exercise in which treatment dates for sewing machine retailers are randomly reassigned across cities. For outcomes with statistically significant baseline effects, the estimates based on the true treatment timing lie in the tails of the placebo distributions, yielding low randomization p-values and indicating that the observed effects reflect actual retailer activity. Moreover, Figure D.10–Figure D.11 present treatment effects obtained by sequentially excluding one town at a time to ensure results are not driven by specific areas of Massachusetts subject to idiosyncratic or correlated shocks. The estimates remain remarkably stable regardless of the excluded town.

Fourth, we address concerns that our treatment measures may not capture the full scope of geographic exposure. Workers could potentially commute to other towns to work in sewing-machine-using factories or purchase machines even if their own town lacked a retailer. In Table C.4–Table C.5, we relax the treatment definitions to include sewing-machine industry and retailer presence within 10, 20, 30, and 40 kilometers of each city's centroid. The results indicate that the effect of industry exposure shows relatively high spatial persistence. In contrast, the effect of retailers quickly fades with distance, suggesting that local proximity was key to sewing machine adoption in households. We further show in Table C.6 that the results are quantitatively unchanged when using two alternative base years (1850 and 1870) to measure employment exposure to sewing-machine-using industries, or when broadening the set of industries categorized as exposed to the diffusion of the sewing machine in the factory (see Section A.3 for additional details).

Finally, we report in Figure D.12–Figure D.13 standard errors computed using alternative variance-covariance estimators, addressing potential spatial autocorrelation arising from the geographic distribution of treatments shown in Figure II. In particular, we implement the Conley (1999) correction, allowing for spatial dependence at different distance thresholds. Statistical significance remains unchanged throughout.[42]

6 Individual-Level Analysis

Our town-level evidence suggests that the diffusion of the sewing machine produced divergent effects on fertility when adopted as an industrial tool versus a household appliance. To investigate the

[41] Our sample period coincides with a phase of large-scale immigration from Europe, and increased mobility of female labor from rural areas and other New England states into Massachusetts manufacturing towns (Dublin, 1994).

[42] Due to technical limitations, the alternative standard errors reported for Equation (3) are obtained from a standard two-way fixed effects regression.

mechanisms underlying these patterns, we use the linked samples described in Section 3.2 to estimate responses to adoption across age cohorts and the wealth distribution.

6.1 Heterogeneous Effects of Sewing Machine Exposure across Age Cohorts

Motivated by the historical narrative, we expect young-adult women to be more directly affected by the adoption of sewing machines than older women (aged 25 and above), who were more likely to have already exited the labor market. To test this hypothesis, we expand our linked sample to include all women born in or before 1860 and examine whether younger cohorts were more likely to enter the labor force when exposed to sewing machines. Specifically, we replace the binary "Young" variable in Equations (4)-(5) with a set of age-bin indicators and omit the wealth quartile indicators. Figure IX presents the likelihood of employment in sewing-machine-intensive industries by age and type of exposure. Figure IXa displays the estimated coefficients by age in the 1860 Census, while Figure IXb reports coefficients corresponding to a woman's age when the first retailer was established in her town. The results strongly support our hypothesis: the labor supply response was driven primarily by younger women in more exposed towns, with only marginal effects observed for older cohorts.

6.2 Heterogeneous Effects of Sewing Machine Exposure across the Wealth Distribution

Having established that the labor supply response is concentrated among young-adult women, we next evaluate how the impact of sewing machine exposure varies across the wealth distribution. We expect a stronger response among young-adult women from lower-wealth households in towns with greater exposure to sewing machines—both as industrial tools and household appliances. In contrast, we expect a relatively inelastic labor supply response for women from wealthier households.

We evaluate this hypothesis using the estimation sample described in Section 4.3. The blue bars in Figure X report the wealth-quartile-specific estimates based on Equation (4).[43] The results reveal substantial heterogeneity across the wealth distribution. Specifically, Figure Xa shows that young women from the first wealth quartile are significantly more likely to be employed in sewing-machine-intensive industries when residing in towns with higher industrial exposure. Consistent with the historical narrative, this employment effect declines monotonically as household wealth increases; we find no significant labor market response for young women at the top of the wealth distribution. A qualitatively similar pattern emerges in Figure Xb when examining the overall probability of employment. These results suggest that the adoption of the sewing machine primarily expanded industrial employment opportunities for young women from less affluent households.

For young women in the lower quartiles of the wealth distribution, we also find a positive and statistically significant effect on income proxied by the occupational income score (see Table C.7). Consistent with the employment patterns documented above, these gains do not extend to women from wealthier households. These results suggest that the adoption of sewing machines in factories facilitated not only labor market entry but also upward mobility in the occupational income distribution

[43] Tabular results are reported in Table C.7. For comparability with the treatment effects of retailers (displayed in red), we divide the industry exposure measure by its standard deviation; thus, the treatment effects represent changes in the dependent variable in response to a one-standard-deviation increase in industrial exposure to the sewing machine.

among young women from lower-wealth households.[44]

Figure Xc presents the fertility results using the number of children as a proxy. Consistent with the increased opportunity cost of child-rearing, young women from the lowest wealth quartile in towns with high industrial exposure were significantly less likely to have children. In contrast, we find no significant fertility response among women from wealthier households (third and fourth quartiles), suggesting that the demographic impact of sewing machine adoption in factories was concentrated among the working poor. Although we cannot directly test for delayed marriage, Figure Xd shows that women from poorer households were significantly less likely to be married by 1870. This effect declines across the wealth distribution, consistent with the historical narrative that expanded industrial employment opportunities altered family formation decisions among young, economically disadvantaged women.

We now turn to the diffusion of the sewing machine as a household appliance, using the presence of local retailers in a town as a proxy for domestic adoption. The red bars in Figure X summarize the wealth-quartile-specific responses (tabular results are reported in Table C.8). The estimated effects on employment in sewing-machine-using industries (Figure Xa) and overall labor force participation (Figure Xb) are similar to those we document for industrial exposure to the sewing machine. However, we find a negative employment response to retailers among women in the upper tail of the wealth distribution. Since the sewing machine acted as a positive productivity shock to home production, this pattern may reflect a substitution away from formal employment and toward unpaid housework for less financially constrained women.

A distinct pattern emerges for fertility. Figure Xc shows that retail access has a statistically insignificant negative impact on the fertility of women in lower-wealth households, while there is a significant positive fertility response among wealthier women. This differential fertility response is concentrated in the third and fourth wealth quartiles. Women in the upper part of the wealth distribution were similarly more likely to marry (Figure Xd), suggesting that, for middle- and upper-class women, the sewing machine acted as a time-saving technology that lowered the burdens of home production and facilitated earlier family formation.

Finally, we extend the analysis using the sample of women linked between 1860 and 1900 to observe their *completed* fertility and marriage decisions. In Table C.10 and Table C.11, we find that the baseline effects are confirmed when examining completed fertility and family choices, even though the coefficients are quantitatively smaller, indicating that sewing machines—at least in part—delayed childbearing and marriage.

Overall, our results document substantial heterogeneity in the impact of sewing machines across the household wealth distribution. For young women from working-class households, sewing machines expanded employment opportunities in factories that adopted the technology. At the same time, by increasing the efficiency of home production, sewing machines also reduced time constraints

[44] In Table C.9, we focus on married individuals and show that the increased labor income for women at the bottom of the wealth distribution in response to the diffusion of sewing machines in manufacturing implied that women in the second quartile earned a larger share of household income. We find no corresponding effects on womens household income shares from exposure to sewing machine retailers.

within the household and facilitated labor market entry. These changes increased the opportunity cost of childbearing, leading to lower fertility and a higher likelihood of remaining unmarried. In contrast, more affluent women did not respond to the industrial adoption of sewing machines but were sensitive to their diffusion as household appliances. Among women in the top quartile of the wealth distribution, access to a sewing machine at home is associated with increased family formation and lower labor force participation rates.

6.3 Robustness Analysis

We also conduct a series of robustness checks for our individual-level analysis. These are detailed in Section B, along with their underlying motivations and a brief summary of the corresponding results.

First, we address potential concerns regarding sample representativeness and selection into the linked sample (Althoff et al., 2025). To mitigate these concerns, we construct weights to align our linked data with the 1870 and 1880 populations along the following key characteristics: age, occupation, number of children, school attendance, race, household relationship, marital status, and wealth. Table C.12 and Table C.13 show that our results remain consistent after reweighting. Moreover, Table C.14 and Table C.15 compare our baseline sample to the Althoff et al. (2025) sample and to the full population in 1870 and 1880, respectively. We find that differences along observables between linked and non-linked women are small and similar across the two linking approaches.[45] Additionally, in Table C.16–Table C.17, we replicate the baseline results using the Multigenerational Linked Panel (MLP), an alternative linking approach developed by Ruggles et al. (2025). All results remain quantitatively similar.

Second, we show in Table C.18 and Table C.19 that the baseline estimates are robust to using an alternative age threshold (20 years) at the time of exposure to define the "young" cohorts. Figure D.15 presents a similar pattern of results when reporting the distribution of treatment effects across ventiles of the household wealth distribution rather than quartiles, although, as expected, the estimates are less precise.

Finally, in Table C.20 and Table C.21, we replicate the baseline estimates while including additional individual-level controls: literacy status, urban-rural status, an indicator for first- and second-generation migrants, and an indicator for women who married within the year prior to the census. The results remain robust across all outcomes.

7 Liberation? The Sewing Machine and the Women's Club Movement

Our individual-level analysis reveals that the domestic adoption of the sewing machine functioned as a labor-liberating technology for working-class women. Conversely, for middle- and upper-class women, prevailing gender norms and a scarcity of socially "respectable" occupations constrained labor supply responses. Instead, our evidence suggests that these women reallocated their freed time

[45] An alternative approach would be to replicate the analysis using the nationally representative intergenerational links constructed by Althoff et al. (2025). However, the lower matching rate yields a sample roughly 90% smaller than ours, which is insufficient to replicate our empirical analysis.

toward marrying earlier and increasing fertility. We now test whether, for wealthier women, the time saved from household production also facilitated an expansion in civic and leisure activities.

Historical accounts suggest that the increase in leisure time among middle- and upper-class women during the Gilded Age contributed to a rise in activities promoting "self-culture" and civic engagement. The emergence of women's clubs in the second half of the nineteenth century reflects this broader expansion in women's community involvement. Women's associations and clubs developed across many parts of the United States, promoting literary studies, civic reform, and philanthropy, among other activities (Scott, 1992; Skocpol, 1995; Gere, 1997).

We thus conclude our analysis by examining whether the time saved in household production due to the sewing machine is associated with the emergence of the women's club movement. To do so, we digitize data on women's clubs from *The History of the Woman's Club Movement in America*, compiled by Croly (1898). This source contains information on the universe of organizations affiliated with the *General Federation of Women's Clubs*, a nondenominational national federation of women's associations. We extract records for clubs located in Massachusetts. These contain information on club names, towns, years of establishment, and membership. Because most associations were established in the 1880s and 1890s, we do not exploit the time dimension and instead construct a cross-sectional dataset at the town level, capturing the number of women's clubs and their total membership.

Our empirical specification is a cross-sectional town-level regression relating the number of women's clubs to the presence of sewing machine retailers and industrial exposure to sewing machines. Table IV summarizes the results. In Panel A, the outcome variable is the number of clubs (columns 1-6) and the number of clubs per capita (columns 7-8); in Panel B, the outcomes are the number of club members (columns 1-6) and the number of club members per capita (columns 7-8). Because these are count variables and the dataset contains many zeros (72% of towns do not have a club), we employ a Poisson quasi-likelihood estimator.

We find a positive association between women's clubs and the presence of sewing machine retailers (column 1). By contrast, industry exposure to sewing machines is not correlated with the presence of women's clubs (column 2). When both variables are included in the regression, only the presence of sewing machine retailers remains associated with women's clubs (column 3), even after including a set of town-level controls (population, the share of manufacturing employment, the share of women, the share of children, the share of Blacks, and the foreign-born share) measured in 1860 and county-level fixed effects (column 4). The women's club movement was a middle-class and elite phenomenon (Skocpol, 1995). Hence, it is plausible that a larger population of affluent women contributed to the diffusion of clubs. We test this argument in columns (5-6) and find a positive association between sewing machine retailers and the number of women's clubs, but only in towns with a larger share of women in above-median-wealth households. By contrast, industry exposure to sewing machines is not associated with the presence of women's clubs, regardless of the size of the affluent female population. We find similar patterns when examining the number of clubs per capita (columns 7-8) and when using club membership as the outcome (Panel B).

Overall, our findings suggest that access to sewing machine retailers—and the corresponding diffusion of sewing machines as household appliances—contributed to the rise of the women's club movement. While we cannot establish causality, these patterns are consistent with historical evidence linking increases in middle- and upper-class women's leisure time to the diffusion of women's clubs.

8 Conclusions

The relatively low participation of women in the labor force remains a key constraint to economic growth in both developing and developed economies (Lewis, 1954; Ashraf et al., 2024). Technological change is often viewed as a "liberating" force because it can alleviate the burden of domestic tasks that have historically been, and largely remain, disproportionately performed by women (Greenwood, 2019). In this paper, we evaluated whether the sewing machine—in its dual role as both an industrial technology and a household appliance—functioned as a "liberation" technology in the context of 19th-century Massachusetts.

While the sewing machine substituted for manual sewing tasks, it also spurred the growth of the clothing and footwear industries, thereby absorbing displaced seamstresses, dressmakers, and shoe binders into new occupations. For working-class women, this expansion in labor market opportunities increased the opportunity cost of childbearing, contributing to lower fertility and delayed marriage. In contrast, although the technology also diffused into middle- and upper-class households, social stigma and the limited availability of "desirable" white-collar occupations constrained the labor supply responses of wealthier women.

These patterns stand in contrast to the effects of mid-20th-century household appliances, such as washing machines and vacuum cleaners, which diffused during a period of rising demand for clerical positions that expanded respectable employment opportunities for married and affluent women (Greenwood et al., 2005b; Goldin, 2006). For 19th-century middle- and upper-class women, the time freed by the sewing machine was instead reallocated toward earlier family formation and greater participation in civic and leisure activities. Evidence from women's clubs suggests that, while these women remained outside the formal labor market, the sewing machine facilitated a shift toward organized social reform and community leadership.

More broadly, our findings underscore the role of household constraints and social norms in shaping the effects of labor-saving technologies. We show that technological change can reinforce social and economic inequality by bifurcating women's economic experiences: it expanded opportunities for working-class women through market entry while enabling more affluent women to reallocate their time toward family formation and high-status civic leadership, thereby reinforcing their standing outside the formal labor market. These findings suggest that the effects of labor-saving technologies depend critically on the interaction between market opportunities and prevailing social norms.

References

Aaronson, Daniel, Fabian Lange, and Bhashkar Mazumder, "Fertility Transitions Along the Extensive and Intensive Margins," *American Economic Review*, 2014, *104* (11), 3701–3724.

Abramitzky, Ran, Leah Boustan, Katherine Eriksson, James Feigenbaum, and Santiago Pérez, "Automated Linking of Historical Data," *Journal of Economic Literature*, 2021, *59* (3), 865–918.

Acemoglu, Daron and David Autor, "Skills, Tasks, and Technologies: Implications for Employment and Earnings," in "Handbook of Labor Economics," Vol. 4, Elsevier, 2011, pp. 1043–1171.

_ **and Pascual Restrepo**, "The Race between Man and Machine: Implications of Technology for Growth, Factor Shares, and Employment," *American Economic Review*, 2018, *108* (6), 1488–1542.

_ **and** _ , "Automation and New Tasks: How Technology Displaces and Reinstates Labor," *Journal of Economic Perspectives*, 2019, *33* (2), 3–30.

_ **and** _ , "Robots and Jobs: Evidence from US Labor Markets," *Journal of Political Economy*, 2020, *128* (6), 2188–2244.

Ager, Philipp and Francesco Cinnirella, "Froebel's Gifts: How The Kindergarten Movement Changed the Immigrant Family," *Journal of Economic Growth*, forthcoming.

_ **, Benedikt Herz, and Markus Brueckner**, "Structural Change and the Fertility Transition," *Review of Economics and Statistics*, 2020, *102* (4), 806–822.

_ **, Casper W. Hansen, and Peter Z. Lin**, "Medical Technology and Life Expectancy: Evidence from the Antitoxin Treatment of Diphtheria," *American Economic Journal: Economic Policy*, 2026, *18* (2), 441–76.

_ **, Marc Goñi, and Kjell G. Salvanes**, "Gender-Biased Technological Change: Milking Machines and the Exodus of Women from Farming," *American Economic Review*, 2026, *116* (1), 246–286.

Albanesi, Stefania and Claudia Olivetti, "Gender Roles and Medical Progress," *Journal of Political Economy*, 2016, *124* (3), 650–695.

Alesina, Alberto, Paola Giuliano, and Nathan Nunn, "On the Origins of Gender Roles: Women and the Plough," *The Quarterly Journal of Economics*, 2013, *128* (2), 469–530.

Alsan, Marcella and Claudia Goldin, "Watersheds in Child Mortality: The Role of Effective Water and Sewerage Infrastructure, 1880–1920," *Journal of Political Economy*, 2019, *127* (2), 586–638.

Althoff, Lukas, Harriet Brookes Gray, and Hugo Reichardt, "America's Rise in Human Capital Mobility," *Working Paper*, 2025.

Arenas-Arroyo, Esther, "'The Queen of Inventions': How Home Technology Shaped Women's Work and Children's Futures," *IZA Discussion Papers*, 2025, (18197).

Ashraf, Nava, Oriana Bandiera, Virginia Minni, and Vıctor Quintas-Martınez, "Gender Gaps across the Spectrum of Development: Local Talent and Firm Productivity," *Woring Paper*, 2024.

Atack, Jeremy, Michael R. Haines, and Robert A. Margo, "Railroads and the Rise of the Factory: Evidence for the United States, 1850–1870," in Paul W. Rhode, Joshua L. Rosenbloom, and David F. Weiman, eds., *Economic Evolution and Revolutions in Historical Time*, Stanford, CA: Stanford University Press, 2011, pp. 162–179.

_ **, Robert A Margo, and Paul W Rhode**, ""Automation" of Manufacturing in the Late Nineteenth Century: The Hand and Machine Labor Study," *Journal of Economic Perspectives*, 2019, *33* (2), 51–70.

_ **,** _ **, and** _ , "Industrialization and Urbanization in Nineteenth Century America," *Regional Science and Urban Economics*, 2022, *94*, 103678.

Bailey, Martha J., "More Power to the Pill: The Impact of Contraceptive Freedom on Women's Life Cycle Labor Supply," *The Quarterly Journal of Economics*, 2006, *121* (1), 289–320.

Bailey, Martha J and William J Collins, "Did Improvements in Household Technology Cause the Baby Boom? Evidence from Electrification, Appliance Diffusion, and the Amish," *American Economic Journal: Macroeconomics*, 2011, pp. 189–217.

Barm, A. and S. E. Klepp, ""If I Didn't Have My Sewing Machine . . .": Women and Sewing Machine Technology," in Joan M. Jensen and Sue Davidson, eds., *A Needle, a Bobbin, a Strike: Women Needleworkers in America*, Temple University Press, 1984, pp. 20–59.

Bau, Natalie and Raquel Fernández, "Culture and the Family," in "Handbook of the Economics of the Family," Vol. 1, Elsevier, 2023, pp. 1–48.

Berkes, Enrico, Ezra Karger, and Peter Nencka, "The Census Place Project: A Method for Geolocating Unstructured Place Names," *Explorations in Economic History*, 2023, *87*, 101477.

Bessen, James, Maarten Goos, Anna Salomons, and Wiljan Van den Berge, "What Happens to Workers at Firms that Automate?," *Review of Economics and Statistics*, 2025, *107* (1), 125–141.

Bleakley, Hoyt and Fabian Lange, "Chronic Disease Burden and the Interaction of Education, Fertility, and Growth," *Review of Economics and Statistics*, 2009, *91* (1), 52–65.

Blewett, Mary H, "Work, Gender and the Artisan Tradition in New England Shoemaking, 1780-1860," *Journal of Social History*, 1983, *17* (2), 221–248.

Boelmann, Barbara, Anna Raute, and Uta Schönberg, "Wind of Change? Cultural Determinants of Maternal Labor Supply," *American Economic Journal: Applied Economics*, 2025, *17* (2), 41–74.

Boserup, Ester, *Woman's Role in Economic Development*, Routledge, 1970.

Boustan, Leah Platt and William J Collins, "The Origin and Persistence of Black-White Differences in Women's Labor Force Participation," in "Human Capital in History: The American Record," University of Chicago Press, 2014, pp. 205–240.

Buckles, Kasey, Adrian Haws, Joseph Price, and Haley EB Wilbert, "Breakthroughs in Historical Record Linking Using Genealogy Data: The Census Tree Project," *Explorations in Economic History*, 2025, p. 101717.

Bursztyn, Leonardo, Alexander W Cappelen, Bertil Tungodden, Alessandra Voena, and David H Yanagizawa-Drott, "How are Gender Norms Perceived?," *NBER Working Paper*, 2023, (No. w31049).

Cain, Louis P. and Donald G. Paterson, "Biased Technical Change, Scale, and Factor Substitution in American Industry, 1850-1919," *The Journal of Economic History*, 1986, *46* (1), 153–164.

Caprettini, Bruno and Hans-Joachim Voth, "Rage Against the Machines: Labor-Saving Technology and Unrest in Industrializing England," *American Economic Review: Insights*, 2020, *2* (3), 305–320.

Cavalcanti, Tiago V and Jose Tavares, "Assessing the "Engines of Liberation": Home Appliances and Female Labor Force Participation," *The Review of Economics and Statistics*, 2008, *90* (1), 81–88.

Chandler, Alfred D, *The Visible Hand: The Managerial Revolution in American Business*, Harvard University Press, 1977.

Chiswick, Barry R and RaeAnn Halenda Robinson, "Women at Work in the United States since 1860: An Analysis of Unreported Family Workers," *Explorations in Economic History*, 2021, *82*, 101406.

Conley, Timothy G, "GMM Estimation with Cross-Sectional Dependence," *Journal of Econometrics*, 1999, *92* (1), 1–45.

Connolly, Marguerite, "The Disappearance of the Domestic Sewing Machine, 1890-1925," *Winterthur Portfolio*, 1999, *34* (1), 31–48.

Cooper, Grace Rogers, *The Sewing Machine: Its Invention and Development*, The Smithsonian Press, 1976.

Cortes, Guido Matias, "Where Have the Middle-Wage Workers Gone? A Study of Polarization Using Panel Data," *Journal of Labor Economics*, 2016, *34* (1), 63–105.

Costa, Dora L, "From Mill Town to Board Room: The Rise of Women's Paid Labor," *Journal of Economic Perspectives*, 2000, *14* (4), 101–122.

Croly, Jane Cunningham, *The History of the Woman's Club Movement in America*, HG Allen & Company, 1898.

de Chaisemartin, Clément and Xavier d'Haultfœuille, "Difference-in-Differences Estimators of Intertemporal Treatment Effects," *Review of Economics and Statistics*, 2024, pp. 1–45.

Doepke, Matthias, "Accounting for Fertility Decline During the Transition to Growth," *Journal of Economic Growth*, 2004, *9* (3), 347–383.

_ **and Fabrizio Zilibotti**, "The Macroeconomics of Child Labor Regulation," *American Economic Review*, 2005, *95* (5), 1492–1524.

_ **, Anne Hannusch, Fabian Kindermann, and Michèle Tertilt**, "The Economics of Fertility: A New Era," in "Handbook of the Economics of the Family," Vol. 1, Elsevier, 2023, pp. 151–254.

Donaldson, Dave and Richard Hornbeck, "Railroads and American Economic Growth: A "Market Access" Approach," *The Quarterly Journal of Economics*, 2016, *131* (2), 799–858.

Dublin, Thomas, *Women at work: The transformation of work and community in Lowell, Massachusetts, 1826-1860*, Columbia University Press, 1979.

_ , *Transforming Women's Work: New England Lives in the Industrial Revolution*, Cornell University Press, 1994.

Feigenbaum, James and Daniel P Gross, "Answering the Call of Automation: How the Labor Market

Adjusted to Mechanizing Telephone Operation," *The Quarterly Journal of Economics*, 2024, *139* (3), 1879–1939.

Fernández, Raquel, "Cultural Change as Learning: The Evolution of Female Labor Force Participation Over a Century," *American Economic Review*, 2013, *103* (1), 472–500.

__ **and Alessandra Fogli**, "Culture: An Empirical Investigation of Beliefs, Work, and Fertility," *American Economic Journal: Macroeconomics*, 2009, *1* (1), 146–177.

Fogel, Robert William, *Railroads and American Economic Growth*, Johns Hopkins Press, Baltimore, 1964.

Galor, Oded, *Unified Growth Theory*, Princeton University Press, 2011.

__ , "The Demographic Transition: Causes and Consequences," *Cliometrica*, 2012, *6* (1), 1–28.

__ **and David Weil**, "The Gender Gap, Fertility, and Growth," *American Economic Review*, 1996, *86* (3), 374–87.

Gamber, Wendy, *The female economy: The millinery and dressmaking trades, 1860-1930*, University of Illinois Press, 1997.

Gere, Anne Ruggles, *Intimate practices: Literacy and cultural work in US women's clubs, 1880-1920*, University of Illinois Press, 1997.

Giuliano, Paola, "Gender and Culture," *Oxford Review of Economic Policy*, 2020, *36* (4), 944–961.

Gobbi, Paula E., Anne Hannusch, and Pauline Rossi, "Family Institutions and the Global Fertility Transition," *Journal of Economic Perspectives*, 2026, *40* (1), 47–70.

Godley, Andrew, "The Global Diffusion of the Sewing Machine, 1850–1914," in "Research in Economic History," Emerald Group Publishing Limited, 2001, pp. 1–45.

__ , "Selling the Sewing Machine Around the World: Singers International Marketing Strategies, 1850–1920," *Enterprise & Society*, 2006, *7* (2), 266–314.

__ , "The Sewing Machine," in "The Routledge History of Fashion and Dress, 1800 to the Present," Routledge, 2023, pp. 17–41.

Goldin, Claudia, "The Work and Wages of Single Women, 1870 to 1920," *The Journal of Economic History*, 1980, *40* (1), 81–88.

__ , *Understanding the Gender Gap: An Economic History of American Women*, National Bureau of Economic Research, 1990.

__ , "The Quiet Revolution that Transformed Women's Employment, Education, and Family," *American Economic Review*, 2006, *96* (2), 1–21.

__ , "Nobel Lecture: An Evolving Economic Force," *American Economic Review*, 2024, *114* (6), 1515–1539.

__ **and Claudia Olivetti**, "Shocking Labor Supply: A Reassessment of the Role of World War II on Women's Labor Supply," *American Economic Review*, 2013, *103* (3), 257–262.

__ **and Kenneth Sokoloff**, "Women, Children, and Industrialization in the Early Republic: Evidence from the Manufacturing Censuses," *The Journal of Economic History*, 1982, *42* (4), 741–774.

__ **and** __ , "The Relative Productivity Hypothesis of Industrialization: The American case, 1820 to 1850," *The Quarterly Journal of Economics*, 1984, *99* (3), 461–487.

Greenwood, Jeremy, *Evolving Households: The Imprint of Technology on Life*, MIT Press, 2019.

__ **, Ananth Seshadri, and Guillaume Vandenbroucke**, "The Baby Boom and Baby Bust," *American Economic Review*, 2005, *95* (1), 183–207.

__ **,** __ **, and Mehmet Yorukoglu**, "Engines of Liberation," *The Review of Economic Studies*, 2005, *72* (1), 109–133.

__ **, Nezih Guner, and Guillaume Vandenbroucke**, "Family Economics Writ Large," *Journal of Economic Literature*, 2017, *55* (4), 1346–1434.

Guinnane, Timothy W, "The Historical Fertility Transition: A Guide for Economists," *Journal of Economic Literature*, 2011, *49* (3), 589–614.

Gutman, Robert, *The accuracy of vital statistics in Massachusetts, 1842-1901*, Columbia University, 1956.

Habakkuk, Hrothgar J, *American and British Technology in the Nineteenth Century*, Vol. 6, Cambridge, 1962.

Haines, Michael R, "Massachusetts State Censuses, 1855-1915," *ICPSR [distributor]*, 2022.

Hounshell, David, *From the American system to mass production, 1800-1932: The development of manu-*

facturing technology in the United States number 4, Jhu Press, 1984.

Jensen, Robert, "Do Labor Market Opportunities Affect Young Women's Work and Family Decisions? Experimental Evidence from India," *The Quarterly Journal of Economics*, 2012, *127* (2), 753–792.

Kelly, Catherine E, *In the New England Fashion: Reshaping Women's Lives in the Nineteenth Century*, Cornell University Press, 1999.

Kleven, Henrik, Camille Landais, Johanna Posch, Andreas Steinhauer, and Josef Zweimüller, "Child Penalties Across Countries: Evidence and Explanations," *AEA Papers and Proceedings*, 2019, *109*, 122–126.

Lampe, Ryan and Petra Moser, "Patent Pools and Innovation in Substitute Technologies: Evidence from the 19th-Century Sewing Machine Industry," *The RAND Journal of Economics*, 2013, *44* (4), 757–778.

Leblanc, Robert G., *The Location of Manufacturing in New England in the 19th Century*, Geography Publications at Dartmouth, 1969.

Lewis, Joshua, "Infant Health, Women's Fertility, and Rural Electrification in the United States, 1930–1960," *The Journal of Economic History*, 2018, *78* (1), 118–154.

Lewis, William Arthur, "Economic Development with Unlimited Supplies of Labour," *The Manchester School*, 1954, *22* (2), 139–191.

Mass. Bureau of Statistics of Labor, *Sixth Annual Report of the Bureau of Statistics of Labor*, Wright & Potter State Printers, 1875.

Massachusetts. Secretary of the Commonwealth, *Abstract of the Census of Massachusetts, 1865: With Remarks on the Same, and Supplementary Tables*, Boston: Wright & Potter, State Printers, 1867. Prepared under the direction of Oliver Warner.

McBride, Theresa M, "A Woman's World: Department Stores and the Evolution of Women's Employment, 1870-1920," *French Historical Studies*, 1978, *10* (4), 664–683.

Moehling, Carolyn M, "State Child Labor Laws and the Decline of Child Labor," *Explorations in Economic History*, 1999, *36* (1), 72–106.

Munshi, Kaivan and Jacques Myaux, "Social Norms and the Fertility Transition," *Journal of Development Economics*, 2006, *80* (1), 1–38.

Olivetti, Claudia and Barbara Petrongolo, "The Evolution of Gender Gaps in Industrialized Countries," *Annual Review of Economics*, 2016, *8* (1), 405–434.

Osaki, Amy Boyce, "A "Truly Feminine Employment:" Sewing and the Early Nineteenth-Century Woman," *Winterthur Portfolio*, 1988, *23* (4), 225–241.

Price, Joseph, Kasey Buckles, Jacob Van Leeuwen, and Isaac Riley, "Combining Family History and Machine Learning to Link Historical Records: The Census Tree Data Set," *Explorations in Economic History*, 2021, *80*, 101391.

Rambachan, Ashesh and Jonathan Roth, "A More Credible Approach to Parallel Trends," *Review of Economic Studies*, 2023, *90* (5), 2555–2591.

Rashid, Myera, "Keys to Upward Mobility: Typewriter Adoption and Women's Economic Outcomes," *Working Paper*, 2025.

Restrepo, Pascual, "Automation: Theory, Evidence, and Outlook," *Annual Review of Economics*, 2023, *16.*

Rosenberg, Nathan, "Technological Change in the Machine Tool Industry, 1840–1910," *The Journal of Economic History*, 1963, *23* (4), 414–443.

Rotella, Elyce J, "The Transformation of the American Office: Changes in Employment and Technology," *The Journal of Economic History*, 1981, *41* (1), 51–57.

Ruggles, Steven, J Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B Schroeder, Matthew Sobek et al., "IPUMS USA: version 15.0 [dataset]," *Minneapolis: University of Minnesota*, 2024, *42.*

__ , Nesile Ozder, Catherine A. Fitch, Matthew Sobek, Julia A. Rivera Drew, J. David Hacker, Jonas Helgertz, Cheyenne Lonobile, Matt A. Nelson, Evan Roberts, and John Robert Warren, "IPUMS Multigenerational Longitudinal Panel: Version 2.0," *Minneapolis: University of Minnesota*, 2025.

Saavedra, Martin and Tate Twinam, "A Machine Learning Approach to Improving Occupational

Income Scores," *Explorations in Economic History*, 2020, *75*, 101304.

Schultz, T Paul, "Changing World Prices, Women's Wages, and the Fertility Transition: Sweden, 1860-1910," *Journal of Political Economy*, 1985, *93* (6), 1126–1154.

Scott, Anne Firor, *Natural allies: Women's associations in American history*, University of Illinois Press, 1992.

Singer Sewing Machine Company, *Mechanics of the Sewing Machine* number Bd. 5. In 'Joint Committee monograph series.', Singer Sewing Machine Company, 1914.

Skocpol, Theda, *Protecting soldiers and mothers: The political origins of social policy in the United States*, Harvard University Press, 1995.

Sokoloff, Kenneth L, "Was the Transition from the Artisanal Shop to the Nonmechanized Factory Associated with Gains in Efficiency?: Evidence from the US Manufacturing Censuses of 1820 and 1850," *Explorations in Economic History*, 1984, *21* (4), 351–382.

Sokoloff, Kenneth Lee, *Industrialization and the Growth of the Manufacturing Sector in the Northeast, 1820-1850*, Harvard University, 1982.

Temin, Peter, "The Industrialization of New England, 1830-1880," 1999.

Vidart, Daniela, "Human Capital, Female Employment, and Electricity: Evidence from the Early 20th-century United States," *Review of Economic Studies*, 2024, *91* (1), 560–594.

_ , "Revisiting the Link Between Electrification and Fertility: Evidence from the Early 20th-Century United States," *Explorations in Economic History*, 2026, *100*, 101749.

Vipond, Hillary G., "Technological Unemployment in Victorian Britain: Young Workers and the Collapse of Entry," *Working Paper*, 2025.

Wanamaker, Marianne H, "Industrialization and Fertility in the Nineteenth Century: Evidence from South Carolina," *The Journal of Economic History*, 2012, *72* (1), 168–196.

Wright, Carroll D., *The Working Girls of Boston: From the Fifteenth Annual Report of the Massachusetts Bureau of Statistics of Labor, for 1884*, Wright & Potter Printing Co., State Printers, 1889.

Wright, Gavin, "The Origins of American Industrial Success, 1879-1940," *The American Economic Review*, 1990, pp. 651–668.

Tables

Table I. Employment Trends by Gender and Sewing Machine Usage, 1850-1900

	SM-Using Mfg. Industries		Non SM-Using Mfg. Industries		Employment		Labor Force Participation	
	All	Women	All	Women	All	Women	All	Women
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. United States								
Panel A.1 Working-Age Population (Ages 15–60)								
1850	189,863		634,129		5,050,873		45.593%	
1860	200,124	14,100	788,311	83,128	7,002,858	1,103,960	45.187%	14.742%
1870	229,862	25,455	1,216,458	155,491	11,095,488	1,701,953	50.959%	15.764%
1880	332,772	64,510	1,970,991	295,867	16,053,546	2,733,565	56.09%	19.47%
1900	372,533	117,583	3,022,994	543,854	25,455,168	4,894,526	55.997%	22.069%
Panel A.2 Young Working-Age Population (Ages 15–30)								
1850	101,750		348,450		2,699,354		42.481%	
1860	94,769	10,456	400,153	62,246	3,514,291	739,906	40.658%	17.25%
1870	105,957	21,217	644,830	128,649	5,808,743	1,230,800	49.428%	20.588%
1880	164,602	53,142	1,108,266	247,012	8,540,992	1,897,608	55.982%	25.077%
1900	202,722	90,948	1,633,680	427,502	12,457,469	3,139,732	54.61%	27.5%
Panel B. Massachusetts								
Panel B.1 Working-Age Population (Ages 15–60)								
1850	36,249		80,353		277,558		44.453%	
1860	38,483	3,079	100,572	16,763	351,312	73,489	45.784%	18.405%
1870	54,066	8,394	178,576	46,541	508,935	118,918	55.476%	24.831%
1880	72,507	15,009	264,013	74,499	675,698	177,333	59.168%	29.562%
1900	69,373	20,599	330,922	98,613	1,103,622	310,867	60.078%	32.812%
Panel B.2 Young Working-Age Population (Ages 15–30)								
1850	22,152		46,968		146,980		42.49%	
1860	21,071	2,362	56,346	13,755	178,054	53,744	44.181%	24.937%
1870	29,565	7,200	106,628	39,071	274,484	91,743	60.15%	37.911%
1880	39,639	12,134	160,545	61,503	358,683	128,684	64.638%	43.824%
1900	35,840	14,120	186,660	73,463	541,280	201,759	63.127%	45.077%

Notes. This table displays the evolution of employment across broad sectors. Panel A presents results for the United States, and Panel B for Massachusetts. Panels A.1 and B.1 (Panels A.2 and B.2) report statistics for the working-age population aged 15-60 (aged 15-30). Columns (1) and (2) report overall and female employment in manufacturing industries that used the sewing machine. Columns (3) and (4) report overall and female employment in manufacturing industries that did not use the sewing machine. Columns (5) and (6) report overall and female employment across all industries. Columns (7) and (8) report the rate of labor force participation, defined as the share of all working-age individuals with a valid occupation, and the female labor force participation, defined as the share of working-age women with a valid occupation. The table uses micro-level individual census data from 1850 to 1900; women's occupations were not recorded in the 1850 census. Panel A refers to the entire United States; Panel B refers to Massachusetts. Referenced on pages: 11, 19.

Table II. Descriptive Statistics

	Observations (1)	Mean (2)	Std. Dev. (3)	Min (4)	Max (5)	Bottom 25% (6)	Top 25% (7)
Panel A. Entire Adult Population							
Panel A.1. Levels							
Population	3,242	11,003.243	171,929.078	73	9,185,969	985	4,665
Employment	2,416	2,384.95	10,333.294	42	251,790	406	1,588
Manufacturing Employment	2,968	971.609	3,907.94	0	93,859	82	676
Agriculture Employment	2,416	169.023	137.706	0	2,540	91	209
Panel A.2. Population Shares							
Labor Force Participation (%)	2,416	47.799	8.539	21	78	40	54
Manufacturing Employment Share (%)	2,940	15.457	10.923	0	52	6	24
Agriculture Employment Share (%)	2,416	10.864	8.295	0	46	4	16
Panel B. Female Adult Population							
Panel B.1. Levels							
Population	3,270	5,459.464	88,712.773	31	4,761,704	445	2,183
Employment	2,114	640.43	3,023.978	2	70,489	53	385
Manufacturing Employment	2,968	280.277	1,184.455	0	24,770	10	180
Agriculture Employment	2,416	2.373	11.645	0	460	0	1
Mothers	2,114	998.803	3,937.5	17	88,557	214	736
Married	2,416	1,159.031	4,663.463	19	116,918	225	810
Panel B.2. Population Shares							
Labor Force Participation (%)	2,114	20.583	12.769	1	80	11	27
Manufacturing Employment Share (%)	2,968	7.997	9.541	0	100	2	11
Agriculture Employment Share (%)	2,416	0.258	0.736	0	8	0	0
Share with Children (%)	2,114	52.084	5.823	25	84	48	56
Share Married (%)	2,416	56.622	10.847	26	86	48	66
Panel C. Children Population							
Panel C.1. Levels							
Population	2,416	1,441.975	5,925.099	21	155,022	266	1,050
At School	2,114	835.54	3,270.207	9	72,845	181	627
At Work	2,114	27.971	126.394	0	3,191	0	19
Panel C.2. Population Shares							
Children per Adult (%)	2,416	33.62	13.427	12	100	19	45
Share of Children at School (%)	2,114	77.026	10.037	14	100	72	83
Share of Children at Work (%)	2,114	5.753	9.572	0	100	0	8
Panel D. Treatment Variables							
Employment in SM Industries	3,874	130.99	323.54	0	3,109	10	113
Has SM Retailer	3,874	0.331	0.471	0	1	0	1
Year of First Retailer	1,281	1,876.21	5.931	1,860	1,885	1,870	1,880

Notes. This table reports descriptive statistics for selected variables. The observation unit is a town observed at census frequency. Some variables are available only in a subset of the censuses, leading to variation in the number of observations across variables. All variables in Panels A-C are constructed from the U.S. and Massachusetts population censuses. Panel D describes the treatment variables: employment in industries that use sewing machines, an indicator variable that equals 1 if a given town has at least one sewing machine retailer, and the year in which a retailer is first observed. Referenced on page: 13.

Table III. Comparison Between Treated and Non-Treated Towns

	Industry Exposure to SM			Presence of SM Retailer		
	Levels		Changes	Levels		Changes
	1850	1860		Pre	Post	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Entire Adult Population						
Population	-0.019	0.051	0.069	0.689	0.625	0.157***
			(0.091)			(0.060)
Employment	1.511	0.695	-0.816	-0.510	-0.317	-0.041
			(0.775)			(0.034)
Manufacturing Employment	5.172	4.053	-1.118**	0.683	1.202	0.145*
			(0.447)			(0.079)
Agriculture Employment	-3.035	-2.132	0.903***	-0.814	-0.968	-0.041
			(0.259)			(0.061)
Panel B. Female Adult Population						
Population	-0.062	0.005	0.067	0.548	0.416	0.066**
			(0.093)			(0.032)
Employment†		0.644		0.676	0.325	0.083
						(0.110)
Mothers	0.012	0.839	0.827**	0.259	0.283	0.079*
			(0.358)			(0.047)
Married	0.038	0.150	0.112	1.444	0.587	0.029
			(0.105)			(0.118)

Notes. This table reports the correlations between town-level observable variables and industry exposure to sewing machines (columns 1–3) and the presence of sewing machine retailers (columns 4–6). In columns (1) and (2), we present the correlations between industry exposure and the variables at their levels in 1850 and 1860, respectively. In columns (4) and (5), we display the difference between townships with and without a sewing machine retailer before and after the retailer is established, respectively. In columns (3) and (6), we report the correlation between the cross-sectional treatment (industry exposure to sewing machine and presence of sewing machine retailers) and an indicator variable for 1860 (column 3) and the post-treatment period (column 6), controlling for town and year fixed effects. All variables in each panel, except the population, are expressed as a percentage share of the population. All variables are standardized. Standard errors are clustered at the town level and are displayed in parentheses. Referenced on page: 16.

†: Female employment is first observed in 1860.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table IV. Sewing Machine Exposure and the Presence of Women's Clubs

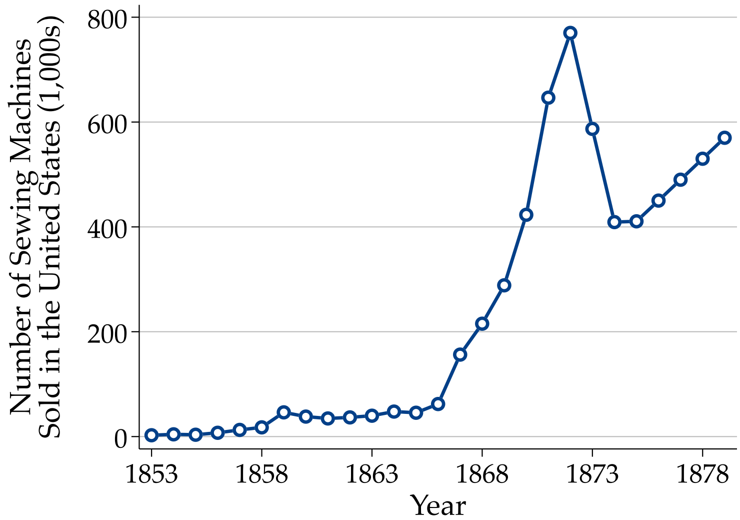
	Number of Women's Clubs						Clubs per Capita	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Number of Women's Clubs								
Has SM Retailer	2.954***		2.993***	1.875***	-0.969	-0.943	1.654***	1.260**
	(0.506)		(0.524)	(0.479)	(1.256)	(1.246)	(0.461)	(0.497)
× Share of Women Above Median Wealth					12.380**	12.289**		
					(5.976)	(5.940)		
Industry Exposure to SM		-0.137	-1.323	-0.462	-0.055	-2.528	-0.635	0.057
		(1.966)	(1.999)	(2.264)	(2.133)	(4.813)	(0.981)	(2.503)
× Share of Women Above Median Wealth						11.895		
						(21.025)		
Share of Women Above Median Wealth					-5.951	-7.033		
					(6.149)	(6.279)		
Mean Dep. Var.	0.278	0.278	0.278	0.300	0.300	0.300	0.000	0.000
Panel B. Number of Members in Women's Clubs								
Has SM Retailer	3.116***		3.168***	2.031***	-0.616	-0.586	1.794***	1.373**
	(0.626)		(0.646)	(0.667)	(2.037)	(2.023)	(0.570)	(0.646)
× Share of Women Above Median Wealth					10.745	10.630		
					(8.748)	(8.618)		
Industry Exposure to SM		-0.595	-1.833	-0.846	-0.684	0.698	-1.161	-2.207
		(2.143)	(2.216)	(2.522)	(2.399)	(5.641)	(1.647)	(2.419)
× Share of Women Above Median Wealth						-6.462		
						(25.280)		
Share of Women Above Median Wealth					-1.340	-0.648		
					(8.112)	(8.494)		
Mean Dep. Var.	40.209	40.209	40.209	45.293	45.293	45.293	0.006	0.007
County FE	No	No	No	Yes	Yes	Yes	No	Yes
Town Controls	No	No	No	Yes	Yes	Yes	No	Yes
Number of Towns	302	302	302	273	273	273	302	273

Notes. This table reports the correlation between the presence of women's clubs and exposure to sewing machines. The sample is a cross-section of towns; in columns (1–6), the outcome is the number of women's clubs (Panel A) and the number of club members (Panel B); in columns (7–8), the dependent variable is the number of women's clubs per capita (Panel A) and the number of members of women's clubs per person (Panel B). The two main explanatory variables are an indicator for towns with at least one sewing-machine retailer during the sample period and a continuous variable equal to the employment share of sewing-machine-using industries in 1860. In columns (5–6), we further interact these variables with the share of women in households with above-median wealth. In columns (4–6) and (8), we include county fixed effects and the following town-level controls: population, the share of manufacturing employment, the share of women, the share of children, the share of Blacks, and the share of immigrants—measured at baseline (in 1860). Since the number of clubs and members are count variables, the regressions are estimated through Poisson quasi-likelihood. Standard errors are clustered at the town level and are displayed in parentheses. Women's club data are from Croly (1898). Referenced on page: 28.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Figures

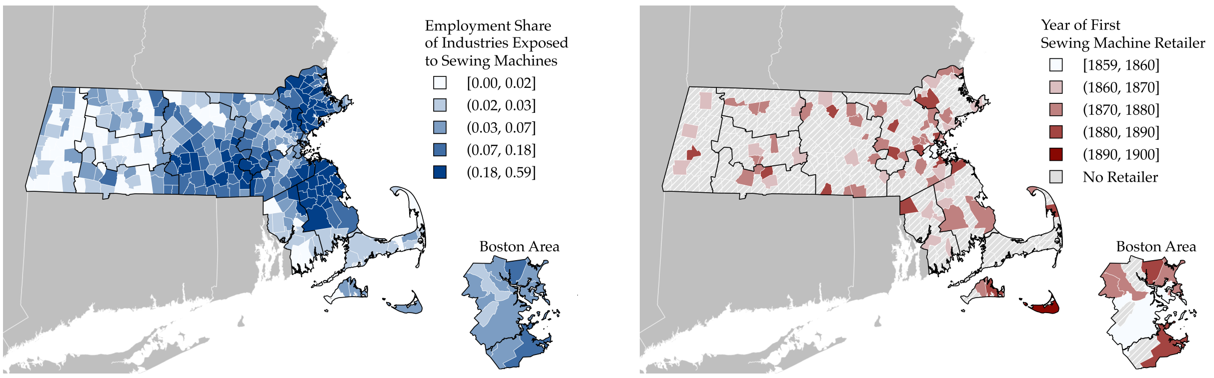
Figure I. Sewing Machine Sales in the United States, 1853–1879



Notes. This figure shows the number of sewing machines sold in the United States between 1853 and 1879. Figures are expressed in thousands. Source: Godley (2001). Referenced on pages: 1, 8.

Figure II. Spatial Variation of Treatment Intensities

(a) Industry Exposure to Sewing Machines **(b)** Presence of Sewing Machine Retailers

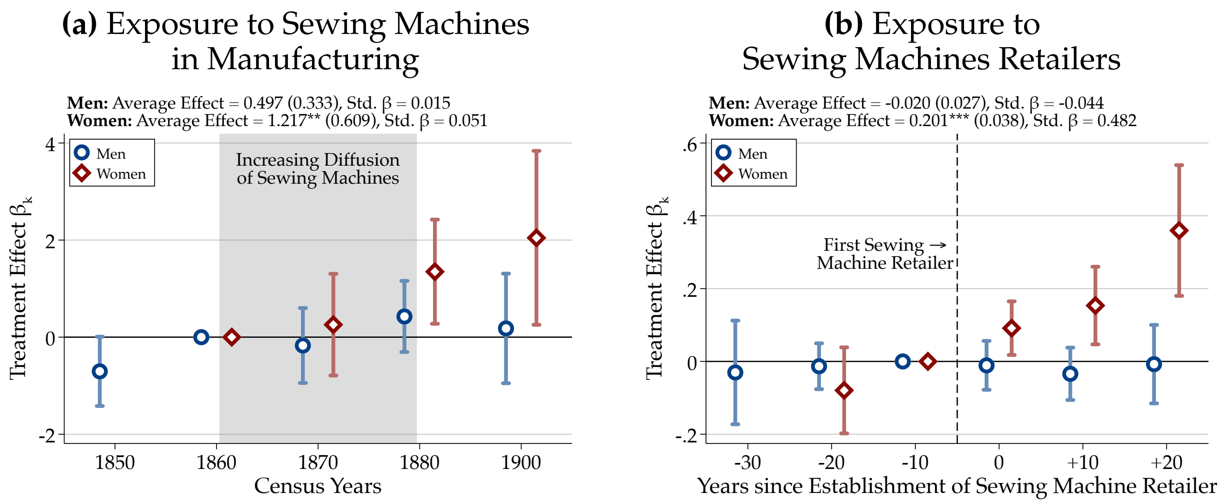


Notes. This figure displays the variation of the treatment variables used in the empirical analysis. The unit of observation is a township. The solid black lines mark county borders in 1870. The Boston area is shown in the bottom-right corner of each panel for better readability. Panel IIa displays the employment share of industries that would be using sewing machines in 1900, as measured in the 1860 census (see Section 3.3. for a detailed discussion); darker shades of blue indicate increasing employment share of industries utilizing sewing machines. Panel IIb displays the first year a sewing machine retailer is observed in each township. No retailer is ever observed in gray areas; darker shades of red indicate later periods. Township borders are constructed such that geographic units remain consistent over time. Referenced on pages: 14, 24.

Figure III. Exposure to Sewing Machines and Female Employment

Notes. This figure reports the estimated dynamic treatment effect of exposure to sewing machines on female employment. The unit of observation is a township observed at census frequency between 1837 and 1900; not all outcomes are available in all censuses. In Panels IIIa and IIIc, the outcome variable is the share of women working in sewing-machine-using industries; in Panels IIIb and IIId, the dependent variable is the share of working women; In Panels IIIa and IIIb each dot displays the coefficient of an interaction term between year dummies and the employment share of industries exposed to sewing machines. In Panels IIIc and IIId each dot displays the coefficient of dummies coding the years since the first period when a sewing machine retailer is established in the town. All outcome variables are expressed in percentage terms. Each regression includes town and time fixed effects. Standard errors are clustered at the town level; the bands report 95% confidence intervals. The 1860 census, the last year before the widespread adoption of sewing machines, is used as the baseline category. Estimates in Panels IIIc and IIId are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Referenced on page: 18.

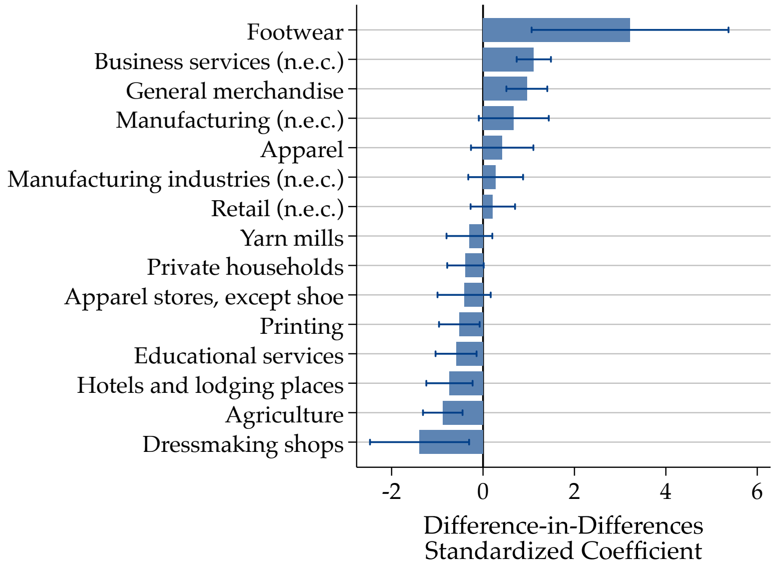
Figure IV. Triple DD Estimates of the Effect of Sewing Machines on Employment



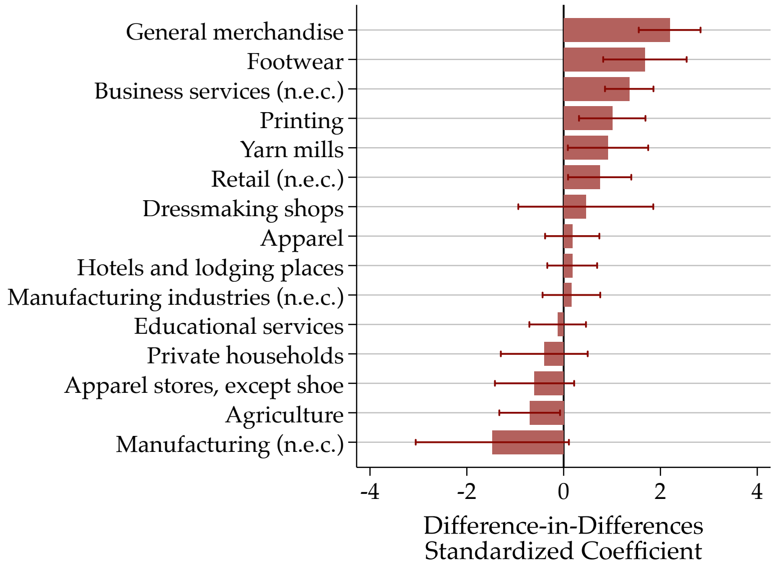
Notes. This figure reports the estimated dynamic treatment effect of industry exposure to sewing machines and the presence of sewing machine retailers on employment. The unit of observation is a township-by-industry observed at census frequency between 1850 and 1900. The outcome variable is log-employment among men (blue dots) and women (red dots). Each dot displays the coefficient of an interaction term between year dummies, the employment share of industries exposed to sewing machines, and an indicator for sewing-machine-using industries (Panel IVa) and years since the first period when a sewing machine retailer is established in the town interacted with an indicator of sewing-machine-using industries (Panel IVb). Regressions include town-by-industry, town-by-year, and industry-by-year fixed effects. Standard errors are clustered at the town level; the bands report 95% confidence intervals. The estimates displayed in Panel IVb are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Referenced on pages: 20, A6.

Figure V. Employment Effects of the Sewing Machine at the Industry Level

(a) Exposure to Sewing Machines in Manufacturing

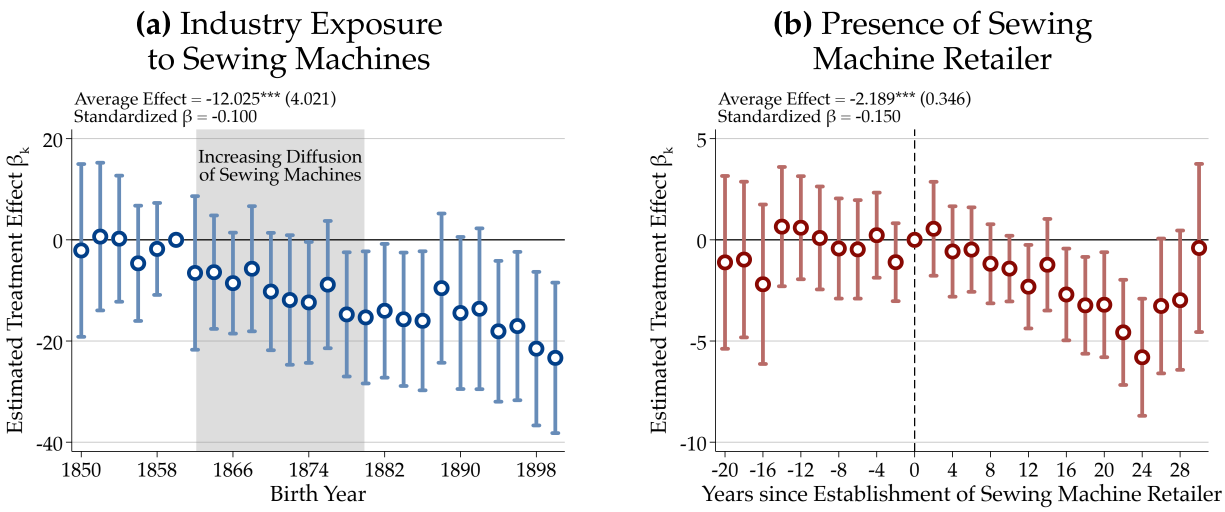


(b) Exposure to Sewing Machines Retailers



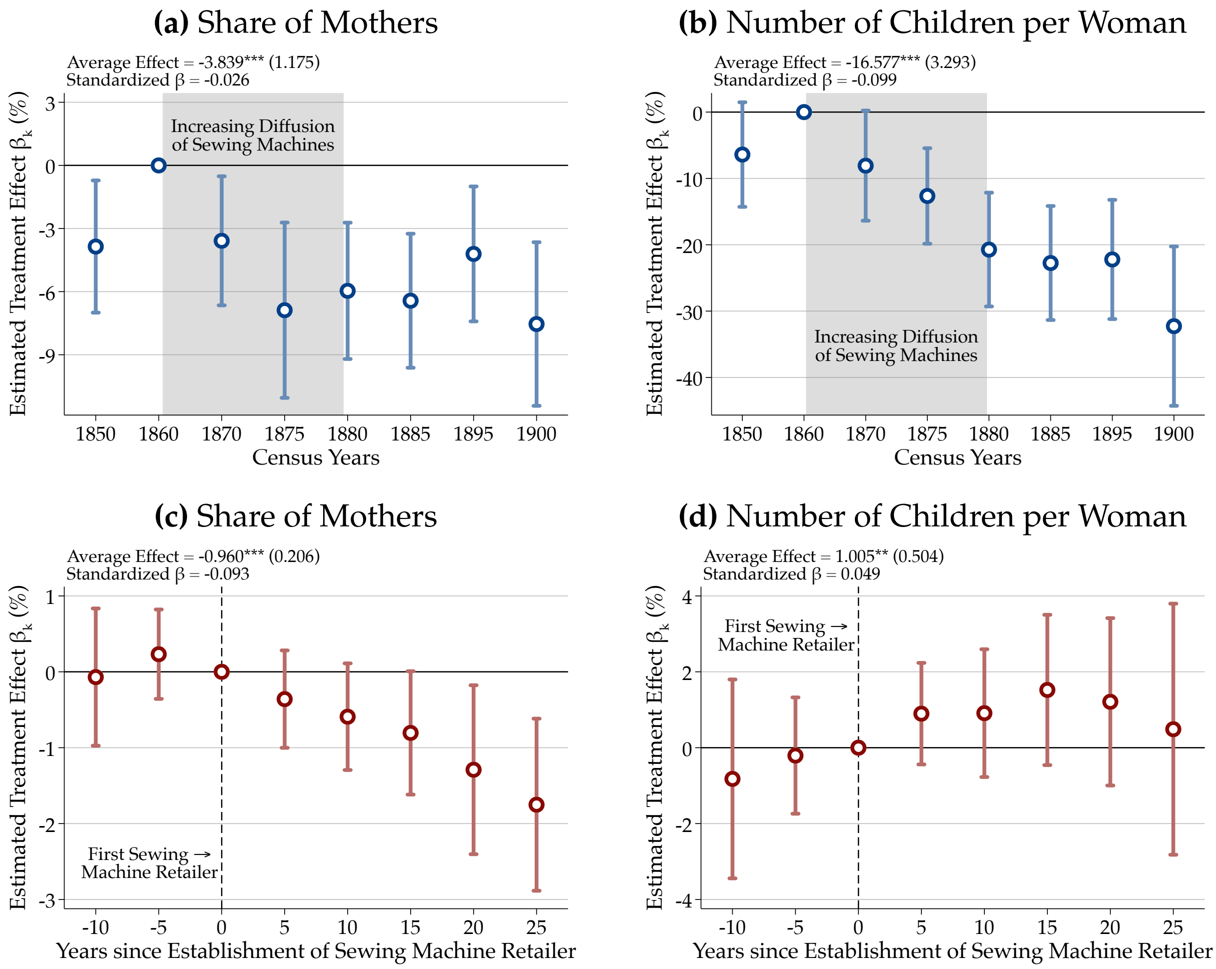
Notes. This figure reports the effect of industry exposure to the sewing machine (Panel Va) and exposure to sewing machine retailers (Panel Vb) on female labor force participation in industries exposed to the sewing machine. The unit of observation is a township observed at census frequency between 1850 and 1900. Each bar reports the estimated treatment effect for one regression where the dependent variable is the women's employment share in one industry relative to the overall female working-age population. The treatment is either an interaction term between the employment share in sewing-machine-using industries in 1860 and a post-1860 period or an indicator variable that returns a value of one after at least one retailer of sewing machines is observed in the given township and zero otherwise. Each regression includes town and time fixed effects. Estimates in Panel Vb are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Standard errors are clustered at the town level. Bands report 95% confidence levels. Referenced on page: 20.

Figure VI. Sewing Machine Exposure and the Crude Birth Rate



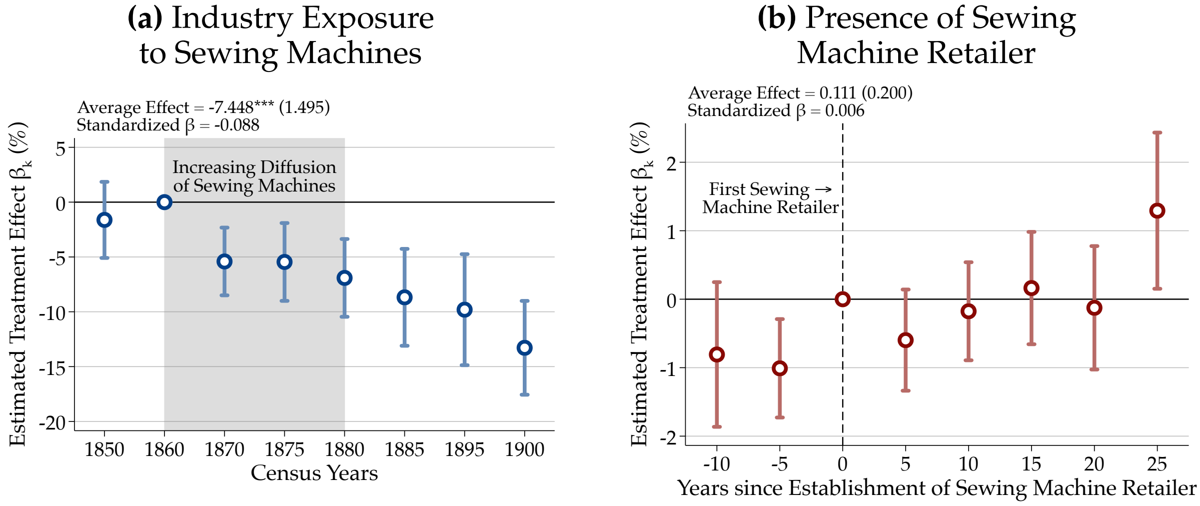
Notes. This figure reports the estimated dynamic treatment effects of industry exposure to sewing machines and the presence of sewing machine retailers on the crude birth rate (i.e., the number of children divided by the population, by cohort, expressed in per-thousand units). The unit of observation is: in Panel VIa, a township at a yearly frequency between 1850 and 1900; in Panel VIb, a township at a yearly frequency over a 10-year window around the time when the sewing machine retailer opened. Each dot displays the coefficient of an interaction term between year dummies and the employment share of industries exposed to sewing machines (in Panel VIa) and a dummy that codes the number of years since the sewing machine retailer opened (Panel VIb). The regression includes town and cohort fixed effects. Standard errors are clustered at the town level; the bands report 95% confidence intervals. Cohorts are grouped in two-year windows. Estimates in Panel VIb are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Referenced on page: 21.

Figure VII. Exposure to Sewing Machines and Fertility: Extensive vs. Intensive Margins



Notes. This figure reports the estimated dynamic treatment effect of exposure to sewing machines and fertility along the extensive and intensive margins. The unit of observation is a township observed at census frequency between 1850 and 1900; not all outcomes are available in all censuses. In Panels VIIa and VIIc, the outcome variable is the share of women with at least one child. In Panels VIIb and VIId, the outcome variable is the number of children per woman. In Panels VIIa and VIIb each dot displays the coefficient of an interaction term between year dummies and the employment share of industries exposed to sewing machines. In Panels VIIc and VIId each dot displays the coefficient of dummies coding the years since the first period when a sewing machine retailer is established in the town. All outcomes are expressed in percentage terms. Regressions include town and time fixed effects. Estimates in Panels VIIc and VIId are obtained using the de Chaisemartin and d'Haultfœuille (2024) estimator. Standard errors are clustered at the town level; the bands report 95% confidence intervals. Referenced on page: 21.

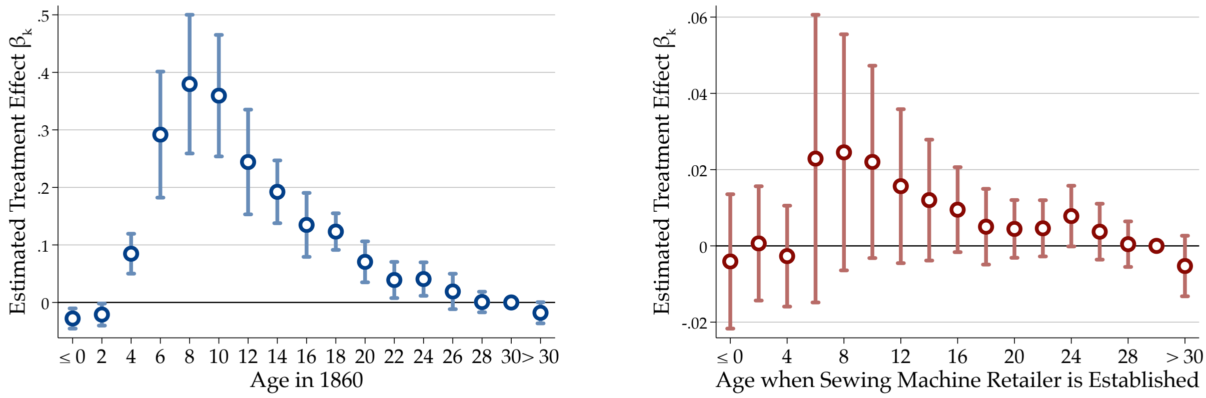
Figure VIII. Exposure to Sewing Machines and Marriage



Notes. This figure reports the estimated dynamic treatment effects of sewing machine exposure on the share of married women. The unit of observation is a township observed at census frequency between 1850 and 1900; not all outcomes are available in all censuses. In Panel VIIIa, each dot displays the coefficient of an interaction term between year dummies and the employment share of industries exposed to sewing machines. In Panel VIIIb, each dot displays the coefficient of dummies coding the years since the first period when a sewing machine retailer is established in the town. All outcomes are expressed in percentage terms. Regressions include town and time fixed effects. Estimates in Panel VIIIb are obtained using the de Chaisemartin and d'Haultfœuille (2024) estimator. Standard errors are clustered at the town level; the bands report 95% confidence intervals. Referenced on page: 22.

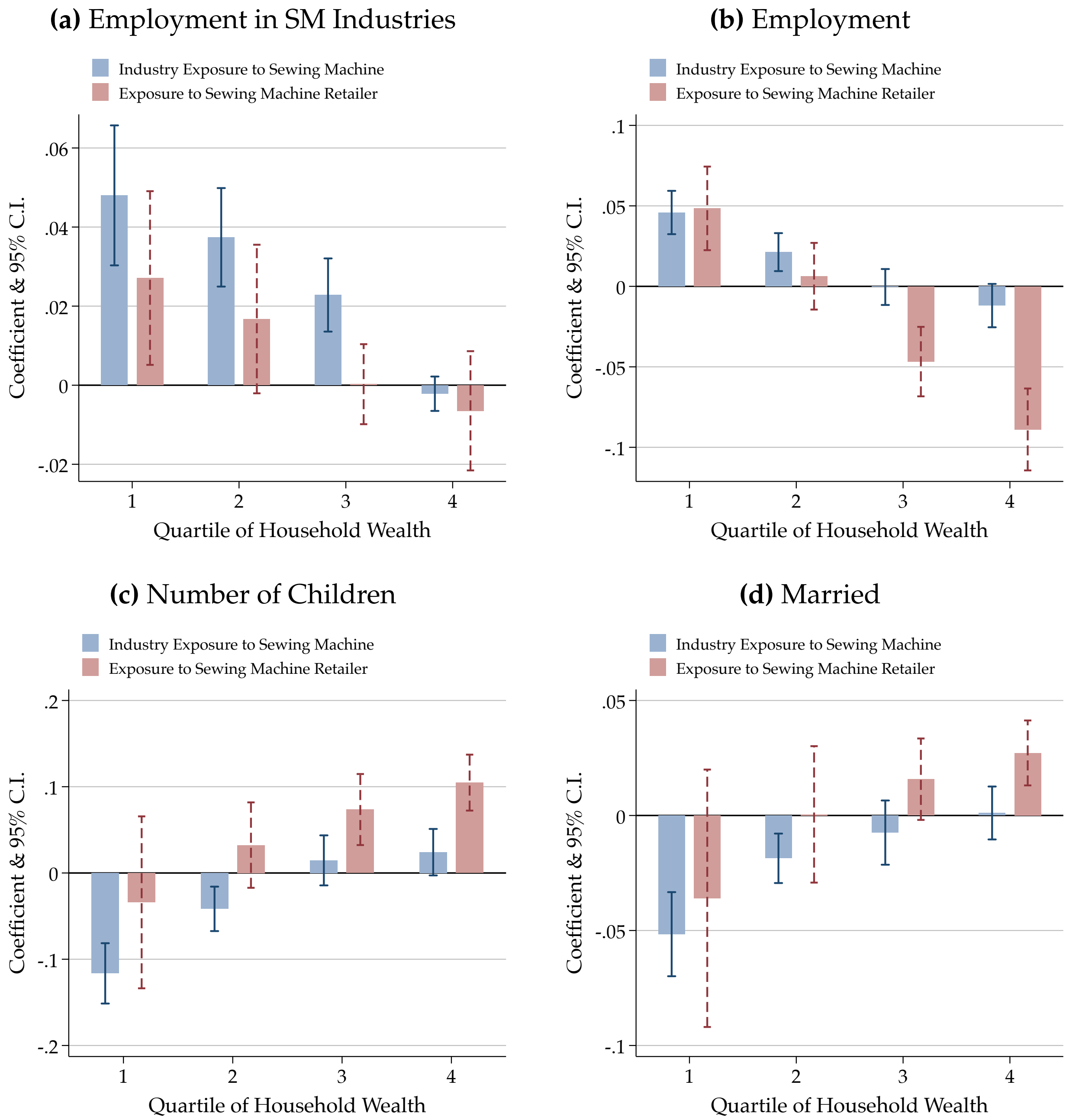
Figure IX. Employment Responses to the Sewing Machine across Age Cohorts

(a) Industry Exposure to Sewing Machine **(b)** Presence of Sewing Machine Retailer



Notes. This figure shows the individual-level responses of women to exposure to sewing machines by age group. The outcome variable is a dummy equal to one if the woman is employed in a sewing-machine-using industry and zero otherwise. In Figure IXa, each dot reports the coefficient of an interaction term between industry exposure to sewing machines and the woman's age in 1860. The unit of observation is a woman observed in the 1870 census. The sample comprises all women born in 1860 or before. In Figure IXb, each dot reports the coefficient of an interaction term between an indicator for towns with at least one sewing machine retailer and dummies that code the woman's age when the retailer opened. The unit of observation is a woman observed in the 1880 census. The sample comprises all women born in 1860 or before. Age categories are grouped in two-year bins; age bin 30–31 is the baseline category. Bin 32+ codes age bins above age 31. Each regression includes cohort, town, wealth quartile, race, and birthplace fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. Referenced on page: 25.

Figure X. Responses to Sewing Machine Exposure across the Wealth Distribution



Notes. This figure reports women's individual-level responses to exposure to sewing machines by income group. The blue bars report the coefficients of interaction terms between household wealth quartiles (in 1860) and an interaction term between industry exposure to the sewing machine (in 1860) and a post-1860 indicator. The unit of observation is an individual woman in 1870. The sample comprises all women born between 1835 and 1855. The red bars report the coefficient of interaction terms between household wealth quartiles (in 1860) and an indicator equal to one for women aged 15 or younger when a sewing machine retailer opened in the town they lived in 1860. The unit of observation is an individual woman in 1880. The sample comprises all women aged 5 to 25 when the first sewing machine retailer opened in their town, or born between 1840 and 1860 in towns that never received a retailer during the sample period. The dependent variable is employment in sewing-machine exposed industries (Panel Xa), employment (Panel Xb), the number of children (Panel Xc), and an indicator equal to one for married women (Panel Xd) All regressions include town, cohort, wealth quartile, race, and birthplace fixed effects. Standard errors are clustered at the town level; bars report 95% confidence intervals. Referenced on pages: 25, 26.

Online Appendix

LIBERATION TECHNOLOGY?

THE IMPACT OF THE SEWING MACHINE ON WOMEN

Philipp Ager and Davide M. Coluccia

May, 2026

TABLE OF CONTENTS

A Data Appendix

This appendix presents technical details on the construction of the datasets to complement the information provided in Section 3.

A.1 Boundary Harmonization

Townships undergo relatively minor boundary changes over the time period due to the incorporation of new townships and the aggregation of old townships into existing ones. We thus need a fixed geography of townships to follow over fifty years. We construct this fixed geography by mapping townships to their coarsest borders throughout the period.

We follow a two-step semi-automated procedure. First, we overlay the coordinates assigned by the census place project (CPP) to the 1850 individual records onto the `GIS` file of townships.[1] This procedure allows us to map the CPP location labels to the appropriate `GIS`-township. Then, we compile a list of all townships that ever existed in Massachusetts. We manually construct a set of "consistent" townships that always existed. We then map each township that either ceased to exist before 1900 or began to exist after 1850 to one of the consistent townships. This concordance matrix also harmonizes the township names between the `GIS` and census data.

The final output is (i) a harmonized `GIS` of townships which agglutinates townships that did not exist and townships that did not always exist into consistent geographical units, and (ii) a concordance matrix which maps the newly incorporated and the dismantled townships into the consistent townships. Approximately 10% of townships were formed after 1850 or were dismantled before 1900.

A.2 Federal Censuses Crosswalks

The federal census does not contain information on the township of residence. The CPP dataset assigns latitude and longitude to the near-universe of census records. To do so, Berkes et al. (2023) geo-reference the raw place names from census manuscripts. Unfortunately, the granularity of the available raw place names varies across censuses. This problem is particularly severe in 1860, when approximately 50% of townships would have zero population if we relied on the CPP locations. However, in later censuses, we similarly fail to assign any individual to more than one township.

We tackle this data limitation using the intergenerational links compiled by Price et al. (2021).[2] We link each individual in the 1860, 1870, and 1880 censuses to the 1850 census, so we can observe the township where they lived in 1850. Then, we assign the township to each census manuscript page in 1860, 1870, and 1880 as the most frequent township where the (linked) individuals in that page lived in 1850, and apply that township to all individuals within that page. This procedure ensures that, even if not everyone is linked to the 1850, we assign consistent 1850 townships to the near-universe (97%) of the population.[3] Then, we map the 1850 townships to the consistent townships as described

[1] The `GIS` file is compiled by the Massachusetts Historic Commission and can be downloaded at the following link.

[2] We are grateful to Ezra Karger for suggesting this method to us.

[3] This method does not allow us to assign a township to the few individuals living in census pages without any link to the 1850 census. These individuals constitute approximately 3% of the population across all censuses.

in the previous section. We do not need to apply this method to the 1900 census because the CPP locations in 1900 allow us to map individuals directly to townships.

The underlying assumption is that the most frequent location within each census page corresponds to the current location. In other words, we assume that, within each page, the relative majority of the individuals remained in the township between the census year and the 1850 census. We view this assumption as reasonable, and the population figures it delivers appear empirically plausible.

A.3 Variable Coding

This section describes how we map the federal (IPUMS) and state census data to the variables.

A.3.1 IPUMS Data Coding

We consider all individuals aged 15 or older as part of the "adult population," and the rest are "children." All individuals with an occupational code (OCC1950) that is not a non-occupational response (above 980) is considered to be employed. "Manufacturing" employment comprises OCC1950 between 500 and 690 (operatives and craftsment); "Agriculture" employment comprises all OCC1950 values between 100 and 123 (farmers). "Retail" employment comprises all OCC1950 between 400 and 490. "Service" employment comprises all OCC1950 between 700 and 790. The immigrant population is constructed as all foreign-born individuals (i.e., BPL above 100). The "Literacy" variable corresponds to LIT code 4 ("can read and write"). A sewing-machine-occupation corresponds to employment in one of the baseline sewing-machine-using industries (IND1950 equal to 448, 449, 457, 487, 488, or 489).

A woman is considered to be married if she lives in a household where she is the spouse of the head (RELATE variable equal to 2). A woman is considered to have at least one child if, within the household where she is either the head (RELATE equal to 1) or the spouse of the head (RELATE equal to 2), with at least one child (NCHILD above 0). To compute household wealth, we sum real estate value and the value of personal estate (REALPROP and PERSPROP).

A child is considered to be working if they are older than 10—the occupation was not recorded for younger children—and employed. A child is considered "at school" if the SCHOOL variable equals 2.

The Census Bureau in 1900 listed the following industries as using the sewing machine: "Awnings, tents, and sails," "Bags, other than paper," "Bookbinding and blank bookmaking," "Boots and shoes, factory product," "Clothing's men, factory product," "Clothing's men, factory product, buttonholes," "Clothing's women, dressmaking," "Clothing's women, factory product," "Corsets," "Flags and banners," "Gloves and mittens," "Hats and caps," "Pocketbooks," "Saddlery and harness," "Shirts," and "Trunks and valises." We map these categories to the following 1950-IPUMS industry codes (IND1950): "Apparel and accessories," "Miscellaneous fabricated textile products," "Paperboard containers and boxes," "Leather: tanned, curried, and finished," "Footwear, except rubber," and "Leather products, except footwear." We then compute the employment share of sewing-machine-using industries as the share of employment in these occupations relative to total employment. In another definition (adopted in Table C.6–Table C.24), we adopt a broader definition of "sewing-machine-using industries" to assess the robustness of the results. In this case, we also include in the set of treated industries "Knitting Mills," "Dyeing and finishing textiles, except knit goods," "Carpets, rugs, and other floor coverings," "Yarn, thread, and fabric mills," "Miscellaneous textile mill products," "Printing, publishing, and allied industries."

A.3.2 Haines State Censuses Coding

The coding of the state census digitized by Haines (2022) follows the IPUMS coding, except that the level of detail is lower; therefore, we aggregate variables to match those from the IPUMS data.

From the 1865 census, we obtain the female child population (TOTFi for i between 0 and 14), the female adult population (TOTFEM minus the female child population), the number of illiterate women (FBFILLIT and NBFILLIT), total and female manufacturing employment (FMFGEMP and MMFGEMP), total and female agriculture employment (FAGRIEMP and MAGRIEMP), and total and female employment (FAGRIEMP and FMFGEMP).

From the 1875 census, we compile total employment (OCCFEM, OCCMALE minus OFFEM and OFFMALE), female employment (OCCFEM minus OFFEM), the female population (TOTFEM minus TOTFi for i between 0 and 14), the number of married women (MARFEM and WIDFEM), total and female manufacturing employment (MFGFEM and MFGMALE), total and female agriculture employment (PRIMFEM and PRIMMALE), the number of working children (CHWORKM, CHSCWKM, CHWORKF, and CHSCHWKF), the number of children at school (SCH59M, SCH59F, SCH1014M, SCH1014F), and the children population (TOTi for i between 0 and 14).

From the 1885 census, we compile female employment (GOVFEM, PROFFEM, PERSFEM, TRADEFEM, AGRIFEM, FISHFEM, MFGFEM, MINEFEM, LABORFEM, APPRFEM) and total employment (same codes, but including men), female population (TOTF minus TOTFi for i between 0 and 14), the number of married women (MARFEM and WIDFEM), total and female manufacturing employment (MFGFEM and MFGMALE), total and female agriculture employment (AGRIFEM and AGRIMALE), the number of working children (CHWORKM, CHSCWKM, CHWORKF, and CHSCHWKF), the number of children at school (SCH59M, SCH59F, SCH1013M, SCH1013F), and the children population (TOTi for i between 0 and 14).

From the 1895 census, we compile female employment (GOVFEM, PROFFEM, PERSFEM, TRADEFEM, AGRIFEM, FISHFEM, MFGFEM, MINEFEM, LABORFEM, APPRFEM) and total employment (same codes, but including men), female population (TOTF minus TOTFi for i between 0 and 14), the number of married women (MARFEM and WIDFEM), total and female manufacturing employment (MFGFEM and MFGMALE), total and female agriculture employment (AGRIFEM and AGRIMALE), and the children population (TOTi for i between 0 and 14).

A.3.3 1837 and 1845 State Censuses Coding

We digitize the 1837 and 1845 Massachusetts censuses to construct measures of female employment and population. While the censuses also report information on manufacturing output (e.g., value of production), these variables are not used in the analysis.

The census returns are tabulations at the townsector level, allowing us to compute both total employment and employment in sewing-machine-using industries. Following the classification used for the federal censuses, we define sewing-machine-using sectors as those related to clothing, footwear, leather manufacturing, and paperboard production.

Because the 1837 and 1845 censuses do not report female population counts, we impute them as $f_i \times \text{Population}_i$, where f_i is the share of women in town i measured in the 1850 census. This procedure implicitly assumes that town-level sex ratios remained stable between 1837 and 1850. Population data are missing for a small number of townships in either 1837 or 1845. We interpolate these values linearly and exclude townships for which the resulting estimates imply implausibly high female labor force participation rates (above 75 percent, which is more than twice the maximum observed in IPUMS data).

A.4 Digitized Business Directories

We digitize the entries of sewing machine retailers appearing in the "Massachusetts Register" (1859–1874) and "The New England Business Directory" (1877–1893). Specifically, we accessed the volumes for the years 1859, 1867, 1869, 1872, 1874, 1877, 1878, 1883, 1887, 1889, and 1893. These volumes contain information on the retailer's name, year of establishment, and address. Few entries specify the brands of the machines sold, and the information is sparse and unusable.

We georeference each retailer manually. The address indicates the retailer's street and city. Since we do not perform within-township analyses, we use only the city to assign retailers to townships. We successfully match all retailers to one consistent township.

We find 1,761 unique retailers established between 1859 and 1893 in Massachusetts. The retailers clustered in 30% of the townships. Hence, 70% never had a retailer throughout the sample period.

B Summary of the Robustness Checks

1. Are the township-level results driven by aggregate trends rather than sewing machines?

Table C.1, Figure IV	Confounding Factors	We run a triple-differences analysis which compares sewing-machine-using industries and other industries. This regression includes township-by-year fixed effects, which control for time-varying heterogeneity at the township level.

2. Are the fertility effects driven by differential child mortality?

Table C.2	Alternative Mechanisms	In columns (2) and (4), we show that neither manufacturing exposure to the sewing machine nor the presence of sewing machine retailers impacted the infant mortality rate.

3. Are the results driven by immigration into towns more exposed to the sewing machine?

Table C.3	Confounding factors	Difference-in-differences analysis: estimate effect of manufacturing exposure to sewing machine on out-of-state and within-state immigration. No effect on within-state, negative effect on out-of-state.

4. Is the township a relevant labor market for sewing machine industries?

Table C.4, Table C.22	Spatial	We compute the employment share of sewing-machine-using industries over a 10, 20, 30, and 40 Km radius around each town. The effect remains similar within a 10-km radius but declines over larger areas.

5. Can't individuals purchase sewing machines from retailers that are close to their town?

Table C.5, Table C.23	Spatial	We re-compute the treatment effects by allowing the treatment to be active for towns within 10, 20, 30, and 40 Km from the closest retailer. The treatment effects remain qualitatively similar but decline and are not statistically significant beyond 10 Km.

6. Is the effect of manufacturing exposure to the sewing machine sensitive to the treatment definition?

Table C.6, Table C.24	Measurement	We recompute the treatment effect using two different baseline dates (1850 and 1870) to construct the treatment and a broader definition of industry exposure to the sewing machine. Results remain qualitatively unchanged.

7. Are the effects on women by household wealth driven by husbands getting better jobs?

Table C.9	Confounding Factors	We replicate the household wealth quartile analysis using the share of household income as the dependent variable. We find that the share of household income provided by women increased at the bottom of the distribution, whereas that of men did not.

8. Are the individual-level fertility effects sensitive to completed fertility measurement?

Table C.10, Table C.11	Measurement	We replicate the baseline regressions but link the 1860 to the 1900 census instead of the 1880 census to measure completed fertility. The marriage patterns (column 1) do not change using the long linked sample; we find no evidence of increased fertility for upper-class women in response to the sewing machine (column 3 of Table C.11).

9. Are the individual-level results influenced by selection into the Census Tree links?

Table C.12, Table C.13	Sample selection	We re-estimate the baseline individual-level results on adult women, weighting each individual to ensure that the linked sample replicates the universe of the population along the following characteristics: age, occupation, number of children, school attendance, race, household relationship, marital status, and wealth. The results remain unchanged.

10. How representative of the population is the intergenerational sample?

Table C.14, Table C.15	Data Quality	We compare the baseline CTP and Althoff et al. (2025) data to the universe of the population in 1870 and in 1880. Differences between the baseline sample and the population are small and comparable with the Althoff et al. (2025), in particular when we apply the balancing weighting scheme.

11. Are the individual-level results robust to alternative linking approaches?

Table C.16, Table C.17	Data Quality	We employ the multigenerational linked panel dataset developed by Ruggles et al. (2025) and find results that are quantitatively similar to the baseline estimates, despite the smaller sample size.

12. Are the effects on women by household wealth sensitive to the cohort exposure definition?

Table C.18, Table C.19	Measurement	We replicate the results using a slacker definition of exposure (20 y.o. instead of 15 y.o.) and find qualitatively similar effects.

13. Are the individual-level results robust to individual-level controls?

Table C.20, Table C.21	Confounding Factors	We include additional controls (literacy, urban status, first- and second-generation dummy, recent marriage dummy) and confirm the baseline estimates.

14. Are the results on fertility driven by differential infant mortality?

Figure D.1	Alternative Mechanism	We leverage the vital statistics data to estimate the effect of industry and retailer exposure on the crude infant mortality rate. We find either marginally significant positive or no effects.

15. Is the parallel trends assumption likely to hold?

Figure D.3, Figure D.4, Figure D.5, Figure D.6	Model Specification	We use the recent method developed by Rambachan and Roth (2023) to assess the robustness of the results to violations of the parallel trends assumption. When the baseline results are significant, they also withstand large deviations from parallel trends.

16. Are the township-level results conflating displacement and re-instatement within textiles?

Figure D.7	Confounding Factors	We estimate the baseline difference-in-differences analysis at the industry level for the subset of textile-related industries and find that the reinstatement effect of the sewing machine largely offsets displacement effects even within textiles.

17. Are the township-level results driven by confounding factors?

Figure D.8, Figure D.9, Figure D.16, Figure D.17	Confounding Factors	We run the baseline double difference regressions and include township-level controls interacted with year dummies. The results remain unchanged.

18. Are the township-level results driven by particular townships?

Figure D.10, Figure D.11, Figure D.18, Figure D.19	Confounding Factors	We re-estimate each double difference regression, dropping one township at a time. The resulting estimated treatment effects remain stable.

19. Are the results sensitive to alternative standard error estimators?

Figure D.12, Figure D.13, Figure D.20, Figure D.21	Model Specification	We re-estimate all the double differences regression using various standard error estimators, including the Conley (1999) correction to allow for spatial autocorrelation. The significance of the treatment effect remains largely unchanged.

20. Do the estimated treatment effects reflect the activity of retailers rather than spurious timing?

Figure D.14, Figure D.22	Confounding Factors	We display the distribution of placebo treatment effect obtained by randomly permuting retailer establishment timing across cities and find low randomization *p*-values for significant estimates.

21. Are the distributional effects sensitive to alternative partitions of the support?

Figure D.15	Model Specification	We display the average treatment effects obtained for each decile of the household wealth distribution and find qualitatively similar (albeit noisier) patterns.

C Additional Tables

Table C.1. Triple Differences Estimates of the Effect of Sewing Machines on Employment

	Dependent Variable: (log) Employment					
	Industry Exposure to the Sewing Machine			Exposure to Sewing Machine Retailer		
	(1) All	(2) Men	(3) Women	(4) All	(5) Men	(6) Women
Post × Exposure to SM × SM Industry	0.974**	0.497	1.217**			
	(0.377)	(0.333)	(0.609)			
Post × SM Retailer × SM Industry				0.159	-0.059	0.478***
				(0.117)	(0.101)	(0.123)
Town-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Town-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of Towns	302	302	302	302	302	302
Number of Observations	220,460	220,460	176,368	176,368	176,368	176,368
R^2	0.910	0.905	0.906			
Mean Dep. Var.	0.754	0.679	0.276	0.822	0.729	0.276
Std. Dev. Dep. Var.	1.384	1.284	0.942	1.423	1.305	0.942
Std. Beta Coef.	0.006	0.003	0.011	0.112	-0.046	0.507

Notes. This Table reports the effect of exposure to sewing machines on employment. The unit of observation is a township-by-industry observed at census frequency between 1850 and 1900. The outcome variable is log employment (columns 1 and 4), male employment (columns 2 and 5), and female employment (columns 3 and 6). In columns (1–3), we display the coefficient of an interaction term between a post-1860 term, the employment share of industries exposed to sewing machines, and an indicator for sewing-machine-using industries; in columns (4–6), we display the coefficient of an interaction term between a post-retailer dummy equal to one after a retailer opens in the given town an indicator of sewing-machine-using industries. Regressions include town-by-industry, town-by-year, and industry-by-year fixed effects. Standard errors are clustered at the town level and are reported in parentheses. The estimates displayed in columns (4–6) report average treatment effects obtained using the de Chaisemartin and d'Haultfœuille (2024) estimator. Referenced on pages: 20, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.2. Difference-in-Differences Estimates: Crude Birth Rate and Infant Mortality Rate in Response to Exposure to the Sewing Machine

	Industry Exposure to SM		Retailer Exposure to SM	
	(1) Crude Birth Rate (%)	(2) Infant Mortality Rate (%)	(3) Crude Birth Rate (%)	(4) Infant Mortality Rate (%)
Post × Exposure to SM	-1.203***	-0.271		
	(0.402)	(0.685)		
Post × SM Retailer			-7.137**	-2.199
			(3.076)	(2.285)
Town FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Number of Towns	302	302	302	302
Number of Observations	14,786	9,316	15,402	15,402
R^2	0.474	0.263		
Mean Dep. Var.	2.672	2.400	2.672	2.650
Std. Beta Coef.	-0.096	-0.014	-4.883	-0.885

Notes. This Table reports the effect of exposure to sewing machines on fertility and infant mortality. The unit of observation is a township observed at yearly frequency between 1850 and 1900 (columns 1 and 3) and between 1858 and 1888 (columns 2 and 4). The outcome variable is: in columns (1) and (3), the crude birth rate, defined as the number of births divided by population; in columns (2) and (4), the infant mortality rate, defined as the number of infant deaths, i.e., children aged 0–5, and the number of births. Both outcomes are expressed as percentages and are winsorized at the top and bottom 1%. In columns (1–2), the estimated treatment effects are reported as the coefficients on the interaction term between a post-1860 indicator variable and the employment share of sewing machine-using industries. In columns (3–4), the treatment is an indicator variable that takes a value of 1 if at least one retailer of sewing machines is observed in the given township, and 0 otherwise. Each regression includes town and time fixed effects. The estimates displayed in columns (3) and (84) report average treatment effects obtained using the de Chaisemartin and d'Haultfœuille (2024) estimator. Standard errors are clustered at the town level and are reported in parentheses. Referenced on pages: 21, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.3. Industry Exposure to the Sewing Machine and Immigration

	Share of Immigrants				Share of Women Among Immigrants			
	(1) Within State	(2) Out of State	(3) Within State	(4) Out of State	(5) Within State	(6) Out of State	(7) Within State	(8) Out of State
Post × Exposure to SM	-2.051	-11.457**			2.268	-16.713		
	(1.360)	(5.353)			(1.636)	(38.750)		
Post × SM Retailer			1.541***	1.385			0.482	-17.442
			(0.545)	(1.891)			(0.438)	(16.540)
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Towns	302	302	302	302	302	302	302	302
Number of Observations	906	906	906	906	906	904	906	906
R^2	0.844	0.301			0.429	0.349		
Mean Dep. Var.	16.456	5.671	16.456	5.671	47.898	53.905	47.898	53.905
Std. Dev. Dep. Var.	5.410	8.559	5.410	8.559	3.037	110.165	3.037	110.165
Std. Beta Coef.	-0.042	-0.148	0.285	0.162	0.083	-0.017	0.159	-0.158

Notes. This Table reports the effect of industry exposure to the sewing machine (columns 1–2 and 5–6) and exposure to sewing-machine retailers (columns 3–4 and 7–8) on immigration. The unit of observation is a township observed at census frequency between 1860 and 1880. In columns (1) and (3), the dependent variable is the share of individuals who, in the preceding census, were living in a different town in Massachusetts. In columns (2) and (4), the dependent variable is the change in the number of residents born out of Massachusetts between the current and the preceding census as a share of the population. In columns (5) and (7), the dependent variable is the share of women among within-state migrants. In columns (6) and (8), the dependent variable is the share of women among out-of-state migrants. Columns (1–2) and (5–6) display the coefficient of the interaction term between a post-1860 term and the 1860 employment share of industries exposed to sewing machines. Columns (3–4) and (7–8) report the coefficient of a term equal to 1 after a retailer is established in the township and 0 otherwise. The estimates displayed in columns (3–4) and (7–8) report average treatment effects obtained using the de Chaisemartin and d'Haultfœuille (2024) estimator. Regressions include town and year fixed effects. Standard errors are clustered at the town level and are reported in parentheses. Referenced on pages: 23, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.4. Difference-in-Differences Estimates: Geographic Spillovers of Industry Exposure to the Sewing Machine on Women

	Female Employmment in SM Industries (%)				Female Labor Force Participation (%)				Share of Women with Children (%)				Share of Married Women (%)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Post × SM Industry Exposure (10 Km)	3.181***				4.501				-3.722***				-8.984***			
	(0.885)				(4.881)				(1.382)				(1.783)			
Post × SM Industry Exposure (20 Km)		2.516***				2.285				-3.173**				-6.929***		
		(0.952)				(5.312)				(1.570)				(2.237)		
Post × SM Industry Exposure (30 Km)			1.529				-1.905				-1.157				-6.449**	
			(1.025)				(7.566)				(2.232)				(2.741)	
Post × SM Industry Exposure (40 Km)				2.175*				2.067				4.297				-3.448
				(1.113)				(9.602)				(2.905)				(3.850)
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Towns	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302
Number of Observations	1,732	1,732	1,732	1,732	2,114	2,114	2,114	2,114	2,416	2,416	2,416	2,416	2,416	2,416	2,416	2,416
R^2	0.548	0.540	0.536	0.536	0.816	0.815	0.815	0.815	0.973	0.973	0.973	0.973	0.916	0.915	0.914	0.914
Mean Dep. Var.	0.937	0.937	0.937	0.937	20.191	20.191	20.191	20.191	45.430	45.430	45.430	45.430	56.497	56.497	56.497	56.497
Std. Dev. Dep. Var.	1.524	1.524	1.524	1.524	11.712	11.712	11.712	11.712	17.918	17.918	17.918	17.918	10.604	10.604	10.604	10.604
Std. Beta Coef.	0.208	0.142	0.073	0.091	0.043	0.018	-0.012	0.011	-0.023	-0.016	-0.005	0.016	-0.093	-0.061	-0.047	-0.021

Notes. This Table reports the effect of exposure to sewing machines on women. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the share of women working in sewing-machine-using industries (columns 1–4), the share of working women (columns 5–8), the share of women with at least one child (columns 9–12), and the share of married women (columns 13–16). Each coefficient reports the estimated treatment effects of a variable that codes an interaction term between the employment share of sewing-machine-using industries in 1860 and a post-1860 term. Across the different rows, we compute the employment share of sewing-machine-using industries over different areas: in the first row, we include all townships whose centroid lies within ten kilometers from the given township; in rows (2–4), we extend the area over which we compute the treatment to 20, 30, and 40 kilometers from the township's centroid. The various coefficients thus quantify the impact of the potential diffusion of the sewing machine in manufacturing industries beyond the township's borders. Each regression includes town and time-fixed effects. Standard errors are clustered at the town level and are reported in parentheses. Referenced on pages: 24, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.5. Difference-in-Differences Estimates: Geographic Spillovers of Sewing Machine Retailer Exposure on Women

	Female Employmment in SM Industries (%)				Female Labor Force Participation (%)				Share of Women with Children (%)				Share of Married Women (%)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	10 Km	20 Km	30 Km	40 Km	10 Km	20 Km	30 Km	40 Km	10 Km	20 Km	30 Km	40 Km	10 Km	20 Km	30 Km	40 Km
Post × SM Retailer	1.788***	1.494***	0.026	0.053	5.841*	10.210	4.501	4.528	-0.662	-4.337	-3.590	-2.029	-5.866***	-9.464**	-9.846	-10.454
	(0.371)	(0.321)	(0.091)	(0.095)	(3.451)	(9.272)	(5.234)	(5.756)	(1.603)	(7.041)	(4.048)	(3.736)	(2.121)	(4.017)	(11.417)	(11.522)
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Towns	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302	302
Number of Observations	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718
Mean Dep. Var.	1.091	1.091	1.091	1.091	20.191	20.191	20.191	20.191	45.430	45.430	45.430	45.430	56.497	56.497	56.497	56.497
Std. Dev. Dep. Var.	1.598	1.598	1.598	1.598	11.712	11.712	11.712	11.712	17.918	17.918	17.918	17.918	10.604	10.604	10.604	10.604
Std. Beta Coef.	1.118	0.935	0.016	0.033	0.499	0.872	0.384	0.387	-0.037	-0.242	-0.200	-0.113	-0.553	-0.892	-0.928	-0.986

Notes. This Table reports the effect of exposure to sewing machines on women. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the share of women working in sewing-machine-using industries (columns 1–4), the share of working women (columns 5–8), the share of women with at least one child (columns 9–12), and the share of married women (columns 13–16). Each coefficient reports the estimated treatment effect of a variable that takes the value 1 when at least one sewing machine retailer is observed within k kilometers of the township centroid, and 0 otherwise. Across the different columns, we compute exposure to sewing machine retailers across different areas: in columns (1), (5), (9), and (13), we include all townships whose centroid lies within ten kilometers from the given township; in columns (2), (6), (10), and (14), we extend the area over which we compute the treatment to 20 kilometers from the township's centroid. The other columns follow the same pattern. The various coefficients thus quantify the impact of sewing machine retailers on areas beyond the township's borders. The estimates report average treatment effects obtained using the de Chaisemartin and d'Haultfœuille (2024) estimator. Each regression includes town and time-fixed effects. Standard errors are clustered at the town level and are reported in parentheses. Referenced on pages: 24, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.6. Difference-in-Differences Estimates: Impact of Industry Exposure on Women, Alternative Treatment Definitions

	Female Employmment in SM Industries (%)			Female Labor Force Participation (%)			Share of Women with Children (%)			Share of Married Women (%)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post × Exposure to SM (1850)	2.804***			3.922			-7.813***			-3.472***		
	(0.631)			(3.852)			(1.272)			(0.989)		
Post × Exposure to SM (1870)		4.972***			6.880*			-8.010***			-3.533***	
		(0.692)			(4.099)			(1.406)			(1.128)	
Post × Exposure to SM (Broad)			3.384***			5.112			-5.613***			-0.692
			(0.739)			(4.617)			(1.556)			(1.233)
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Towns	302	302	302	302	302	302	302	302	302	302	302	302
Number of Observations	1,732	1,732	1,732	2,114	2,114	2,114	2,416	2,416	2,416	2,416	2,416	2,416
R^2	0.552	0.572	0.553	0.816	0.816	0.816	0.916	0.915	0.915	0.973	0.973	0.973
Mean Dep. Var.	0.937	0.937	0.937	20.191	20.191	20.191	56.497	56.497	56.497	45.430	45.430	45.430
Std. Dev. Dep. Var.	1.524	1.524	1.524	11.712	11.712	11.712	10.604	10.604	10.604	17.918	17.918	17.918
Std. Beta Coef.	0.224	0.327	0.256	0.048	0.069	0.056	-0.101	-0.085	-0.066	-0.027	-0.022	-0.005

Notes. This Table reports the effect of exposure to sewing machines on women. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the share of women working in sewing-machine-using industries (columns 1–3), the share of working women (columns 4–6), the share of married women (columns 7–9), and the share of women with at least one child (columns 10–12). Each coefficient reports the estimated treatment effects of a variable that codes an interaction term between the employment share of sewing-machine-using industries and a post term. The first two rows report the estimated treatment effect when measuring the employment share of sewing-machine-using industries in the two pre-treatment census years (1850 and 1870). The baseline is 1860. In the last row, we adopt a broader definition of sewing-machine-using industries that comprises, on top of the baseline definition, "Knitting mills," "Dyeing and finishing textiles, except knit goods," "Carpets, rugs, and other floor coverings," "Yarn, thread, and fabric mills," "Miscellaneous textile mill products," and "Printing, publishing, and allied industries." Each regression includes town and time-fixed effects. Standard errors are clustered at the town level and are reported in parentheses. Referenced on pages: 24, A3, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.7. Individual-Level Response to Industry Exposure to Sewing Machines, by Wealth

	Employment			Income	Motherhood		Married
	(1) SM Industry	(2) Manufacturing	(3) Any Industry	(4)	(5) Has Child	(6) N. Children	(7)
Young × Exposure to SM	0.333***	0.251***	0.282***	0.834***	-0.294***	-0.807***	-0.349***
	(0.062)	(0.062)	(0.041)	(0.139)	(0.046)	(0.123)	(0.061)
Young × Exposure to SM ×							
No Reported Wealth	-0.067	-0.029	-0.108***	-0.236*	0.260***	0.710***	0.324***
	(0.056)	(0.049)	(0.041)	(0.125)	(0.041)	(0.111)	(0.051)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.296]	[0.220]	[0.425]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.072	-0.118***	-0.141***	-0.396***	0.183***	0.518***	0.221***
	(0.045)	(0.043)	(0.040)	(0.129)	(0.032)	(0.071)	(0.040)
	[0.000]	[0.006]	[0.000]	[0.001]	[0.003]	[0.001]	[0.000]
Household Wealth Quartile = 3	-0.177***	-0.234***	-0.338***	-0.971***	0.318***	0.915***	0.312***
	(0.047)	(0.051)	(0.050)	(0.163)	(0.037)	(0.094)	(0.046)
	[0.000]	[0.603]	[0.138]	[0.237]	[0.567]	[0.287]	[0.429]
Household Wealth Quartile = 4	-0.352***	-0.434***	-0.435***	-1.278***	0.317***	0.984***	0.376***
	(0.068)	(0.071)	(0.067)	(0.222)	(0.046)	(0.113)	(0.051)
	[0.233]	[0.000]	[0.002]	[0.004]	[0.578]	[0.064]	[0.498]
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Individuals	107,592	107,592	107,592	107,592	107,592	107,592	107,592
R^2	0.084	0.111	0.118	0.108	0.298	0.324	0.292
Mean Dep. Var.	0.033	0.117	0.275	0.804	0.305	0.584	0.305
Std. Dev. Dep. Var.	0.179	0.322	0.446	1.331	0.460	0.998	0.460

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1870. The sample only includes women born between 1835 and 1855. The baseline treatment is an interaction term between an indicator variable equal to 1 for women under 15 in 1860 and 0 otherwise, and the employment share of industries exposed to the sewing machine. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables in columns (1–3) are indicators that return a value of one if the woman is employed in a sewing machine-using industry (1) or if she is employed in manufacturing (2) or in any industry (3). In column (4), the dependent variable is the occupation-imputed income; in column (5), the outcome is an indicator variable that returns one for women with at least one child; in column (6), the outcome is the number of children; in column (7), the dependent variable is an indicator for married women. Each regression includes town, wealth quartile, birthplace, and race fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the *p*-value of a test of joint significance of the baseline treatment and the wealth quartile-specific coefficients. Referenced on page: 25.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.8. Individual-Level Response to Exposure to Sewing Machine Retailers, by Wealth

	Employment			Income	Motherhood		Married	Single
	(1) SM Industry	(2) Manufacturing	(3) Any Industry	(4)	(5) Has Child	(6) N. Children	(7)	(8)
Young × SM Retailer	0.030***	0.067***	0.075***	0.227***	-0.023	-0.038	-0.048*	0.053***
	(0.011)	(0.014)	(0.015)	(0.043)	(0.017)	(0.044)	(0.027)	(0.019)
Young × SM Retailer ×								
No Reported Wealth	-0.012	-0.027**	-0.040*	-0.115**	0.026	0.072	0.051	-0.032
	(0.010)	(0.013)	(0.021)	(0.056)	(0.021)	(0.056)	(0.035)	(0.020)
	[0.016]	[0.006]	[0.001]	[0.001]	[0.633]	[0.073]	[0.814]	[0.001]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.014	-0.057***	-0.062***	-0.180***	0.032**	0.072**	0.049***	-0.035**
	(0.009)	(0.017)	(0.021)	(0.060)	(0.013)	(0.034)	(0.018)	(0.016)
	[0.084]	[0.339]	[0.342]	[0.218]	[0.424]	[0.174]	[0.985]	[0.117]
Household Wealth Quartile = 3	-0.031***	-0.100***	-0.122***	-0.350***	0.040*	0.106**	0.062***	-0.050**
	(0.011)	(0.022)	(0.018)	(0.050)	(0.020)	(0.046)	(0.022)	(0.020)
	[0.841]	[0.012]	[0.000]	[0.000]	[0.124]	[0.000]	[0.184]	[0.720]
Household Wealth Quartile = 4	-0.040**	-0.110***	-0.176***	-0.519***	0.054***	0.155***	0.084***	-0.073***
	(0.018)	(0.033)	(0.017)	(0.065)	(0.019)	(0.043)	(0.023)	(0.021)
	[0.292]	[0.086]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.023]
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Individuals	87,246	87,246	87,246	87,246	87,246	87,246	87,246	87,246
R^2	0.072	0.108	0.094	0.094	0.185	0.211	0.162	0.205
Mean Dep. Var.	0.043	0.124	0.288	0.848	0.417	0.841	0.416	0.464
Std. Dev. Dep. Var.	0.202	0.330	0.453	1.360	0.493	1.136	0.493	0.499

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1880. The sample only includes women aged between 5 and 25 when a retailer in their town was established, or born between 1840 and 1860 for women living in towns without a retailer. The baseline treatment is an interaction term between an indicator variable equal to one for towns with at least one retailer, an individual-specific indicator equal to one for women below 15 when the retailer opened, and zero otherwise. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables in columns (1–3) are indicators that return a value of one if the woman is employed in a sewing machine-using industry (1) or if she is employed in manufacturing (2) or in any industry (3). In column (4), the dependent variable is the occupation-imputed income; in column (5), the outcome is an indicator variable that returns one for women with at least one child; in column (6), the outcome is the number of children; in column (7), the dependent variable is an indicator for married women; in column (8), the outcome is an indicator for women who never married. Each regression includes town, wealth quartile, birthplace, and race fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the p-value of a test of joint significance of the baseline treatment and the wealth quartile-specific coefficients. Referenced on page: 26.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.9. Individual-Level Response to Exposure to Sewing Machines, by Wealth: Household Income Shares Across Genders

	Household Income Share			
	(1) Women	(2) Men	(3) Women	(4) Men
Panel A. Exposure to Sewing Machine Industries				
Young × Exposure to SM	-0.018	-0.028		
	(0.013)	(0.023)		
Young × Exposure to SM × No Reported Wealth	0.009	0.008		
	(0.014)	(0.025)		
Household Wealth Quartile = 1	Baseline	Baseline		
Household Wealth Quartile = 2	0.067**	-0.010		
	(0.028)	(0.024)		
Household Wealth Quartile = 3	0.028	0.018		
	(0.023)	(0.022)		
Household Wealth Quartile = 4	0.005	0.020		
	(0.018)	(0.016)		
Panel B. Exposure to Sewing Machine Retailers				
Young × SM Retailer			-0.001	-0.001
			(0.005)	(0.007)
Young × SM Retailer × No Reported Wealth			-0.003	-0.001
			(0.006)	(0.007)
Household Wealth Quartile = 1			Baseline	Baseline
Household Wealth Quartile = 2			-0.008	0.009
			(0.007)	(0.008)
Household Wealth Quartile = 3			-0.006	0.005
			(0.007)	(0.007)
Household Wealth Quartile = 4			-0.004	-0.003
			(0.005)	(0.008)
Town FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Number of Individuals	23,628	23,503	24,087	23,829
R^2	0.028	0.043	0.018	0.029
Mean Dep. Var.	0.009	0.994	0.016	0.990
Std. Dev. Dep. Var.	0.077	0.060	0.102	0.068

Notes. This Table reports individual-level responses to industry-level exposure to sewing machines and sewing machine retailers, by income group. The unit of observation is an individual in 1870 (columns 1–2) or 1880 (columns 3–4). The sample only includes women (columns 1 and 3) and men (columns 2 and 4) in households where the woman was exposed to either the sewing machine in manufacturing or to sewing machine retailers according to our baseline treatment definitions; we only include married couples. In columns (1–2), the baseline treatment is an interaction term between the employment share in sewing-machine-using industries and an indicator equal to on for households where the wife was below 15 in 1860; in columns (3–4), the baseline treatment is an interaction term between an indicator variable equal to one for towns with at least one retailer and an individual-specific indicator equal to one for households where the wife was below 15 when the retailer opened. We then display the coefficients of further interaction terms between the baseline treatment and the quartiles of the household wealth at baseline (in 1860). The first quartile serves as the baseline category. The dependent variable is the share of household income that the individual earns. Each regression includes town, wealth quartile, birthplace, and race fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. Referenced on pages: 25, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.10. Individual-Level Response to Industry Exposure to Sewing Machines, by Wealth; Completed Marriage and Fertility Analysis

	Never Married	Childless	Number of Children
	(1)	(2)	(3)
Young × Exposure to SM	1.092***	0.314***	-0.999***
	(0.164)	(0.094)	(0.251)
Young × Exposure to SM ×			
No Reported Wealth	-1.336***	-0.386***	1.213***
	(0.177)	(0.100)	(0.256)
	[0.000]	[0.012]	[0.001]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.291	-0.192	0.267
	(0.182)	(0.133)	(0.355)
	[0.000]	[0.205]	[0.004]
Household Wealth Quartile = 3	-0.196	-0.344***	0.739***
	(0.162)	(0.104)	(0.262)
	[0.000]	[0.699]	[0.244]
Household Wealth Quartile = 4	-0.394*	-0.356***	0.785**
	(0.217)	(0.124)	(0.327)
	[0.000]	[0.682]	[0.473]
Town FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Number of Individuals	71,984	71,352	71,352
R^2	0.087	0.032	0.065
Mean Dep. Var.	0.480	0.244	1.846
Std. Dev. Dep. Var.	0.500	0.430	1.251

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1900. The sample only includes women born between 1835 and 1855. The baseline treatment is an interaction term between an indicator variable equal to 1 for women under 15 in 1860 and 0 otherwise, and the employment share of industries exposed to the sewing machine. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables are: in column (1), a dummy for women who never married; in column (2), a dummy for women who never had children; in column (3), the total number of children women ever had. Since women are observed past their fertile age, the dependent variables in columns (2–3) should be interpreted as reflecting completed fertility. Each regression includes town, wealth quartile, birthplace, and race fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the p-value from a test of the joint significance of the baseline treatment and the wealth-quartile-specific coefficients. Units are weighted so that the sample reproduces the universe of the population along the following characteristics: age, occupation, number of children, school attendance, race, household relationship, marital status, and wealth. Referenced on pages: 26, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.11. Individual-Level Response to Exposure to Sewing Machine Retailers, by Wealth; Completed Marriage and Fertility Analysis

	Never Married	Childless	Number of Children
	(1)	(2)	(3)
Young × SM Retailer	0.124**	0.062***	-0.170***
	(0.049)	(0.022)	(0.062)
Young × SM Retailer ×			
No Reported Wealth	-0.129**	-0.047**	0.138*
	(0.053)	(0.023)	(0.071)
	[0.444]	[0.056]	[0.102]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.052*	-0.025	0.030
	(0.028)	(0.036)	(0.094)
	[0.056]	[0.170]	[0.122]
Household Wealth Quartile = 3	-0.118**	-0.024	0.103
	(0.053)	(0.036)	(0.078)
	[0.784]	[0.143]	[0.217]
Household Wealth Quartile = 4	-0.083*	-0.022	0.083
	(0.046)	(0.028)	(0.071)
	[0.029]	[0.038]	[0.062]
Town FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Number of Individuals	64,661	63,689	63,689
R^2	0.056	0.025	0.034
Mean Dep. Var.	0.438	0.312	1.616
Std. Dev. Dep. Var.	0.496	0.463	1.283

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1900. The sample only includes women between 5 and 25 years old when a retailer opened in their town, or born between 1840 and 1860 if they lived in towns without a retailer. The baseline treatment is an interaction term between an indicator variable equal to one for towns with at least one retailer, an individual-specific indicator equal to one for women below 15 when the retailer opened, and zero otherwise. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables are: in column (1), a dummy for women who never married; in column (2), a dummy for women who never had children; in column (3), the total number of children women ever had. Since women are observed past their fertile age, the dependent variables in columns (2–3) should be interpreted as reflecting completed fertility. Each regression includes town, wealth quartile, birthplace, and race fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the p-value from a test of the joint significance of the baseline treatment and the wealth-quartile-specific coefficients. Units are weighted so that the sample reproduces the universe of the population along the following characteristics: age, occupation, number of children, school attendance, race, household relationship, marital status, and wealth. Referenced on pages: 26, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.12. Individual-Level Response to Industry Exposure to Sewing Machines, by Wealth; Representative Weighting Scheme

	Employment			Income	Motherhood		Married
	(1) SM Industry	(2) Manufacturing	(3) Any Industry	(4)	(5) Has Child	(6) N. Children	(7)
Young × Exposure to SM	0.324***	0.251***	0.295***	0.798***	-0.282***	-0.796***	-0.354***
	(0.070)	(0.062)	(0.050)	(0.150)	(0.056)	(0.152)	(0.076)
Young × Exposure to SM ×							
No Reported Wealth	-0.082	-0.029	-0.164***	-0.329**	0.290***	0.773***	0.357***
	(0.061)	(0.049)	(0.052)	(0.142)	(0.046)	(0.124)	(0.060)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.803]	[0.776]	[0.942]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.079	-0.118***	-0.185***	-0.475***	0.204***	0.551***	0.245***
	(0.050)	(0.043)	(0.046)	(0.141)	(0.035)	(0.080)	(0.046)
	[0.000]	[0.006]	[0.012]	[0.027]	[0.117]	[0.035]	[0.021]
Household Wealth Quartile = 3	-0.168***	-0.234***	-0.377***	-1.031***	0.344***	0.950***	0.325***
	(0.060)	(0.051)	(0.056)	(0.168)	(0.041)	(0.104)	(0.051)
	[0.000]	[0.603]	[0.068]	[0.088]	[0.264]	[0.232]	[0.639]
Household Wealth Quartile = 4	-0.331***	-0.434***	-0.495***	-1.395***	0.322***	0.974***	0.365***
	(0.072)	(0.071)	(0.075)	(0.234)	(0.048)	(0.119)	(0.054)
	[0.701]	[0.000]	[0.001]	[0.001]	[0.400]	[0.110]	[0.831]
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Individuals	107,592	107,592	107,592	107,592	107,592	107,592	107,592
R^2	0.073	0.111	0.141	0.111	0.194	0.198	0.192
Mean Dep. Var.	0.033	0.117	0.275	0.804	0.305	0.584	0.305
Std. Dev. Dep. Var.	0.179	0.322	0.446	1.331	0.460	0.998	0.460

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1870. The sample only includes women born between 1835 and 1855. The baseline treatment is an interaction term between an indicator variable equal to 1 for women under 15 in 1860 and 0 otherwise, and the employment share of industries exposed to the sewing machine. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables in columns (1–3) are indicators that return a value of one if the woman is employed in a sewing machine-using industry (1) or if she is employed in manufacturing (2) or in any industry (3). In column (4), the dependent variable is the occupation-imputed income; in column (5), the outcome is an indicator variable that returns one for women with at least one child; in column (6), the outcome is the number of children; in column (7), the dependent variable is an indicator for married women. Each regression includes town, wealth quartile, birthplace, and race fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the p-value from a test of the joint significance of the baseline treatment and the wealth-quartile-specific coefficients. Units are weighted so that the sample reproduces the universe of the population along the following characteristics: age, occupation, number of children, school attendance, race, household relationship, marital status, and wealth. Referenced on pages: 27, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.13. Individual-Level Response to Exposure to Sewing Machine Retailers, by Wealth; Representative Weighting Scheme

	Employment			Income	Motherhood		Married	Single
	(1) SM Industry	(2) Manufacturing	(3) Any Industry	(4)	(5) Has Child	(6) N. Children	(7)	(8)
Young × SM Retailer	0.025**	0.067***	0.057***	0.182***	-0.027	-0.033	-0.039**	0.054***
	(0.011)	(0.014)	(0.012)	(0.037)	(0.017)	(0.043)	(0.018)	(0.017)
Young × SM Retailer ×								
No Reported Wealth	-0.009	-0.027**	-0.031**	-0.089**	0.020	0.047	0.031	-0.025
	(0.009)	(0.013)	(0.016)	(0.042)	(0.019)	(0.049)	(0.023)	(0.019)
	[0.029]	[0.006]	[0.031]	[0.009]	[0.317]	[0.411]	[0.414]	[0.000]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.011	-0.057***	-0.052***	-0.146***	0.028**	0.065*	0.033**	-0.026*
	(0.009)	(0.017)	(0.018)	(0.054)	(0.014)	(0.037)	(0.013)	(0.016)
	[0.118]	[0.339]	[0.720]	[0.389]	[0.913]	[0.198]	[0.645]	[0.018]
Household Wealth Quartile = 3	-0.027**	-0.100***	-0.113***	-0.323***	0.041*	0.097**	0.047***	-0.046**
	(0.012)	(0.022)	(0.016)	(0.048)	(0.022)	(0.046)	(0.014)	(0.022)
	[0.763]	[0.012]	[0.000]	[0.000]	[0.281]	[0.005]	[0.458]	[0.491]
Household Wealth Quartile = 4	-0.036**	-0.110***	-0.174***	-0.501***	0.052**	0.138***	0.071***	-0.073***
	(0.018)	(0.033)	(0.021)	(0.078)	(0.022)	(0.044)	(0.013)	(0.020)
	[0.266]	[0.086]	[0.000]	[0.000]	[0.015]	[0.000]	[0.012]	[0.042]
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Individuals	86,023	87,246	86,023	86,023	86,023	86,023	86,023	86,023
R^2	0.069	0.108	0.092	0.089	0.164	0.181	0.147	0.188
Mean Dep. Var.	0.043	0.124	0.289	0.854	0.412	0.827	0.413	0.468
Std. Dev. Dep. Var.	0.203	0.330	0.453	1.364	0.492	1.128	0.492	0.499

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1880. The sample only includes women aged 5 to 25 when a retailer opened in their town, or born between 1840 and 1860 for women living in towns without a retailer. The baseline treatment is an interaction term between an indicator variable equal to one for towns with at least one retailer, an individual-specific indicator equal to one for women below 15 when the retailer opened, and zero otherwise. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables in columns (1–3) are indicators that return a value of one if the woman is employed in a sewing machine-using industry (1) or if she is employed in manufacturing (2) or in any industry (3). In column (4), the dependent variable is the occupation-imputed income; in column (5), the outcome is an indicator variable that returns one for women with at least one child; in column (6), the outcome is the number of children; in column (7), the dependent variable is an indicator for married women; in column (8), the outcome is an indicator for women who never married. Each regression includes town, wealth quartile, birthplace, and race fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the p-value from a test of the joint significance of the baseline treatment and the wealth-quartile-specific coefficients. Units are weighted so that the sample reproduces the universe of the population along the following characteristics: age, occupation, number of children, school attendance, race, household relationship, marital status, and wealth. Referenced on pages: 27, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.14. Representativeness of the 1870 Intergenerational Linked Sample

	Universe of Population	Price et al. (2021) Linked Sample			Price et al. (2021) Reweighted Linked Sample			Althoff et al. (2025) Linked Sample		
	Mean	Mean	Difference		Mean	Difference		Mean	Difference	
			Difference	p-value		Difference	p-value		Difference	p-value
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Age	21.350	20.997	-0.737**	(0.037)	21.308	-0.427	(0.257)	14.971	-6.446***	(0.000)
Working-Age	0.618	0.576	-0.087***	(0.000)	0.604	-0.059***	(0.000)	0.442	-0.178***	(0.000)
Woman	0.512	0.497	-0.031***	(0.000)	0.498	-0.030***	(0.000)	0.408	-0.105***	(0.000)
Child	0.362	0.406	0.093***	(0.000)	0.377	0.063***	(0.000)	0.532	0.172***	(0.000)
Household Head	0.170	0.186	0.034***	(0.000)	0.188	0.035***	(0.000)	0.126	-0.044***	(0.000)
N. of Children	0.751	0.925	0.364***	(0.000)	0.915	0.354***	(0.000)	0.523	-0.231***	(0.000)
White	0.992	0.996	0.007***	(0.000)	0.994	0.006***	(0.000)	0.995	0.002***	(0.000)
Native-Born	0.779	0.840	0.128***	(0.000)	0.810	0.097***	(0.000)	0.902	0.124***	(0.000)
Employed	0.264	0.250	-0.029***	(0.000)	0.257	-0.022***	(0.000)	0.215	-0.050***	(0.000)
Woman; Employed	0.072	0.048	-0.049***	(0.000)	0.064	-0.033***	(0.000)	0.042	-0.031***	(0.000)
Mfg. Employment	0.143	0.131	-0.025***	(0.000)	0.138	-0.018***	(0.000)	0.116	-0.026***	(0.000)
Agri. Employment	0.020	0.027	0.015***	(0.000)	0.027	0.015***	(0.000)	0.023	0.003*	(0.052)
Child; At School	0.193	0.217	0.051***	(0.000)	0.187	0.021***	(0.000)	0.270	0.078***	(0.000)
Household Wealth	6465.925	5412.475	-2201.180	(0.106)	5431.839	-2181.816	(0.111)	4382.938	-2104.702***	(0.007)
SM Employment	0.114	0.125	0.023***	(0.000)	0.124	0.022***	(0.000)	0.131	0.018***	(0.000)
SM Retailer	0.713	0.689	-0.050***	(0.000)	0.698	-0.042***	(0.000)	0.658	-0.056***	(0.000)

Notes. This Table compares selected individual-level characteristics in the population (column 1), in the intergenerational linked 1860–1870 sample constructed using the links of Price et al. (2021) (columns 2–5), in the same link when we re-weight individuals to increase the representativeness of the sample (columns 5–7), and in the intergenerational linked 1860–1880 sample constructed using the links of Althoff et al. (2025). The sample comprises all individuals younger than 60 in 1860. Variables are measured in the 1870 census. Columns (1), (2), (5), and (8) report the sample mean for each variable in each sample; columns (3), (6), and (9) report the difference between the sample means in the intergenerational linked samples and the population; columns (4), (7), and (10) report the associated p-values constructed by clustering standard errors at the city level. Referenced on pages: 27, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.15. Representativeness of the 1880 Intergenerational Linked Sample

	Universe of Population	Price et al. (2021) Linked Sample			Price et al. (2021) Reweighted Linked Sample			Althoff et al. (2025) Linked Sample		
	Mean	Mean	Difference		Mean	Difference		Mean	Difference	
			Difference	*p*-value		Difference	*p*-value		Difference	*p*-value
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Age	21.350	21.011	-0.599	(0.116)	21.211	-0.399	(0.382)	14.682	-6.747***	(0.000)
Working-Age	0.618	0.589	-0.051***	(0.000)	0.605	-0.035***	(0.003)	0.427	-0.193***	(0.000)
Woman	0.512	0.496	-0.029***	(0.000)	0.497	-0.027***	(0.000)	0.425	-0.089***	(0.000)
Child	0.362	0.392	0.054***	(0.000)	0.373	0.035***	(0.001)	0.544	0.185***	(0.000)
Household Head	0.170	0.183	0.023***	(0.000)	0.184	0.023***	(0.002)	0.116	-0.055***	(0.000)
N. of Children	0.751	0.909	0.279***	(0.000)	0.902	0.273***	(0.000)	0.468	-0.286***	(0.000)
White	0.992	0.997	0.007***	(0.000)	0.995	0.006***	(0.000)	0.995	0.003***	(0.000)
Native-Born	0.779	0.843	0.113***	(0.000)	0.826	0.096***	(0.000)	0.898	0.120***	(0.000)
Employed	0.264	0.254	-0.017***	(0.000)	0.258	-0.013**	(0.032)	0.210	-0.055***	(0.000)
Woman; Employed	0.072	0.051	-0.038***	(0.000)	0.060	-0.029***	(0.000)	0.044	-0.029***	(0.000)
Mfg. Employment	0.143	0.134	-0.015***	(0.000)	0.138	-0.011***	(0.000)	0.118	-0.025***	(0.000)
Agri. Employment	0.020	0.028	0.014***	(0.000)	0.028	0.014***	(0.000)	0.021	0.001	(0.664)
Child; At School	0.193	0.207	0.025***	(0.000)	0.193	0.011***	(0.000)	0.292	0.100***	(0.000)
Household Wealth	6465.925	5477.745	-1744.064	(0.131)	5373.961	-1847.848	(0.112)	4286.476	-2204.965***	(0.004)
SM Employment	0.114	0.127	0.023***	(0.000)	0.126	0.022***	(0.000)	0.131	0.017***	(0.000)
SM Retailer	0.713	0.687	-0.047***	(0.000)	0.691	-0.043***	(0.000)	0.657	-0.057***	(0.000)

Notes. This Table compares selected individual-level characteristics in the population (column 1), in the intergenerational linked 1860–1880 sample constructed using the links of Price et al. (2021) (columns 2–5), in the same link when we re-weight individuals to increase the representativeness of the sample (columns 5–7), and in the intergenerational linked 1860–1880 sample constructed using the links of Althoff et al. (2025). The sample comprises all individuals younger than 60 in 1860. Variables are measured in the 1880 census. Columns (1), (2), (5), and (8) report the sample mean for each variable in each sample; columns (3), (6), and (9) report the difference between the sample means in the intergenerational linked samples and the population; columns (4), (7), and (10) report the associated *p*-values constructed by clustering standard errors at the city level. Referenced on pages: 27, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.16. Individual-Level Response to Industry Exposure to Sewing Machines, by Wealth: IPUMS Multigenerational Longitudinal Panel

	Employment			Income	Motherhood		Married
	(1) SM Industry	(2) Manufacturing	(3) Any Industry	(4)	(5) Has Child	(6) N. Children	(7)
Young × Exposure to SM	0.344***	0.283***	0.348***	1.077***	-0.437***	-1.066***	-0.554***
	(0.067)	(0.063)	(0.049)	(0.156)	(0.062)	(0.152)	(0.071)
Young × Exposure to SM ×							
No Reported Wealth	-0.010	-0.026	-0.051	-0.140	0.251***	0.696***	0.375***
	(0.050)	(0.044)	(0.043)	(0.131)	(0.039)	(0.102)	(0.046)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.068	-0.163***	-0.185***	-0.567***	0.270***	0.698***	0.310***
	(0.050)	(0.046)	(0.056)	(0.168)	(0.040)	(0.084)	(0.037)
	[0.000]	[0.019]	[0.001]	[0.001]	[0.000]	[0.001]	[0.000]
Household Wealth Quartile = 3	-0.233***	-0.291***	-0.448***	-1.351***	0.459***	1.155***	0.508***
	(0.063)	(0.070)	(0.065)	(0.206)	(0.050)	(0.114)	(0.056)
	[0.000]	[0.797]	[0.031]	[0.052]	[0.629]	[0.403]	[0.414]
Household Wealth Quartile = 4	-0.424***	-0.493***	-0.483***	-1.487***	0.533***	1.354***	0.675***
	(0.082)	(0.080)	(0.081)	(0.260)	(0.059)	(0.139)	(0.067)
	[0.005]	[0.000]	[0.046]	[0.049]	[0.041]	[0.009]	[0.010]
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Individuals	68,060	68,060	68,060	68,060	68,060	68,060	68,060
R^2	0.114	0.146	0.136	0.135	0.451	0.465	0.489
Mean Dep. Var.	0.043	0.146	0.313	0.943	0.205	0.438	0.178
Std. Dev. Dep. Var.	0.203	0.353	0.464	1.417	0.404	0.946	0.382

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1870. The sample is constructed using the IPUMS Multigenerational Longitudinal Panel links. The sample only includes women born between 1835 and 1855. The baseline treatment is an interaction term between an indicator variable equal to 1 for women under 15 in 1860, and 0 otherwise, and the employment share of industries exposed to the sewing machine. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables in columns (1–3) are indicators that return a value of one if the woman is employed in a sewing machine-using industry (1) or if she is employed in manufacturing (2) or in any industry (3). In column (4), the dependent variable is the occupation-imputed income; in column (5), the outcome is an indicator variable that returns one for women with at least one child; in column (6), the outcome is the number of children; in column (7), the dependent variable is an indicator for married women. Each regression includes town, wealth quartile, birthplace, and race fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the p-value of a test of joint significance of the baseline treatment and the wealth quartile-specific coefficients. Referenced on pages: 27, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.17. Individual-Level Response to Exposure to Sewing Machine Retailers, by Wealth: IPUMS Multigenerational Longitudinal Panel

	Employment			Income	Motherhood		Married	Single
	(1) SM Industry	(2) Manufacturing	(3) Any Industry	(4)	(5) Has Child	(6) N. Children	(7)	(8)
Young × SM Retailer	0.025**	0.045***	0.049**	0.154**	-0.019	-0.053	-0.041*	0.022*
	(0.011)	(0.016)	(0.021)	(0.066)	(0.013)	(0.038)	(0.021)	(0.012)
Young × SM Retailer ×								
No Reported Wealth	-0.004	-0.019	-0.036	-0.110	0.046**	0.117**	0.075*	-0.048***
	(0.014)	(0.021)	(0.024)	(0.078)	(0.019)	(0.055)	(0.039)	(0.016)
	[0.054]	[0.078]	[0.313]	[0.264]	[0.008]	[0.006]	[0.076]	[0.007]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.010	-0.045*	-0.056*	-0.170*	0.043***	0.103***	0.058***	-0.023
	(0.014)	(0.027)	(0.032)	(0.098)	(0.012)	(0.032)	(0.014)	(0.016)
	[0.272]	[0.969]	[0.729]	[0.775]	[0.007]	[0.004]	[0.090]	[0.915]
Household Wealth Quartile = 3	-0.050***	-0.115***	-0.127***	-0.391***	0.064***	0.155***	0.081***	-0.060***
	(0.017)	(0.017)	(0.023)	(0.072)	(0.020)	(0.055)	(0.022)	(0.020)
	[0.013]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.009]
Household Wealth Quartile = 4	-0.040**	-0.105***	-0.177***	-0.538***	0.084***	0.210***	0.112***	-0.091***
	(0.018)	(0.022)	(0.025)	(0.079)	(0.026)	(0.079)	(0.035)	(0.031)
	[0.219]	[0.003]	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]	[0.003]
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Individuals	40,491	40,491	40,491	40,491	40,491	40,491	40,491	40,491
R^2	0.121	0.148	0.116	0.117	0.287	0.367	0.347	0.269
Mean Dep. Var.	0.070	0.200	0.430	1.303	0.162	0.324	0.106	0.788
Std. Dev. Dep. Var.	0.255	0.400	0.495	1.523	0.369	0.815	0.308	0.409

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1880. The sample is constructed using the IPUMS Multigenerational Longitudinal Panel links. The sample only includes women aged 5 to 25 when a retailer opened in their town, or born between 1840 and 1860 for women living in towns without a retailer. The baseline treatment is an interaction term between an indicator variable equal to one for towns with at least one retailer, an individual-specific indicator equal to one for women below 15 years old when the retailer opened, and zero otherwise. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables in columns (1–3) are indicators that return a value of one if the woman is employed in a sewing machine-using industry (1) or if she is employed in manufacturing (2) or in any industry (3). In column (4), the dependent variable is the occupation-imputed income; in column (5), the outcome is an indicator variable that returns one for women with at least one child; in column (6), the outcome is the number of children; in column (7), the dependent variable is an indicator for married women; in column (8), the outcome is an indicator for women who never married. Each regression includes town, wealth quartile, birthplace, and race fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the p-value of a test of joint significance of the baseline treatment and the wealth quartile-specific coefficients. Referenced on pages: 27, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.18. Individual-Level Response to Industry Exposure to Sewing Machines, by Wealth: Alternative "Young" Threshold

	Employment			Income	Motherhood		Married
	(1) SM Industry	(2) Manufacturing	(3) Any Industry	(4)	(5) Has Child	(6) N. Children	(7)
Young (20 y.o.) × Exposure to SM	0.292***	0.163***	0.160***	0.462***	-0.169***	-0.512***	-0.204***
	(0.048)	(0.056)	(0.043)	(0.138)	(0.033)	(0.081)	(0.042)
Young (20 y.o.) × Exposure to SM ×							
No Reported Wealth	-0.064*	-0.017	-0.088**	-0.185*	0.190***	0.548***	0.283***
	(0.037)	(0.037)	(0.037)	(0.106)	(0.041)	(0.116)	(0.049)
	[0.000]	[0.000]	[0.171]	[0.046]	[0.591]	[0.714]	[0.025]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.014	-0.005	-0.025	-0.027	0.113***	0.293***	0.163***
	(0.034)	(0.037)	(0.038)	(0.118)	(0.036)	(0.080)	(0.036)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.118]	[0.008]	[0.176]
Household Wealth Quartile = 3	-0.113***	-0.081*	-0.155***	-0.402***	0.178***	0.564***	0.212***
	(0.032)	(0.044)	(0.041)	(0.133)	(0.031)	(0.075)	(0.034)
	[0.000]	[0.005]	[0.869]	[0.552]	[0.776]	[0.458]	[0.789]
Household Wealth Quartile = 4	-0.278***	-0.238***	-0.198***	-0.555***	0.161***	0.586***	0.240***
	(0.050)	(0.057)	(0.057)	(0.189)	(0.037)	(0.093)	(0.037)
	[0.307]	[0.000]	[0.331]	[0.427]	[0.790]	[0.368]	[0.302]
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Individuals	107,592	107,592	107,592	107,592	107,592	107,592	107,592
R^2	0.081	0.109	0.117	0.106	0.298	0.323	0.291
Mean Dep. Var.	0.033	0.117	0.275	0.804	0.305	0.584	0.305
Std. Dev. Dep. Var.	0.179	0.322	0.446	1.331	0.460	0.998	0.460

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1870. The sample only includes women born between 1835 and 1855. The baseline treatment is an interaction term between an indicator variable equal to 1 for women under 20 in 1860 (15 in the main analysis), and 0 otherwise, and the employment share of industries exposed to the sewing machine. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables in columns (1–3) are indicators that return a value of one if the woman is employed in a sewing machine-using industry (1) or if she is employed in manufacturing (2) or in any industry (3). In column (4), the dependent variable is the occupation-imputed income; in column (5), the outcome is an indicator variable that returns one for women with at least one child; in column (6), the outcome is the number of children; in column (7), the dependent variable is an indicator for married women. Each regression includes town, wealth quartile, birthplace, and race fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the p-value of a test of joint significance of the baseline treatment and the wealth quartile-specific coefficients. Referenced on pages: 27, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.19. Individual-Level Response to Exposure to Sewing Machine Retailers, by Wealth: Alternative "Young" Threshold

	Employment			Income	Motherhood		Married	Single
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	SM Industry	Manufacturing	Any Industry		Has Child	N. Children		
Young (20 y.o.) × SM Retailer	0.025**	0.059***	0.064***	0.187***	-0.047***	-0.086*	-0.077**	0.066***
	(0.010)	(0.012)	(0.015)	(0.044)	(0.017)	(0.044)	(0.033)	(0.015)
Young (20 y.o.) × SM Retailer ×								
No Reported Wealth	-0.012	-0.031***	-0.051***	-0.140***	0.053**	0.140**	0.096**	-0.056***
	(0.009)	(0.011)	(0.017)	(0.048)	(0.021)	(0.057)	(0.046)	(0.018)
	[0.023]	[0.007]	[0.167]	[0.119]	[0.533]	[0.029]	[0.213]	[0.216]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.003	-0.046***	-0.059***	-0.162***	0.049***	0.114***	0.059***	-0.042**
	(0.009)	(0.016)	(0.017)	(0.052)	(0.016)	(0.037)	(0.021)	(0.019)
	[0.015]	[0.193]	[0.735]	[0.551]	[0.885]	[0.243]	[0.318]	[0.029]
Household Wealth Quartile = 3	-0.028***	-0.076***	-0.078***	-0.212***	0.060***	0.133***	0.074***	-0.063***
	(0.009)	(0.016)	(0.016)	(0.047)	(0.014)	(0.027)	(0.026)	(0.013)
	[0.675]	[0.077]	[0.195]	[0.453]	[0.343]	[0.173]	[0.857]	[0.798]
Household Wealth Quartile = 4	-0.032**	-0.089***	-0.137***	-0.388***	0.058***	0.153***	0.099***	-0.083***
	(0.013)	(0.020)	(0.017)	(0.049)	(0.015)	(0.034)	(0.026)	(0.015)
	[0.288]	[0.033]	[0.000]	[0.000]	[0.272]	[0.009]	[0.126]	[0.068]
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Individuals	93,367	93,367	93,367	93,367	93,367	93,367	93,367	93,367
R^2	0.059	0.100	0.089	0.091	0.186	0.216	0.147	0.203
Mean Dep. Var.	0.035	0.105	0.256	0.747	0.480	1.001	0.470	0.398
Std. Dev. Dep. Var.	0.183	0.306	0.436	1.301	0.500	1.199	0.499	0.490

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1880. The sample only includes women aged 5 to 25 when a retailer opened in their town, or born between 1840 and 1860 for women living in towns without a retailer. The baseline treatment is an interaction term between an indicator variable equal to one for towns with at least one retailer, an individual-specific indicator equal to one for women below 20 years old (15 in the main analysis) when the retailer opened, and zero otherwise. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables in columns (1–3) are indicators that return a value of one if the woman is employed in a sewing machine-using industry (1) or if she is employed in manufacturing (2) or in any industry (3). In column (4), the dependent variable is the occupation-imputed income; in column (5), the outcome is an indicator variable that returns one for women with at least one child; in column (6), the outcome is the number of children; in column (7), the dependent variable is an indicator for married women; in column (8), the outcome is an indicator for women who never married. Each regression includes town, wealth quartile, birthplace, and race fixed effects. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the p-value of a test of joint significance of the baseline treatment and the wealth quartile-specific coefficients. Referenced on pages: 27, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.20. Individual-Level Response to Industry Exposure to Sewing Machines, by Wealth: Additional Controls

	Employment			Income	Motherhood		Married
	(1) SM Industry	(2) Manufacturing	(3) Any Industry	(4)	(5) Has Child	(6) N. Children	(7)
Young × Exposure to SM	0.335***	0.281***	0.325***	0.959***	-0.300***	-0.809***	-0.366***
	(0.063)	(0.067)	(0.049)	(0.159)	(0.049)	(0.126)	(0.067)
Young × Exposure to SM ×							
No Reported Wealth	-0.069	-0.045	-0.132***	-0.308**	0.264***	0.713***	0.336***
	(0.056)	(0.053)	(0.047)	(0.143)	(0.041)	(0.113)	(0.051)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.287]	[0.221]	[0.381]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.074	-0.140***	-0.171***	-0.482***	0.186***	0.512***	0.229***
	(0.046)	(0.044)	(0.043)	(0.138)	(0.032)	(0.072)	(0.040)
	[0.000]	[0.005]	[0.000]	[0.001]	[0.004]	[0.001]	[0.001]
Household Wealth Quartile = 3	-0.175***	-0.220***	-0.318***	-0.911***	0.311***	0.900***	0.306***
	(0.047)	(0.053)	(0.050)	(0.162)	(0.036)	(0.093)	(0.046)
	[0.000]	[0.074]	[0.855]	[0.692]	[0.802]	[0.385]	[0.237]
Household Wealth Quartile = 4	-0.349***	-0.409***	-0.399***	-1.172***	0.305***	0.962***	0.367***
	(0.067)	(0.076)	(0.066)	(0.220)	(0.046)	(0.114)	(0.052)
	[0.374]	[0.000]	[0.125]	[0.158]	[0.902]	[0.115]	[0.995]
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Individuals	107,592	107,592	107,592	107,592	107,592	107,592	107,592
R^2	0.085	0.144	0.154	0.143	0.301	0.326	0.299
Mean Dep. Var.	0.033	0.117	0.275	0.804	0.305	0.584	0.305
Std. Dev. Dep. Var.	0.179	0.322	0.446	1.331	0.460	0.998	0.460

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1870. The sample only includes women born between 1835 and 1855. The baseline treatment is an interaction term between an indicator variable equal to 1 for women under 15 in 1860, and 0 otherwise, and the employment share of industries exposed to the sewing machine. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables in columns (1–3) are indicators that return a value of one if the woman is employed in a sewing machine-using industry (1) or if she is employed in manufacturing (2) or in any industry (3). In column (4), the dependent variable is the occupation-imputed income; in column (5), the outcome is an indicator variable that returns one for women with at least one child; in column (6), the outcome is the number of children; in column (7), the dependent variable is an indicator for married women. Each regression includes town, wealth quartile, birthplace, and race fixed effects. In addition, we include controls for literacy, urban status, an indicator for individuals that got married in the previous year, and an indicator for first- or second-generation migrants. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the *p*-value of a test of joint significance of the baseline treatment and the wealth quartile-specific coefficients. Referenced on pages: 27, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.21. Individual-Level Response to Exposure to Sewing Machine Retailers, by Wealth: Additional Controls

	Employment			Income	Motherhood		Married	Single
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	SM Industry	Manufacturing	Any Industry		Has Child	N. Children		
Young × SM Retailer	0.026**	0.045***	0.049***	0.153***	-0.010	-0.025	-0.030	0.030
	(0.011)	(0.011)	(0.014)	(0.037)	(0.018)	(0.048)	(0.028)	(0.019)
Young × SM Retailer ×								
No Reported Wealth	-0.011	-0.020*	-0.033*	-0.093*	0.022	0.067	0.044	-0.024
	(0.010)	(0.012)	(0.019)	(0.051)	(0.021)	(0.058)	(0.035)	(0.019)
	[0.036]	[0.050]	[0.073]	[0.036]	[0.089]	[0.018]	[0.121]	[0.233]
Household Wealth Quartile = 1	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Household Wealth Quartile = 2	-0.011	-0.040***	-0.044**	-0.128**	0.021*	0.061*	0.034**	-0.017
	(0.009)	(0.015)	(0.018)	(0.050)	(0.013)	(0.037)	(0.017)	(0.014)
	[0.095]	[0.633]	[0.645]	[0.420]	[0.328]	[0.162]	[0.804]	[0.277]
Household Wealth Quartile = 3	-0.028**	-0.077***	-0.097***	-0.280***	0.026	0.095*	0.042	-0.024
	(0.011)	(0.016)	(0.020)	(0.053)	(0.023)	(0.052)	(0.026)	(0.025)
	[0.781]	[0.000]	[0.000]	[0.000]	[0.156]	[0.000]	[0.212]	[0.532]
Household Wealth Quartile = 4	-0.034**	-0.077***	-0.139***	-0.412***	0.036	0.140***	0.058**	-0.040*
	(0.017)	(0.027)	(0.014)	(0.052)	(0.022)	(0.051)	(0.026)	(0.024)
	[0.339]	[0.117]	[0.000]	[0.000]	[0.004]	[0.000]	[0.001]	[0.284]
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wealth Quartiles FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Individuals	87,246	87,246	87,246	87,246	87,246	87,246	87,246	87,246
R^2	0.077	0.155	0.130	0.129	0.191	0.214	0.172	0.225
Mean Dep. Var.	0.043	0.124	0.288	0.848	0.417	0.841	0.416	0.464
Std. Dev. Dep. Var.	0.202	0.330	0.453	1.360	0.493	1.136	0.493	0.499

Notes. This Table reports women's individual-level responses to industry-level exposure to sewing machines by income group. The unit of observation is an individual woman in 1880. The sample only includes women aged 5 to 25 when a retailer opened in their town, or born between 1840 and 1860 for women living in towns without a retailer. The baseline treatment is an interaction term between an indicator variable equal to one for towns with at least one retailer, an individual-specific indicator equal to one for women below 15 years old when the retailer opened, and zero otherwise. We then display the coefficients of additional interaction terms between the baseline treatment and the baseline household wealth quartiles (in 1860). The first quartile serves as the baseline category. The dependent variables in columns (1–3) are indicators that return a value of one if the woman is employed in a sewing machine-using industry (1) or if she is employed in manufacturing (2) or in any industry (3). In column (4), the dependent variable is the occupation-imputed income; in column (5), the outcome is an indicator variable that returns one for women with at least one child; in column (6), the outcome is the number of children; in column (7), the dependent variable is an indicator for married women; in column (8), the outcome is an indicator for women who never married. Each regression includes town, wealth quartile, birthplace, and race fixed effects. In addition, we include controls for literacy, urban status, an indicator for individuals that got married in the previous year, and an indicator for first- or second-generation migrants. Standard errors are clustered at the town level and are displayed in parentheses. In square brackets, we report the p-value of a test of joint significance of the baseline treatment and the wealth quartile-specific coefficients. Referenced on pages: 27, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.22. Difference-in-Differences Estimates: Geographic Spillovers of Industry Exposure to the Sewing Machine on Children

	Children per Woman (%)				Share of Children at School (%)				Share of Children at Work (%)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post × SM Industry Exposure (10 Km)	-8.780*				3.807				-8.890***			
	(4.672)				(2.941)				(2.036)			
Post × SM Industry Exposure (20 Km)		-1.927				3.856				-10.478***		
		(6.260)				(3.730)				(2.556)		
Post × SM Industry Exposure (30 Km)			3.975				5.654				-10.679***	
			(8.213)				(5.013)				(3.557)	
Post × SM Industry Exposure (40 Km)				22.575**				15.477**				-9.300*
				(10.567)				(6.405)				(4.927)
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Towns	302	302	302	302	302	302	302	302	302	302	302	302
Number of Observations	2,416	2,416	2,416	2,416	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114
R^2	0.845	0.844	0.844	0.845	0.453	0.453	0.453	0.454	0.500	0.500	0.500	0.499
Mean Dep. Var.	71.849	71.849	71.849	71.849	77.026	77.026	77.026	77.026	5.755	5.755	5.755	5.755
Std. Dev. Dep. Var.	22.232	22.232	22.232	22.232	10.037	10.037	10.037	10.037	9.588	9.588	9.588	9.588
Std. Beta Coef.	-0.043	-0.008	0.014	0.067	0.041	0.035	0.043	0.102	-0.101	-0.101	-0.085	-0.064

Notes. This Table reports the effect of exposure to sewing machines on children. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the number of children per woman (columns 1–4), the share of children attending school (columns 5–8), and the share of children at work (columns 9–12). Each coefficient reports the estimated treatment effects of a variable that codes an interaction term between the employment share of sewing-machine-using industries in 1850 and a post-1860 term. Across the different rows, we compute the employment share of sewing-machine-using industries over different areas: in the first row, we include all townships whose centroid lies within ten kilometers from the given township; in rows (2–4), we extend the area over which we compute the treatment to 20, 30, and 40 kilometers from the township's centroid. The various coefficients thus quantify the impact of the potential diffusion of the sewing machine in manufacturing industries beyond the township's borders. Each regression includes town and time-fixed effects. Standard errors are clustered at the town level and are reported in parentheses. Referenced on page: A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.23. Difference-in-Differences Estimates: Geographic Spillovers of Sewing Machine Retailer Exposure on Children

	Children per Woman (%)				Share of Children at School (%)				Share of Children at Work (%)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	10 Km	20 Km	30 Km	40 Km	10 Km	20 Km	30 Km	40 Km	10 Km	20 Km	30 Km	40 Km
Post × SM Retailer	-2.076	20.541***	9.512***	16.211***	13.012***	8.098	11.771	10.758	-6.479***	6.725**	12.389	12.826
	(4.050)	(6.112)	(3.555)	(5.864)	(3.125)	(9.083)	(9.152)	(8.238)	(1.835)	(3.110)	(9.307)	(9.582)
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Towns	302	302	302	302	302	302	302	302	302	302	302	302
Number of Observations	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718
Mean Dep. Var.	71.262	71.262	71.262	71.262	76.895	76.895	76.895	76.895	5.092	5.092	5.092	5.092
Std. Dev. Dep. Var.	20.870	20.870	20.870	20.870	9.808	9.808	9.808	9.808	6.837	6.837	6.837	6.837
Std. Beta Coef.	-0.099	0.984	0.456	0.777	1.327	0.826	1.200	1.097	-0.948	0.984	1.812	1.876

Notes. This Table reports the effect of exposure to sewing machines on women. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the number of children per woman (columns 1–4), the share of children attending school (columns 5–8), and the share of children at work (columns 9–12). Each coefficient reports the estimated treatment effect of a variable that takes the value 1 when at least one sewing machine retailer is observed within k kilometers of the township centroid, and 0 otherwise. Across the different columns, we compute the employment share of sewing-machine-using industries over different areas: in columns (1), (5), (9), and (13), we include all townships whose centroid lies within ten kilometers from the given township; in columns (2), (6), (10), and (14), we extend the area over which we compute the treatment to 20 kilometers from the township's centroid. The other columns follow the same pattern. The various coefficients thus quantify the impact of sewing machine retailers on areas beyond the township's borders. The estimates report average treatment effects obtained using the de Chaisemartin and d'Haultfœuille (2024) estimator. Each regression includes town and time-fixed effects. Standard errors are clustered at the town level and are reported in parentheses. Referenced on page: A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

Table C.24. Difference-in-Differences Estimates: Impact of Industry Exposure on Children, Alternative Treatment Definitions

	Children per Woman (%)			Share of Children at School (%)			Share of Children at Work (%)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post × Exposure to SM (1850)	-12.278***			3.777*			-5.718***		
	(2.849)			(2.131)			(1.218)		
Post × Exposure to SM (1870)		-14.982***			2.724			-6.480***	
		(3.363)			(2.363)			(1.469)	
Post × Exposure to SM (Broad)			-7.282*			7.112***			-0.975
			(3.957)			(2.510)			(1.861)
Town FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Towns	302	302	302	302	302	302	302	302	302
Number of Observations	2,416	2,416	2,416	2,114	2,114	2,114	2,114	2,114	2,114
R^2	0.875	0.875	0.874	0.448	0.448	0.449	0.628	0.627	0.625
Mean Dep. Var.	71.262	71.262	71.262	76.895	76.895	76.895	5.092	5.092	5.092
Std. Dev. Dep. Var.	20.870	20.870	20.870	9.808	9.808	9.808	6.837	6.837	6.837
Std. Beta Coef.	-0.081	-0.081	-0.044	0.052	0.031	0.090	-0.113	-0.106	-0.018

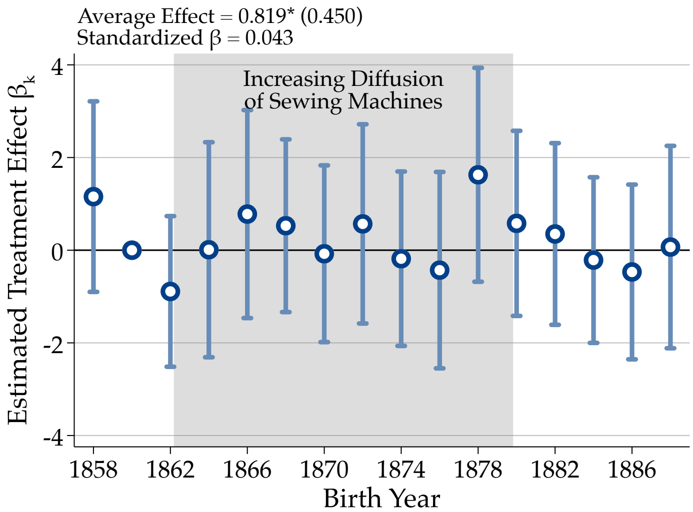
Notes. This Table reports the effect of exposure to sewing machines on children. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the number of children per woman (columns 1–3), the share of children attending school (columns 4–6), and the share of children working (columns 7–9). Each coefficient reports the estimated treatment effects of a variable that codes an interaction term between the employment share of sewing-machine-using industries and a post term. The first two rows report the estimated treatment effect when measuring the employment share of sewing-machine-using industries in the three pre-treatment census years (1850 and 1870). The baseline year we employ in the analysis is 1860. In the last row, we adopt a broader definition of sewing-machine-using industries that comprises, on top of the baseline definition, "Knitting mills," "Dyeing and finishing textiles, except knit goods," "Carpets, rugs, and other floor coverings," "Yarn, thread, and fabric mills," "Miscellaneous textile mill products," and "Printing, publishing, and allied industries." Each regression includes town and time-fixed effects. Standard errors are clustered at the town level and are reported in parentheses. Referenced on pages: A3, A6.

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$

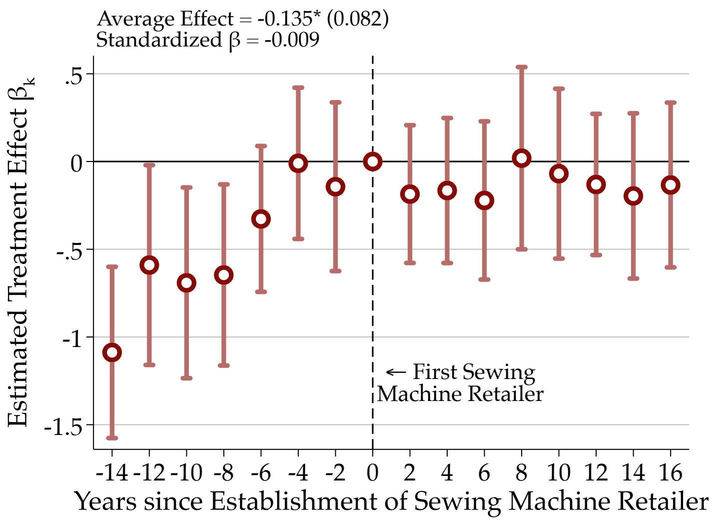
D Additional Figures

Figure D.1. Sewing Machine Exposure and Crude Infant Mortality Rate

(a) Industry Exposure to Sewing Machines

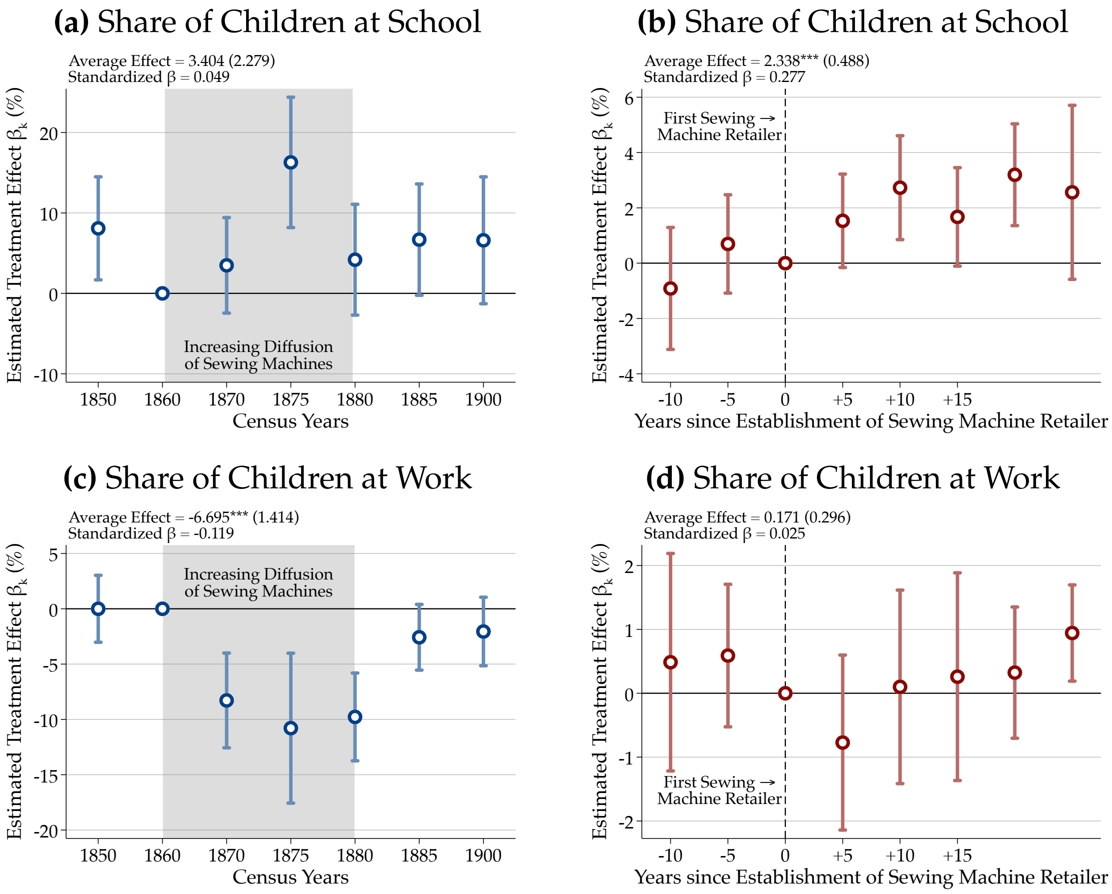


(b) Presence of Sewing Machine Retailer



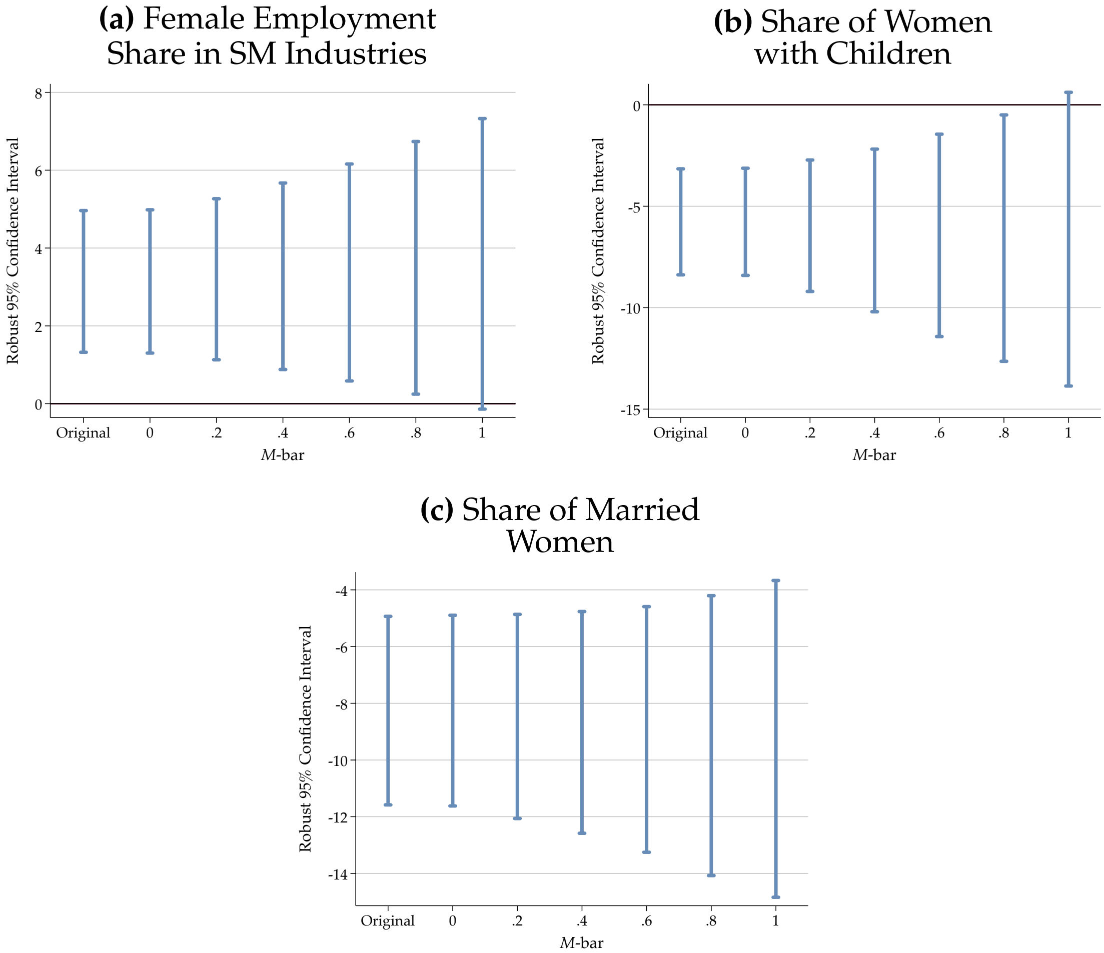
Notes. These Figures report the estimated dynamic treatment effect of industry exposure to sewing machines and the presence of sewing machine retailers on the child mortality rate, i.e., the number of dead children aged 0 to 5 over the number of children in the same age range. The unit of observation is: in Panel D.1a, a township at a yearly frequency between 1858 and 1888; in Panel D.1b, a township at a yearly frequency over a 10-year window around the time when the sewing machine retailer opened. Each dot displays the coefficient of an interaction term between year dummies and the employment share of industries exposed to sewing machines (in Panel D.1a) and a dummy that codes the number of years since the sewing machine retailer opened (Panel D.1b). The regression includes town and cohort fixed effects. Standard errors are clustered at the town level; the bands report 95% confidence intervals. Cohorts are grouped in two-year windows. Estimates in Panel D.1b are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Referenced on pages: 22, A6.

Figure D.2. Exposure to Sewing Machines, Child Labor and School Attendance



Notes. These Figures report the estimated dynamic treatment effect of industry exposure to sewing machines and the presence of sewing machine retailers on children's outcomes. The unit of observation is a township observed at census frequency between 1850 and 1900; not all outcomes are available in all censuses. In Panel D.2a–D.2b, the dependent variable is the share children attending school; in Panel D.2c–D.2d, the outcome variable is the share of working children. Each dot displays the coefficient of an interaction term between year dummies and the employment share of industries exposed to sewing machines (Panels D.2a, and D.2c) and years since the first period when a sewing machine retailer is established in the town (Panels D.2b, and D.2d). All outcomes are expressed in percentage terms. Regressions include town and time fixed effects. Estimates in Panels D.2b and D.2d are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Standard errors are clustered at the town level; the bands report 95% confidence intervals. Referenced on page: 23.

Figure D.3. Robustness of Parallel Trends Assumption: Industry Exposure to Sewing Machine, Women



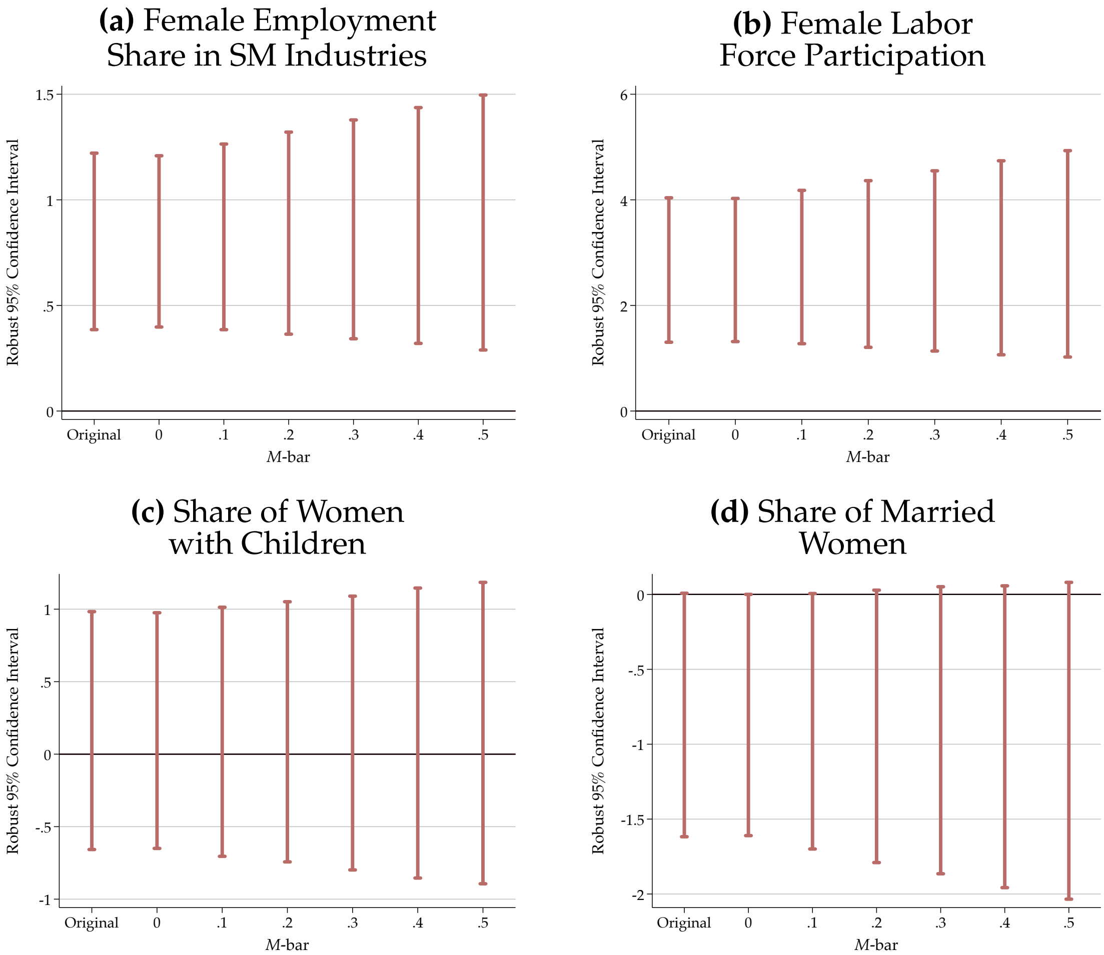
(a) Female Employment Share in SM Industries

(b) Share of Women with Children

(c) Share of Married Women

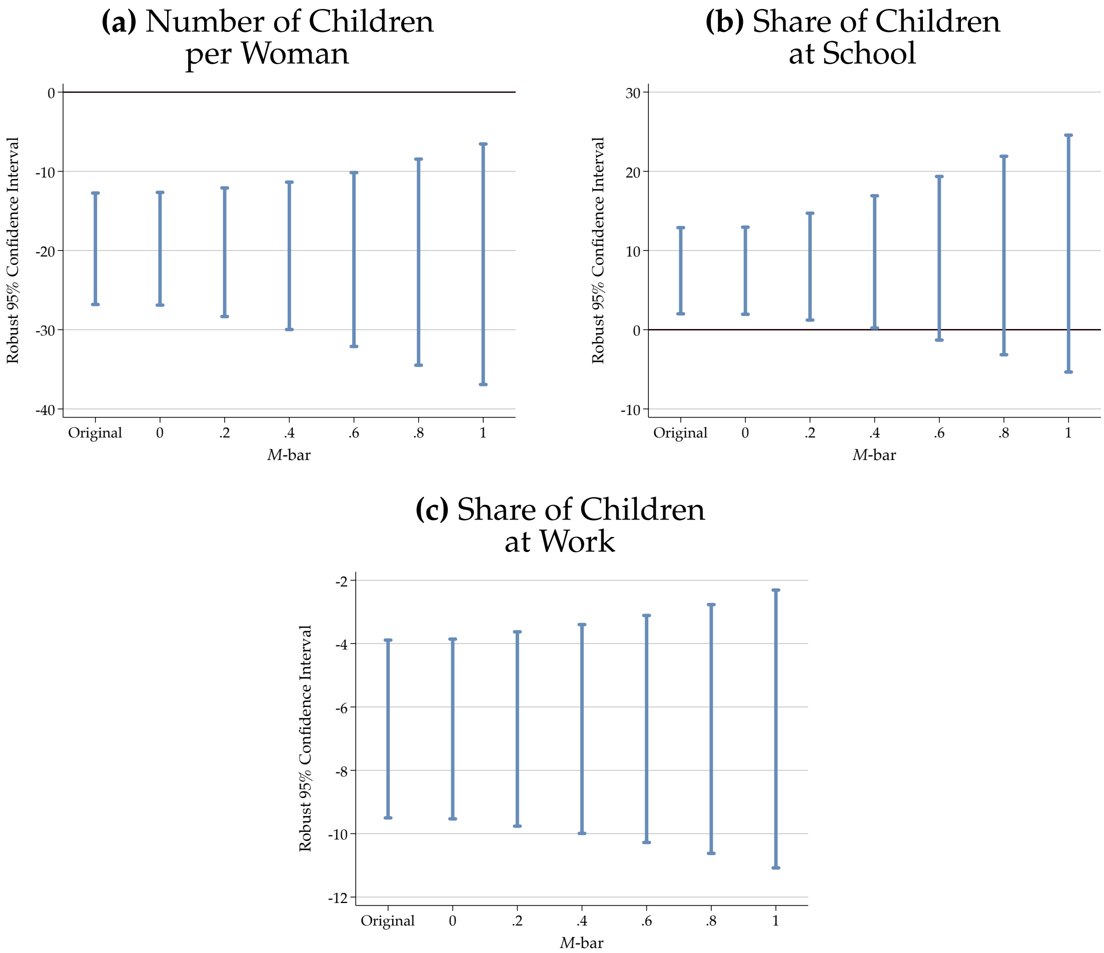
Notes. This Figure presents alternative confidence intervals for the effect of industry exposure to the sewing machine on the share of women employed in a sewing-machine-using industry (Panel D.3a), the share of women with at least one child (Panel D.3b), and the share of married women (Panel D.3c). The bands report 95% robust confidence intervals constructed following the method developed by Rambachan and Roth (2023). The unit of observation is a township observed at census frequency between 1850 and 1900. The treatment variable is an interaction term between the employment share of sewing machine-using industries and year dummies relative to the 1860 baseline. Each regression includes town and time fixed effects. Referenced on pages: 24, A6.

Figure D.4. Robustness of Parallel Trends Assumption: Exposure to Sewing Machine Retailers, Women



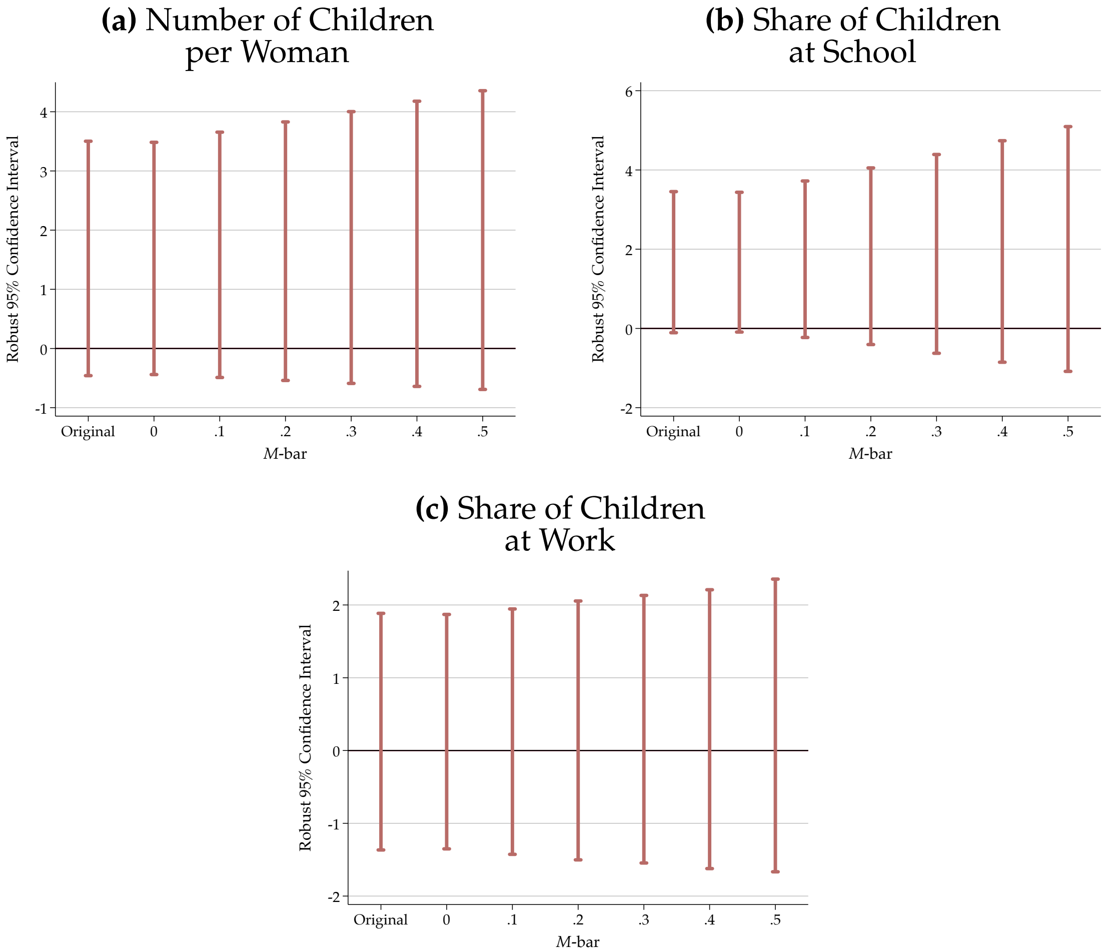
Notes. This Figure presents alternative confidence intervals for the effect of exposure to sewing machine retailers on the share of women employed in a sewing-machine-using industry (Panel D.3a), the share of women in the labor market (Panel D.4b), the share of women with at least one child (Panel D.4c), and the share of married women (Panel D.4c). The bands report 95% robust confidence intervals constructed following the method developed by Rambachan and Roth (2023). The unit of observation is a township observed at census frequency between 1850 and 1900. The treatment is an indicator variable that returns a value of one after at least one retailer of sewing machines is observed in the given township and zero otherwise. Estimates are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Each regression includes town and time fixed effects. Referenced on pages: 24, A6.

Figure D.5. Robustness of Parallel Trends Assumption: Industry Exposure to Sewing Machine, Children



Notes. This Figure presents alternative confidence intervals for the effect of industry exposure to the sewing machine on the number of children per woman (Panel D.5a), the share of children at school (Panel D.5b), and the share of children at work (Panel D.5c). The bands report 95% robust confidence intervals constructed following the method developed by Rambachan and Roth (2023). The unit of observation is a township observed at census frequency between 1850 and 1900. The treatment variable is an interaction term between the employment share of sewing machine-using industries and year dummies relative to the 1860 baseline. Each regression includes town and time fixed effects. Referenced on page: A6.

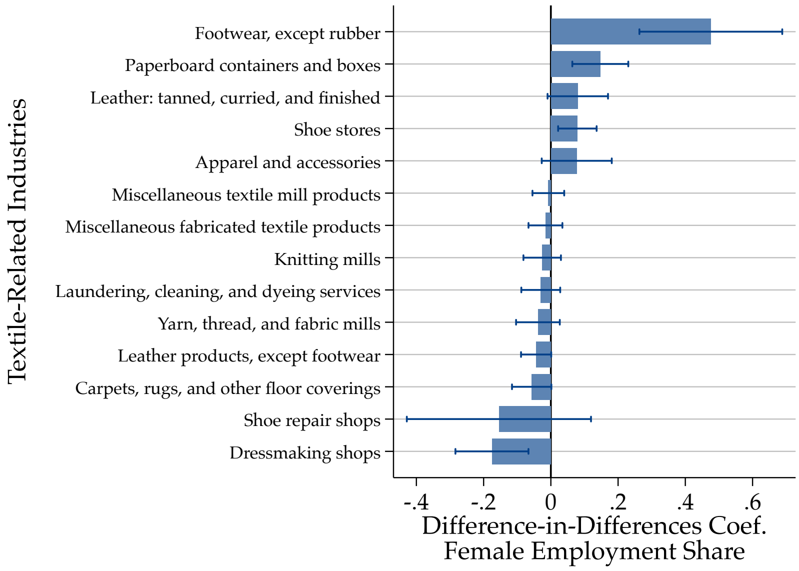
Figure D.6. Robustness of Parallel Trends Assumption: Exposure to Sewing Machine Retailers, Children



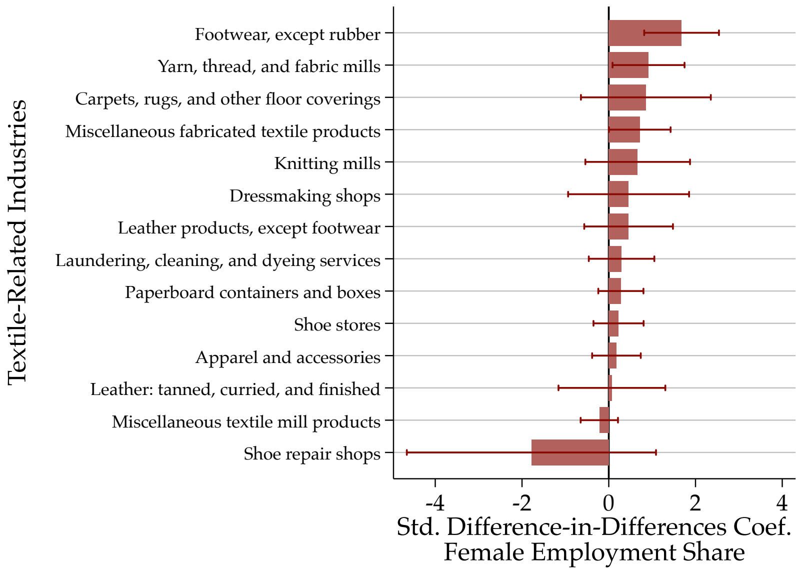
Notes. This Figure presents alternative confidence intervals for the effect of exposure to sewing machine retailers on the number of children per woman (Panel D.6a), the share of children at school (Panel D.6b), and the share of children at work (Panel D.6c). The bands report 95% robust confidence intervals constructed following the method developed by Rambachan and Roth (2023). The unit of observation is a township observed at census frequency between 1850 and 1900. The treatment is an indicator variable that returns a value of one after at least one retailer of sewing machines is observed in the given township and zero otherwise. Estimates are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Each regression includes town and time fixed effects. Referenced on page: A6.

Figure D.7. Employment Effects of the Sewing Machine at the Industry Level: Textile, Apparel, and Leather Industries

(a) Exposure to Sewing Machines in Manufacturing

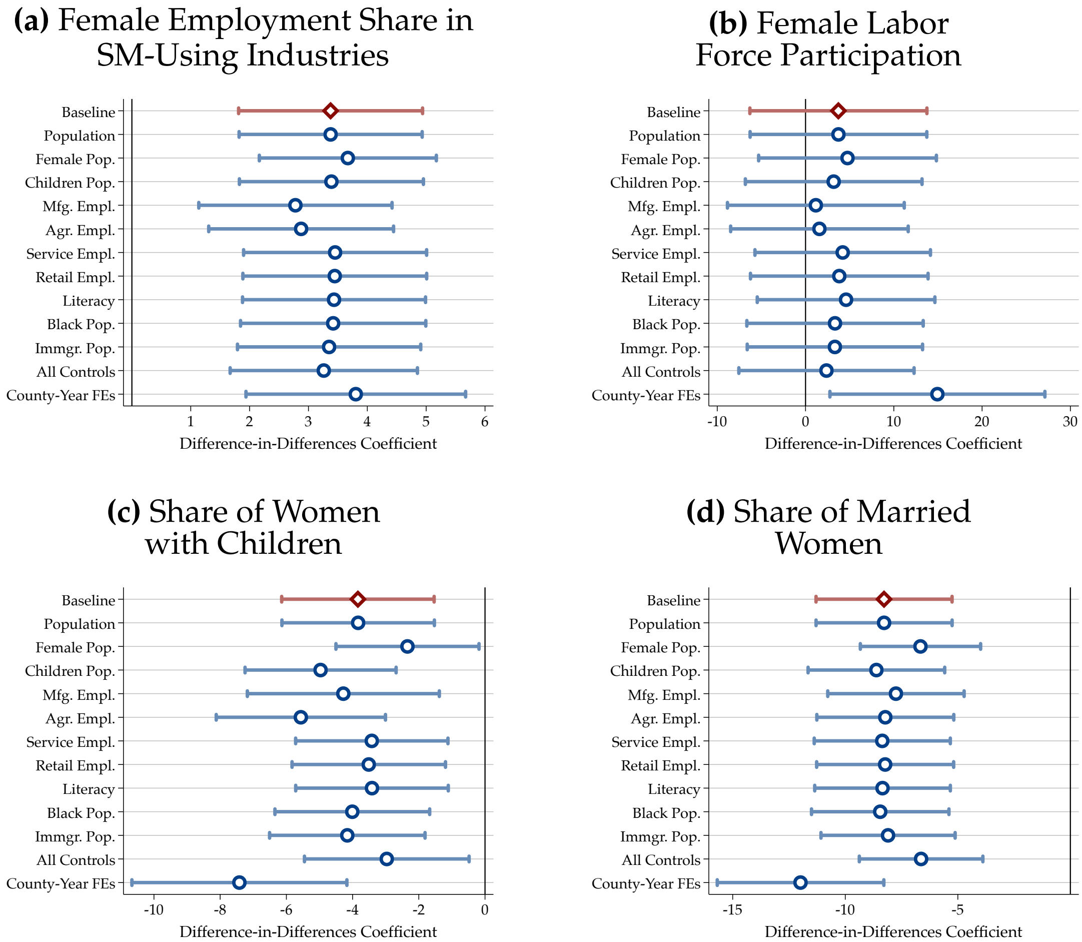


(b) Exposure to Sewing Machines Retailers



Notes. This Figure reports the effect of industry exposure to the sewing machine (Panel D.7a) and exposure to sewing machine retailers (Panel D.7b) on female labor force participation in sectors exposed to the sewing machine in the textile, apparel, and leather industries. The unit of observation is a township observed at census frequency between 1850 and 1900. Each bar reports the estimated treatment effect for one regression where the dependent variable is the women's employment share in one sector relative to the overall female working-age population. The treatment is either an interaction term between the employment share in sewing-machine-using industries in 1860 and a post-1860 indicator variable that returns a value of one after at least one retailer of sewing machines is observed in the given township and zero otherwise. Each regression includes town and time fixed effects. Estimates in Panel D.7b are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Standard errors are clustered at the town level. Bands report 95% confidence levels. Referenced on pages: 21, A6.

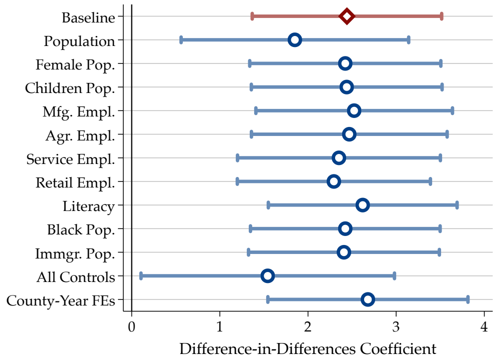
Figure D.8. Horserace Regressions: Industry Exposure to the Sewing Machines and Women



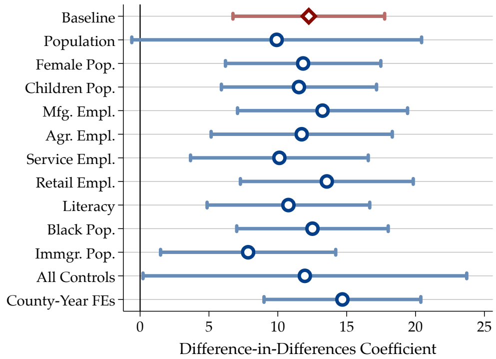
Notes. This Figure reports the effect of exposure to sewing machines on women. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the share of women working in sewing-machine-using industries (Panel D.8a), the share of women working (Panel D.8b), the share of women with at least one child (Panel D.8c), and the share of married women (Panel D.8d). In each panel, the red dot reports the baseline coefficient of an interaction term between the employment share in sewing-machine-using industries in 1860 and a post-1860 indicator; each blue dot reports the difference-in-difference coefficient when controlling for the displayed variable measured in 1850 and interacted with time dummies; the one-but-last coefficient displays the treatment effect when we include all the controls shown above at the same time in the estimating equation. Each regression includes town and time fixed effects; in the last regression of each panel, we replace year with county-year fixed effects. The red square reports the estimates obtained in the baseline specification. Standard errors are clustered at the town level; bands report 95% confidence intervals. Referenced on pages: 23, A6.

Figure D.9. Horserace Regressions: Exposure to Sewing Machine Retailers and Women

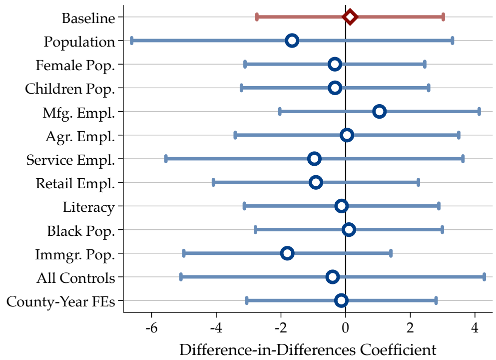
(a) Female Employment Share in SM-Using Industries



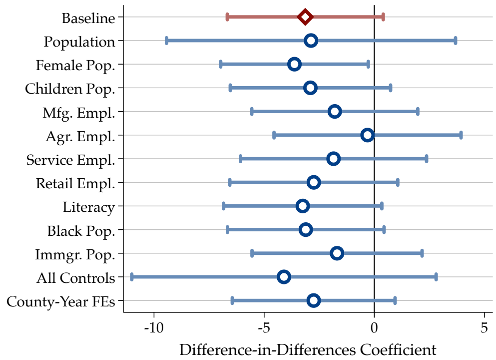
(b) Female Labor Force Participation



(c) Share of Women with Children

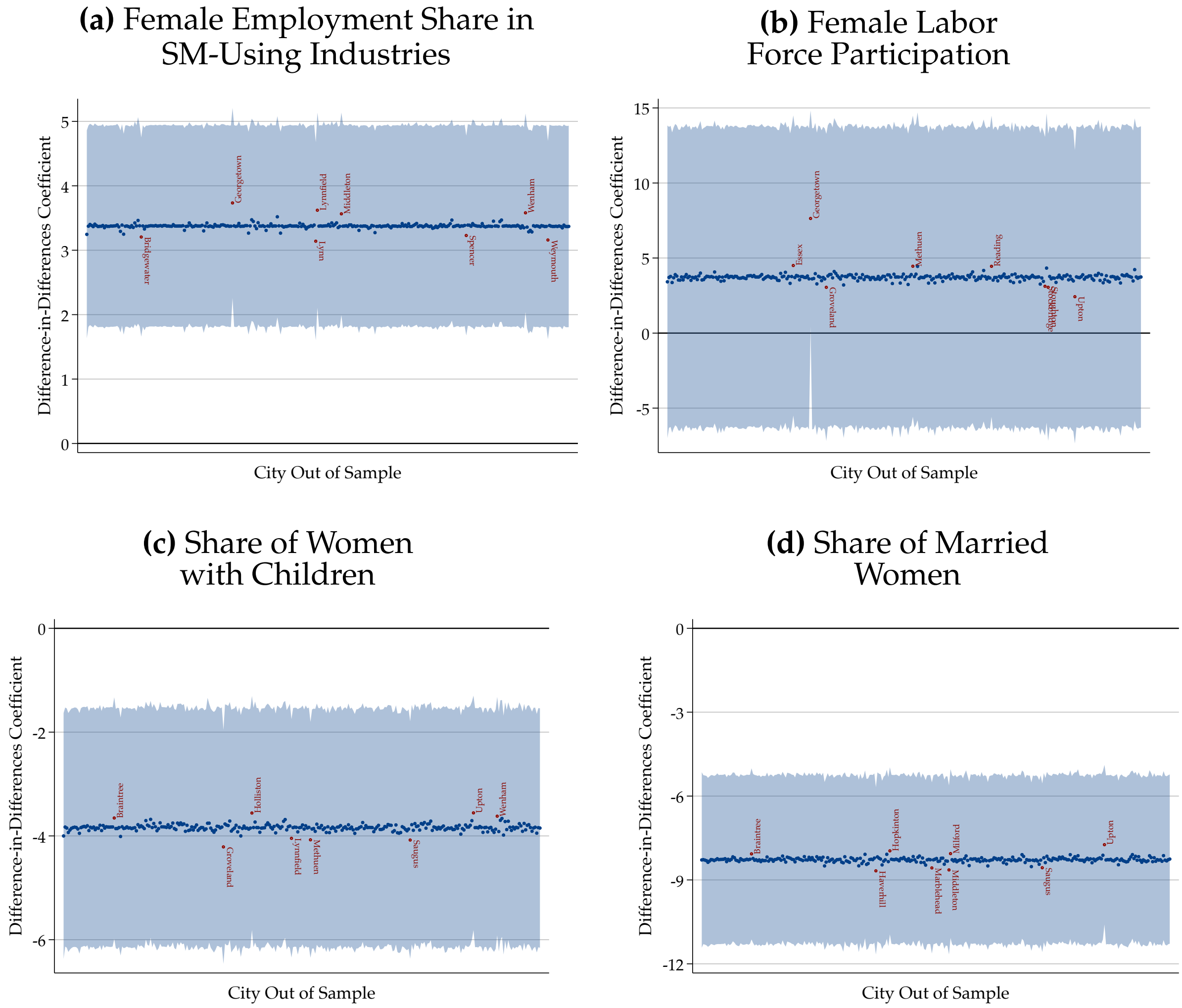


(d) Share of Married Women



Notes. This Figure reports the effect of exposure to sewing machines on women. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the share of women working in sewing-machine-using industries (Panel D.9a), the share of working women (Panel D.9b), the share of women with at least one child (Panel D.9c), and the share of married women (Panel D.9d). In each panel, the red dot reports the baseline coefficient of a variable equal to one for towns with at least one retailer after the retailer opened and zero otherwise; each blue dot reports the difference-in-difference coefficient when controlling for the displayed variable measured in 1850 and interacted with time; the one-but-last coefficient displays the treatment effect when we include all the controls shown above at the same time in the estimating equation. Each regression includes town and year fixed effects; in the last regression of each panel, we replace year with county-year fixed effects. Estimates are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). The red square reports the estimates obtained in the baseline specification. Standard errors are clustered at the town level; bands report 95% confidence intervals. Referenced on pages: 23, A6.

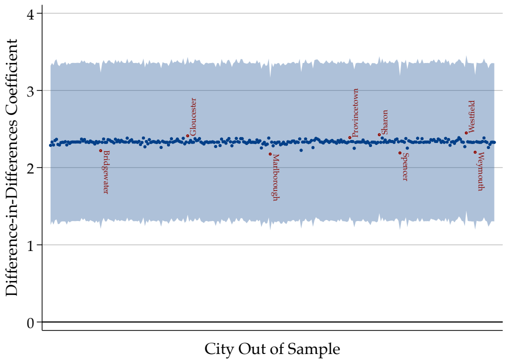
Figure D.10. Leaveout Regressions: Industry Exposure to the Sewing Machines and Women



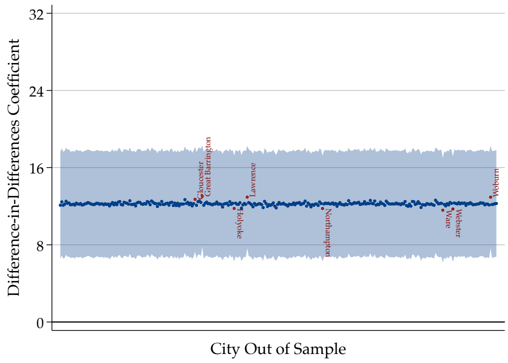
Notes. This Figure reports the effect of exposure to sewing machines on women. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the share of women working in sewing-machine-using industries (Panel D.10a), the share of working women (Panel D.10b), the share of women with at least one child (Panel D.10c), and the share of married women (Panel D.10d). Each panel displays the treatment effect dropping one city at a time from the estimation sample; the red dots highlight cities that, when excluded from the sample, yield treatment effects in the top and bottom 1% of the distribution. The treatment effect is the coefficient of an interaction term between the employment share in sewing-machine-using industries in 1860 and a post-1860 indicator. Each regression includes town and time fixed effects. Standard errors are clustered at the town level; bands report 95% confidence intervals. Referenced on pages: 24, A6.

Figure D.11. Leaveout Regressions: Exposure to Sewing Machine Retailers and Women

(a) Female Employment Share in SM-Using Industries

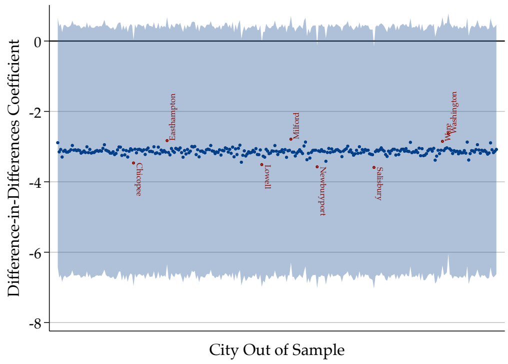


(b) Female Labor Force Participation



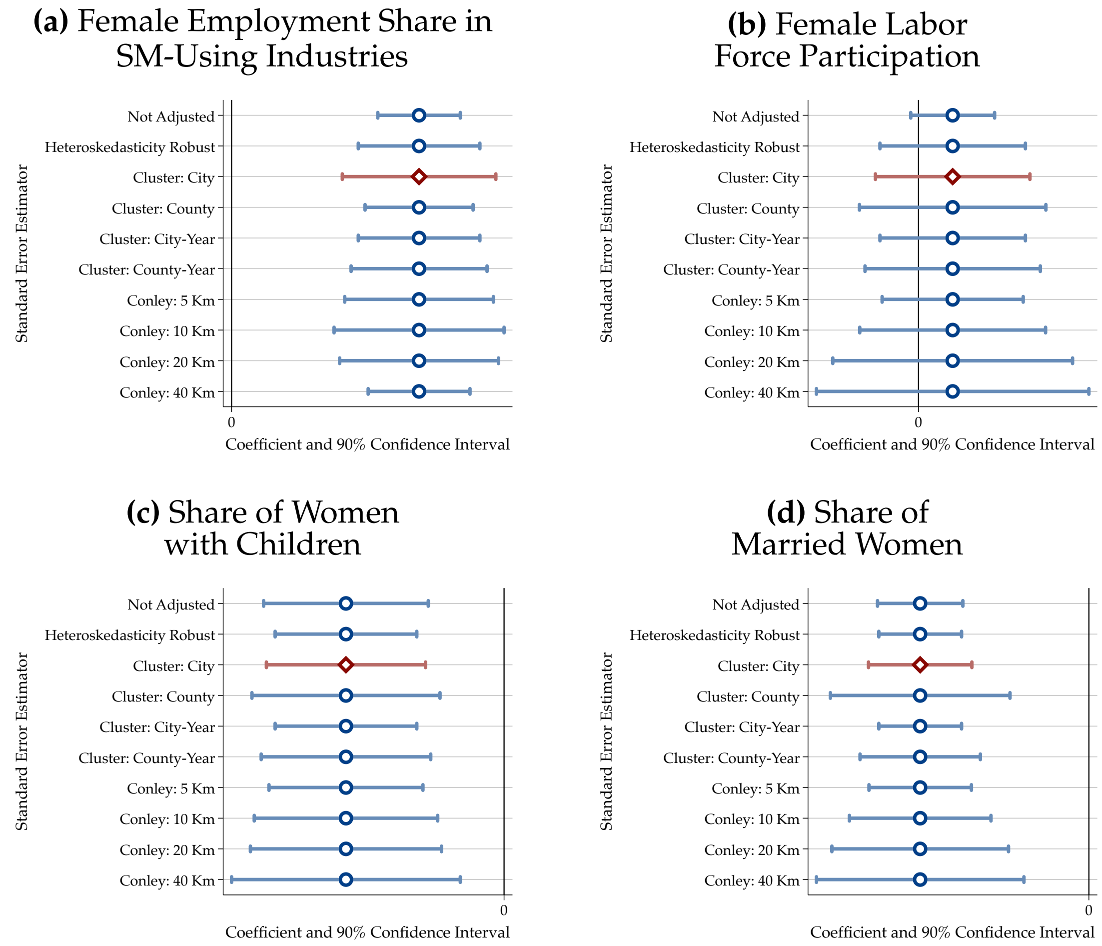
(c) Share of Women with Children

(d) Share of Married Women



Notes. This Figure reports the effect of exposure to sewing machines on women. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the share of women working in sewing-machine-using industries (Panel D.11a), the share of working women (Panel D.11b), the share of women with at least one child (Panel D.11c), and the share of married women (Panel D.11d). Each panel displays the treatment effect dropping one city at a time from the estimation sample; the red dots highlight cities that, when excluded from the sample, yield treatment effects in the top and bottom 1% of the distribution. The treatment effect is the baseline coefficient of a variable equal to one for towns with at least one retailer after the retailer opened and zero otherwise. Each regression includes town and time fixed effects. Estimates are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Standard errors are clustered at the town level; bands report 95% confidence intervals. Referenced on pages: 24, A6.

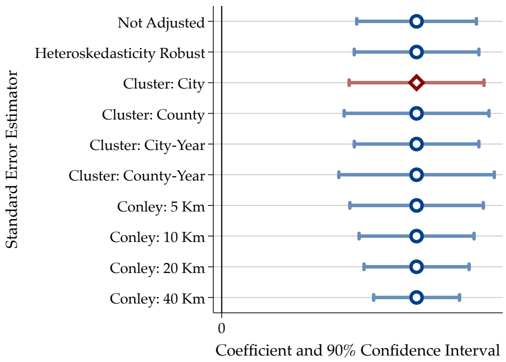
Figure D.12. Effect of Industry Exposure to the Sewing Machine on Women: Alternative Standard Errors



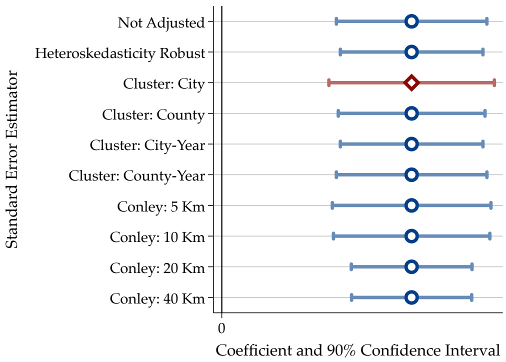
Notes. This Figure reports the effect of exposure to sewing machines on women. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the share of women working in sewing-machine-using industries (Panel D.12a), the share of working women (Panel D.12b), the share of women with at least one child (Panel D.12c), and the share of married women (Panel D.12d). Each dot reports the estimated treatment effect where the treatment is an interaction term between a post-1870 indicator variable and the employment share of sewing machine-using industries. Each regression includes town and time fixed effects. We report various estimators for the standard errors: no adjustment, White (heteroskedasticity-robust), clustered by city, county, city-by-year, and county-by-year, and correcting for spatial autocorrelation at various thresholds following Conley (1999) and implemented through the method of Colella et al. (2023). The red square reports the estimates obtained in the baseline specification. Referenced on pages: 24, A6.

Figure D.13. Effect of Exposure to Sewing Machine Retailers on Women: Alternative Standard Errors

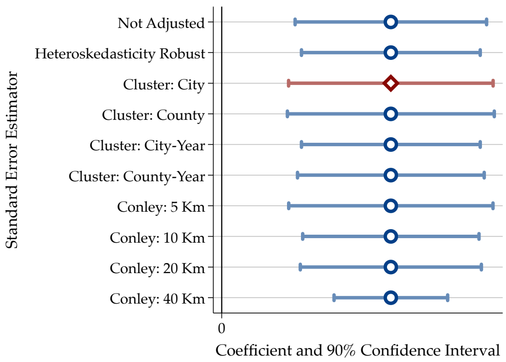
(a) Female Employment Share in SM-Using Industries



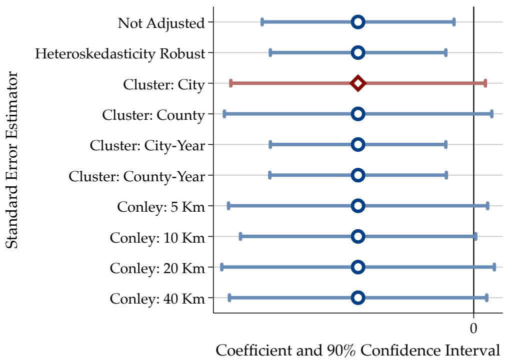
(b) Female Labor Force Participation



(c) Share of Women with Children



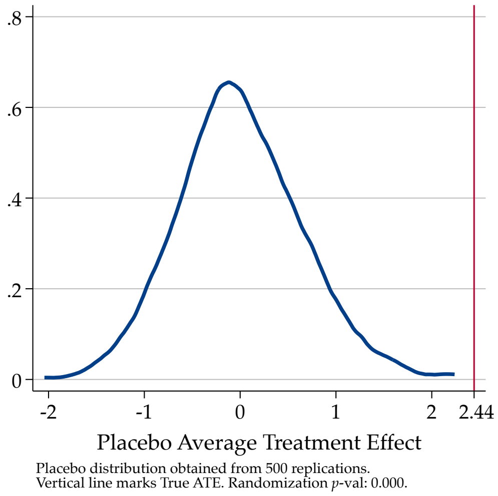
(d) Share of Married Women



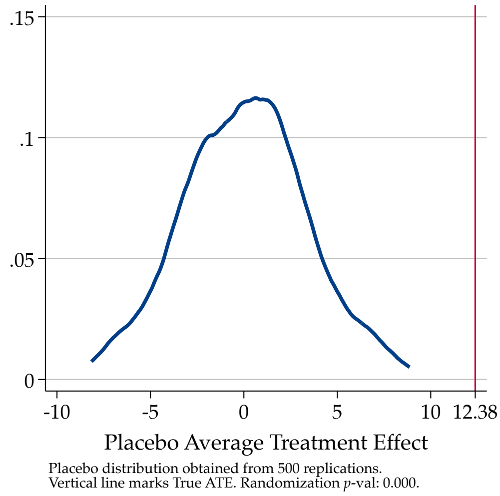
Notes. This Figure reports the effect of exposure to sewing machines on women. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the share of women working in sewing-machine-using industries (Panel D.13a), the share of working women (Panel D.13b), the share of women with at least one child (Panel D.13c), and the share of married women (Panel D.13d). Each dot reports the estimated treatment effect, where treatment is an indicator variable that returns a value of one after at least one retailer of sewing machines is observed in the given township and zero otherwise. Each regression includes town and time fixed effects. We report various estimators for the standard errors: no adjustment, White (heteroskedasticity-robust), clustered by city, county, city-by-year, and county-by-year, and correcting for spatial autocorrelation at various thresholds following Conley (1999) and implemented through the method of Colella et al. (2023). The red square reports the estimates obtained in the baseline specification. Referenced on pages: 24, A6.

Figure D.14. Randomization Treatment Effect Distribution of Retailer Exposure on Women

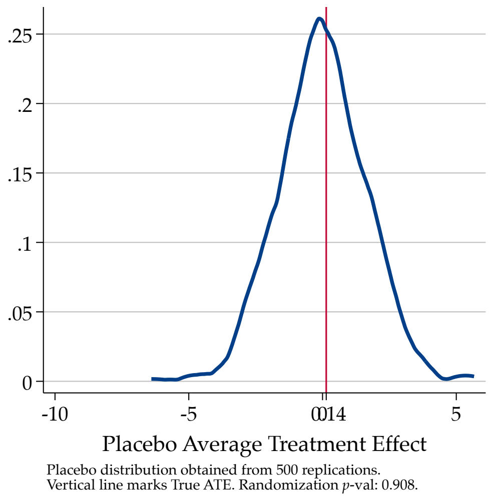
(a) Female Employment Share in SM-Using Industries



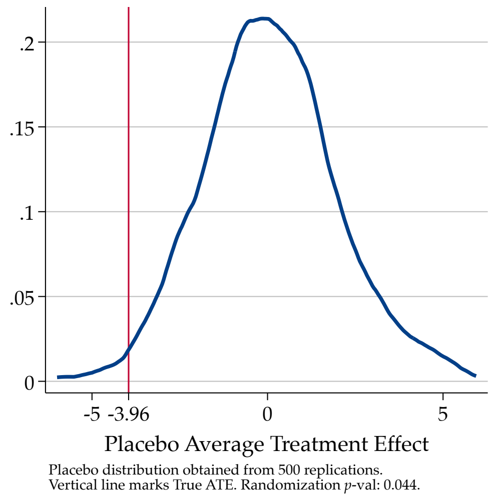
(b) Female Labor Force Participation



(c) Share of Women with Children



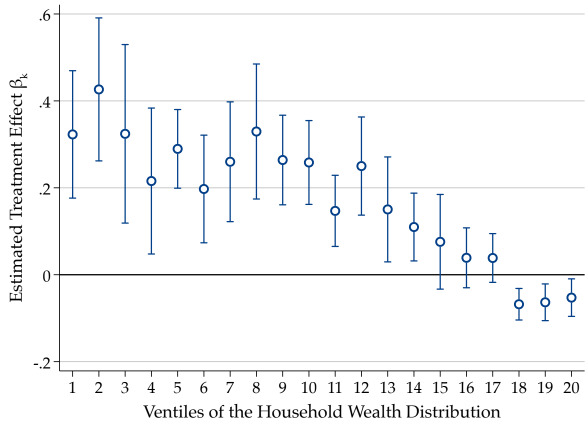
(d) Share of Married Women



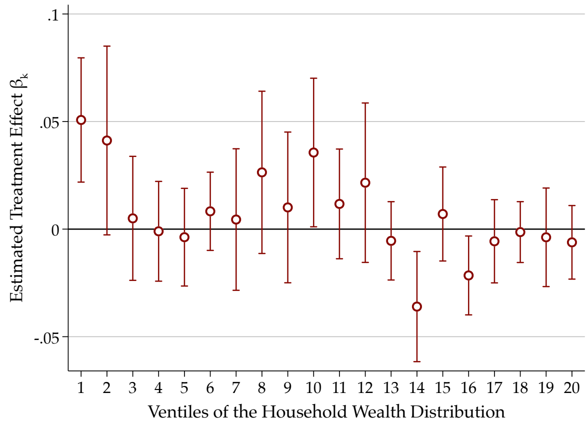
Notes. This Figure reports the effect of exposure to sewing machines on women. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the share of women working in sewing-machine-using industries (Panel D.14a), the share of working women (Panel D.14b), the share of women with at least one child (Panel D.14c), and the share of married women (Panel D.14d). Each regression includes town and time fixed effects. The blue line displays the randomization-inference distribution of the difference-in-differences estimate, constructed by randomly reshuffling treatment timing across cities. The red line reports the baseline estimate. In each panel, we report the randomization p-value, which corresponds to the share of placebo estimates that are at least as large in absolute value as the estimate obtained using the true treatment timing. Estimates are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Referenced on pages: 24, A6.

Figure D.15. Distribution of Individual ATE Across the Wealth Distribution

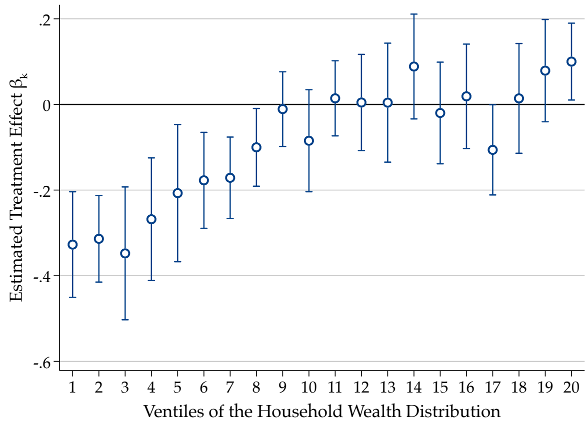
(a) Industry Exposure, SM Employment



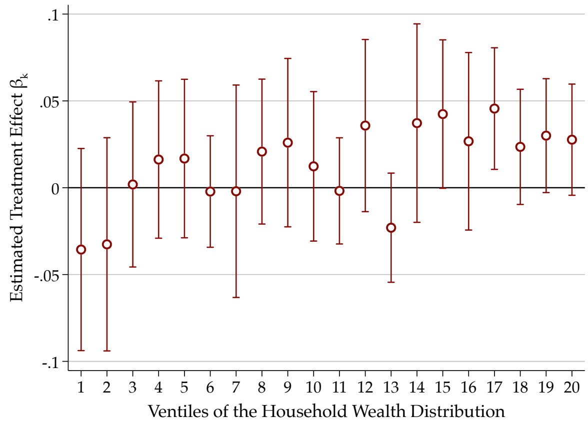
(b) Retailer Exposure, SM Employment



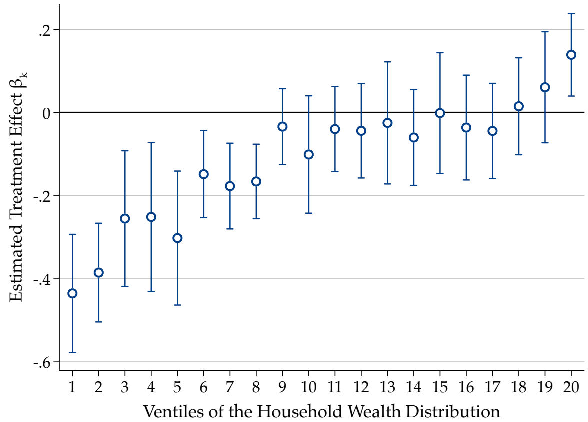
(c) Industry Exposure, Has Children



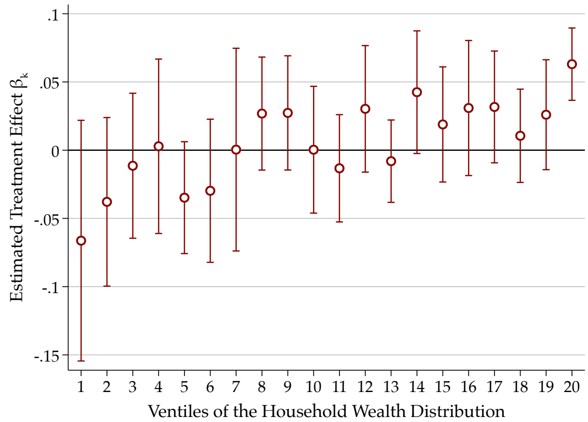
(d) Retailer Exposure, Has Children



(e) Industry Exposure, Married

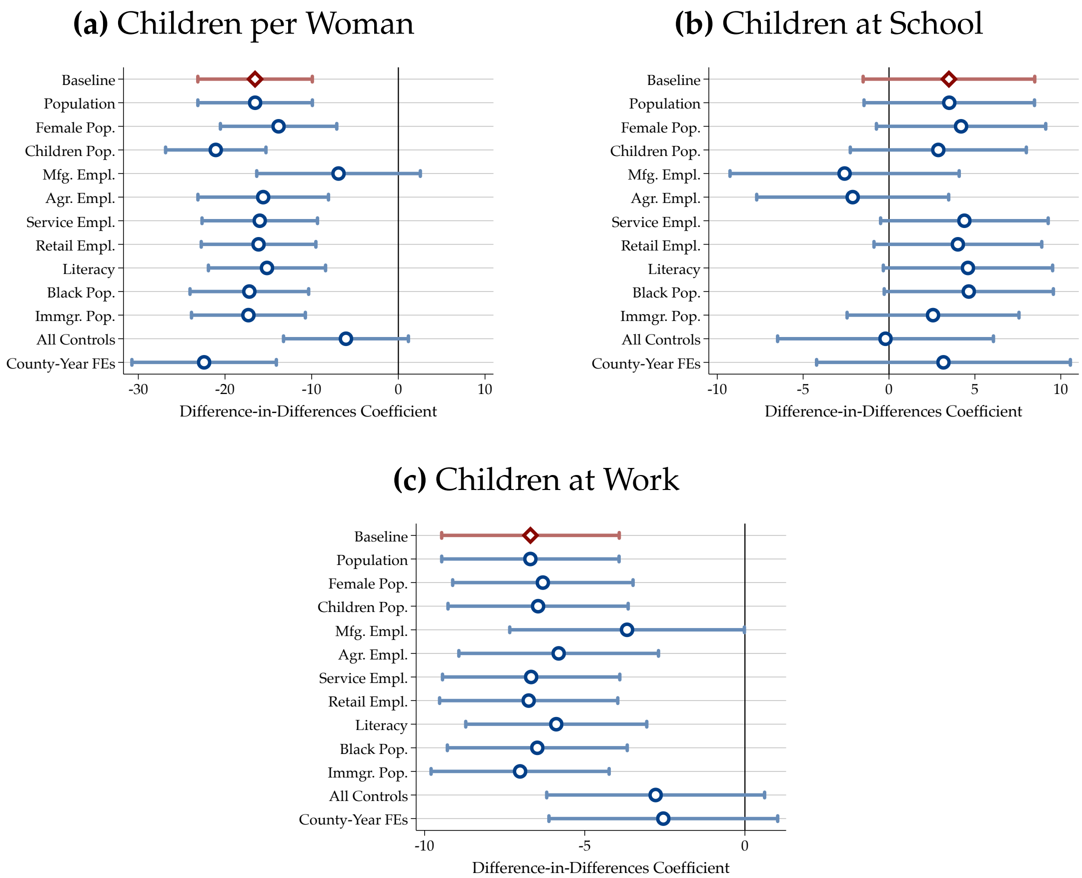


(f) Retailer Exposure, Married



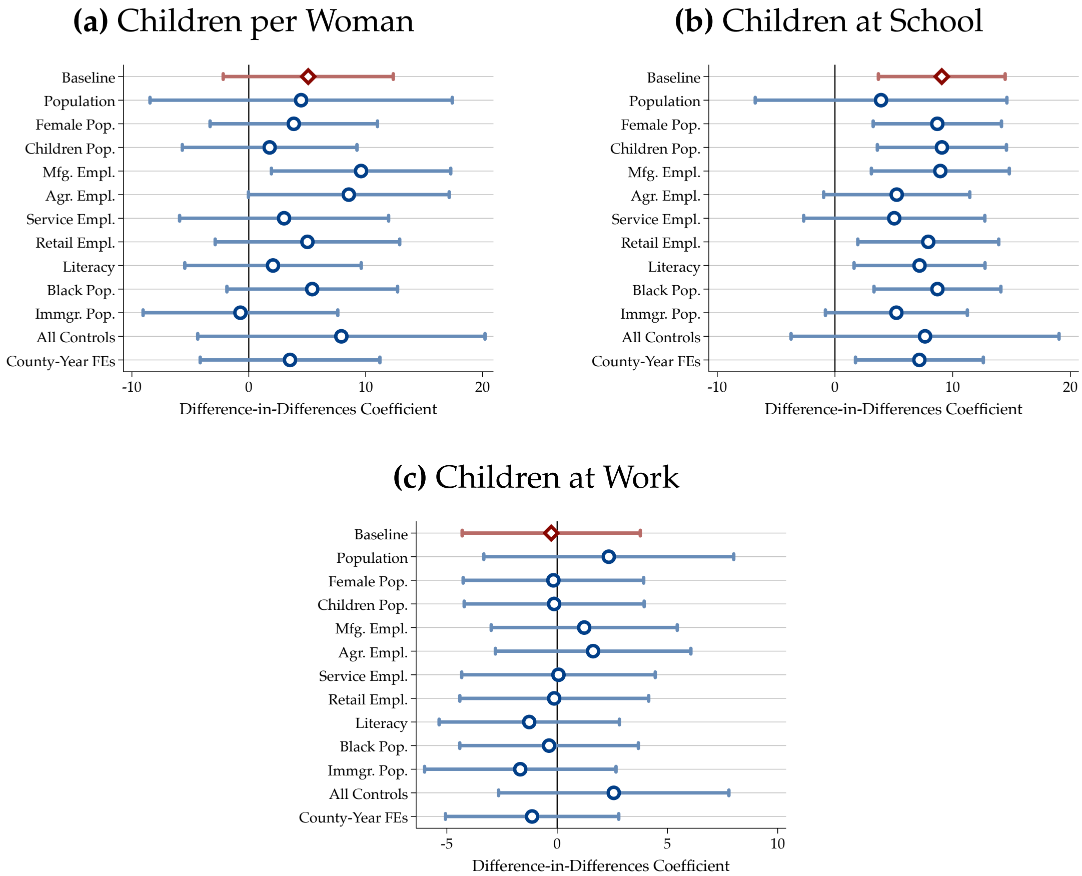
Notes. This Figure reports the distribution of the average treatment effects estimated through equation (4), for Panels D.15a, D.15c, and D.15e, and (5), for Panels D.15b, D.15d, and D.15f, except that we substitute wealth quartiles with ventiles for increased granularity. Referenced on pages: 27, A6.

Figure D.16. Horserace Regressions: Industry Exposure to the Sewing Machines and Children



Notes. This Figure reports the effect of exposure to sewing machines on children. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the number of children per woman (Panel D.16a), the share of children at school (Panel D.16b), and the share of children at work (Panel D.16c). In each panel, the red dot reports the baseline coefficient of an interaction term between the employment share in sewing-machine-using industries in 1860 and a post-1860 indicator; each blue dot reports the difference-in-differences coefficient, controlling for the displayed variable measured in 1850 and interacted with time dummies. Each regression includes town and time fixed effects; the one-but-last coefficient shows the treatment effect when we include all the controls shown above simultaneously in the estimating equation. Each regression includes town and year fixed effects; in the last regression of each panel, we replace year with county-year fixed effects. Standard errors are clustered at the town level; bands report 95% confidence intervals. Referenced on page: A6.

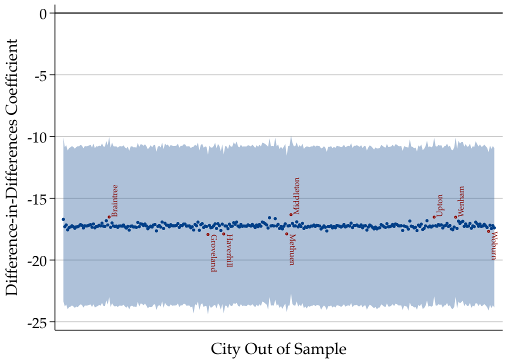
Figure D.17. Horserace Regressions: Exposure to Sewing Machines Retailers and Children



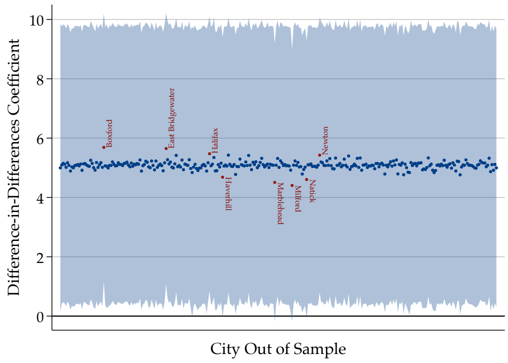
Notes. This Figure reports the effect of exposure to sewing machines on children. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the number of children per woman (Panel D.17a), the share of children at school (Panel D.17b), and the share of children at work (Panel D.17c). In each panel, the red dot reports the baseline coefficient of a variable equal to one for towns with at least one retailer after the retailer opened and zero otherwise; each blue dot reports the difference-in-difference coefficient when controlling for the displayed variable measured in 1850 and interacted with time dummies. Each regression includes town and time fixed effects; the one-but-last coefficient shows the treatment effect when we include all the controls shown above simultaneously in the estimating equation. Each regression includes town and year fixed effects; in the last regression of each panel, we replace year with county-year fixed effects. Estimates are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Standard errors are clustered at the town level; bands report 95% confidence intervals. Referenced on page: A6.

Figure D.18. Leaveout Regressions: Industry Exposure to the Sewing Machines and Children

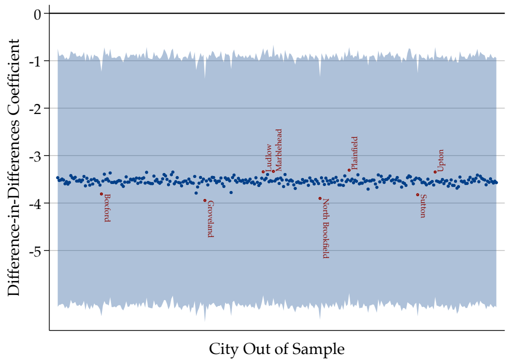
(a) Children per Woman



(b) Children at School



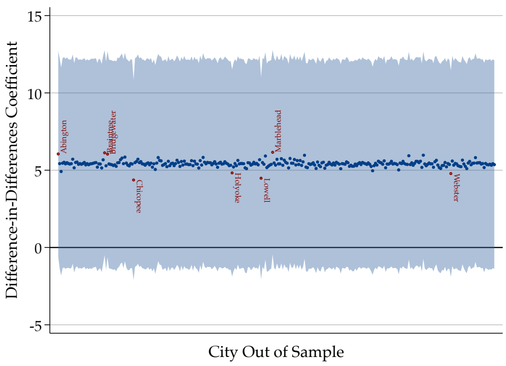
(c) Children at Work



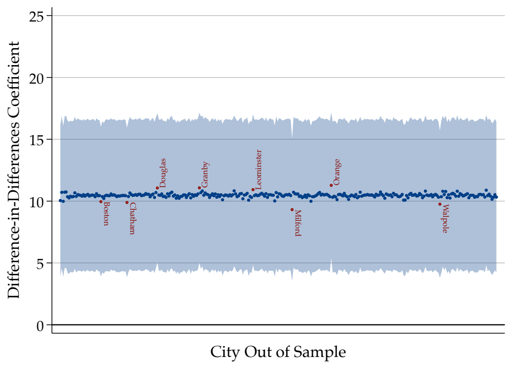
Notes. This Figure reports the effect of exposure to sewing machines on children. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the number of children per woman (Panel D.18a), the share of children at school (Panel D.18b), and the share of children at work (Panel D.18c). Each panel displays the treatment effect dropping one city at a time from the estimation sample; the red dots highlight cities that, when excluded from the sample, yield treatment effects in the top and bottom 1% of the distribution. The treatment effect is the coefficient on the interaction term between the 1860 employment share in sewing-machine-using industries and a post-1860 indicator. Each regression includes town and time fixed effects. Standard errors are clustered at the town level; bands report 95% confidence intervals. Referenced on page: A6.

Figure D.19. Leaveout Regressions: Exposure to Sewing Machines Retailers and Children

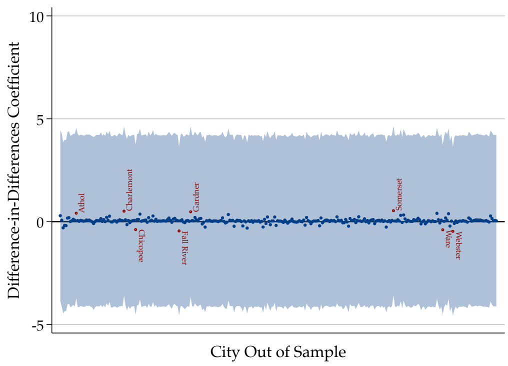
(a) Children per Woman



(b) Children at School



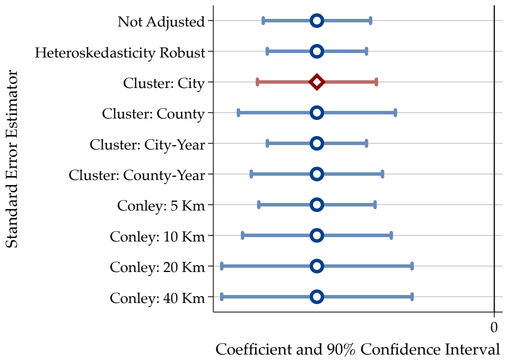
(c) Children at Work



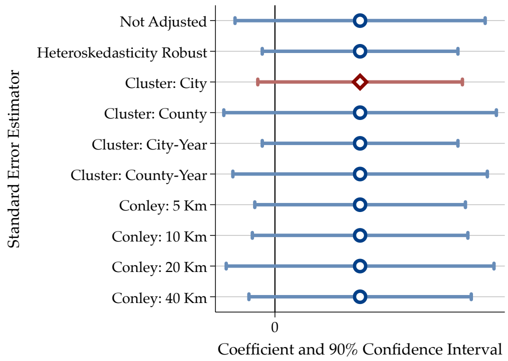
Notes. This Figure reports the effect of exposure to sewing machines on children. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the number of children per woman (Panel D.19a), the share of children at school (Panel D.19b), and the share of children at work (Panel D.19c). Each panel displays the treatment effect dropping one city at a time from the estimation sample; the red dots highlight cities that, when excluded from the sample, yield treatment effects in the top and bottom 1% of the distribution. The treatment effect is the baseline coefficient for a variable that equals one for towns with at least one retailer after the retailer opened and zero otherwise. Each regression includes town and time fixed effects. Estimates are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Standard errors are clustered at the town level; bands report 95% confidence intervals. Referenced on page: A6.

Figure D.20. Effect of Industry Exposure to the Sewing Machine on Children: Alternative Standard Errors

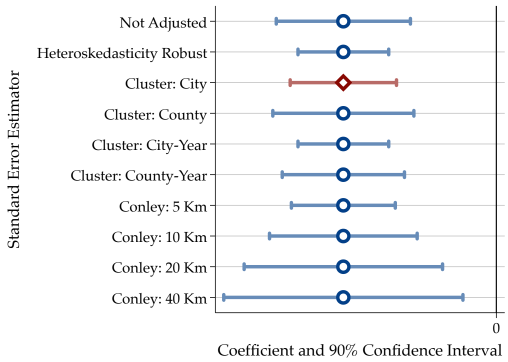
(a) Number of Children per Woman



(b) Share of Children at School



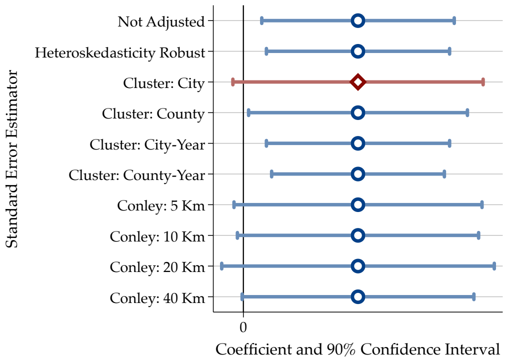
(c) Share of Children at Work



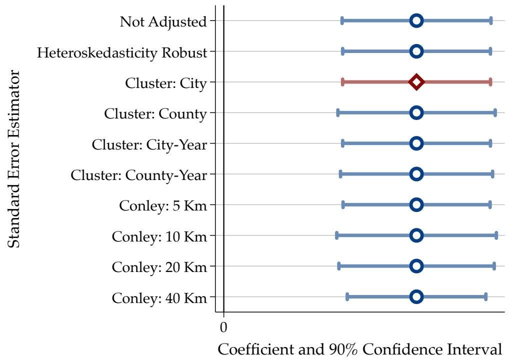
Notes. This Figure reports the effect of exposure to sewing machines on children. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the number of children per woman (Panel D.20a), the share of children at school (Panel D.20b), and the share of children at work (Panel D.20c). Each dot reports the estimated treatment effect, where the treatment is an interaction term between a post-1870 indicator variable and the employment share of sewing-machine-using industries. Each regression includes town and time fixed effects. We report various standard-error estimators: no adjustment, White (heteroskedasticity-robust), clustered by city, county, city-by-year, and county-by-year, and a correction for spatial autocorrelation at various thresholds, following Conley (1999) and implemented via the method of Colella et al. (2023). The red square shows the estimates from the baseline specification. Referenced on page: A6.

Figure D.21. Effect of Exposure to Sewing Machine Retailers on Children: Alternative Standard Errors

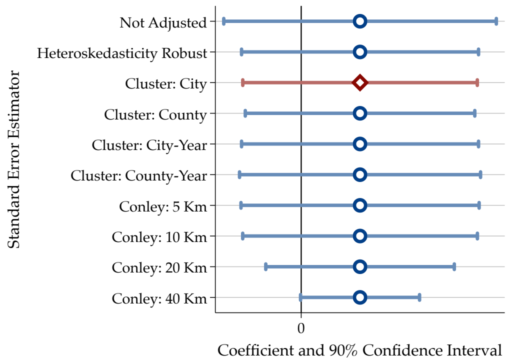
(a) Number of Children per Woman



(b) Share of Children at School



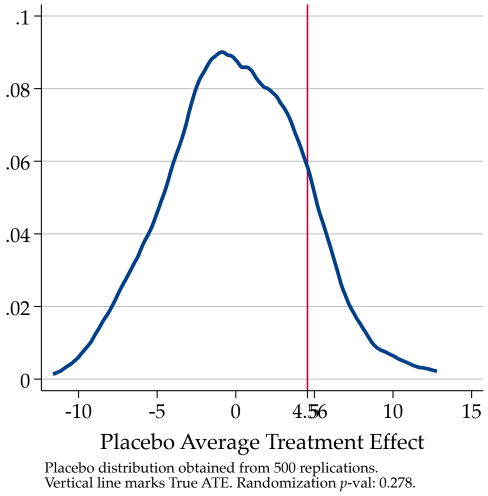
(c) Share of Children at Work



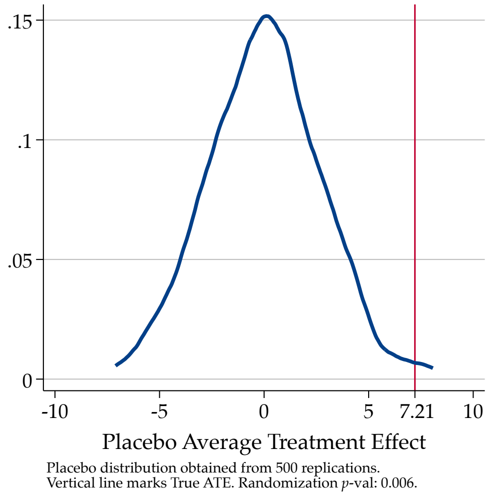
Notes. This Figure reports the effect of exposure to sewing machines on children. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the number of children per woman (Panel D.21a), the share of children at school (Panel D.21b), and the share of children at work (Panel D.21c). Each dot reports the estimated treatment effect, where treatment is an indicator variable that returns a value of one after at least one retailer of sewing machines is observed in the given township and zero otherwise. Each regression includes town and time fixed effects. We report various standard-error estimators: no adjustment, White (heteroskedasticity-robust), clustered by city, county, city-by-year, and county-by-year, and a correction for spatial autocorrelation at various thresholds, following Conley (1999) and implemented via the method of Colella et al. (2023). The red square shows the estimates from the baseline specification. Referenced on page: A6.

Figure D.22. Randomization Treatment Effect Distribution of Retailer Exposure on Children

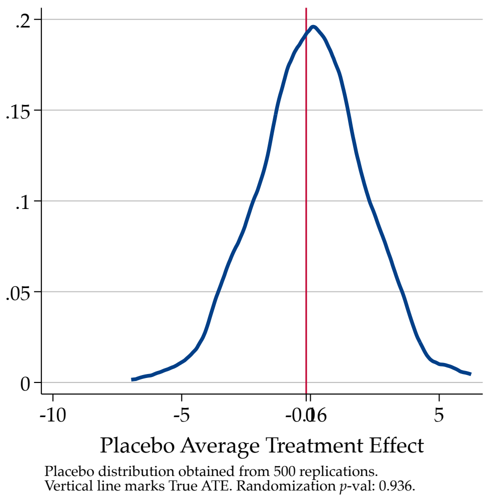
(a) Number of Children per Woman



(b) Share of Children at School



(c) Share of Children at Work



Notes. This Figure reports the effect of exposure to sewing machines on children. The unit of observation is a township observed at census frequency between 1850 and 1900. The dependent variable is the number of children per woman (Panel D.22a), the share of children at school (Panel D.22b), and the share of children at work (Panel D.22c). Each regression includes town and time fixed effects. The blue line displays the randomization-inference distribution of the difference-in-differences estimate, constructed by randomly reshuffling treatment timing across cities. The red line reports the baseline estimate. In each panel, we report the randomization *p*-value, which corresponds to the share of placebo estimates that are at least as large in absolute value as the estimate obtained using the true treatment timing. Estimates are obtained using the estimator developed by de Chaisemartin and d'Haultfœuille (2024). Referenced on page: A6.

Appendix References

Althoff, Lukas, Harriet Brookes Gray, and Hugo Reichardt, "America's Rise in Human Capital Mobility," *Working Paper*, 2025.

Berkes, Enrico, Ezra Karger, and Peter Nencka, "The Census Place Project: A Method for Geolocating Unstructured Place Names," *Explorations in Economic History*, 2023, *87*, 101477.

Colella, Fabrizio, Rafael Lalive, Seyhun Orcan Sakalli, and Mathias Thoenig, "acreg: Arbitrary Correlation Regression," *The Stata Journal*, 2023, *23* (1), 119–147.

Conley, Timothy G, "GMM Estimation with Cross-Sectional Dependence," *Journal of Econometrics*, 1999, *92* (1), 1–45.

de Chaisemartin, Clément and Xavier d'Haultfœuille, "Difference-in-Differences Estimators of Intertemporal Treatment Effects," *Review of Economics and Statistics*, 2024, pp. 1–45.

Price, Joseph, Kasey Buckles, Jacob Van Leeuwen, and Isaac Riley, "Combining Family History and Machine Learning to Link Historical Records: The Census Tree Data Set," *Explorations in Economic History*, 2021, *80*, 101391.

Rambachan, Ashesh and Jonathan Roth, "A More Credible Approach to Parallel Trends," *Review of Economic Studies*, 2023, *90* (5), 2555–2591.

Ruggles, Steven, Nesile Ozder, Catherine A. Fitch, Matthew Sobek, Julia A. Rivera Drew, J. David Hacker, Jonas Helgertz, Cheyenne Lonobile, Matt A. Nelson, Evan Roberts, and John Robert Warren, "IPUMS Multigenerational Longitudinal Panel: Version 2.0," *Minneapolis: University of Minnesota*, 2025.