"The Queen of Inventions": How Home Technology Shaped Women's Work and Children's Futures[*]

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Abstract

This paper studies the impact of the home sewing machine—an innovation that enabled women to generate income from within the household—on women's employment and intergenerational mobility. Exploiting geographic and temporal variation in the expansion of sewing machine sales agents, I show that access to sewing machines increased demand for dressmakers, raised women's employment in this occupation, and reduced reliance on child labor. These effects were strongest in households most reliant on children's earnings, particularly those with boys, older children, and single mothers, where exposure lowered child labor and increased school attendance. In the long run, children exposed early in life attained higher literacy, better employment opportunities, greater intergenerational mobility, and lower marriage and fertility rates. The findings highlight how domestic production technologies expanded women's economic opportunities and generated lasting gains across generations.

Keywords: Women's work, home production, child labor, Children

JEL Codes: J16, N31, J22, J24, J13

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1 Introduction

How did new production technologies reshape women's economic opportunities and intergenerational mobility? This paper studies the impact of one such innovation—the home sewing machine—which enabled women to generate income from within the household. Marketed directly to women as a tool for both domestic use and paid work, the sewing machine provides a unique setting to study how production technologies altered women's labor market participation and intergenerational mobility. While technological change has long reshaped the landscape of work and family life, much of the literature has focused on industrial production outside the home (e.g., Feigenbaum and Gross (2024)), overlooking the effects of technologies that allowed women to participate in market work from within the household. To this end, I study the diffusion of the home sewing machine—recognized as one of the most important innovations of the nineteenth century—as a driver of women's economic participation and intergenerational mobility.

Introduced in the nineteenth century, at a time when sewing was a central domestic task across all social classes, it was dubbed the "Queen of Inventions" by *Godey's Lady's Book* (Godey, 1860) and hailed by the *New York Times* as "the best boon to women in the nineteenth century."[1] *Scientific American* described it as, after the Spinning Jenny and the plough, "the most important invention that has ever been made since the world began." The sewing machine reduced the time required for garment making, improved quality, and enabled the production of goods for the market within the household. In doing so, it transformed a domestic task into a remunerative activity, allowing women to contribute to household income while remaining within socially respectable roles. By facilitating home-based work, the sewing machine may have helped women reconcile market work with caregiving, increasing labor force participation among those otherwise excluded from outside employment. At the same time, it may have reinforced gendered labor patterns that concentrated women in garment production, even as it encouraged the rise of small-scale businesses requiring little initial investment. By boosting household resources, the spread of the sewing machine could also have reduced reliance on child labor, enabling greater investment in children's education and long-term opportunities. Understanding how production technologies transform women's work and economic opportunities remains important today, as new innovations continue to reshape labor markets and family life.

To study the impact of the home sewing machine on women's work, I rely on Singer's initial expansion strategy across U.S. counties. In 1856, Singer introduced the first sewing machine designed specifically for home use and built its business model around women as primary consumers (Brandon, 1996). Its marketing emphasized labor efficiency, creativity, ornamentation, and individual expression, while also highlighting the machine's potential as a source of supplemental income. As a result, Singer became the leading seller of home sewing machines and, by 1912, the seventh-largest firm in the world (Records Company, 1850; Godley, 2001). Singer's sales model explicitly centered the household as a site of production, appealing both to women sewing for private use and to those seeking to establish sewing-related busi-

[1] See https://www.nytimes.com/1860/01/07/archives/the-story-of-the-sewingmachine-its-invention-improvements-social
html.

nesses from home (Buckman, 2016). The company's goal was to reach every woman in the United States and make the machine widely accessible. To achieve this, Singer pioneered the installment plan, which significantly lowered the barrier to adoption, and initially relied on independent commission-based local agents to expand rapidly and at low cost across the country (Brandon, 1996).

This early agent-based expansion strategy poses a challenge for studying the impact of the sewing machine, as detailed historical records on initial sales at the local level are scarce. Although the company's archives document the establishment of central offices from 1880 onward, they lack systematic information on independent agents and salesmen during the main period of early expansion (Records Company, 1850). To address this gap, I construct a new dataset from historical newspapers that records the exact timing of each Singer agent's arrival in a city. Because these events were announced in local papers, I identify the first mention of a Singer salesman in each location, allowing me to trace the company's initial rollout and measure the timing of sewing machine availability across counties. This novel dataset provides an opportunity to study how access to home production technologies shaped women's economic participation and intergenerational outcomes.

Using this new dataset, I estimate the effect of the home sewing machine on women's work by exploiting variation in the timing of Singer agent openings across counties. Measuring these effects requires overcoming a key challenge: women's work in the nineteenth century was systematically underreported in official census records, particularly for married women engaged in home-based market production. To address this limitation, I use linked city directory and census data following Arenas Arroyo and Lin (2025), which corrects for bias in census occupational data. Access to sewing machines substantially increased women's likelihood of working as dressmakers, with employment rising by 27-36 percent after ten years of exposure. Comparisons between city directories and census records indicate that census-based estimates likely represent a lower bound, as directories capture increases in women's dressmaking work that the census often missed due to misclassification as "keeping house." The effects were strongest in absolute terms for single female household heads, but relative gains were largest for married women, whose baseline participation was much lower. Dynamic estimates reveal no pre-trends and a steadily growing impact over time, consistent with gradual adoption and household reorganization. Finally, I construct a novel dataset of job advertisements to measure labor demand for home-based dressmakers and document a persistent increase in demand following the expansion of sewing machine access. Taken together, these findings highlight the sewing machine's role in expanding women's economic opportunities, redefining the boundary between domestic and market production, and motivating an exploration of its broader effects on household dynamics and intergenerational outcomes.

Beyond women's employment, the expansion of the home sewing machine also affected children. In households most reliant on child earnings—especially among boys, older children, and single-mother families—exposure reduced child labor and increased school attendance. In the longer run, exposed children attained higher literacy, greater employment opportunities, and improved intergenerational mobility, alongside lower marriage and fertility rates. The gains were largest for children from single-headed households, where budget con-

straints were likely most binding. These results show that the sewing machine relaxed household constraints, enabled families to substitute schooling for child labor, and laid the foundation for higher investment in human capital. More broadly, the diffusion of the home sewing machine illustrates the economic significance of domestic technologies: by transforming the household into a site of market production, it reshaped women's roles and altered the prospects of the next generation.

This paper makes several contributions to the literature. First, it provides the first estimates of the short-run and long-run effects of access to a technology that enabled market production within the household on women's employment and intergenerational outcomes. While previous work has shown that twentieth-century innovations such as labor-saving household appliances and the birth control pill reduced domestic burdens and expanded women's autonomy (e.g., Bailey, 2006; Greenwood, 2019), most studies have focused either on technologies that lowered the time required for home production or on industrial innovations that transformed production outside the home (e.g., Feigenbaum and Gross, 2024; Goldin, 1985).[2] By showing that the home sewing machine expanded women's opportunities for market work from home, the paper highlights the household as a site of economic production and technological change. More broadly, it identifies the home sewing machine as an important driver of women's labor force participation.

Second, the paper contributes to the literature on the historical evolution of female labor force participation. By examining how a nineteenth-century household innovation reshaped women's work, it enhances our understanding of women's economic contributions over time. In doing so, it builds upon foundational studies documenting the rise of women's labor force participation in the twentieth century (e.g., Goldin, 1990, 2006; Olivetti, 2014), offering new evidence on earlier transformations that expanded women's access to paid work.

Finally, the paper examines the long-run and intergenerational consequences of this technological change. A growing literature emphasizes that mothers are key determinants of children's outcomes, both through household resource allocation and time investment (e.g., Black et al., 2005; García and Heckman, 2023). This study contributes by showing that access to the sewing machine increased children's school attendance and improved their adult outcomes, reinforcing mothers' role as central agents of intergenerational mobility (e.g., Olivetti and Paserman, 2015; Abramitzky et al., 2021). More broadly, it highlights the household as a crucial sites of technological change, providing new historical evidence on how home-based innovations reshaped gender roles, human capital investment, and the economic lives of future generations.

The paper proceeds as follows. Section 2 describes how access to the sewing machine could influence women's labor market opportunities and investments in children. Section 3 describes the census microdata and newly constructed measures of Singer's diffusion. Section 4 presents the empirical strategy. Section 5 discusses the short-run effects of sewing machine ac-

[2] A large literature also examines how automation and other production technologies affect labor markets (e.g., Acemoglu and Restrepo, 2019; Black and Spitz-Oener, 2010). In contrast, this paper studies an innovation that enabled market work within the household rather than at the firm, and traces its intergenerational consequences.

cess on women's employment. Section 6 turns to the short and long-run and intergenerational outcomes. Finally, Finally, section 7 concludes the study.

2 Home Sewing Machine and Women's Work

The home sewing machine was recognized in the nineteenth century as one of the most important domestic innovations of its time. The popular and influential *Godey's Lady's Book* dubbed it "The Queen of Inventions," proclaiming its indispensability to women readers: "Every family in the United States ought to have one, and would if they only knew the saving and the quantity of work that can be done in a day." (Godey, 1860). Similarly, the *New York Times* described it as "the best boon to women in the nineteenth century."[3] The sewing machine thus promised to reduce the burden of household sewing while opening opportunities for market work, making it both a practical aid and an aspirational good.

How could the home sewing machine have affected women's labor force participation? Access to the machine created new opportunities for women to engage in market work without leaving the household. By reducing the time cost of garment production, this innovation transformed a domestic task into a remunerative activity. Importantly, it was work that was socially accepted and expected of women-every woman was supposed to know how to sew. Sewing was considered *women's work* and therefore respectable, whereas many other occupations were not deemed proper. As Caroline Dall wrote in 1859, "the command of society to the uneducated class is, 'Marry, stitch, die, or do worse' " (Barm and Klepp, 1995). Therefore, by allowing women to remain within socially respectable occupations, the sewing machine lowered the barriers to entering paid employment, particularly for women constrained by childcare and household responsibilities, or for female breadwinners who could not easily seek work as domestics, teachers, or factory workers (Barm and Klepp, 1995). Moreover, by reducing production costs and increasing productivity, the sewing machine expanded demand for sewing-related occupations, especially dressmakers and seamstresses.

These changes in women's labor market opportunities could also have affected children. Additional household income from sewing might have reduced reliance on child labor and lowered the effective opportunity cost to the household, thereby fostering greater investment in education. Furthermore, because mothers play a central role in allocating household resources (García and Heckman, 2023), their increased access to income could have influenced not only immediate schooling decisions but also long-run outcomes such as literacy, occupational attainment, and family formation.

Overall, access to the home sewing machine generated both direct effects on women's employment and indirect intergenerational effects by altering household resources, parental investments, and children's life trajectories. The sewing machine thus provides a unique setting for studying how household technologies transformed women's labor market participation and shaped the prospects of the next generation. The aim of this paper is to examine these effects by exploiting variation in Singer's expansion strategy across U.S. counties, which I describe in the next section.

[3] See https://www.nytimes.com/1860/01/07/archives/the-story-of-the-sewingmachine-its-invention-improvements-social
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2.1 Background: The Home Sewing Machine and Singer's Expansion Strategy

Singer was not the first to design a home sewing machine; but it developed the first commercially successful and practical home sewing machine. In 1856 it launched the Turtleback, a smaller and lighter model that came in a wooden cabinet doubling as a table (Brandon, 1996). Yet entering this new market posed both psychological and financial barriers. Sewing machines were expensive, selling for about $125 at a time when average family income was around $500 a year. For most households, ownership remained out of reach. To overcome this obstacle, Singer pioneered the hire-purchase system, offering machines on an installment plan of five dollars down and three to five dollars per month (see for example Figure 6 in the appendix). This innovation, widely regarded as the origin of modern installment selling (Bacon, 1946), made the sewing machine accessible to a broad range of women.

Singer's ambition was to place a sewing machine in every household. Unlike other manufacturers that relied on wholesalers or retailers, the company developed an integrated marketing and distribution system that allowed it to control pricing, advertising, and service. Initially, Singer relied on independent commission-based agents to reach every town in the United States quickly and at low cost (Brandon, 1996). It later shifted to a dense network of permanent agencies and retail shops. Agents canvassed towns and rural districts on horseback or by buggy, demonstrating machines door-to-door (Godley, 2001).

Newspaper advertisements and exhibitions in women's magazines reinforced this approach, encouraging women to view the machine as both a domestic aid and a tool for home-based enterprise. Seamstressing and dressmaking—occupations socially accepted as "women's work"—were promoted as natural extensions of domestic skills, offering women a socially legitimate path to supplement household income. Advertisements portrayed women as household decision-makers and emphasized both domestic efficiency and the potential for supplemental income. One campaign promised that "any good female operator can earn with them $1,000 a year." The launch of the "New Family" model in 1865 emphasized quietness and ease of use, presenting the machine as a morally acceptable domestic aid rather than an industrial intrusion into the home (Brandon, 1996).

After the Civil War, the household or "family" market expanded rapidly. In 1862 only about one-quarter of machines were purchased for home use, but between 1865 and 1872 sales grew more than tenfold. Millions of American families acquired machines during these years, driven by liberal credit arrangements, expanding distribution networks, rising incomes, and a surge in demand for women's fashion. By the early 1870s the U.S. market was close to saturation, with evidence suggesting that most households that could afford a machine had already purchased one (Godley, 2001). By the late 1870s Singer's success was unmatched: company leaflets claimed that three-quarters of all sewing machines sold worldwide were Singer machines, implying a global market share above 75% and more than 80% outside the United States. Diffusion in the U.S. was both earliest and fastest—ownership passed 1% of the population by 1865 and within ten years had reached over 10% of the population, the equivalent of more than half of all American households (Godley, 2001).

Singer's integrated model of marketing, financing, and distribution made this extraordinary diffusion possible. By pioneering installment credit, developing a vast sales and service network, and explicitly targeting women as both consumers and potential earners, the company ensured that the sewing machine reached nearly every household that could afford one. In doing so, Singer not only transformed domestic production but also positioned the sewing machine as a symbol of women's economic independence and respectability, reshaping norms around their roles in the household and the economy.

3 Data

I draw on a combination of historical and digitized sources to construct a novel dataset. These sources allow for a comprehensive picture of the short- and long-run effects of access to home-based production technology on women's labor market participation and children's well-being.

3.1 Singer Agents

To study the impact of home sewing machines on women's work, I exploit geographic and temporal variation in Singer's expansion across the United States. In its early years, the company relied on independent agents and salesmen, before it gradually shifted to establishing permanent shops. Although Singer's company records provide information on local offices, they do not include systematic data on these early agents (Records Company, 1850). When a Singer agent arrived in a city, however, the event was advertised widely in local newspapers (see for example, Figure 6 in the Appendix).

To address this gap, I use historical newspapers from the *Newspapers.com* archive (Newspapers.com, 2025) and developed an automated script to identify the first year in which a Singer agent appeared in each city. This allows me to trace the company's initial rollout and measure the timing of sewing machine availability across counties (see Figure 1). I restricted searches to advertisements and announcements explicitly mentioning Singer agents. In addition, I validated the automated results against a hand-collected sample of articles from major cities, finding a close match between the two. These steps help ensure that the timing of agent entry is measured accurately and consistently across counties.

3.2 U.S. Census Data

I combine individual-level census microdata with newly constructed measures of the geographic diffusion of Singer sewing machines described above. The analysis focuses on the initial expansion of Singer, using the 1860, 1870, and 1880 census years (Ruggles et al., 2024). These census data are merged to a county-level dataset that records the first year a Singer agent or shop appeared in each county. This linkage allows me to exploit variation in the timing of Singer's entry across local labor markets.

The main sample consists of women between the ages of 18 and 60. I restrict attention to the 1860–1880 period to capture the initial diffusion of the home sewing machine (see figure 5 in the appendix). The 1860 census is the starting point because the 1850 enumeration did not systematically collect information on women's occupations.[4] The primary outcome of interest

[4]See the Census Office's occupational classification notes: here.

is an indicator variable, *Dressmaker/Seamstress*, which equals one if a woman reported working in either of these occupations. This outcome captures the occupational category most directly affected by the sewing machine, as dressmaking and seamstressing represented key avenues for women's wage-earning work within the household production sector.

To examine impacts on children, I construct additional outcomes capturing work and school attendance. *Work* is defined as a dummy equal to 1 if a child under age 14 was reported as working, and 0 otherwise. *School attendance* is coded from census responses on whether a child attended school in the past year. These measures allow me to assess whether women's increased ability to earn income at home translated into greater investments in their children's human capital during the diffusion period.

Finally, to assess the long-run effects of childhood exposure to the sewing machine, I link individuals across census years using the Census Tree Project (Price et al., 2023a,b,c). Unlike previous linkage efforts, the Census Tree includes women, generating millions of connections between childhood and adulthood (Buckles et al., 2024). Using the 1900 census, I link individuals observed as children in 1860, 1870, or 1880 to their adult records in 1900. This linkage allows me to incorporate county of birth and family or maternal characteristics, and to study adult outcomes such as literacy, marital status, employment, intergenerational occupational mobility (measured by the daughter–son occupational gap), and fertility.

4 Empirical Strategy

To identify the effects of access to the home sewing machine on women's employment, I first estimate the following equation by exploiting geographic and temporal variation in the timing of Singer's expansion:

$$Y_{ict} = \alpha + \beta \cdot YearsSinger_{c,t} + \gamma' X_{ict} + \theta_{\text{age}} + \theta_c + _t + \varepsilon_{ict}, \tag{1}$$

where Y_{ict} is a dummy 1 is an women work as works as a dressmaker i in county c and census year t; $YearsSinger_{ct}$ measures exposure time since Singer's first agent is presence in the county; X_{ict} is the vector of individual controls, and household-level controls, such as race, marital status, number of children, whether the hourshold resides on a farm or is located in an urban area. θ_{age} are age fixed effects. Additionally, I include geographic and temporal fixed effects. The county fixed effects θ_c absorb unobserved, time-invariant county-level characteristics that may be correlated with women's occupational outcomes. The year fixed effects $_t$ capture aggregate shocks, such as nationwide economic or social changes, that could affect women's employment opportunities independently of Singer's expansion. Standard errors are clustered at the county level. The parameter of interest, β, measures how each additional year since the arrival of Singer in county c affects women's occupational outcomes, specifically their probability of working as dressmakers.

I also estimate dynamic effects of sewing machine's impact on women's employment within an event-study framework as in equation(2) This approach helps identify whether the effects of Singer's expansion materialized immediately or with delay, and whether they faded or persisted over time. For example, if households needed time to acquire a machine or reorganize

domestic production, women's entry into dressmaking might have increased gradually rather than instantaneously.

$$Y_{ict} = \alpha + \sum_{k \neq -1} \beta_k \cdot \mathbf{1}\{YearsSinceSinger_{c,t} = k\} + \gamma' X_{ict} + \theta_{\text{age}} + \theta_c + \theta_t + \varepsilon_{ict}, \tag{2}$$

The dynamic specification also enables us to examine potential differences in outcomes prior to Singer's arrival in a county. Evidence of flat pre-trends would support the parallel trends assumption required for identification in the difference-in-differences framework. In contrast, systematic differences before Singer's entry would raise concerns about confounding factors unrelated to sewing machine diffusion.

5 The Impact of Sewing Machine on Women's Occupation

Table 1 presents the estimates of the effect of Singer's expansion on women's employment as dressmakers. All specifications include county and year fixed effects, so identification comes from within-county changes relative to the staggered timing of Singer's rollout. Colums 1 show that on average, each year of exposure raised the probability of working as a dressmaker by 0.03 percentage points, or about a 3 percent increase relative to the baseline mean of 1.1 percent. After ten years, this effect cumulates to 0.3 percentage points, or 27 percent relative to the mean. Although modest in absolute terms, the long-run impact is economically meaningful.

The effects are concentrated among white women, while estimates for Black women are small and statistically insignificant. Family circumstances also mattered: single female household heads experienced larger absolute gains (0.6 percentage points after ten years, about 17 percent relative to their baseline mean of 3.6 percent), while married women exhibited smaller absolute gains (0.3 percentage points) but larger relative increases (36 percent relative to their baseline mean of 0.8 percent). Overall, these results based on census data suggest that Singer's expansion disproportionately benefited women with fewer household constraints, while also drawing more married women into market work.

These results are robust to alternative specifications such as controlling for transportation costs between each county and Manhattan. Accounting for these costs—which capture Singer's geographically mediated expansion path from its headquarters—leads to very similar conclusions (see Column (1) of Table 6). The findings are likewise robust to the inclusion of state-specific time trends, which absorb secular changes in women's work at the state level; adding these trends (Column (2) of Table 6) leaves the results largely unchanged, indicating that state-level dynamics are unlikely to drive the estimates. One might also be concerned that the findings are driven by Singer's early presence in large cities such as New York or Boston[5]. Column (3) of Table 6 shows that this is not the case; the results are not driven by these urban centers.

A potential concern is that the arrival of Singer agents may be correlated with pre-existing concentrations of dressmakers. For example, areas with a larger share of dressmakers could have been viewed by Singer as more promising markets for sewing machine adoption, prompt-

[5]I exclude a set of early-adopting cities, including Albany, Baltimore, Boston, Brooklyn, Charleston, Chicago, Gloversville, Nashville, Newark, New Haven, Philadelphia, Rochester, Troy, and Syracuse. (Jack, 1957)

ing the company to deploy agents there earlier. If Singer's market expansion strategy responds to local industry composition in this way, the timing of agent arrival would not be exogenous. This would violate our identification assumptions.

To examine whether the local concentration of dressmakers predicts the timing of Singer's entry into a county, I estimate the following specification using data from 1860 Census (at the begining of the period):

$$\textit{First Year Agent}_c = \alpha + Z_c^{1860\prime}\delta + X_c^{1860\prime}\mu + \epsilon_c, \tag{3}$$

where $\textit{First Year Agent}_c$ denotes the year in which the first Singer agent was recorded in county c. The vector Z_c^{1860} captures our measure of the share of dressmakers in 1860. The control vector X_c^{1860} includes the share of rural counties, the cost-distance to Singer headquarters and factory[6] , and the female population share. The goal is to assess whether the prevalence of dressmakers predicts the timing of Singer's market entry. If Singer did not strategically target counties based on pre-existing sewing-related occupations or demographic characteristics, the coefficient δ should be close to zero and statistically insignificant.

Table 6 reports the results. Consistent with our identification assumption, the coefficient on the share of dressmakers is small relative to its standard error and statistically insignificant, indicating that counties with a higher concentration of sewing-related occupations in 1860 did not experience earlier arrival of Singer agents. Instead, the only predictors of entry timing are geographic and structural characteristics: more rural counties received Singer agents slightly later, and counties that were more costly to reach from Manhattan—Singer's headquarters and main manufacturing base—experienced systematically delayed entry. In contrast, the female population share does not predict the timing of Singer's expansion. Overall, these findings suggest that Singer's early diffusion was driven primarily by transportation frictions and urbanization patterns rather than by pre-existing local demand from dressmakers, supporting the exogeneity of the timing of Singer's arrival with respect to sewing-related labor supply.

Measuring Women's Work in the 19th Century: One of the main challenges in studying women's work in the 19th century is its systematic underreporting. Official U.S. census records prior to 1940 understated women's economic activity, reflecting both enumerator bias and the social construction of occupational identity. Married women who worked from home were especially likely to be recorded as "keeping house" rather than as economically active (U.S. Census (1873),Gamber (1997)). Before 1940, the census distinguished between "gainful" and "non-gainful" activities, a classification that reflected social roles rather than actual economic contributions. Enumerators rarely challenged these responses, leading to systematic undercounting of women's employment.

To address this limitation, I draw on city directories. I correct for measurement bias in census occupational data using the adjustment proposed in Arenas Arroyo and Lin (2025), which links annual occupational information from digitized city directories with full-count

[6] By 1857, Singer had established its main showroom and headquarters at 458 Broadway in New York City, supported by three small manufacturing sites located elsewhere in the city. I use the lowest-cost county to county freight routes estimated by (Donaldson and Hornbeck, 2016)

census records.[7] City directories provide complementary evidence. For example, for Boston and New York, each additional year of Singer presence raised the probability of women being recorded as dressmakers by about 0.045 percentage points, implying a 20 percent increase after ten years and a 40 percent increase after twenty years relative to the baseline (Arenas Arroyo and Lin, 2025). While economically large, these results should be interpreted with caution given the small number of city clusters. By contrast, census data for the same cities suggest a negative relationship: the probability of women being reported as dressmakers declines by about 5 percentage points after ten years of Singer exposure, corresponding to a 19 percent drop relative to the census mean. This divergence suggests the systematic underreporting of women's home-based work in census records, where many married women engaged in sewing were instead classified as "keeping house." Taken together, this comparison underscores both the economic significance of the sewing machine for women's employment and the importance of incorporating alternative sources, such as city directories, to correct for biases in official statistics. Although the evidence from directories is initially limited to two large cities, it strongly suggests that census-based estimates provide a lower bound of the true impact.

Denand for dressmarkers working from home: Dressmakers typically worked from home, which allowed them to participate in market work while remaining within the household. Because census records do not report place of work, I use job advertisements as an measure of labor demand. Job ads often specify both the place of work and the requirements for the position, such as owning a sewing machine (see Figure 7). To construct this measure, I draw on historical newspapers from the *Newspapers.com* archive (Newspapers.com, 2025) and developed an automated script to identify the number of dressmaker ads by year and county. Figure 3 plots dynamic estimates of the effect of Singer's expansion on the share of ads seeking dressmakers between 1850 and 1880. The coefficients prior to Singer's entry are close to zero and statistically indistinguishable from zero, consistent with the parallel trends assumption. After Singer's arrival, however, the estimates turn positive and increase steadily over time. Although confidence intervals widen at longer horizons, the upward trajectory indicates that Singer's expansion led to a persistent increase in labor demand for home-based dressmakers. This complementary evidence reinforces the conclusion that the diffusion of the sewing machine substantially expanded market opportunities for women by raising demand for dressmaking work at home. Before turning to children's outcomes, I first present the dynamic effects of Singer's expansion on women's employment. This specification allows me to examine whether the impact of sewing machine availability emerged immediately or developed gradually over time, and to assess any trends in women's employment prior to Singer's entry. The next section then turns to children's work and schooling to explore whether these changes in women's employment translated into shifts in household investments in human capital.

5.1 Dynamic Effects

I next investigate the dynamic effects of Singer's expansion on women's occupational outcomes. This specification allows me to examine whether the impact of sewing machine availability

[7] Arenas Arroyo and Lin (2025) constructs a new dataset that links annual occupational information from digitized city directories with full-count census records.

emerged immediately or developed gradually over time, and to assess any trends in women's employment prior to Singer's entry.

Figure 2 plots the coefficient δ_a from equation (2) for women's probability of working as a dressmaker, measured relative to the year of the first Singer agent's arrival in a county. The estimates are shown with 95 percent confidence intervals.[8]

Two important features emerge from the figure. First, the estimates in the years prior to Singer's arrival are small and statistically indistinguishable from zero, supporting the parallel trends assumption. Second, beginning shortly after Singer's entry, the coefficients turn positive and increase steadily over time. This pattern suggests that the diffusion of sewing machines had a persistent and growing effect on women's labor market participation. The gradual increase is consistent with households requiring time to adopt sewing machines and reorganize domestic production around this new technology. Importantly, the absence of pre-trends indicates that these gains were not driven by prior differences across counties but reflect the causal impact of Singer's expansion.

Taken together, the findings indicate that Singer's diffusion disproportionately benefited women with fewer household constraints and those more reliant on self-employment for income, highlighting the role of domestic technologies in shaping gendered and family-based patterns of work.

6 Impact on Children

The home sewing machine increased women's labor force participation by enabling them to work from home and generate additional earnings while balancing childcare responsibilities. These resources may have reduced reliance on children's labor to support the household economy and lowered the opportunity cost of schooling. In this way, greater access to sewing machines could have reduced child labor and increased school attendance, fostering higher levels of human capital and improving long-run outcomes. I next examine how the expansion of the home sewing machine affected children's work and schooling.

In many nineteenth-century families, children's earnings represented an important share of household income, particularly in poorer or single-headed households (Hindman (2002), Parsons and Goldin (1989)). If the sewing machine provided mothers with an alternative source of income that could substitute for children's work, its diffusion should have reduced the need for child labor. I therefore begin by estimating the impact of Singer's expansion on the likelihood that children were recorded as working. Using census data from 1860 to 1880, I estimate equation 1 for the probability that a child between 4 and 14 years old was working. The specification includes individual characteristics (age, gender, race, nativity, farm status, number of siblings, single-headed household, mother's age, and mother's nativity) and controls for compulsory schooling laws at the state–year level to account for the enactment of mandatory school laws during this period. All regressions include county, birth cohort, and year fixed effects, and standard errors are clustered at the county level.

[8] The estimates for the earliest and latest periods represent binned effects.

Table 2 presents the results. Across all children, an additional year of exposure to Singer's expansion reduced the probability of working by 0.09 percentage points, a decline of about two percent relative to the mean of 4 percent. These reductions are not evenly distributed across groups. White children experienced declines of 0.08 percentage points per year, and the largest effects are found among children in single female-headed households, where the probability of working fell by 0.13 percentage points annually. Boys and older children above age ten also saw sharp reductions, with declines of 0.14 and 0.17 percentage points, respectively. By contrast, the effect for girls is close to zero. These results suggest that the sewing machine most strongly reduced children's participation in market work where household reliance on child earnings was greatest—among boys, older children, and in vulnerable households headed by single women.

If the home sewing machine reduced the probability of children working, we would expect that households relied less on child earnings and were able to invest more in education. To test this, I re-estimate equation 1 using school attendance as the outcome. Table 3 shows that, on average, each year of exposure increased the probability of school attendance by about 0.17 percentage points, corresponding to a 3 percent increase relative to the baseline mean of 54 percent. The effects are evident for both boys and girls, for children in single-headed households, and especially for white children, whose gains average 0.16 percentage points per year and are larger for those aged ten and above. As before, I do not find any effect for Black children.

Taken together, the results indicate that Singer's expansion both reduced children's participation in work and fostered greater school enrollment. These effects accumulate over time: after ten years, school attendance is about 1.7 percentage points higher, while the probability of working is nearly one percentage point lower. The evidence is consistent with the interpretation that the sewing machine relaxed household budget constraints, enabling families—especially those led by single mothers and those with sons—to substitute children's labor with schooling. In the next section, I examine whether these short-run shifts translated into long-run improvements in literacy, family formation, and intergenerational mobility.

6.1 Long-Run Outcomes

The findings on child labor and school attendance point to the potential for the sewing machine to shape not only children's immediate educational decisions but also their long-term trajectories. By easing household budget constraints, reducing the need for child labor, and enabling mothers to combine income generation with caregiving, the sewing machine created conditions for greater investment in children's human capital. I therefore turn to long-run outcomes to assess whether these short-run gains translated into improvements in literacy, family formation, and economic opportunities in adulthood.

To examine the long-run consequences of childhood exposure to the sewing machine, I estimate regressions of the following form, linking children observed in the 1860, 1870, or 1880 censuses to their adult records in 1900:

$$Y_{ict} = \beta \cdot Treat_{ic} + \Gamma' X_{ict} + \alpha_{\text{birthyear}} + \alpha_{\text{state}\times\text{birthyear}} + \alpha_c + \alpha_t + \varepsilon_{ict}, \tag{4}$$

where Y_{ict} denotes adult outcomes of individual i born in county c and observed in census year t. The treatment variable $Treat_{ic}$ equals one if the individual was exposed to Singer's entry into her county between ages 0 and 14, and zero otherwise. The coefficient of interest, β, captures the effect of early-life exposure to the sewing machine on adult outcomes. These include literacy, marital status, employment, intergenerational occupational mobility (measured by the daughter/son–mother occupational gap), and fertility.

The regressions control for household and demographic characteristics, including farm and urban residence, nativity, and whether the household was headed by a single woman. All specifications include birth-year, state-by-birth-year, county, and year fixed effects. Standard errors are clustered at the county of birth and birth-year level.

Table 4 shows that exposure to the sewing machine modestly improved literacy and employment while reducing marriage and fertility. The effects are small in absolute terms—typically on the order of one to two percentage points—but meaningful relative to baseline levels. Intergenerational measures indicate gains of about 0.1 to 0.3 standard deviations, pointing to sustained upward mobility across generations.

Table 5 builds on the short-run results, where the largest reductions in child labor and the strongest gains in schooling occurred among children from single female-headed households. The long-run estimates reveal a similar pattern. For women raised in single-headed households, exposure to the sewing machine led to substantially larger improvements than for those from married-couple households, with literacy and employment gains nearly twice as large and intergenerational mobility increases of almost half a standard deviation. Marriage and fertility also declined more sharply. Men display the same pattern: those raised in single-headed households experienced sizeable gains in literacy and employment and particularly strong improvements in intergenerational mobility, whereas effects for men from married-couple households were positive but more modest. These results underscore that while the sewing machine improved long-run outcomes across the board, its transformative effects were concentrated in more vulnerable households where additional resources most directly relaxed budget constraints.

Overall, these findings suggest that early-life exposure to the sewing machine improved human capital and employment prospects, facilitated intergenerational mobility, and reshaped family formation. The magnitudes are modest on average, but the concentration of larger gains in vulnerable households underscores how new household technologies could disproportionately benefit families facing tighter budget constraints.

7 Conclusion

This paper shows that the expansion of the home sewing machine—one of the first major household production technologies—substantially expanded women's opportunities for paid work and reshaped family outcomes. Exploiting variation in the timing of Singer's rollout across counties, I find that sewing machine access increased women's employment as dressmakers, with particularly large relative gains for married women. Complementary evidence from directories and job advertisements confirms that both labor demand and supply shifted,

underscoring the machine's role in transforming the household into a site of market production.

The effects extended to the next generation. By relaxing household budget constraints, the sewing machine reduced reliance on child labor and increased schooling, fostering higher literacy, greater occupational mobility, and altered family formation patterns in adulthood. These findings underscore the household as a crucial site of technological change. Whereas much prior research has emphasized industrial innovations outside the home, this study shows that domestic technologies could also generate profound economic and social transformations.

The historical experience of the sewing machine also carries contemporary relevance. While access to home production tools once allowed women to enter self-employment, only one-third of small and medium-sized enterprises worldwide are women-owned today. Lowering barriers to entry into entrepreneurship remains crucial not only for economic development but also for narrowing persistent gender gaps in labor markets. The sewing machine reminds us that when technologies reduce barriers to participation, they can generate enduring gains for women and for society as a whole.

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8 Tables

Table 1: Effect of Singer Expansion on Women's Employment as Dressmakers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All	Race		Family Circumstances		With Children	
		White	Black	Single female head	Married	Single head	Married
Years since Singer entry	0.0003***	0.0004***	-0.0002	0.0006***	0.0003***	0.0003**	0.0001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	23,969,267	21,485,229	2,462,790	7,809,092	17,703,846	1,669,667	11,824,715
R-squared	0.027	0.028	0.032	0.031	0.016	0.032	0.014
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean dep. var.	0.0111	0.0120	0.0045	0.0361	0.0082	0.0319	0.0024

Notes: Each column reports the effect of years since Singer's entry on the probability of being employed as a dressmaker. Robust standard errors clustered at the county level are shown in parentheses. All specifications include county and year fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 2: Effect of Years Since Singer Entry on Children (Working Outcomes)

	(1) All	(2) White	(3) Black	(4) Single HHead	(5) Married	(6) Female	(7) Male	(8) Older than 10
Years since Singer entry	-0.0009***	-0.0008***	-0.0003	-0.0013***	-0.0009***	-0.0002	-0.0014***	-0.0017***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Observations	14,788,471	13,501,100	1,282,805	1,065,916	11,793,026	6,636,673	6,864,426	4,416,995
R-squared	0.149	0.112	0.334	0.149	0.109	0.047	0.165	0.155
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean D.V.	0.04	0.03		0.06	0.03	0.01	0.05	0.09

Robust standard errors clustered at the county level in parentheses.
Sample: Children between 4 and 14 years old.
Column (1): all children. Column (2): white children. Column (3): Black children. Column (4): children in single female-headed households. Column (5): children in married households. Column (6): girls. Column (7): boys. Column (8): children older than 10.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 3: Impact of Singer Expansion on School Attendance

	(1) All Children	(2) White	(3) Black	(4) In Single HH	(5) Married Mother	(6) Female	(7) Male	(8) Younger than 10	(9) Older than 10
Years since Singer entry	0.0017***	0.0016***	0.0010	0.0014*	0.0015**	0.0017***	0.0016**	0.0016**	0.0019***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	14,787,015	13,499,649	1,287,340	1,065,833	11,791,750	6,635,983	6,863,665	9,083,237	4,416,407
R-squared	0.337	0.317	0.199	0.265	0.332	0.316	0.318	0.348	0.122
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean DV	0.54	0.57	0.17	0.56	0.57	0.57	0.57	0.49	0.73

Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
All regressions include county and year fixed effects.
Sample: Children between 4 and 14 years old.
Column (1): all children. Column (2): white children. Column (3): Black children. Column (4): children in single female-headed households.
Column (5): children with married mothers. Column (6): girls. Column (7): boys. Column (8): children younger than 10. Column (9): children older than 10.

Table 4: Long-Run Effects of Singer's Expansion on Children's and Adults' Outcomes

	Literacy	Married	Employed	Child-Mother Gap	Fertility
Panel A: Women					
Treat	0.0120***	-0.0148***	0.0019***	0.1006***	-0.0076***
	(0.001)	(0.001)	(0.000)	(0.008)	(0.002)
Observations	1,814,879	4,592,096	4,592,096	4,473,723	2,610,080
R-squared	0.187	0.143	0.064	0.041	0.206
Mean D.V.	0.88	0.69	0.04	0.15	0.30
Panel B: Men					
Treat	0.0130***	-0.0067***	0.0028*	0.2725***	
	(0.001)	(0.001)	(0.001)	(0.029)	
Observations	2,895,811	6,777,362	6,777,362	6,596,693	
R-squared	0.171	0.228	0.159	0.121	
Mean D.V.	0.86	0.70	0.22	2.50	
County FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
State×Cohort FE	Yes	Yes	Yes	Yes	Yes

Notes: Each panel reports the effect of exposure to Singer's expansion (treat) on long-run outcomes. Standard errors in parentheses. Fertility is reported only for women. All specifications include county, state, cohort, and state×cohort fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5: Heterogeneous Long-Run Effects by Household Structure and Gender

	Literacy	Married	Employed	Child–Mother Gap	Fertility
Panel A: Women from Married-Couple Households					
Treat	0.0114***	-0.0142***	0.0013***	0.0718***	-0.0072***
	(0.001)	(0.001)	(0.000)	(0.008)	(0.002)
Observations	1,631,403	4,323,274	4,323,274	4,204,893	2,402,141
R-squared	0.170	0.237	0.137	0.120	0.208
Mean D.V.	0.89	0.76	0.06	0.60	0.31
Panel B: Women from Single-Headed Households					
Treat	0.0178***	-0.0202***	0.0036**	0.4512***	-0.0122***
	(0.002)	(0.002)	(0.001)	(0.051)	(0.003)
Observations	183,258	268,604	268,604	268,604	207,740
R-squared	0.218	0.157	0.111	0.082	0.194
Mean D.V.	0.87	0.66	0.13	-1.09	0.20
Panel C: Men from Single-Headed Households					
Treat	0.0180***	-0.0078***	0.0057**	0.5924***	–
	(0.001)	(0.002)	(0.003)	(0.086)	
Observations	338,390	485,823	485,823	485,823	–
R-squared	0.189	0.103	0.166	0.151	–
Mean D.V.	0.83	0.76	0.46	4.20	–
Panel D: Men from Married-Couple Households					
Treat	0.0123***	-0.0066***	0.0020	0.2262***	–
	(0.001)	(0.001)	(0.001)	(0.025)	
Observations	2,557,211	6,291,312	6,291,312	6,110,651	–
R-squared	0.170	0.237	0.137	0.120	–
Mean D.V.	0.86	0.70	0.20	2.40	–
County FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
State×Cohort FE	Yes	Yes	Yes	Yes	Yes

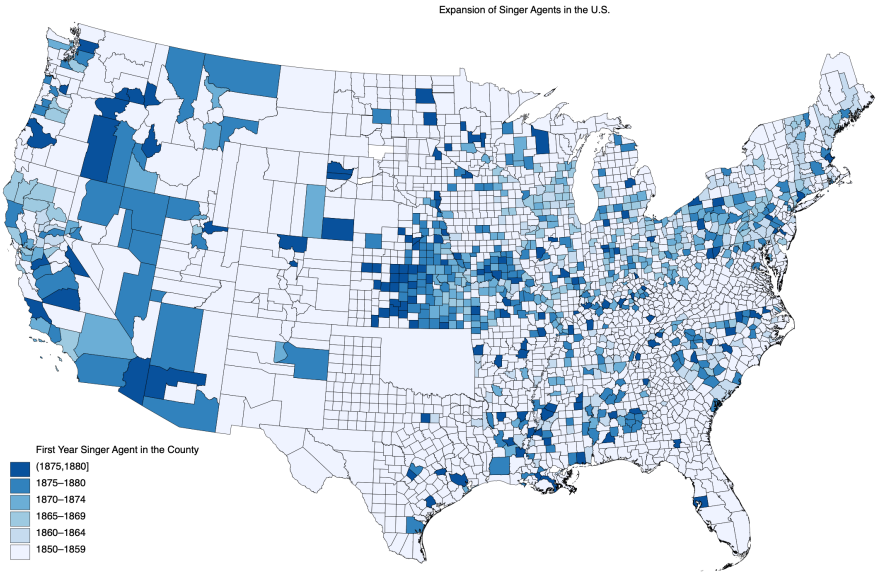
Notes: Each panel reports the effect of exposure to the sewing machine (treat) on the indicated outcome. Standard errors in parentheses. Fertility outcomes are not available for men. Mean dependent variables reflect pre-treatment averages. All specifications include county, state, cohort, and state×cohort fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6: Robustness and Determinants of Early Entry of Singer Agents

	(1) Dressmaker	(2) Dressmaker	(3) Dressmaker	(4) First year 1860
Years since Singer entry	0.0003***	0.0003***	0.0003***	
	(0.000)	(0.000)	(0.000)	
Share dressmarkers$_{1860}$				3.9695
				(10.977)
Share rural$_{1860}$				0.5497**
				(0.249)
Share female$_{1860}$				3.2016
				(5.313)
Cost from Manhattan$_{1860}$				0.0569***
				(0.018)
Observations	21,485,229	21,485,229	19,440,423	2,044
R-squared	0.025	0.029	0.026	0.018
County FE	Yes	Yes	Yes	No
Year FE	Yes	Yes	Yes	No
State-Trend	Yes	Yes	Yes	No
Mean dep. var.	0.0120	0.0120	0.0120	–

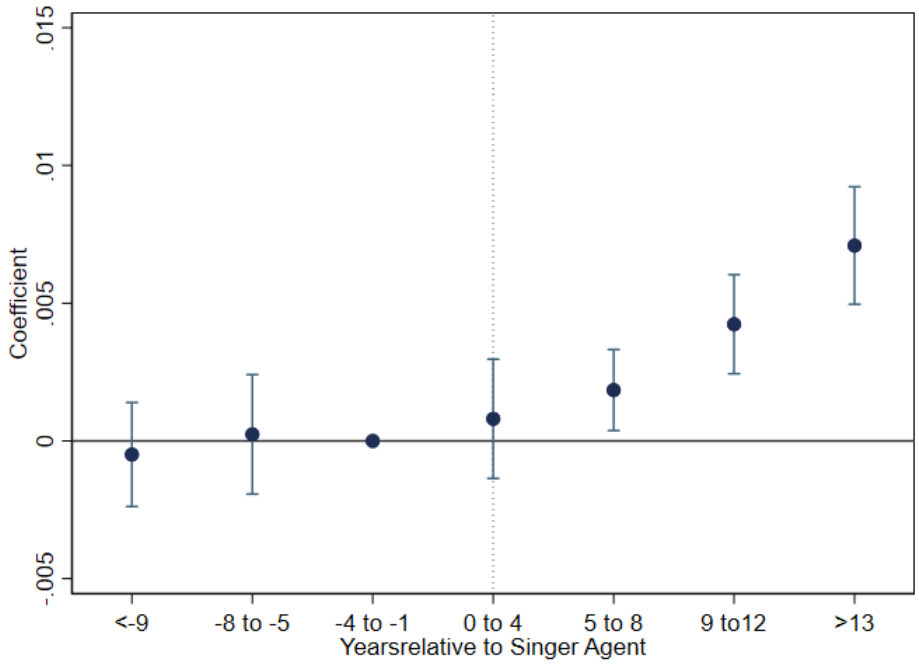
Notes: Columns (1)–(3) report the effect of years since Singer's entry on the probability of being employed as a dressmaker. Column (4) reports the determinants of the first year in which a Singer agent is observed in the county (variables are measured at the begining of the period in 1860). Robust standard errors clustered at the county level are shown in parentheses where applicable. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Figure 1: Expansion of Singer Agents in the U.S. by County.



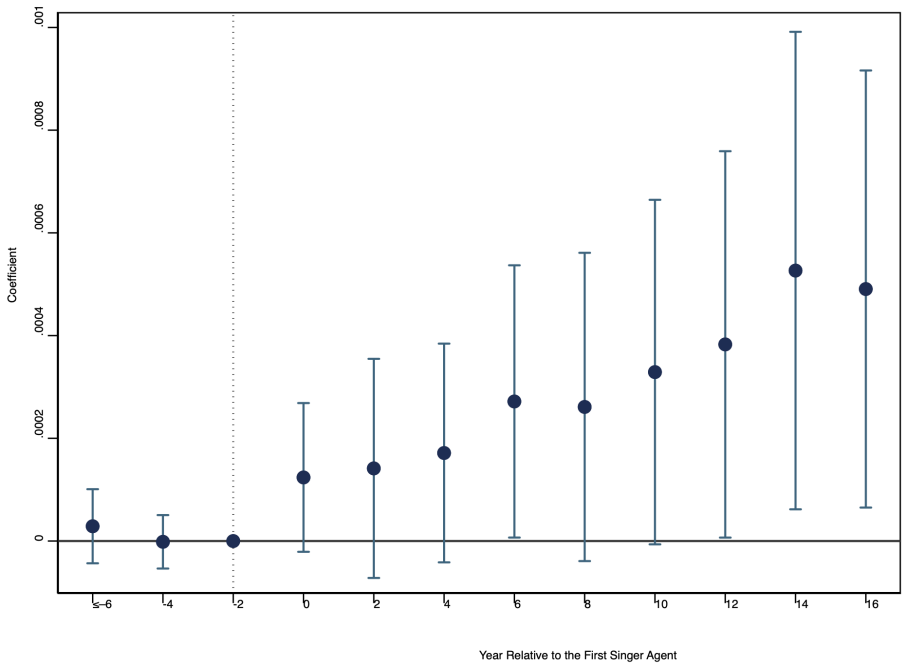
Notes: The shading corresponds to the first year in which a Singer agent was established in each county.

Figure 2: Dynamic effect of Singer's expansion on the probability that white women worked as dressmakers



Notes: The figure plots the coefficients from equation (2), estimated with county and year fixed effects. The shaded areas represent 95 percent confidence intervals, with standard errors clustered at the county level.

Figure 3: Demand for Dressmarkers

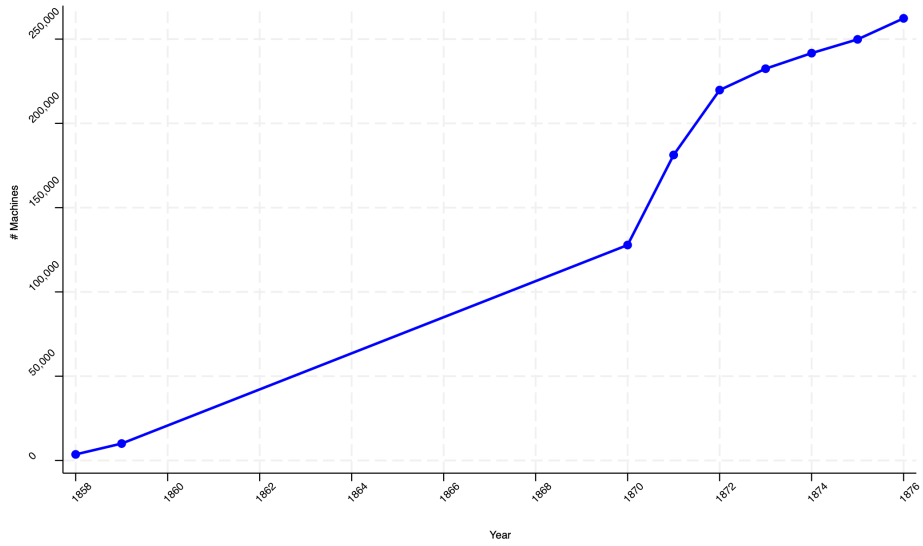


Notes: The figure plots the coefficients from equation (2), estimated with county and year fixed effects. The shaded areas represent 95 percent confidence intervals, with standard errors clustered at the county level.

Online Appendix

A Singer

Figure 4: Singer Annual Sewing Machine Production, 1858–1876



Sources: "Results of Business (Branches), Annual 1867–73," Micro 2002, Reel 16, Singer Archives, State Historical Society of Wisconsin, Madison, Wisconsin; and Brandon (1996).

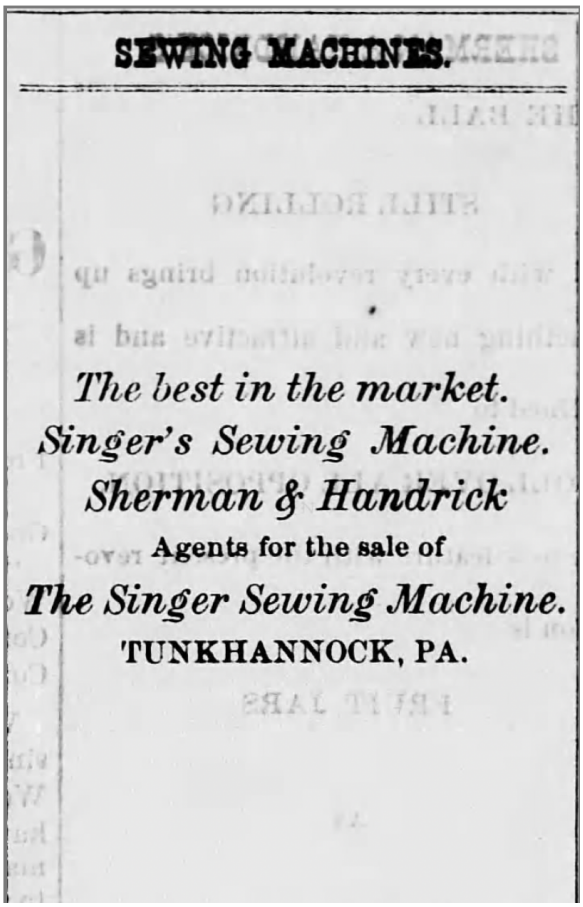
Figure 5: Singer advertisement



Sources: Source: 1874 Boston City Directory

B Newspaper Singer Agents

Figure 6: Examples of Singer agent advertisements in U.S. newspapers



SEWING MACHINES.

The best in the market.
Singer's Sewing Machine.
Sherman & Handrick
Agents for the sale of
The Singer Sewing Machine.
TUNKHANNOCK, PA.

(a) Singer agent advertisement, 1860s



SINGER'S
SEWING MACHINES!

With Late and Great Improvements.

ABUNDANT evidence has already been published of the general success of SINGER'S SEWING MACHINES in Louisiana, Mississippi and Texas, and their sale has increased astonishingly in the last few months. Their freedom from liability to get out of repair, and their perfect adaptation to all kinds of Sewing, have made them not only the manufacturing Machine of this country, but the

MOST RELIABLE
FAMILY MACHINE
IN THE WORLD!

As, with the recent improvements, they sew with equal facility with from No. 200 to 8 cord thread, of either cotton, flax or silk, on cloth or leather.

SINGER'S
SEWING MACHINES!
Are warranted three years, even in the charge of Negroes,
And will last a life time to do the sewing for a family or a plantation.

They are warranted to perform equal to any other Machine in the world on any kind of sewing, fine or coarse, or the *MONEY REFUNDED.*

It is universally known that
SINGER'S SEWING MACHINES
make the most approved stitch that human ingenuity has ever invented, it being the most uniformly the same on both sides of the fabric, and there is no longer room for cavil, as nine-tenths of the Clothing and Shoes sold in New Orleans is made on these machines, and they are used in preference to all others, after a fair trial, in the largest and most fashionable Dress-making establishments in New Orleans.

They are used at all the large Hotels in New Orleans, and at the principal Boarding houses also, by a large portion of the Tailors and Shoemakers, and in hundreds of private families, and have given universal satisfaction.

The public will bear in mind that Singer's Machines are sold upon a trial if desired with any and all other machines, and of the trials that have been made in this city in nineteen cases out of twenty they have been kept and the others returned.

The price of Singer's Sewing Machines has been
GREATLY REDUCED,
and the best machine is only $100, and the tables from six to twelve dollars; with cover and lock, $17.

WALTER BENNETT, AGENT,
33 Camp Street, New Orleans.
April 7, 1860. n29-1y

(b) *Texas Republican,* April 14, 1860

Notes: Source: *newspapers.com,* including the *Tunkhannock Republican* (Tunkhannock, Pennsylvania), 1870.

C Newspaper Job Ads

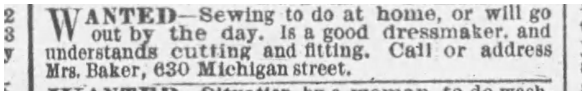
Figure 7: Examples of newspaper job advertisements for dressmakers



Sewing Machine Hands.

WANTED Twenty Sewing Machine Hands for important Government work. Those having Machines of their own preferred. Apply to
SAM'L J. GUSTIN,
june 3—1w* Cotton Avenue, near Mulberry St.

(a) *Macon Telegraph*, June 9, 1862



WANTED—Sewing to do at home, or will go out by the day. Is a good dressmaker, and understands cutting and fitting. Call or address Mrs. Baker, 630 Michigan street.

(b) *Buffalo News*, March 14, 1885

Notes: Source: *newspapers.com*.