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Women's Employment in the United States After the 1918 Influenza Pandemic

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Abstract

Lasting changes in women's employment followed the 1918 influenza pandemic in the United States. In the decades before the pandemic, consistently fewer women reported an occupation in cities that would go on to have longer interventions targeted at curbing influenza. This gap narrowed after the pandemic, and by 1930 cities with longer interventions experienced a 3.9 percentage point improvement in women's employment rates on average, relative to cities with shorter interventions. These gains were concentrated in cities in which women had the right to vote prior to 1920.

JEL Classifications: N32, I18, J16.

Keywords: Employment, Gender, Influenza, Pandemic.

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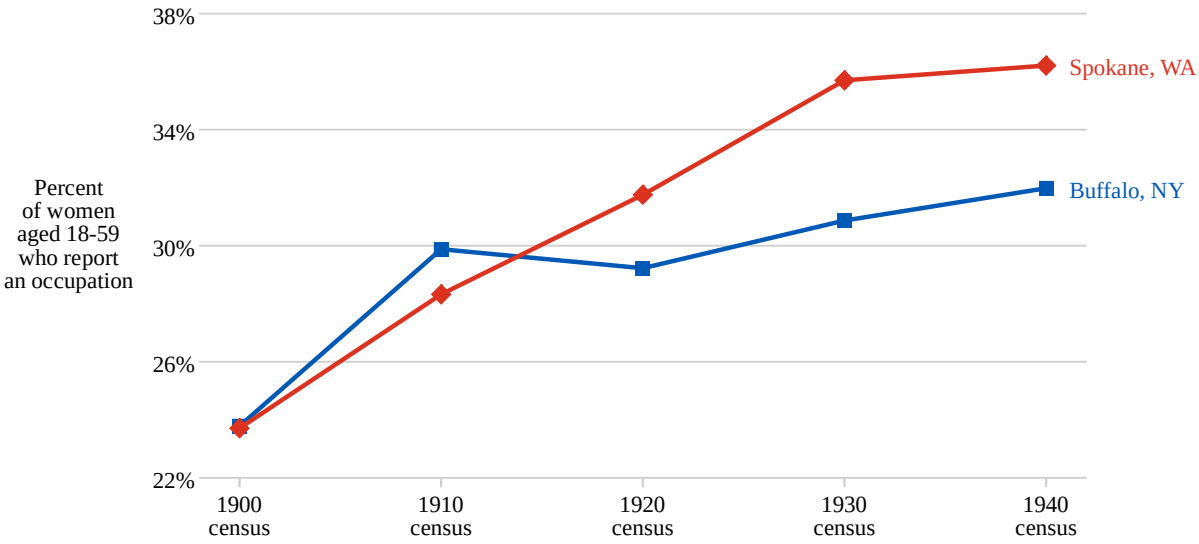
Introduction

In the 1900 US census, 22 percent of women aged 18-59 reported an occupation. In 1940, 31 percent did so. This increase was unevenly distributed across the country. For example, Figure 1 compares two cities, Buffalo, New York, and Spokane, Washington. In both cities, 24 percent of women reported an occupation in 1900. By 1940, the share of women reporting an occupation rose by eight percentage points in Buffalo and 12 percentage points in Spokane. Using full-count census records and other information from these and another 41 of the largest cities at the time, we show that differences in how cities responded to the 1918 influenza pandemic explain some of the gains in women's employment.



Source: Steven Ruggles, Matt Nelson, Matthew Sobek, Catherine Fitch, Ronald Goeken, David Hacker, Evan Roberts, and Robert Warren (2024).
Note: The gainful employment rate is calculated as the share of women aged 18-59 who report an occupation.

Figure 1
Gainful Employment Rate

The influenza of 1918 was the deadliest pandemic in the United States during the twentieth century. Deaths due to influenza and pneumonia accelerated in September 1918 and remained elevated into early 1919, in many places double or triple what was normal (Edgar Sydenstricker 1918; United States Census Bureau 1913-1925). October 1918 remains the deadliest month since recordkeeping began. Local governments responded by imposing isolation and quarantine measures, school and business closures, and other bans on public gatherings. The duration of these non-pharmaceutical interventions varied from just a few weeks to several months. On average, cities with longer interventions experienced fewer deaths during the peak months of the pandemic (Robert Barro 2022; Howard Markel, Harvey Lipman, Alexander Navarro, Alexandra Sloan, Joseph Michalsen, Alexandra Minna Stern, and Martin Cetron 2007).

Interventions lasted 49 days in Buffalo and 164 days in Spokane. Again, the share of women reporting an occupation rose by one-third in Buffalo and by one-half in Spokane. We use a regression framework to measure the average change in women's employment

associated with the duration of interventions across all 43 cities. In cities that would later keep interventions in place for at least 67 days during the pandemic, 27 percent of women reported an occupation in the 1900 census. In cities that would later impose shorter interventions, 33 percent of women reported an occupation in 1900. In both groups of cities, employment rates rose by six percentage points in 1910. It was only starting in 1920, after the pandemic, that this gap narrowed, with employment rates rising faster in those cities that had imposed longer interventions. What had been a six-percentage point gap in women's employment rates between cities in 1910 narrowed to just two percentage points by 1930.

There are several potential explanations for this finding. One is that women joined the labor force to replace deceased workers. With the experience they obtained, these women stayed in the labor force over the subsequent decades. Using the 1917-19 Bureau of Labor Statistics (BLS) Cost of Living Survey administered during the pandemic in many of these cities (Bureau of Labor Statistics 1992), we find a brief increase in the proportion of women working at the height of the pandemic in cities with the most deaths, but long-run census data show that this increase quickly abated. Similarly, we find no long-run increase in women's employment associated with World War One conscription or mortality. There is thus no evidence to suggest that replacement of workers lost to the pandemic or the war led to long-term improvements in women's employment rates.

A second potential explanation is that extended interventions led men to spend more time at home, establishing a norm of shared domestic responsibilities and thereby enabling women to participate more in the labor force over time. This time at home may have also allowed or encouraged men to develop skills that lowered the opportunity cost of continuing to share domestic responsibilities in the future. However, we find that the increase in employment associated with longer interventions was as large for unmarried women as for married women, suggesting that a redistribution of responsibilities between husbands and wives was not the primary factor leading more women to work outside the home.

A third potential explanation is that longer interventions were associated with broader improvements in women's standing and the gendered division of labor. The extended periods of instability brought by prolonged interventions may have pushed more women into the public sphere, taking on roles traditionally held by men and heightening awareness of the need for progressive social policies. For instance, the establishment of the US Children's Bureau in 1912 exemplified the growing influence of women in social policy. Following the 1918 influenza pandemic, the Bureau conducted a comprehensive international study of maternity benefits in 1919. According to Seth Koven and Sonya Michel (1990, 1094), "The very existence of the Children's Bureau testifies to the unusual power and vigor of women's higher education and women's movements in the United States and, more generally, to their authority as social policy experts … American women became entrenched in several branches of the federal bureaucracy, on state boards of charity, and in local and state welfare agencies".

This trend suggests that the disruptions caused by longer interventions may have accelerated changes in gender roles, particularly in cities where women had the right to vote before the ratification of the Nineteenth Amendment in 1920. In these cities, traditional gender roles had already been challenged, creating a more supportive environment for changes in women's employment. Our analysis reveals that the improvements in women's employment associated with longer interventions were concentrated exclusively in these cities, indicating that pre-existing conditions favoring gender equality played a crucial role. We argue that the convergence of prolonged public health measures and a progressive social climate likely facilitated a more enduring shift in the labor force participation of women.

In the next section, we review existing evidence of changes in women's employment during and after pandemics. We then describe our main sources of data regarding the 1918 influenza pandemic and women's employment. After presenting our main findings of an increase in women's employment rates after the pandemic in cities that imposed longer

interventions during the pandemic, we assess several possible explanations for this relationship. We conclude by comparing the evidence from 1918 to recent changes in women's labor force participation during the COVID-19 pandemic.

Pandemics and Women's Employment

Pandemics can shape societies long into the future. The Black Death, the deadliest pandemic in recorded history, claimed the lives of more than one-third of people in Europe and North Africa between 1346 and 1353 (Remi Jedwab, Noel Johnson, and Mark Koyama 2022). Depopulation raised land-labor ratios, drew more women into farming, and led to higher-paying labor market opportunities (Nico Voigtländer and Hans-Joachim Voth 2013). These changes resulted in the European Marriage Pattern, a demographic trend in which women in predominantly north-western Europe married later and had fewer children or were more likely to remain single (Tine De Moor and Jan Luiten Van Zanden 2010). These smaller households depended on wage labor and increasingly relied on the market for both consumption and investment.

The largest pandemic of the twentieth century, the 1918 influenza pandemic had a global mortality rate of between one and three percent. Although this average hides regional differences, even at its most severe the death rate was far lower than during the Black Death (Peter Spreeuwenberg, Madelon Kroneman, and John Paget 2018). It is therefore not surprising that there is little evidence linking the 1918 influenza pandemic to women's long-run economic outcomes. In South Africa, pandemic mortality had no short or long-term effect on female unemployment (Daniel De Kadt, Johan Fourie, Jan Greyling, Elie Murard, and Johannes Norling 2021). In Sweden, there was a positive correlation between pandemic mortality and female employment, but only in the short run (Martin Karlsson, Therese Nilsson, and Stefan Pichler 2014). In Brazil, literacy rates rose after the pandemic, but only for men (Amanda Guimbeau, Nadhiya Menon, and Aldo Musacchio 2022). In India, high mortality districts experienced an immediate increase in female labor participation, but no sustained response beyond 1921 (James Fenske, Bishnupriya Gupta, and Song Yuan 2022).

In the United States, women increasingly joined the labor force over the twentieth century, a development that has attracted much attention (Marina Adshade and Ian Keay 2010; Heather Boushey 2008; Claudia Goldin 1990, 2006, 2021; Joan Huber 1976). Reasons for this rise include changing regulations, access to education, family structure and technology. However, we find no study that explicitly links the 1918 influenza pandemic to women's labor market outcomes. Douglas Almond (2006) shows that children *in-utero* during the pandemic had lower educational attainment, income, and other outcomes later in life, but the consequences were similar for women and men. Keith Meyers and Melissa Thomasson (2021) show that the 1916 polio epidemic, which also resulted in mass quarantines and prolonged school closures, also had adverse effects on education that, again, were similar for both women and men. In this article, we contribute new evidence of the changes to women's labor market outcomes that followed the 1918 influenza pandemic in the United States.

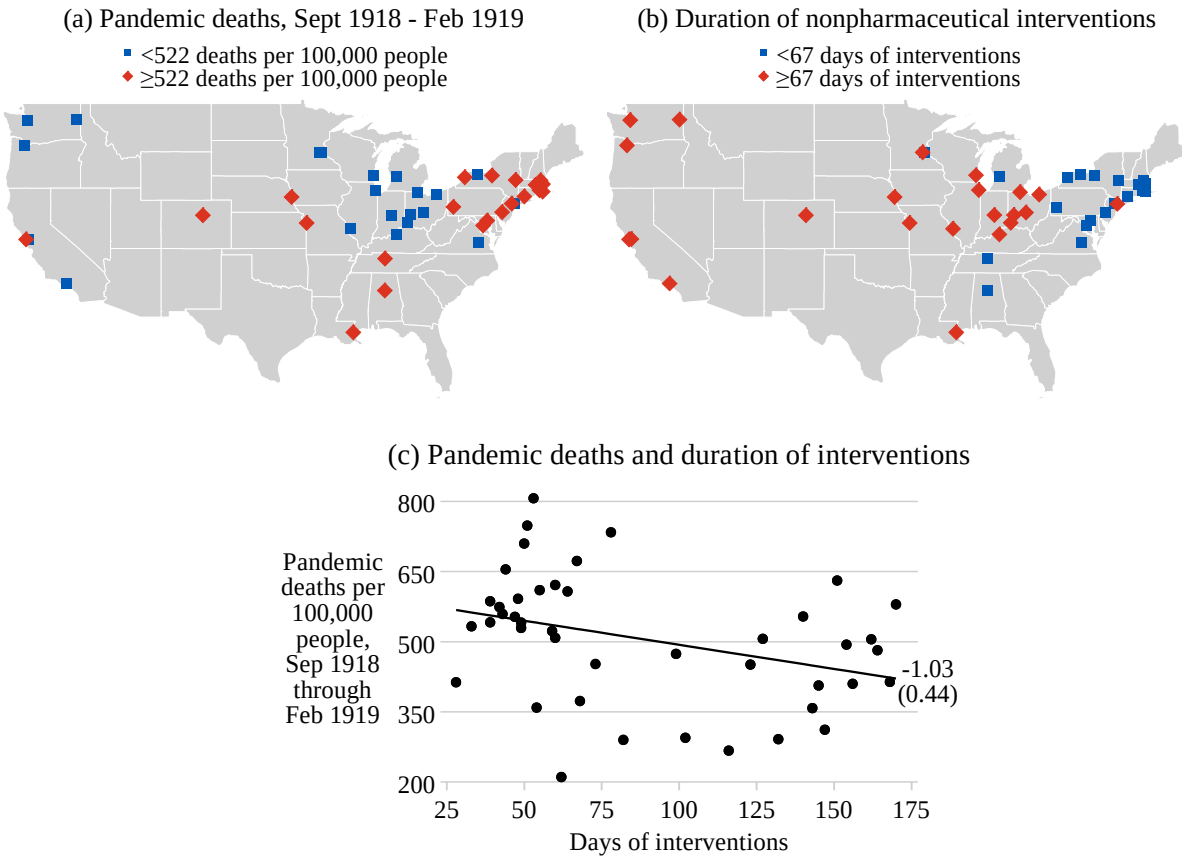
Characteristics of the 1918 Influenza Pandemic

Markel et al. (2007) tallied pandemic deaths from September 1918 through February 1919 in 43 cities. These were among the 50 largest cities and contained one-fifth of the US population. Cumulative mortality ranged from 211 deaths per 100,000 people in Grand Rapids, Michigan, to 807 deaths per 100,000 people in Pittsburgh, Pennsylvania. As depicted in panel (a) of Figure 2, cities with above-median pandemic mortality were concentrated in the northeast. Cities in the industrial Midwest and west coast tended to have fewer deaths.

Non-pharmaceutical interventions are a primary policy lever available to local officials during a pandemic. Markel et al. (2007) also compiled information about the timing and

duration of isolation and quarantine measures, school closures, and bans on public gatherings in the same cities. There was little variation in how quickly cities imposed interventions in 1918: 37 of the 43 cities first imposed an intervention in the last week of September or first two weeks of October. There was more variation in the duration of interventions, which ranged from four weeks in St. Paul, Minnesota, to nearly six months in Kansas City, Missouri. Interventions during COVID-19 in the United States followed a similar pattern. For example, nearly every school district closed in the same two weeks in March 2020. Some returned to in-person schooling in August, others not until spring 2021 (Shira Haderlein, Anna Rosefsky Saavedra, Morgan Polikoff, Daniel Silver, Amie Rapaport, and Marshall Garland 2021; Nicole Zviedrite, Jeffrey Hodis, Ferdous Jahan, Hongjiang Gao, and Amra Uzicanin 2021).

As depicted in panel (b) of Figure 2, longer interventions, above the sample median of 67 days, were concentrated in cities in the Midwest and west coast—many of the same cities that experienced fewer deaths. Panel (c) compares duration of interventions and cumulative mortality across the 43 cities. The linear best fit line indicates that, on average, each additional day of interventions was associated with 1.03 fewer deaths per 100,000 people. As Markel et al. (2007) conclude, more robust public policy interventions were associated with lower mortality.



Source: Markel et al. (2007).
Note: The sample consists of 43 cities.

Figure 2
Pandemic Characteristics

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Main Findings

Using full-count population censuses (Ruggles et al. 2024), we calculate the percent of women aged 18-59 who report an occupation, in each of the 43 cities in each census year between 1900 and 1940. This "gainful employment rate" was the only measure of labor force participation consistently recorded across this period (Nancy Folbre and Marjorie Abel 1989; Jon Moen 1988). Our dataset therefore consists of a panel of 43 cities, each observed across five censuses, 1900 through 1940.

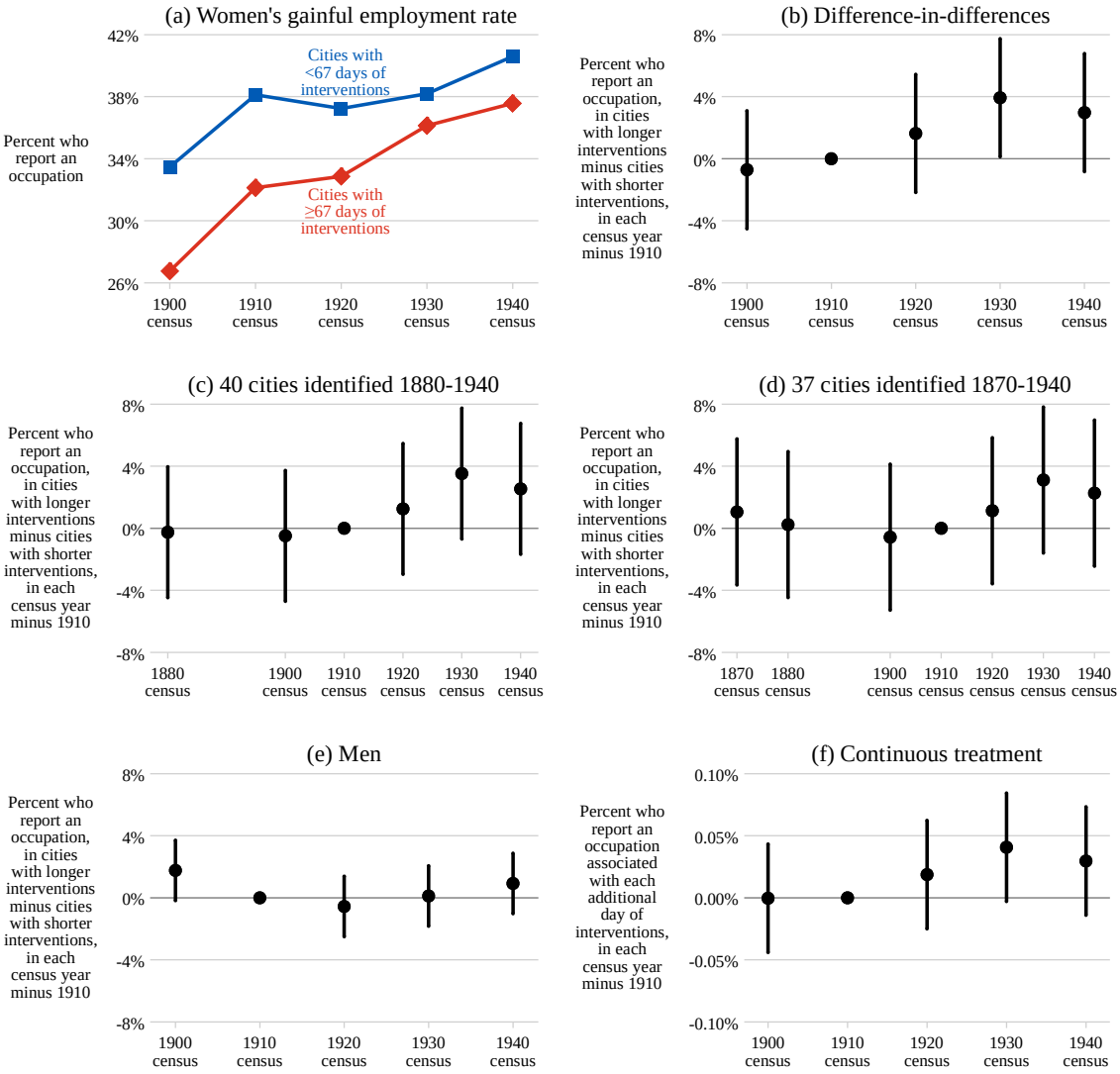
We aim to compare gains in women's employment in cities with longer interventions to cities with shorter interventions. Panel (a) of Figure 3 motivates this comparison. In cities with shorter interventions, 33.5 percent of women reported an occupation in 1900. This share rose to 38.1 percent in 1910, then stagnated through 1930 before rising again to 40.6 percent in 1940. In cities with longer interventions, a smaller share of women reported an occupation in every year: in 1900, just 26.8 percent of women reported an occupation, and in 1910 just 32.1 percent did so. The gap then narrowed. Whereas women's gainful employment rates stagnated between 1910 and 1930 in cities with shorter interventions, the gains continued over this period in cities with longer interventions.

This comparison suggests that cities that imposed longer interventions in 1918 experienced particular gains in women's employment starting in 1920. We use the following event study difference-in-differences ordinary least squares regression to measure the difference in gainful employment rates between these two groups of cities, before and after the pandemic:

$$EmplRate_{cy} = \alpha + \sum_{j \neq 1910} \delta_j 1(y = j) + \beta LongNPI_c + \sum_{j \neq 1910} \gamma_j 1(y = j) \times LongNPI_c + \varepsilon_{cy} \quad (1)$$

EmplRate records the gainful employment rate in city *c* in year *y*. The first set of right-hand side variables are year fixed effects, to account for the overall gains in women's employment over time. The omitted year, 1910, was the last census before the pandemic. *LongNPI* is a dummy variable equal to 1 if non-pharmaceutical interventions were in place for 67 or more days in the city (the median duration of interventions among the 43 cities). The coefficients of interest, γ_{1900} through γ_{1940}, estimate the difference-in-differences: the

percentage point difference between women's employment rates in cities with longer interventions and cities with shorter interventions, in each year minus the difference in 1910.



Sources: Markel et al. (2007), Ruggles et al. (2024).
Note: Estimates in panels (b) through (f) using equation 1, with 95-percent confidence intervals. Panels (b) through (e) report the difference-in-differences estimates using binary treatment. Panel (f) reports the difference-in-difference estimates using continuous treatment, days of interventions.

Figure 3
Main Findings

Column 1 of Table 1 presents the regression results. Compared to 1910, the average gainful employment rate for women was 4.7 percentage points lower in 1900. The average then fell again by 0.9 percentage points in 1920 before rebounding in 1930 and 1940. Also in 1910, cities that would go on to impose longer interventions had 6.0 percentage points fewer women reporting an occupation, compared to cities with shorter interventions. The remaining estimates in column 1 subtract this difference from the corresponding difference in the other four census years. Panel (b) of Figure 3 depicts these difference-in-differences estimates. The difference between gainful employment rates in cities with longer versus shorter interventions was similar in 1900 as in 1910, although with a wide 95-percent confidence interval. (In the

appendix, we show that this wide confidence interval is due to substantial variation across cities in the gains in women's employment between 1900 and 1910). Relative employment rates in cities with longer interventions then grew, by up to 3.9 percentage points by 1930. The 95 percent confidence interval around this differences-in-differences estimate in 1930 does not overlap zero, meaning that the narrowing gap between the two gainful employment rate trends in panel (a) is statistically significant. This is the main finding of the article: women's gainful employment rates notably rose after the pandemic in cities that had imposed longer non-pharmaceutical interventions during the pandemic. (John Barry 2007 challenges the accuracy of intervention records from New York City and Chicago. Our main finding is unchanged if these two cities are excluded from the sample.)

Table 1
Main Findings

Dependent variable: Gainful employment rate	(1)	(2)
	Women	Men
First difference: Time		
Year=1900	-4.66	-4.59
	(1.39)	(0.71)
Year=1920	-0.89	-0.61
	(1.39)	(0.71)
Year=1930	0.072	-1.68
	(1.39)	(0.71)
Year=1940	2.46	-6.54
	(1.39)	(0.71)
Second difference: Treatment		
Interventions in the city lasted ≥67 days	-6.00	0.057
	(1.37)	(0.70)
Difference-in-differences		
Year=1900 × City with long interventions	-0.71	1.76
	(1.94)	(0.99)
Year=1920 × City with long interventions	1.63	-0.56
	(1.94)	(0.99)
Year=1930 × City with long interventions	3.93	0.12
	(1.94)	(0.99)
Year=1940 × City with long interventions	2.97	0.93
	(1.94)	(0.99)
Constant	38.12	96.11
Cities	43	43
Years	5	5
Observations	215	215
R^2	0.41	0.50

Note: The sample consists of the same 43 cities in each year. Estimates using equation 1. Data sources: Markel et al. (2007), Ruggles et al. (2024).

Interventions were not imposed randomly. Richard Hatchett, Carter Mecher, and Marc Lipsitch (2007), Markel et al. (2007), and Barro (2022) document how the timing of interventions depended on particular local public health and political circumstances. Table 2 shows that the two groups of cities differed across several observable characteristics in 1910. Compared to cities with shorter interventions, cities with longer interventions were generally located outside of the Northeast, and had more residents but were less densely populated. Women in these cities were more likely to belong to farm households and be married, and were younger with fewer children on average. Men in these cities had a slightly higher occupational earnings score (an estimate of earnings for each occupation; income was not recorded by the 1910 census) and were more likely to be self-employed. Several of these differences are statistically significant.

Table 2
Balance Test

	Average in 1910 in cities with pandemic interventions that lasted **at least** 67 days	Average in 1910 in cities with pandemic interventions that lasted **less than** 67 days	Difference
Percent located in the Northeast	4.5	66.7	-62.1 (11.3)
Population	572,542	305,904	266,638 (236,024)
Population density per square mile	6,567	8,333	-1,766 (1,255)
Percent of women in a farm household	0.40	0.32	0.083 (0.053)
Average age of women	33.9	34.1	-0.23 (0.20)
Percent of women who are married	61.6	57.7	3.90 (1.13)
Average number of children per woman	1.15	1.26	-0.11 (0.042)
Average men's occupational earnings score	572.6	570.2	2.45 (5.30)
Percent of men who are self-employed	14.2	11.8	2.43 (0.67)

Note: The sample consists of the 43 cities identified in panel (b) of Figure 2. Average number of children per women is calculated using only children present in the household.
Data sources: Markel et al. (2007), Ruggles et al. (2024).

Because cities with longer and shorter interventions differed in observable and perhaps unobservable ways, we cannot conclude that longer interventions alone caused employment gains for women. However, the gap in employment rates between these two groups of cities remained roughly constant ahead of the pandemic. We focus on censuses since 1900, the year in which all 43 cities are identified. The 1890 census records were lost in a fire. The 1880 census records do not identify Birmingham, Alabama, Seattle, Washington, and Spokane, Washington. The 1870 census records further do not identify Denver, Colorado, Los Angeles, California, and Portland, Oregon. Panels (c) and (d) of Figure 3 repeat the main differences-in-differences estimates, using these longer time periods and smaller samples of cities. In each case, the main findings generally hold: a relatively flat pre-trend through 1910, followed by a particular increase in women's employment in cities that imposed longer interventions.

The association between longer interventions and employment gains began only after the pandemic, and only for women: column 2 of Table 1 and panel (e) of Figure 3 present equivalent difference-in-differences estimates for men, which show no relative improvement in men's employment after the pandemic in cities with longer interventions. We therefore interpret the association between longer interventions and employment gains for women as being consistent with an explanation in which longer interventions, possibly along with other changes around the time of the pandemic that only affected women's employment, contributed to lasting gains in women's employment. In the next section, we consider one such possible alternative explanation, county-level involvement in World War One.

We have two final notes about the empirical specification and data. First, equation 1 groups cities by whether they had longer or shorter than median duration of interventions. This grouping compresses a distribution that ranges from 28 to 170 days of interventions. An alternative specification of equation 1 could use this continuous measure of interventions in place of the *LongNPI* dummy variable. Panel (f) of Figure 3 presents these difference-in-difference estimates, which are interpreted as the additional percent of women who report an occupation associated with every additional day of interventions, in each year minus 1910. These estimates once again show relative gains in women's employment in the decades after the pandemic in cities that imposed longer interventions. However, recent research raises concerns about the validity of difference-in-differences with continuous treatment, such as regarding the assumption that treatment effects are linear (Brantly Callaway, Andrew Goodman-Bacon, and Pedro Sant'Anna 2024; Clément De Chaismartin, Xavier D'Haultfœuille, and Gonzalo Vazquez-Barre 2024). We therefore continue with the difference-in-differences with binary treatment specification in equation 1.

Second, decennial censuses in the late 1800s and early 1900s likely undercounted labor force participation by women who were living with self-employed family members (Barry Chiswick and RaeAnn Robinson 2021). In many cases, these women were recorded as not working even though they likely contributed to a family business. This undercounting means the true gain in women's employment may have been smaller than that suggested by official statistics. As given in the final row of Table 2, the share of men who were self-employed in 1910 was 2.4 percentage points higher in cities that went on to impose longer pandemic interventions. It is possible that women in those households were in fact working prior to the pandemic, diminishing the apparent gains in women's employment after the pandemic. However, by 1940, men remained 1.4 percentage points more likely to be self-employed in cities that had imposed longer interventions (10.3 percent compared to 8.9 percent). The gap in self-employment rates between the two groups of cities only narrowed slightly, suggesting that undercounting of women's work in family businesses alone cannot explain the nearly four percentage point relative improvement in women's gainful employment rates in cities with the longest interventions.

Explaining the Main Findings

Pandemic Deaths

In this section, we seek to understand why women's employment particularly improved after the pandemic in cities that left interventions in place longer. We first test whether women entered the labor force as replacements for deceased workers during the pandemic. We begin by using the 1917-19 BLS Cost of Living Survey (Bureau of Labor Statistics 1992). Several studies, including Sergio Correia, Stephan Luck, and Emil Verner (2022) and François Velde (2022), document city-level macroeconomic changes during the pandemic. But, to the best of our knowledge, available macroeconomic data do not distinguish the economic experiences of women and men. Only the BLS Cost of Living Survey allows us to observe how women's employment may have changed during the pandemic.

Coincident with the main wave of the pandemic, between July 1918 and February 1919 the BLS surveyed 12,817 households in 99 cities, including 33 of the 43 cities in our sample. The survey identified whether each household member had worked over the past 12 months. Few Black households were surveyed, so we focus on white households. Every household had a wife, a husband who was currently employed as a wage earner or salaried worker, and at least one child. Because every husband was alive and working, we cannot observe women who entered the labor force after their husbands died during the pandemic. Any changes we find resulting from the experience of sickness or some indirect effect of the pandemic may therefore understate the full labor market changes during the pandemic.

We divide the sample into three groups: 2,353 households located in the 11 cities surveyed in July, August, or September 1918, right before or as deaths accelerated (group 1); 2,517 households located in the 12 cities surveyed in October or November 1918, at the height of the pandemic (group 2); and 1,248 households located in the 10 cities surveyed in December 1918 or January or February 1919, as deaths waned (group 3). We then estimate the following regression:

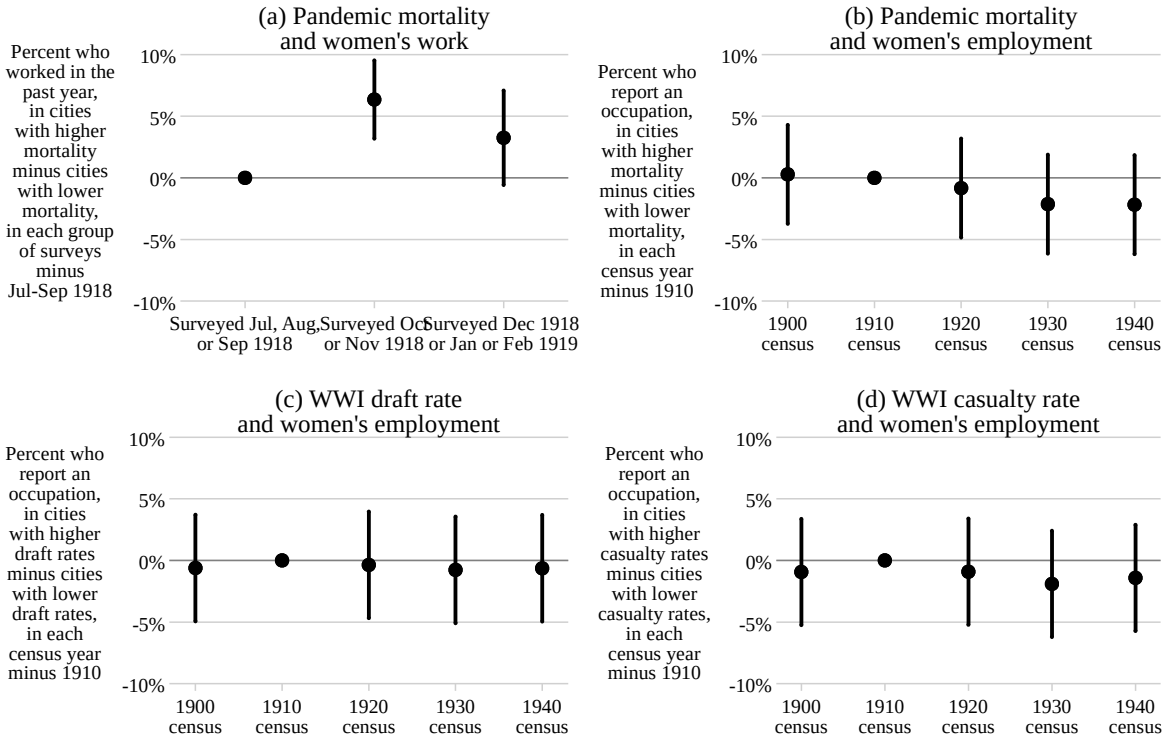
$$Worked_{icg} = \alpha + \sum_{j \neq 1} \delta_j 1(g = j) + \beta HighMort_c + \sum_{i \neq 1} \gamma_j 1(g = j) \times HighMort_c + \varepsilon_{icg} \qquad (2)$$

This is again an event study difference-in-differences regression. *Worked* equals 1 if woman *i*, living in city *c* and surveyed in month group *g*, worked in the past 12 months. The first set of right-hand side variables are survey month group fixed effects. *HighMort* is a dummy variable equal to one if there were at least 522 deaths due to the pandemic per 100,000 people in the city (the median mortality rate). The coefficients of interest, γ_2 and γ_3, estimate the difference-in-differences: the percentage point difference between the share of women who worked in cities with higher mortality minus cities with lower mortality, in each survey month group minus the difference in July-September.

Panel (a) of Figure 4 reports the difference-in-differences estimates. Compared to the difference between high-mortality cities and low-mortality cities surveyed in July through September, the relative share of women who had worked was six percentage points higher among households surveyed in high-mortality cities in October and November. During the deadliest months of the pandemic, women in cities with more deaths were relatively more likely to have worked. The difference-in-differences estimate then declined but remained positive in late 1918 and early 1919.

Unlike the long-run census data, the BLS Cost of Living Survey did not follow a panel of cities, so it is possible that changing composition of cities could explain the estimates in panel (a). For this reason, we interpret this evidence as only suggestive of an immediate spike in women working in cities with the most pandemic deaths. However, this evidence is supported

by contemporary newspaper accounts that reported more women joining the workforce. For example, the *Spokesman-Review* (1919) in Spokane, Washington reported that "influenza was furnishing considerable employment for women", and the *Rochester Times-Union* (1919) in Rochester, New York reported that "influenza has forced women to enter business life".



Sources: Bureau of Labor Statistics (1992), Andreas Ferrara and Price Fishback (2024), Markel et al. (2007), Ruggles et al. (2024).

Note: Difference-in-differences estimates, with 95-percent confidence intervals. Panel (a): Estimated using equation 2, on a sample of white women surveyed by the 1917-19 BLS Cost of Living Survey, living in cities with pandemic information compiled by Markel et al. (2007). Standard errors clustered by city. Panels (b) through (d): Estimated using equation 1, with duration of interventions replaced by cumulative pandemic mortality (panel [b]), WWI draft rate (panel [c]), and WWI casualty rate (panel [d]).

Figure 4
Mortality

Did women's employment rates continue to improve in these cities in the decades after the pandemic? To answer this question, we return to the full-count census data between 1900 and 1940 and again estimate equation 1, but with pandemic mortality (*HighMort*) in place of duration of interventions (*LongNPI*). Panel (b) of Figure 4 presents the difference-in-differences estimates. The association between women's employment rates and pandemic mortality remained constant between 1900 and 1910, then fell slightly through 1940. After the pandemic, relatively fewer women worked in cities that had more influenza deaths. Women may have temporarily stepped in to fill the jobs of those who died during the pandemic, but there is no evidence of any lasting increase in women's employment.

A variation of the mortality hypothesis is that departure of working-age men for the war effort drew women into the formal labor market. Nearly 3 million men were drafted and more than 100,000 died, representing substantial reductions in working-age men, although at lower rates than in European countries during World War One and the United States during World

War Two (Elliott Davis, Jr. 2024; Library of Congress 2024; Selective Service System 2024). For example, Victor Gay (2023) shows that World War One casualties in France opened lasting labor market opportunities for women. To test this possibility in the United States, we again estimate equation 1, but in place of duration of interventions we use a dummy variable equal to one if the city's draft rate was above the sample median. Panel (c) of Figure 3 presents the difference-in-differences estimates. There was little change over time in the relationship between draft rates and women's employment. Panel (d) presents equivalent difference-in-difference estimates of equation 1, but in place of duration of interventions we use a dummy variable equal to one if the city's World War One casualty rate was above the sample median. Women's gainful employment rates fell in high-casualty cities relative to low-casualty cities starting in 1920, although the differences are not statistically significant. There is no evidence of any lasting increase in women's employment in cities in which more men joined or died in the war effort.

By Marriage Status

A second hypothesis focuses on the gendered consequences of non-pharmaceutical interventions. In cities that experienced extended interventions during the pandemic, husbands may have learned, out of necessity or circumstance, to take on a greater share of household responsibilities. If these men then adapted to a more balanced division of household tasks even after interventions were lifted, then their wives may have had greater opportunity to seek formal employment outside the home. If so, we would expect employment gains following long interventions to be greater for married women than unmarried women.

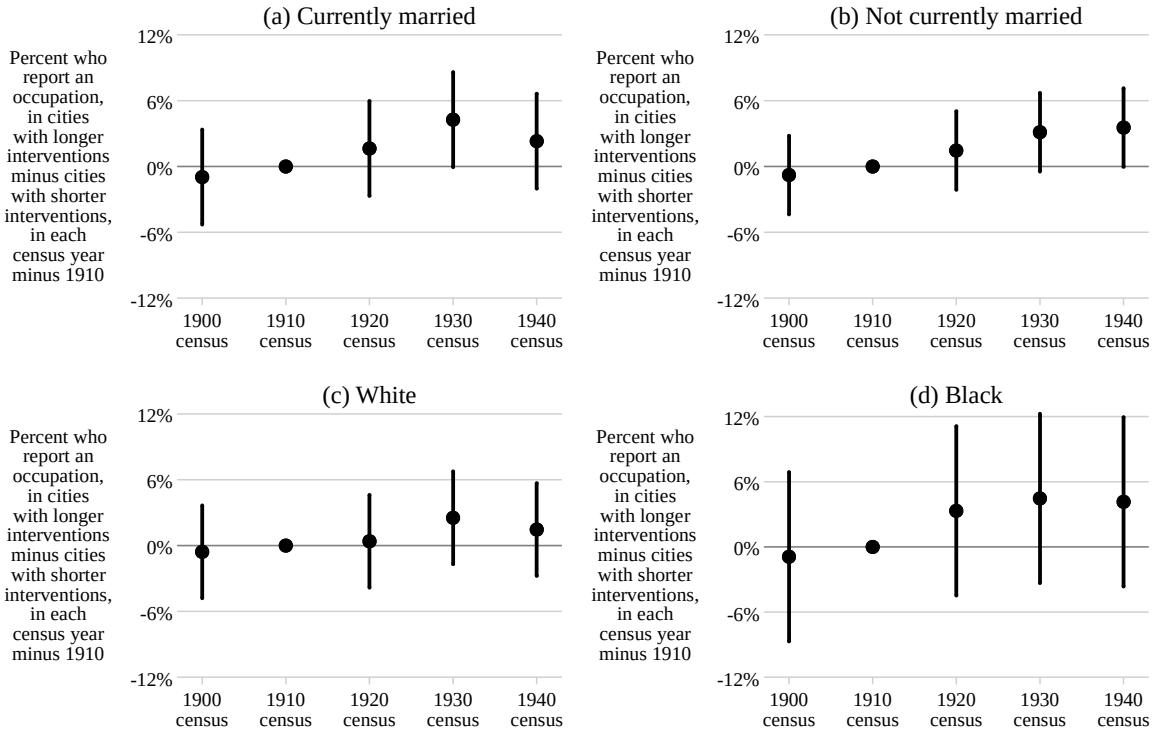
To test this hypothesis, we estimate equation 1 separately for married and unmarried women. Figure 5 presents the difference-in-differences estimates. For both groups in 1900, the confidence intervals are wide but the estimates are nearly zero, suggesting that employment differences in 1900 between cities that would go on to have longer versus shorter pandemic interventions were similar in 1910. For both groups, relative employment then rose starting in 1920 in cities with longer interventions. This evidence does not support the hypothesis that the interventions particularly opened opportunities for married women to work. If anything, by 1940, the gains for unmarried women were longer lasting.

Panels (c) and (d) of Figure 5 additionally present difference-in-difference estimates for white women and black women separately. Although the confidence intervals are wide, the difference-in-differences estimates for both are similar. Both white and Black women experienced employment gains in cities that had imposed longer interventions.

War Production and Suffrage

Finally, we search for evidence that broader changes in traditional gender roles affected women's employment. Raquel Fernández (2013, 474) argues that both "beliefs and earnings played important roles in the transformation of women's work". She constructs a model in which women have private information about the long-term costs of working and observe a noisy public signal reflecting past beliefs, which is influenced by the proportion of women who worked in the previous generation. Women update their beliefs based on this information and decide whether to work, creating a cycle where each generation's work decisions inform the next through intergenerational learning. Using cross-state variation in the impact of World War Two on women's labor supply, Fernández finds a significant shift in beliefs after 1950, with intergenerational learning playing a crucial role in the increased willingness of women to join the labor market.

We consider two possible disruptions to assumptions about gender roles earlier in the twentieth century: involvement in World War One, and the suffrage movement. Contemporary accounts claimed that wartime production opened opportunities for women to work that could



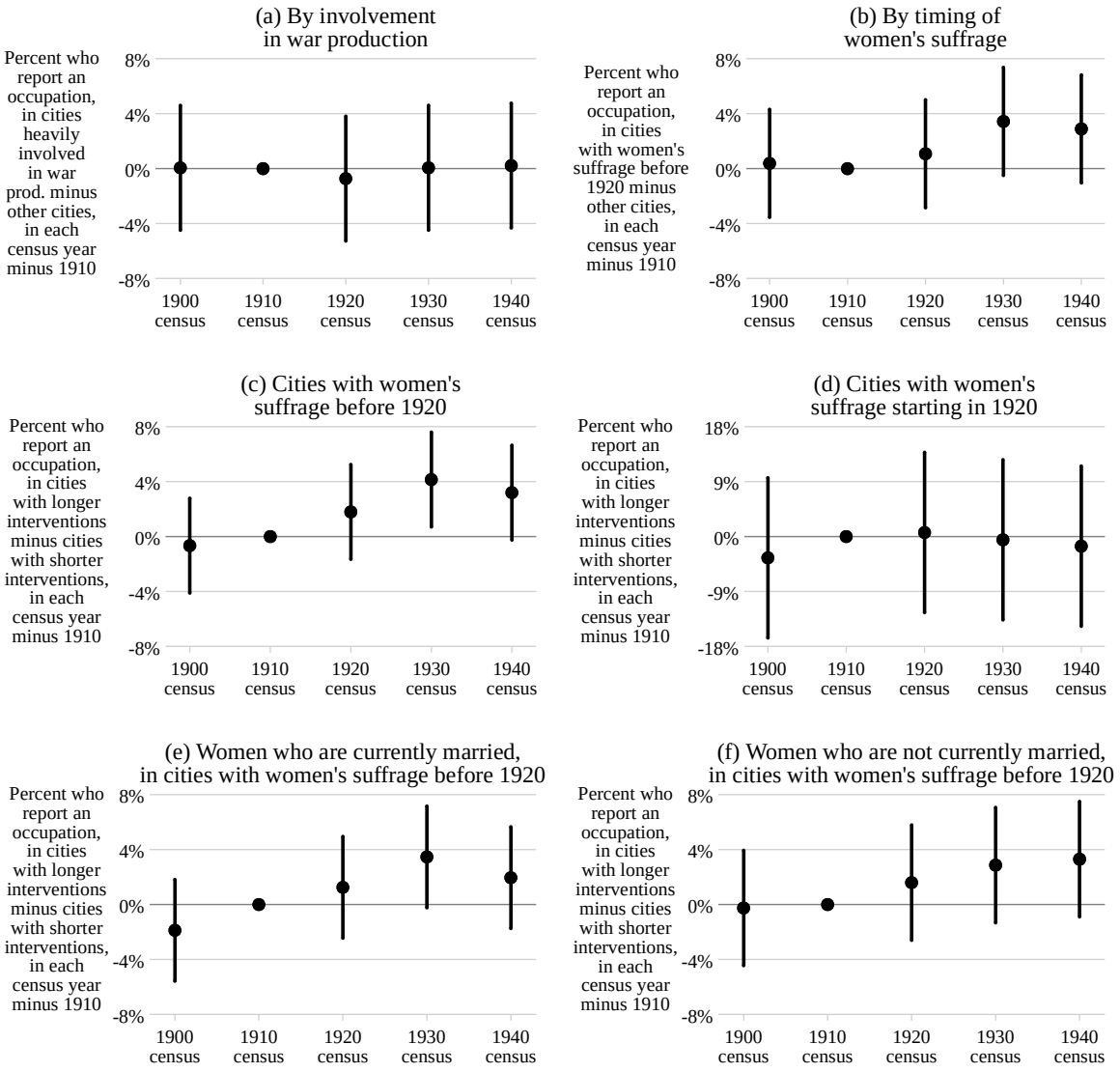
Sources: Markel et al. (2007), Ruggles et al. (2024).
Note: Difference-in-differences estimates of equation 1, estimated separately using only women who are currently married (panel [a]), women who are not currently married (panel [b]), white women (panel [c]), and Black women (panel [d]), with 95-percent confidence intervals.

Figure 5
Demographic Groups

go on to have persistent effects. For example, as argued in the *Glenwood Post* (1919), "women are now being offered an unprecedented chance to show what they can do in industry … in many cases there will be tendency and disposition to broaden the scope of women's employment after the end of the war". The suffrage movement likewise may have changed expectations about women's roles. For example, Jane Fisher (2012, 28) argues that "suffrage protests in America and the United Kingdom had excited expectations for expanded rights for middle- and upper-class women".

We again estimate equation 1, but in place of duration of interventions we use a dummy variable equal to one if the city is located in Michigan, New Jersey, New York, or Ohio, the states heavily involved in industrial production for the war effort (Thomas Garrett 2009). Panel (a) of Figure 6 reports the difference-in-differences estimates. There was little change over time in the difference in women's gainful employment rates between cities heavily involved and not heavily involved in the wartime industrial production. These estimates fail to support the hypothesis that increased labor market opportunities during the war effort translated into lasting gains in women's employment.

In panel (b) of Figure 6, we provide equivalent evidence for cities in which women's suffrage began before versus in 1920, when ratification of the nineteenth amendment to the US constitution guaranteed all women the right to vote. We again estimate equation 1, but in place of duration of interventions we use a dummy variable equal to one if the city is located in a state in which women had the right to vote before 1920 (Center for American Women and Politics 2014). In 1910, women's employment rates were 6.6 percentage points lower in these



Sources: Bureau of Labor Statistics (1992), Center for American Women and Politics (2014), Garrett (2009), Markel et al. (2007), Ruggles et al. (2024).

Note: Difference-in-differences estimates of equation 1, with 95-percent confidence intervals. In panels (a) and (b), the longer-interventions dummy variable is replaced by a dummy variable equal to 1 if the state was heavily involved in wartime production (panel [a]), or a dummy variable equal to 1 if women in the city could vote before 1920 (panel [b]). Women had the right to vote at least for president before 1920 in the following states: Alaska, Arizona, California, Colorado, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New York, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Dakota, Tennessee, Utah, Washington, Wisconsin, and Wyoming. Panels (c) and (d) estimate equation 1, but the sample is restricted to just cities with women's suffrage before 1920 (panel [c]) and cities where women gained the right to vote in 1920 (panel [d]). Panels (e) and (f) do the same for women who are currently married and not currently married.

Figure 6

War Production and Suffrage

cities. This difference was nearly the same as it had been in 1910, but starting in 1920, relative employment rates began to rise in cities with earlier suffrage. By 1930, the difference had halved to 3.1 percentage points. Although fewer women worked in cities where women had the right to vote prior to 1920, the employment gap narrowed starting in 1920, lending support to the hypothesis that the suffrage movement was associated with changing opportunities for women. (Other research shows that early suffrage was similarly associated with improvements in children's education and mortality and intergenerational gains in earnings [Esra Kose, Elira Kuka, and Na'ama Shenhav 2021; Grant Miller 2008; Hamid Noghanibehambari, and Farzaneh Noghani 2023; Noghanibehambari, Noghani, and Nahid Tavassoli 2023]).

We next divide the sample into cities with women's suffrage before 1920 and cities with suffrage starting in 1920, and separately estimate equation 1 using each sample. Panel (c) reports the difference-in-differences estimates using the 28 cities with suffrage before 1920, 20 of which had interventions lasting at least 67 days. Relative employment rates rose by up to 4.1 percentage points by 1930 in cities that had imposed longer interventions. As shown in panel (d), there were no equivalent gains in cities with suffrage starting in 1920 (although just two of these 15 cities had long interventions). Longer interventions were associated with gains in women's employment, but only in cities where women could vote prior to the ratification of the nineteenth amendment. As shown in panels (e) and (f), these gains were again common across married and unmarried women.

Discussion

Differences in how cities responded to the 1918 influenza pandemic were associated with lasting changes in women's employment. Specifically, more women reported an occupation in the decades after the pandemic, but especially so in cities with sustained isolation and quarantine measures, school closures, and bans on public gatherings during the pandemic. These gains in women's employment were concentrated in cities where women had the right to vote prior to 1920.

These findings leave three questions. First, did interventions *cause* changes in women's employment? Duration of interventions was not randomly assigned, and fewer women worked in 1900 in cities that would go on to have longer interventions. However, this relationship remained steady in 1910, meaning there was no pre-trend in the association between duration of interventions and women's employment. It was only after the interventions had actually taken place that women's employment rates improved in cities with longer interventions. We cannot rule out that some other factor jointly determined the duration of interventions and changes in women's employment starting in 1920, but we show that one such candidate, the war effort, does not explain the main findings.

Second, did the public policy response to the 1918 influenza pandemic change beliefs about women's work? Cities with longer interventions exhibited relative gains in women's employment only starting in 1920, after the pandemic. This evidence is consistent with an explanation in which longer pandemic interventions disrupted gender roles and improved opportunities for women. High influenza mortality may have attracted more women into formal employment, but only temporarily. In contrast, prolonged quarantines, school closures, and other non-pharmaceutical interventions may have required a more fundamental reshuffling of societal roles, including contributions to the labor force. Such changes might be most possible in places already receptive to changes in women's roles. Only in cities with women's suffrage before 1920 did more women work after experiencing long interventions, suggesting that these interventions may have acted as a catalyst in changing gender norms.

Unfortunately, though, we are unable to directly measure expectations or norms for gender roles around the time of the 1918 pandemic. For example, the Gallup poll, which

consistently surveyed public opinion, only began in 1935. It is possible that interventions were longer in cities in which beliefs about women's work, although not actual employment rates, were already changing prior to 1918. As Matthias Doepke, Michèle Tertilt, and Alessandra Voena (2012) note, beliefs about gender roles and women's work can influence public policy. For example, the suffrage movement may have already begun to affect beliefs about gender roles: many of the cities with longer interventions were located in Midwestern and western states with women's suffrage before 1920, and several labor organizations in these states, such as the American Federation of Labor, supported women's suffrage since the late 1800s (Elizabeth Clapp 2007; Rebecca Mead 2004). Again, following Fernández (2013), changing beliefs about gender roles may have contributed to the rise in women's employment following the 1918 influenza pandemic, but we cannot rule out that these beliefs or some other related factor influenced the duration of interventions.

Third, does this evidence provide lessons for the possible long-term consequences of the COVID-19 pandemic? Goldin (2022) identifies several stylized facts about the early months of the COVID-19 pandemic in the United States. Unlike during typical recessions, women's labor force participation declined more than men's (Naila Kabeer, Shahra Razavi and Yana Van der Meulen Rodgers 2021). This decline was greatest among less-educated women and women with young children at home, but was short-lived: 75.6 percent of women were in the labor force in November 2018, and 75.6 percent were in the labor force in November 2021.

On one hand, the 1918 influenza pandemic was far deadlier, especially for working-age adults, than the early years of COVID-19 (Centers for Disease Control and Prevention 2023). High influenza mortality led to no lasting improvements in women's employment after 1918, suggesting that COVID-19 mortality may not as well. On the other hand, during the COVID-19 pandemic, some localities kept non-pharmaceutical interventions in place for a year or more, far longer than any city did during the 1918 influenza pandemic. Longer interventions in 1918 were associated with lasting improvements in women's employment. It will be fascinating to similarly track the association between COVID-19 interventions and women's labor market opportunities over the coming decades.

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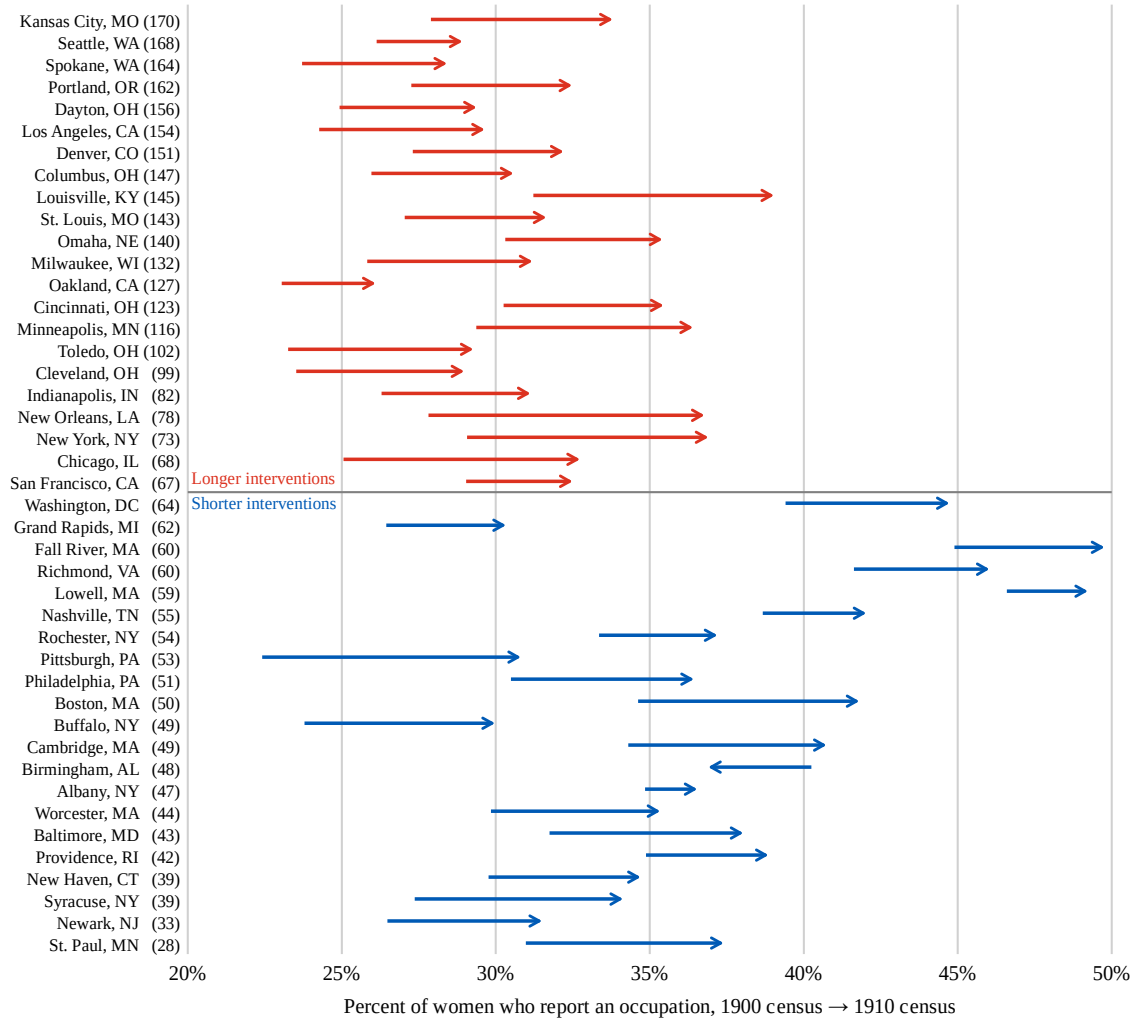
Appendix

As shown in panel (a) of Figure 3, the average gainful employment rate for women in 1900 was six percentage points higher in cities that would go on to impose longer non-pharmaceutical interventions during the pandemic. The difference remained six percentage points in 1910. The difference-in-differences estimate for 1900 in panel (b) is therefore about zero, but with a wide confidence interval. This wide confidence interval is due to the substantial variation across cities in women's employment in 1900 and gains by 1910. Figure A1 depicts these changes, with cities ordered by duration of interventions. For example, New Orleans, Louisiana had the largest gain, of 8.9 percentage points. Only in Birmingham, Alabama did fewer women report an occupation in 1910.



Source: Markel et al. (2007), Ruggles et al. (2024).
Note: In parentheses next to each city is the number of days of non-pharmaceutical interventions. Each arrow shows the change between 1900 and 1910 in the gainful employment rate for women aged 18-59 in each city.

Figure A1
Employment Gains between 1900 and 1910