WOMEN'S PREFERENCES AND CHILD SURVIVAL IN AMERICAN HISTORY

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Abstract:

Women's preferences are thought to place greater weight on child welfare and the provision of public goods than do those of men. Empowering women is therefore seen as a potent means of increasing investments in children. This paper provides new evidence on how a historical milestone in the advancement of American women – their enfranchisement through suffrage rights – influenced infant and child mortality. I find that women's suffrage helped children to benefit from the scientific breakthroughs of the bacteriological revolution, increasing public health spending by 20% and decreasing child mortality by 8-15%. These results suggest two general conclusions: (1) Even in the presence of price effects, strengthening the expression of women's preferences can deliver large benefits to children, and (2) Although health improvement strategies in high-mortality environments generally focus on supply-side obstacles, demand-side approaches also deserve careful attention.

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1. Introduction

Women are thought to have preferences that systematically differ from those of men (Fuchs 1988 and 1989, Lott and Kenny 1999). The underlying causes of these differences remain unclear, but a growing body of evidence suggests that women place relatively more emphasis on child welfare and the provision of public goods (Thomas 1990 and 1994, Lundberg, Pollak, and Wales 1997, Case and Deaton 1998, Pitt and Khandker 1998, Edlund and Pande 2001, Duflo 2003, Chattopadhyay and Duflo 2004, Duflo and Topalova 2004, Rangel 2004). Such sex differences are now leading many to view promoting gender equality as a potent means of human development in poor countries (beyond being fundamentally important in its own right) (United Nations 1981, Longwe 1995, United Nations 1995, Duflo 2005, UN Population Division 2005).[1] In particular, empowering women is believed to increase investments in children (World Bank 2001).[2]

Despite recent interest, this issue is not new; a long history links the status of women with child well-being. For example, early twentieth century America witnessed large gains in women's rights that historians link to striking reductions in infant and child mortality (Ewbank and Preston 1990, Meckel 1990, Preston and Haines 1991, U.S. Bureau of the Census 1900 to 1936, Goldin 1990, Goldin 2006). At their height, women's voluntary organizations advanced unprecedented child health and welfare agendas at the local, state, and national levels as the Children's Bureau was created in 1912 and the Sheppard-Towner Act was passed in 1921. The

[1] There has also been renewed controversy about whether or not women's issues belong on child welfare agendas, especially when weighed against technological interventions known to promote child survival. For example, see discussions of the controversy surrounding outgoing UNICEF Executive Director Carol Bellamy (Sylva 2003 and Horton 2004

[2] Kofi Anan, Secretary General of the United Nations, recently argued that gender equality is a "prerequisite" for achieving other Millennium Development Goals on infant survival, education, and poverty reduction (United Nations 2005). This view is also reflected in the popular media: "It is now accepted in most institutions… that without an improvement in women's lives,… children will not go to school, childhood disease will persist and younger and younger children, living in the most destructive poverty, will be vulnerable to abuses of all kinds…" (The Atlantic On-Line, 9/02/03).

distillation of historical lessons about the expression of women's preferences and child survival is directly relevant to contemporary development challenges because of similarities in epidemiological conditions (other than HIV/AIDS), economic circumstances, and the relative standing of women.

This paper investigates how the widespread enfranchisement of women through suffrage rights influenced child survival in the historical United States, drawing out new quantitative lessons where there is rich qualitative history. Specifically, it relates the sharp timing of state-level women's suffrage laws enacted between 1869 and 1920 to state-level trend breaks in infant and child mortality and mediating changes in state and local public spending. This approach has a number of attractive features. First, America's system of federalism created enormous variation across states and over time in laws governing women's suffrage. This variation aids in the estimation of their consequences and permits a number of validity tests to address natural – but seemingly unfounded – concerns about the possibility of endogenous state-level legislation. Second, although many related studies have focused on lump-sum transfers to women, most policies and programs that empower women have price effects with theoretically ambiguous consequences for children (Becker 1981).[3] Women's suffrage rights provide a salient example. Third, data from the early twentieth century United States is unusually rich in comparison with vital registries and public finance data available in developing countries today. Finally, unlike many activities which aim to improve women's standing by changing deeply-rooted social norms, this paper examines a means of empowering women which can readily be pursued through public policy.

[3] Many empirical studies of women's status and child welfare have emphasized testing unitary models of household behavior, focusing on lump-sum transfers targeted to women (Thomas 1990 and 1994, Lundberg, Pollak, and Wales 1997, Duflo 2003, Rangel 2004). Notable exceptions are Qian (2005) and Luke and Munshi (2005). Opponents of women's enfranchisement often supported their position with arguments about the potential neglect of children (Flexner and Fitzpatrick 1959).

In general, I find that the extension of suffrage rights to American women helped children to benefit from the scientific breakthroughs of the bacteriological revolution. Child mortality declined by 8-15% under women's suffrage, and the only causes of death that responded to the laws were leading childhood infectious diseases (diphtheria, meningitis, and diarrheal disease). An important way that suffrage rights produced these child survival benefits was by increasing state and local public health spending by roughly 20%. Widespread public health campaigns were a primary means of promoting important new health innovations based on recent scientific discoveries – simple hygienic health behaviors like water and milk boiling, food and hand washing, breastfeeding, and meat refrigeration (Duffy 1990, Meckel 1990). Overall, women's suffrage and its consequences account for nearly 10% of the unprecedented child mortality decline between 1900 and 1930.

These findings are bolstered by a variety of corroborating validity tests. Specifically: (1) There is no evidence of relative increases or decreases in child mortality just before suffrage laws were enacted; (2) There are no meaningful relationships between state characteristics in 1900 or the timing of state laws reflecting women's status and the timing of woman suffrage laws; (3) There is no evidence that suffrage effects differed between states choosing to allow women to vote and states having women's suffrage imposed on them by the 19th Amendment; and (4) There is no evidence of confounding changes in the composition of births or mothers after women began voting. Taken together, this evidence suggests that extending suffrage rights to women may have been causally responsible for large improvements in child survival – even in the presence of price effects.

2. Background

2.1. Child Survival in Early Twentieth Century America

In the late nineteenth and early twentieth centuries, infant and child mortality in the United States declined dramatically. In urban areas in 1900, one in five children born did not survive to age five (US Bureau of the Census 1900). By the late 1930s, the probability of dying by age five had declined by 65% (US Bureau of the Census 1936). Primarily because of increases in infant and child survival, life expectancy at birth rose from 47 to 63 (Preston and Haines 1991, Haines 2001). Much of this mortality decline is explained by reductions in infectious disease deaths (particularly tuberculosis, pneumonia, diarrheal disease, and diphtheria deaths) as America underwent its epidemiological transition. No other documented period in American history witnessed such sustained declines in infant and child mortality (Preston and Haines 1991).

Many studies have investigated the relative importance of various explanations for these striking health improvements, including: (1) economic innovation and nutritional gains, (2) large-scale public health interventions including clean water technologies, sanitation, refuse management, milk pasteurization, and meat inspection, and (3) improved personal hygiene and better health behaviors (hand and food washing, the boiling of milk, meat refrigeration, and breastfeeding, for example) (Meeker 1972, McKeown 1976, Condran and Crimmins-Gardner 1978, Szreter 1988, Wrigley and Schofield 1989, Ewbank and Preston 1990, Preston and Haines 1991, Thomas 1991, Fogel 1994, Elo and Preston 1996, Deaton and Paxson 2003, Cutler and Miller 2005). Given the emphasis that contemporary development agendas now place on the status of women, it is surprising that no empirical study has examined how women's suffrage or the advancement of women in general influenced child survival. In particular, historical accounts suggest that women played a leading role in the widespread promotion of better

personal hygiene and health behaviors (Smith-Rosenberg 1985, Meckel 1990, Skocpol 1992). Despite its simplicity, improved household hygiene was a leading innovation produced by the nascent science of bacteriology born with the discoveries of Ignaz Semmelweis**,** Louis Pasteur, Joseph Lister, Robert Koch, and others.

2.2. "Separate Spheres" Ideology and Women's Voluntary Organizations

As these rapid public health advances occurred, women were also making rapid social, political, and economic strides in the United States. With the rise of industrialization, the social and economic "spheres" of men and women had become more distinct and segregated as men were disproportionately drawn into jobs away from the home.[4] However, American women responded to this segregation by seizing the civic possibilities of their separate sphere and building civic voluntary organizations to promote "feminine virtues" – both for their own edification and for the good of the society. Some were comprised of elite, urban women, but more often they were grounded in religion and joined middle-class women across many localities. Despite their heterogeneity, women's voluntary organizations collectively capitalized on the perception of women's moral superiority as homemakers and caregivers to promote broad public welfare agendas. A term popularized by women's organizations – "municipal housekeeping" – provides a clear example of this strategy: "Woman's place is in the home… But Home is not contained within the four walls of an individual home. Home is the community. The city full of people is the Family" (Dorr 1910).[5]

[4] The industrial revolution created new jobs for women, too – primarily young, unmarried women (Goldin 1990).
[5] A similar illustration: when "men and women divide the work of governing and administering, each according to his special capacities and natural abilities," the city "will be like a great, well-ordered, comfortable, sanitary household. Everything will be as clean as in a good home. Every one, as in a family, will have enough to eat, clothes to wear, and a good bed to sleep on. There will be no slums, no sweat shops, no sad women and children toiling in tenement rooms. There will be no babies dying because of an impure milk supply. There will be no 'lung

Among the enormous diversity of women's organizations, three stand out. One of the early leaders was the Women's Christian Temperance Union, which sought to combat male irresponsibility on many fronts, including fighting prostitution, promoting temperance agendas in schools, running day nurseries for working mothers, supporting labor reforms to benefit working-class families, and eventually, working for women's suffrage. Another prominent voluntary organization, the General Federation of Women's Clubs, began as a literary organization but eventually coalesced into an extensive network to advance a women's and children's issues. The Federation hosted large biennial conventions, published an official journal, maintained a national office, and created standing committees on civil service reform, education, home economics, pure food, library extension, public health, and industrial and child labor (Skocpol 1992). A third leader organized by the urban elite was the National Congress of Mothers (later to become the National Congress of Parents and Teachers, or the PTA).

2.3. Women and Child Health Promotion during the Progressive Era

Well-organized women's voluntary organizations provided the infrastructure necessary for mounting new large-scale child health campaigns during the Progressive Era (Smith-Rosenberg 1985, Meckel 1990, Skocpol 1992).[6] These efforts specifically targeted women as the agents most concerned with infant and child welfare within the household. Women's organizations built political campaigns as well at the local, state, and national levels to pressure

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blocks' poisoning human beings that landlords may pile up sordid profits. No painted girls, with hunger gnawing their empty stomachs, will walk in the shadows" (Dorr 1910).

[6] For example, the Ladies' Health Protective Association (LHPA) of New York City became a leader in sanitary reform in American cities, targeting slaughterhouse and school sanitation, street-cleaning, and refuse management practices (Melosi 2000).

government to finance more of this work (Smith-Rosenberg 1985, Skocpol 1992).[7] The longstanding perception of women's superior morality made it difficult for legislators to ignore their demands (Skocpol 1992).

One of the most important political achievements of women's organizations during the Progressive Era began in 1912 with the establishment of a federal Children's Bureau charged to "investigate and report… upon all matters pertaining to the welfare of children and child life among all classes of our people" (Children's Bureau 1914). Its most dramatic expansion came in 1921 under the Sheppard-Towner Act, which provided the Bureau with over one million dollars (in 1920s terms) each year for five years. The Act came just after all American women were given the right to vote under the 19th Amendment but before actual patterns of female voting had become clear. In the words of one historian, the "principal force moving Congress was fear of being punished at the polls. Politicians feared that women voters would cast a bloc vote or remain aloof from the regular parties" if their convictions about child welfare were not heeded (Lemons 1973). In the next seven years, the Children's Bureau coordinated a nationwide program that distributed "over 22 million pieces of literature, conducted 183,252 health conferences, established 2,978 permanent prenatal centers, and visited over 3 million homes" (Ladd-Taylor 1986). Women spurred similar public sector efforts at the state and local levels as well.

2.4. The Woman Suffrage Movement

The birth of women's voluntary organizations also went hand-in-hand with the birth of the women's suffrage movement.[8] Broad new ideals among women about their public and

[7] The most prominent organizations included the Women's Christian Temperance Union, the General Federation of Women's Clubs, and the National Congress of Mothers (later to become the National Congress of Parents and Teachers, or the PTA).

private roles became manifest both in new voluntary organizations and in the agenda articulated by Lucretia Mott and Elizabeth Cady Stanton at the women's rights convention held in Seneca Falls, New York during the summer of 1848. Although formal efforts were at first small, the end of the Civil War invigorated the women's suffrage movement as the emancipation of slaves and the extension of voting rights to black men under the 15th Amendment in 1870 called new public attention to the issue of expanding the electorate (Flexner and Fitzpatrick 1959).[9]

State-level suffrage efforts during the late 19th century proclaimed social justice as the basis for enfranchising women and emphasized two types of activities – organizing meetings of already-sympathetic women to increase membership in suffrage organizations and discretely lobbying state legislators (McCammon 2003). The movement had several early successes in the west (in the territories of Wyoming in 1869 and Utah in 1870 and later in Colorado and Idaho), surprising both proponents and opponents alike (Flexner and Fitzpatrick 1959, Dubois 1998).[10]

These successes were followed by a period of slowed progress and setbacks, however, leading the suffrage movement to shift its focus to reaching the broader electorate. Women organized informal open-air meetings and mounted soap-boxes to make street-corner speeches, they distributed flyers and ran newspaper advertisements, and they even staged parades to raise the visibility of the suffrage cause (McCammon 2003). Suffragists also reshaped the content of their message, aligning it more closely with the "separate spheres" tradition and stressing

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[8] A number of suffrage historians link the growth of state suffrage movements to the local strength of the Women's Christian Temperance Union (WCTU), the General Federation of Women's Clubs (GFWC), and other voluntary organizations (Scott 1970, McCammon 2001). However, I present evidence in the *Validity Tests* section that suggest this relationship not to be present for the GFWC (the only voluntary organization for which I have data).

[9] In 1869, two new organizations explicitly dedicated to the cause of women's suffrage emerged: a more radical organization focused on Constitutional change (The National Woman Suffrage Association, led by Elizabeth Cady Stanton and Susan B. Anthony) and a more moderate organization emphasizing state-level reforms (The American Woman Suffrage Association, led by Lucy Stone and Henry Blackwell). The two formally joined forces in 1890, merging to form the National American Woman Suffrage Association (NAWSA).

[10] For example, Wyoming's otherwise staunchly conservative governor at the time, John Campbell, reportedly signed a women's suffrage bill into law because of a little-known women's meeting which he enjoyed attending as a child in his hometown of Salem, Ohio (Flexner and Fitzpatrick 1959).

women's superior morality and the potential social benefits of "public motherhood" (McCammon and Campbell 2001, King, Cornwall, and Dahlin 2005). The result was a string of new successes, especially in the West and Midwest. Before the ratification of the19th Amendment gave women the Constitutional right to vote, 29 of 48 states had already extended suffrage rights to women.[11] Figure 1 shows the timing of suffrage laws in American states.

2.5. Explaining the Spatial and Temporal Pattern of State-Level Women's Suffrage Laws

Understanding the timing of state-level suffrage laws is important for evaluating validity of this paper's empirical strategy. This section briefly reviews historical evidence, and the *Validity Tests* section considers a variety of more formal statistical evidence.

The most obvious pattern of state-level suffrage law adoption is geographic – all else equal, women in western states could vote before women elsewhere in America (as shown in Figure 1). Some historians have argued that frontier conditions were amenable to women's suffrage for at least two reasons (Brown 1958, Grimes 1967). One is rooted in the "separate spheres" and "municipal housekeeping" ideologies. Because women generally supported restrictions on drunkenness, gambling, and prostitution, it was hoped that enfranchising them would help to re-assert Puritan values and accompanying lifestyles among young, single, transient men in the West (McCammon and Campbell 2001). The other is that the practical demands and harsh realities of frontier life required women to break with traditional gender roles as families struggled to establish new settlements in the wilderness (Schiffman 2006). Alternatively, other historians have argued that idiosyncratic circumstances in each state resulted

[11] Although most laws passed before the 19th Amendment extended full suffrage rights to women, some only extended partial rights (presidential- and primary-only voting rights). These partial suffrage laws were generally enacted a year or two preceding the 19th Amendment in the Midwest. Presidential suffrage laws were enacted in Illinois, Indiana, Iowa, Maine, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Rhode Island, Tennessee, Vermont, and Wisconsin. Primary suffrage laws were enacted in Arkansas and Texas.

in the vote for women (Larson 1971, Beeton 1986, McCammon and Campbell 2001, King, Cornwall, and Dahlin 2005). These arguments are generally supported by observations about the remarkably poor correspondence between suffrage movement strength and the passage of laws.[12]

The creation of digital databases from state legislative archives has also facilitated quantitative analyses of women's suffrage laws. Two broad types of explanations for the timing suffrage laws have been tested more formally: those emphasizing institutional differences (legislative rules, electoral incentives determined by political competition, and democratic reforms including the adoption of secret ballots, mandatory direct primaries, and creation of initiative and referendum processes) and those emphasizing differences in the social and economic roles of women. However, this body of research provides a conflicted view of suffrage law adoption (McCammon 2003, Cornwall, Dahlin, King, and Schiffman 2004, King, Cornwall, and Dahlin 2005).[13] The single robust correlate of suffrage law success that emerges from these studies is the share of women working non-agricultural occupations (King, Cornwall, and Dahlin 2005). This variable presumably captures changing gender norms, and because it evolved gradually over time (Smith and Ward 1985, Goldin 1990), it can be distinguished

[12] Historical evidence commonly cited in support of this view includes: (1) the absence of an organized movement in Wyoming (home of the first suffrage law), (2) the absence of a suffrage law in Connecticut before the 19th Amendment (home of the first state women's suffrage organization), (3) equivalently small suffrage organization membership in the West and the South (the regions where suffrage efforts were most and least successful), (4) early mobilization in eastern states not accompanied by early suffrage law successes, (5) the correlation between movement strength and the introduction of suffrage bills does not extend to the passage of suffrage bills, and (6) equivalence, decade by decade, in the number of full suffrage bills introduced in states eventually passing full vs. presidential suffrage laws (Baumgartner and Leech 1998, McCammon 2001, McCammon and Campbell 2001, Schiffman 2006).

[13] Meaningful positive associations have been found between suffrage law adoption in a given state and year and: the number of suffrage mobilization events, legislative rules more conducive to bill success, less centrally-organized suffrage movements, the amount of suffrage movement fundraising, the presence of third political parties, conflict within state suffrage organizations, and the recent defeat of a suffrage bill (McCammon 2003, Cornwall, Dahlin, King, and Schiffman 2004, King, Cornwall, and Dahlin 2005). Interpreting these relationships is not straightforward, however, and these relationships are not persistent across studies. This literature itself has drawn conclusions such as: "Movement mobilization explanations of suffrage success have proved insufficient" (Cornwall, Dahlin, King, and Schiffman 2004).

econometrically from abrupt year-to-year legislative changes governing women's right to vote (as discussed in detail under *Validity Tests*).[14]

3. Data and Graphical Analysis

3.1. Data

To investigate how women's suffrage influenced child survival, state-level mortality data by age and sex and by cause is necessary. However, there was no national system of death records in the United States prior to 1933 (Haines, 2001). The Bureau of the Census first established an official 'death registration area' in 1880 and began publishing its annual *Mortality Statistics* for death registration states (those deemed to have adequate death registration systems) in 1900 (US Bureau of the Census 1900 to 1936, Haines 2001). As shown in Figure 2, the registration area grew from ten states in 1900 to include all forty-eight states in 1933.[15] The published historical series was used to construct an unbalanced panel of annual state-level deaths in each registration area state by cause and by age and sex for years 1900-1936.[16] Descriptive Statistics are shown in Panels A and B of Table 1.

Conducting analyses with an unbalanced panel of state-level mortality data raises the potential concern that entry into the death registration area was correlated with the timing of women's suffrage laws (or their social, demographic, or economic determinants) and mortality. To explore this possibility, regressions of registration area entry dates were run on state socio-

[14] Other proxies for the role of women in society, such as the establishment of a state GFWC chapter, suggest no relationship with women's suffrage laws (see Table 7, Figure 8, and discussion under *Validity Tests*).
[15] Delaware technically entered the death registration area in 1890 but does not appear in the annual *Mortality Statistics* until 1919.
[16] To the best of my knowledge, the state-level *Mortality Statistics* series have never before been digitized. This data is available upon request: ngmiller@stanford.edu. Specific causes of death reported consistently throughout the 1900-1936 period include typhoid fever, malaria, small pox, tuberculosis, measles, scarlet fever, whooping cough, diphtheria, influenza, meningitis, pneumonia, childbirth-related causes, diabetes, heart/circulatory disease, nephritis, cancer, violent accidents, and suicide.

economic characteristics in 1900 (literacy, employment, manufacturing sector wages, and workforce share in the manufacturing sector) and the dates of Progressive Era events (women's suffrage laws, divorce/alimony laws, mother's pension laws, state GFWC chapter establishment, women's maximum hour laws, or women's minimum wage laws). The results (not shown) reveal no statistically meaningful relationships.[17] Figure 3 also plots the distribution of time between death registration area entry and women's suffrage rights in each state.

These state-level mortality statistics were then matched to information about when women gained the legal right to vote in each state as well as the timing of other state laws that may have influenced women's voting behavior (including the use of secret ballots, poll taxes, and literacy tests).[18] As shown in Figure 1, twenty-nine states extended the right to vote to women before Nineteenth Amendment was approved in 1920. Among the other nineteen states, seven approved the amendment and twelve had suffrage imposed on them. In this paper, I follow Lott and Kenny (1999) by not distinguishing partial and full suffrage rights, recognizing the flux of electoral rules during this period and uncertainty among politicians about the inevitability of full enfranchisement following partial suffrage laws. Sensitivity analyses indicate that drawing this distinction does not influence the results.[19]

To better understand how women's suffrage may have effected child survival by altering the size or composition of public spending, state and local public finance data was also matched

[17] These results are available upon request. Because the annual mortality statistics are not available before 1900, this paper focuses on suffrage laws that were passed after 1900. Specifically, for states *s,* I estimate: $l_s = \alpha + \mu x_s + \varepsilon_s$, where *l* is the date of death registration entry and *x* is state-specific covariate (either a state socio-economic characteristic in 1900 or a Progressive Era event. State characteristics in 1900 are available in the 1900 population census (United States Census Office 1902) and were provided by John Lott and Larry Kenny; Progressive Era event dates are available in Skocpol (1992). Where appropriate, a parametric hazard models also yield no evidence of meaningful associations with death registration entry.

[18] This state-level legislative data was generously provided by John Lott and Larry Kenny.

[19] The major distinction relevant to this paper's analyses is the creation of "presidential-only" suffrage rights in mid-western states between 1917 and 1919. Excluding these states or re-coding their woman suffrage dates to be 1920 (the ratification of the 19th Amendment) increases the infant and child mortality declines that I present under *Empirical Strategy and Results*, but not significantly so.

to the mortality statistics and legislation data. Annual information about state revenue and spending in real (1967) dollars per capita was provided by John Lott and Larry Kenny (Lott and Kenny 1999).[20] The specific categories of revenue and spending that are comparable over time include: total public spending, total public revenue, property tax revenue, transportation spending (current and capital expenditures on highways), education spending (current and capital expenditures on elementary and secondary schools) and social service spending (current expenditures on state health boards, charities, hospitals, and corrections). Importantly, the state health board spending captured by the social service spending category was commonly directed to establishing and strengthening city public health departments and supporting widespread local health education campaigns. Descriptive statistics for the state-level public finance data are shown in Panel C of Table 1.

State public finance information is also not available for all states and years between 1900 and 1936. As with the mortality statistics, a potential concern is that the availability of public finance data is correlated with women's suffrage (or its determinants) and mortality. To test this concern, probit specifications were used to estimate how the presence of public finance data in each state and year is correlated with state socio-economic characteristics in 1900 and the dates of Progressive Era events. The resulting estimates (not shown) reveal no statistically meaningful associations.[21] For all state by year observations, Figure 3 shows the distribution of time between year of observation and year of women's suffrage legislation as well.

[20] Lott and Kenny (1999) obtained the state-level public finance data from the *Financial Statistics of States* for years 1915-1919 and 1921-1931 and made this series comparable with data provided by John Wallis for earlier years (see Sylla, Legler, and Wallis ICPSR Study # 9728, "Sources and Uses of Funds in State and Local Governments, 1790-1915").

[21] These results are available upon request. For states s and years y, probit specifications of the following form were estimated: $\Pr(p_{sy}=1) = \alpha + \psi x_s + \varepsilon_{sy}$, where p is a dichotomous indicator of whether or not state public finance data is available for state s in year y and x is a state-specific covariate.

<DESCRIBE MUNICIPAL PUBLIC SPENDING DATA FROM THE *STATISTICS OF CITIES* AND *FINANCIAL STATISTICS OF CITIES* HERE.>

Finally, for analyses of how fertility responded to women's suffrage, I use the 1% sample of the 1940 population census made available through the Integrated Public Use Microdata Series (IPUMS) by the University of Minnesota's Population Center.

3.2. Graphical Analysis

Before pursuing more formal statistical analyses, simple event study graphs provide insight into the relationship between women's suffrage and child survival. Because annual time series of deaths are noisy and the timing of women's suffrage varied considerably over time, it is appropriate to remove non-linear time effects common to all states in constructing event study graphs. Also, because state-level population measures by age are not available annually between 1900 and 1936, annual mortality rates cannot be constructed using annual deaths. To account for this, it is also necessary to condition annual age-specific deaths on state-level fixed effects and state-specific time.[22] To make these adjustments, residuals were obtained from regressions for states s and years y in the annual mortality statistics:

$$(1) \qquad \ln(d_{sy}) = \alpha + \delta_y + \delta_s + \delta_s \times y + \varepsilon_{sy}$$

where d is age-specific deaths reported consistently over time in each age group (0-1, 1-4, 5-9, 10-14, and 15-19), δ_y and δ_s represent year and state fixed effects, and $\delta_s \times y$ represents state-specific linear time trends.

[22] Using annual state-level mortality statistics from the 1960s and 1970s when state-level population measures – and therefore mortality rates – are available, I have conducted analyses that confirm the equivalence of using raw mortality rates and deaths conditional on state fixed effects and state-specific time trends. These analyses are available upon request.

Defining year 0 as the year that each state enacted a women's suffrage law, Figure 4 shows plots of residual means for each year -5 through +5 relative to the first year of suffrage. In general, they suggest that abrupt mortality reductions of 5-10% occurred for both boys and girls of all ages in the precise years that suffrage laws were passed. Because death rates were much higher at younger ages, these graphs imply that averted deaths were concentrated in the younger ages. The correspondence between the sharp timing of women's suffrage laws and mortality trend breaks – as well as the absence of rising or falling mortality just before the laws were adopted – suggests that the laws may have been causally related to infant and child mortality declines.[23]

4. Empirical Strategy and Results

4.1. Empirical Strategy

Exploiting the plausibly exogenous timing of state-level women's suffrage laws, I use a difference-in-difference strategy to estimate more formally the mortality reductions shown in Figure 4. Specifically, I estimate equations of the following general form for states *s* and years *y*:

$$(2) \qquad \ln(d_{sy}) = \alpha + \beta v_{sy} + \delta_y + \delta_s + \delta_s \times y + \sum_k \gamma_k c_{sk} + \varepsilon_{sy}$$

where *d* is age-specific deaths in state *s* and year *y* in each child age group reported consistently between 1900 and 1936 (0-1, 1-4, 4-9, 10-14, etc.), *v* is a dummy variable indicating whether or not women could legally vote in state *s* and year *y*, δ_s and δ_y represent state and year fixed

[23] Relative declines in suffrage just before laws were passed might imply that pre-existing trends are mistaken for suffrage effects, while relative increases in suffrage just before laws were passed might imply that mean reversion is mistaken for suffrage effects. Some mortality declines in year -1 are due to how suffrage years were coded. If a law was passed in the latter part of a year, this year was coded as year -1. More formal analyses presented under *Validity Tests* confirm the absence of meaningful relative increases or decreases in mortality just before suffrage laws were enacted.

effects, $\delta_s \times y$ represents state-specific linear time trends, c is state-level economic and demographic characteristics in 1900, and the parameter estimate of interest is the estimate of β.

In this difference-in-difference framework, only the timing of state suffrage laws is assumed to be exogenous. Fixed differences across states, common factors varying non-linearly over time (such as the establishment of the Children's Bureau in 1912, the ratification of the 19th Amendment in 1920, or the passage of the Sheppard-Towner Act in 1921), and state-specific differences that vary linearly over time are all purged from the estimate of β.[24] Only trend breaks in child mortality that coincide precisely with the timing of women's suffrage laws identify the effects of interest. The validity of the identifying assumption is explored in detail under *Validity Tests*; no evidence of endogenous law enactment is found.

4.2. Mortality Results

Figure 5 shows estimates of β obtained by estimating equation 2 for deaths in each age interval separately for females and males. Because the dependent variables (age-specific deaths) are in logarithmic form, the coefficient estimates can roughly be interpreted as percent changes. In general, women's suffrage is associated with mortality reductions for children at all ages between age one and age nineteen, but not for infants in their first year of life or for adults at any age.[25] In contrast with contemporary evidence on women's empowerment developing countries, there are no meaningful gender differences in the survival gains associated with women's suffrage (Duflo 2003, Qian 2005).

[24] The results are also not sensitive to the inclusion of state-specific polynomials in equation 2.

[25] The absence of infant mortality effects is not surprising given the poor state of early twentieth century obstetrics (even relative to other specialties). Midwives delivered a large share of babies but were incapable of managing common complications of childbirth and were uninformed about hygienic practices (Meckel 1990, Preston and Haines 1991). Despite the large shift of childbirth from home to hospital between 1900 and 1930, birth conditions did not improve and may have even deteriorated; maternal mortality rates did not begin declining until the mid-1930s (Thomasson and Treber 2004). Public health campaigns emphasizing health behaviors at home did little to address birth conditions.

These child mortality reductions are large, with point estimates ranging between 8% and 15%.[26] Because child mortality is concentrated at young ages, the largest absolute child survival gains occurred at young ages. To place these estimates in context, between 1900 and 1930, mortality rates in death registration states fell by 72% for children between ages 1 and 4, 59% for children 5 to 9, 48% for children 10 to 14, and 42% for children 15 to 19. The proportion of these declines explained by the women's suffrage estimates shown in Figure 5 are 5%, 10%, 13%, and 10%, respectively, in each age interval.[27]

To explore how mortality reductions associated with women's suffrage changed over time, variants of equation 2 were re-estimated with additional suffrage dummy variables lagged by varying amounts of time.[28] As discussed later under *Validity Tests*, there is no evidence that the composition of births or surviving adult caregivers changed under women's suffrage. Instead, any changing suffrage effects over time are most likely due to changes in the composition of surviving children or to behavioral responses to the disease environment (Dow, Holmes, Philipson, and Sala-i-Martin 1999, Philipson 2000). Figures 6a and 6b show results for time lags of 3 and 6 years and for time lags of 5 and 10 years, respectively. In general there is little evidence of changing suffrage effects over time, and the main suffrage estimates are robust to lag structure choice. The exception is that survival gains may have eroded for children over age ten a decade after suffrage laws were enacted. This result could suggest that public health interventions pursued under women's suffrage were substitutes for other private health behaviors. Given the absence of lagged effects at younger ages, however, it more likely reflects

[26] Excluding states in which women were unable to vote until the 19th Amendment was ratified in 1920 yields statistically identical results, although the standard errors are somewhat larger (estimates significant at the α=0.05 level are still significant at the α=0.10 level).

[27] To calculate these shares explained by women's suffrage, the fraction of years women could vote in each state between 1900 and 1930 was used to weight the mean mortality reductions shown in Figure 5. The share of the decline at ages 1-4 is calculated for girls only, which is significant at the p<0.10 level.

[28] Specifically, for t=3 and t=5, I estimated: $\ln(d_{sy}) = \alpha + \beta_1 v_{sy} + \beta_2 v_{sy+t} + \beta_3 v_{sy+2t} + \delta_s + \delta_y + \delta_s \times y + \Sigma_k \gamma_k c_{sk} + \varepsilon_{sy}$

that those initially saved at younger ages were relatively weak and therefore more likely to die at older ages.

Although state-level mortality data by both age and cause is reported erratically between 1900 and 1936, cause of death effects can reasonably be attributed to children given the absence of evidence that adult mortality changed under women's suffrage. Table 2 shows suffrage estimates obtained by re-estimating equation 2 using cause-specific deaths as dependent variables. It suggests that child mortality declined because of decreases in deaths due to meningitis and most likely diphtheria and diarrhea. Meningitis mortality declined by 23%, while diphtheria deaths declined by 24% and diarrheal deaths under the age of 2 declined by 11%.[29] All three were leading infectious killers of children in early Twentieth Century America (they did not generally result in adult deaths), and importantly, all three can be effectively combated by hygienic household health behaviors and public health measures of the day.[30]

4.3. How Did Suffrage Reduce Child Mortality?

An intuitive explanation for how women's suffrage improved child survival is through its impact on public spending. Standard models of electoral competition predict that the introduction of woman suffrage would cause politicians' policy positions to better reflect women's preferences (Hotelling 1929, Downs 1957, Shepsle 1979, Shepsle 1991). These policy position changes should occur immediately if politicians believed that the laws would actually

[29] As shown in Table 2, the diphtheria and diarrhea estimates are statistically significant at the $p<0.10$ level.
[30] Meningitis is an inflammation of the membrane surrounded the brain and spinal column generally caused by any of roughly fifty types of bacteria. Good household hygiene was the best prevention at the time (it is transmitted by respiratory droplets and other bodily fluids), although there were some early therapeutic successes with intrathecal equine meningococcal antiserum and then the first sulfa drugs before the advent of modern antibiotics. Diphtheria is an upper respiratory-tract illness caused by airborne bacteria. An effective anti-toxin became available in the 1890s, but its use was not widespread; sulfa drugs became the most effective modern therapy. Specific types of diarrheal disease are not well defined in the historical mortality statistics (other than typhoid fever); the best preventive measures other than municipal-level drinking water disinfection were hand and food washing and water and milk boiling.

result in women voting (with the weight given to women's preferences depending on their beliefs about female turnout). At the federal level, for example, historical analyses directly link the landmark Sheppard-Towner Act of 1921 to the ratification of the 19th Amendment in 1920 (Lemons 1973).[31] At the state level, the share of the electorate ages 21+ who voted increased by 50% immediately after women were enfranchised (Lott and Kenny 1999).

Intensifying health campaigns linked to woman suffrage should therefore be evident in historical state and local public finance data. Before the development of sulfa drugs and antibiotics in the late 1930s and 1940s, many health gains attributable to the late Nineteenth century bacteriological revolution were achieved through simply hygienic health behaviors. These simple practices (such as water and milk boiling, food- and hand-washing, breastfeeding, meat refrigeration, and infant and child growth monitoring) were publicized and promoted through large-scale state and local public health and health education campaigns (Duffy 1990). The evidence presented in Table 2 on causes of death that responded to women's suffrage (meningitis, diphtheria, and diarrheal disease) is consistent with an explanation based on increased health spending and improvements in hygienic practices.

To explore changes in the size and composition of public finance, variants of equation 2 were re-estimated using state and local public revenue and public spending data by type of expenditure. Table 3 shows results for state spending. There are no statistically meaningful changes in total state spending or total state revenue under women's suffrage, although both point estimates are large and positive. Transportation and education spending also do not appear to have changed, but social service spending (hospitals, charities, corrections, and state health

[31] The "principal force moving Congress [to pass the Sheppard-Towner Act] was fear of being punished at the polls. Politicians feared that women voters would cast a bloc vote or remain aloof from the regular parties if their convictions about child welfare were not heeded" (Lemons 1973).

boards) increased by an about 24%.[32] The important role of state health boards in strengthening municipal public health efforts and in spearheading public health and health education campaigns should be captured by this increase in public health spending. Consistent with the predictions of electoral competition models, this increase occurred rapidly after suffrage laws were passed rather than increasing gradually over time.

Table 4 shows results for municipal spending. <DISCUSS MUNICIPAL SPENDING RESULTS HERE>

4.4. Women's Suffrage and Changes in the Distribution of Public Health Spending and Mortality

If women's preferences placed relatively greater weight on public health activities, states with higher infant/child mortality rates should have experienced larger increases in public health spending and larger mortality declines following suffrage legislation. To test how state responses varied with the level of baseline mortality, I first estimate:

$$(3) \qquad \ln(spend_{sy}) = \alpha + \kappa \ln(\bar{d}_s) + \phi post_{sy} + \lambda(\ln(\bar{d}_s) \times post_{sy}) + \delta_y + \delta_s + \delta_s \times y + \sum_k \gamma_k c_{sk} + \varepsilon_{sy}$$

where *spend* is per capita public revenue or spending on a given type of government activity (total and property tax revenue, total spending, and spending on transportation, education, and social services), $\bar{d}$ is mean age-specific deaths (0-1, 1-4, 4-9, 10-14, and 15-19) in the five years preceding women's enfranchisement in state *s* and year *y*, *post* is an indicator denoting women's legal right to vote, all other variables are defined as before, and the parameter of interest is λ.[33]

[32] These estimates are also not sensitive to the exclusion of states granting suffrage rights to women under the 19th Amendment in 1920. Lott and Kenny (1999) provide evidence suggesting that women's suffrage increased total public spending when analyzing suffrage laws before 1900. Given that social service spending is a small share of total spending, increases in total spending may be difficult to detect.

[33] For states entering the Census of the Bureau's death registration area less than five years before women gained the right to vote, I use mean age-specific mortality for the available pre-suffrage years. Given evidence on the arbitrary timing of death registration area entry and the fact that I condition on state fixed effects and state-specific linear time trends, this should not influence the results shown in Table 5 and Figure 7.

Table 5 shows estimates of λ, which can be interpreted as elasticities of public spending with respect to baseline (pre-suffrage) mortality. In general, these estimates suggest no meaningful relationship between baseline mortality and any public finance measure other than social service spending. Although significant only at the $p<0.10$ level, the bottom row of Table 5 suggests elasticities of approximately 0.04 – states with higher mortality when suffrage laws were passed increased social service spending (including public health spending) relatively more. Similar analyses were repeated using ln(age-specific deaths) as dependent variables. Although the resulting point estimates for λ are all negative, they are not statistically distinguishable from zero (as shown in Figure 7), suggesting that the relatively larger (but modest) increases in social service spending in high-mortality states had little or no additional effect on child survival.

5. Validity Tests

Natural concerns with the empirical strategies employed by this paper are the possibility of endogenous state-level suffrage legislation and confounding changes in the composition of births and mothers. This section presents a range of tests that investigate – and fail to corroborate – such concerns.

First, I formally estimate whether or not there were relative increases or decreases in child mortality, cause-specific mortality, or public health spending just before women's suffrage laws were adopted (staggered across states and over time in the same pattern as the laws). Relative increases might suggest that estimates of β in equation 2 mistakenly capture mean reversion, while relative decreases might imply that suffrage laws were adopted in response to changing conditions in states related to the status of women and infant and child health. To test for mortality trend breaks just prior to passage of laws, lead dummy variables denoting state by

year observations two, four, and six years before suffrage ($v[t\text{-}z, t\text{-}1]$ for suffrage year t and z = 2, 4, and 6) were separately added to equation 2: $ln(d_{sy}) = \alpha + \pi v[t\text{-}z, t\text{-}1]_{sy} + \beta v_{sy} + \delta_s + \delta_y + \delta_s \times y + \Sigma_k \gamma_k c_{sk} + \varepsilon_{sy}$.[34] Table 6 shows estimates of π. As suggested by Figure 4, all are statistically indistinguishable from zero.

Second, I investigate how state-level social, economic, and demographic conditions in 1900 (literacy, employment, manufacturing sector wages, and workforce share in the manufacturing sector) and the timing of other Progressive Era laws and events (women's suffrage laws, divorce/alimony laws, mother's pension laws, state GFWC chapter establishment, women's maximum hour laws, women's minimum wage laws, or prohibition laws) are related to suffrage dates.[35] Specifically, for states *s,* I estimate: $l_s = \alpha + \rho x_s + \varepsilon_s$, where l is the date of suffrage law enactment and x is a state-specific covariate. Table 7 shows estimates of ρ obtained from separate regressions – there are no meaningful relationships between the timing of women's suffrage laws and any of these covariates.[36] The timing of suffrage laws does not generally appear related to a broad array of social, economic, and demographic measures. Because the estimates in Table 7 are imprecise, Figure 8 also shows the distribution of suffrage law years and the years of related Progressive Era events. It shows no similarities between the distribution of suffrage law years and other important Progressive Era reforms.

Third, if there were state-level political climates that fostered both women's suffrage and better child health, child mortality reductions should differ between states that voluntarily

[34] The results are not sensitive to the specific lead structure chosen.
[35] In this analysis, I examine states enacting woman suffrage laws after 1900.
[36] Where appropriate, a parametric hazard model also produces estimates that are statistically indistinguishable from zero. The timing of suffrage laws is positively correlated with total state population in 1900 at the $p<0.10$ level. This relationship is not statistically meaningful at conventional significance levels; more generally, bias introduced into the main analyses would be detected as meaningful changes in mortality just before the adoption of suffrage laws. As shown in Table 6, there is no such evidence. Analyses not shown also suggest no meaningful relationships with the timing of state child labor and compulsory schooling laws, although these laws are complex (Lleras-Muney 2002).

granted suffrage and those who had it imposed on them by the 19th Amendment. Similarly, if getting the "right" people into state legislatures led both to women's enfranchisement and to increases in public health spending – but there was no causal link between the two – child mortality should fall in the former states but not the latter. This alternative interpretation would also not be detected by validity tests that rely on the sharp timing of suffrage laws. Following Lott and Kenny (1999), I define voluntary states as those that passed state-level suffrage laws or that voted for the 19th Amendment.[37] Creating a dummy variable z for states choosing suffrage, I then incorporate it and its interaction with women's suffrage into equation 2: $ln(d_{sy}) = \alpha + \beta v_{sy} + \tau z_s + \mu(v_{sy} \times z_s) + \delta_s + \delta_y + \delta_s \times y + \Sigma_k \gamma_k c_{sk} + \varepsilon_{sy}$. Table 8 shows estimates of μ. Consistent with the identifying assumption, there is no evidence that child mortality effects differed between states that chose women's suffrage and those on whom it was imposed.

Fourth, I consider whether or not changes in the composition of births might produce the illusion of child mortality reductions under women's suffrage. The absence of meaningful suffrage effects on adult mortality shown in Figure 5 suggests that the composition of potential mothers did not change.[38] This concern is also not relevant to child mortality at older ages. However, women's suffrage may have produced incentives for women to have fewer children – by lowering the relative price of child quality or by raising the relative price of time spent at home, for example (Becker and Lewis 1973). Changes in fertility under suffrage laws would lend credibility to this potential concern. Because the Bureau of the Census' birth registration area was not established until 1915, fertility responses to suffrage laws must be investigated using population census data.

[37] The states that did not enact suffrage laws before 1920 but ratified the 19th Amendment were Kentucky, Massachusetts, New Hampshire, New Jersey, New Mexico, Pennsylvania, and West Virginia (Lott and Kenny 1999). Figure 1 shows this distinction.

[38] This is also consistent with other findings that maternal mortality did not begin to decline in absolute terms until the 1930s (Thomasson and Treber 2004).

Exploiting the fact that any fertility effects should vary by women's age when suffrage laws were enacted (and not be present at all among women first able to vote after menopause), I simultaneously make comparisons both (i) between women the same age born in different states and (ii) between women of different ages born in the same state.[39] Using individual sample-line women w born in states s and who were age a in the 1940 population (and who were in a five-year age interval i 15-19, 20-24, …, 50-54 when a suffrage law was passed in their state of birth), I estimate:

$$(4) \qquad b_{was} = \alpha + \sum_i \beta_i v_{ias} + \delta_s + \delta_a + \delta_s \times a + \varepsilon_{was}$$

where b is the number of lifetime births reported by each woman, v represents age interval-specific dummy variables indicating whether or not a woman could first legally vote in each age interval i, δ_s and δ_a represent state and age fixed effects, $\delta_s \times a$ represents state-specific linear time (or age) trends, and the parameter estimates of interest are the βs. Because lifetime births can reasonably be considered count data and the distribution of lifetime births is left-censored at zero, equation 4 was estimated by maximum likelihood estimation using a negative binomial model. Estimates of β are shown in Figure 9. There is no evidence that women's fertility responded to suffrage laws.

6. Conclusion

The extension of suffrage rights to American women allowed children to benefit more fully from the scientific breakthroughs of the bacteriological revolution. Some of the most beneficial innovations due to this transformation were simple ones – water and milk boiling, food- and hand-washing, breastfeeding, and meat refrigeration. However, communicating them

[39] This approach based on women's state of birth (rather than state of residence) is essentially an intent-to-treat analysis.

to the American public required widespread public health campaigns. As women began voting, public health spending increased by 20% or more, and deaths due to leading childhood killers such as diphtheria, meningitis, and diarrheal diseases declined substantially. This paper finds that women's suffrage accounts for nearly 10% of the unprecedented child mortality decline between 1900 and 1930.

Debate continues today in international health and development circles about the appropriate role of women's issues on child welfare agendas. The findings presented in this paper offer at least two insights. First, even in the presence of theoretically ambiguous price effects, the stronger expression of women's preferences can deliver large benefits for children. Second, tension between spending on technological innovations to improve child survival and broader efforts to advance the standing of women (or supply- vs. demand-oriented strategies for health improvement generally) may be unwarranted. In early twentieth century America, technological child health innovations and the promotion of gender inequality were in fact complementary as women became leading promoters (and practitioners) of simple health behaviors with important child survival benefits. In developing countries today, over 10 million children die each year – many of them from preventable causes (WHO 2002, Black, Morris, and Bryce 2003). Because the use of existing technologies is not limited by supply-side obstacles alone (Thornton 2005), demand-side factors also deserve careful consideration. Promoting gender equality may be an important means of encouraging the adoption of beneficial but under-used health technologies.[40]

[40] This may especially be true for environments in which women's investments in children are likely to have the greatest child health benefits – contexts of poor economic conditions and prevalent infectious disease (Ewbank and Preston 1990, Henriques, Strauss, and Thomas 1991, Dasgupta 1993, Elo and Preston 1996, Basu 1998, Cleland and Kaufmann 1998, Hobcraft 2000, Kishor 2000, Deaton and Paxson 2003).

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Figure 1: The Timing of Women's Suffrage Rights across American States

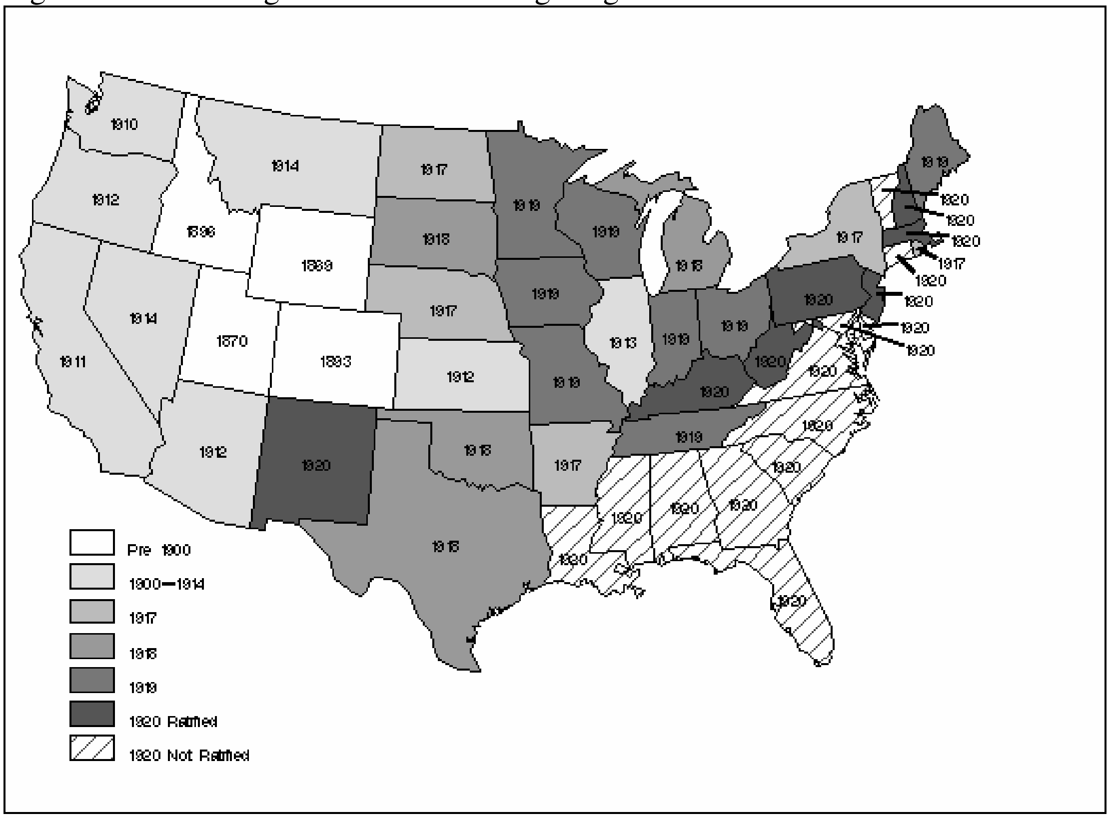


Figure 2: The Timing of Death Registration Area Entry across American States

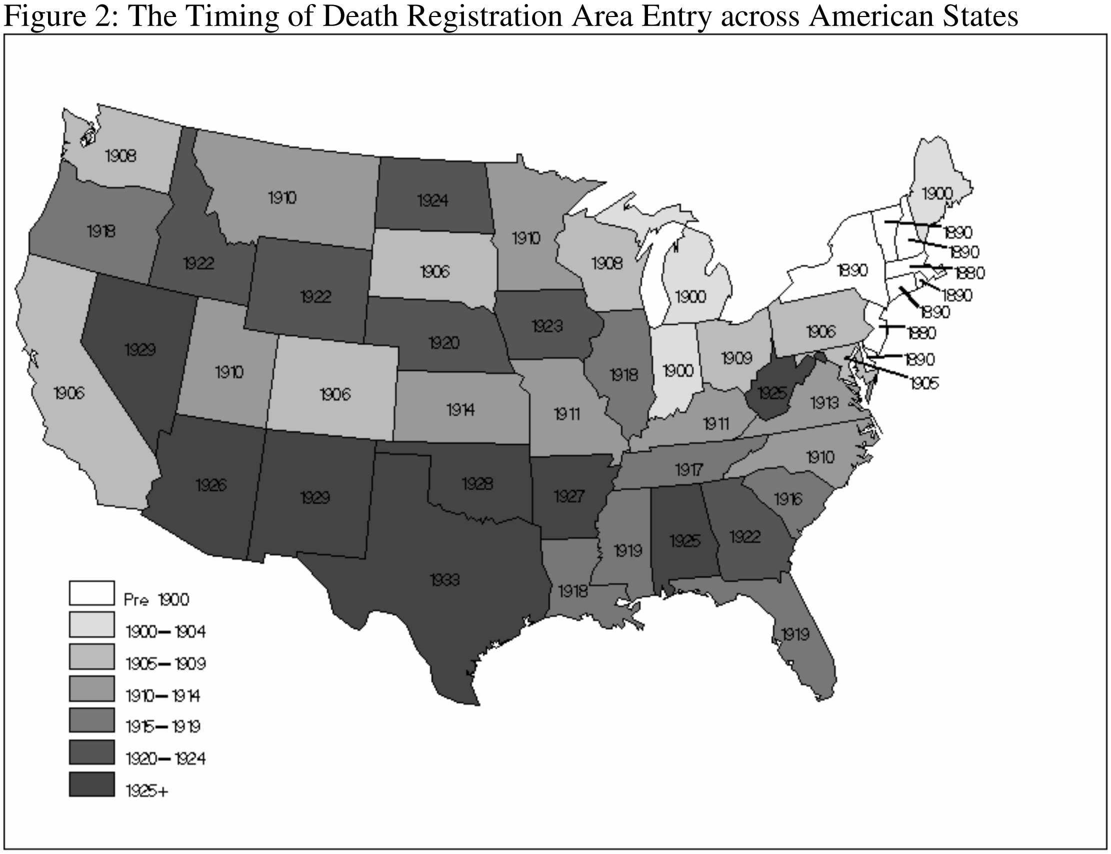


Figure 3: Density of State-Level Data Relative to Suffrage Law

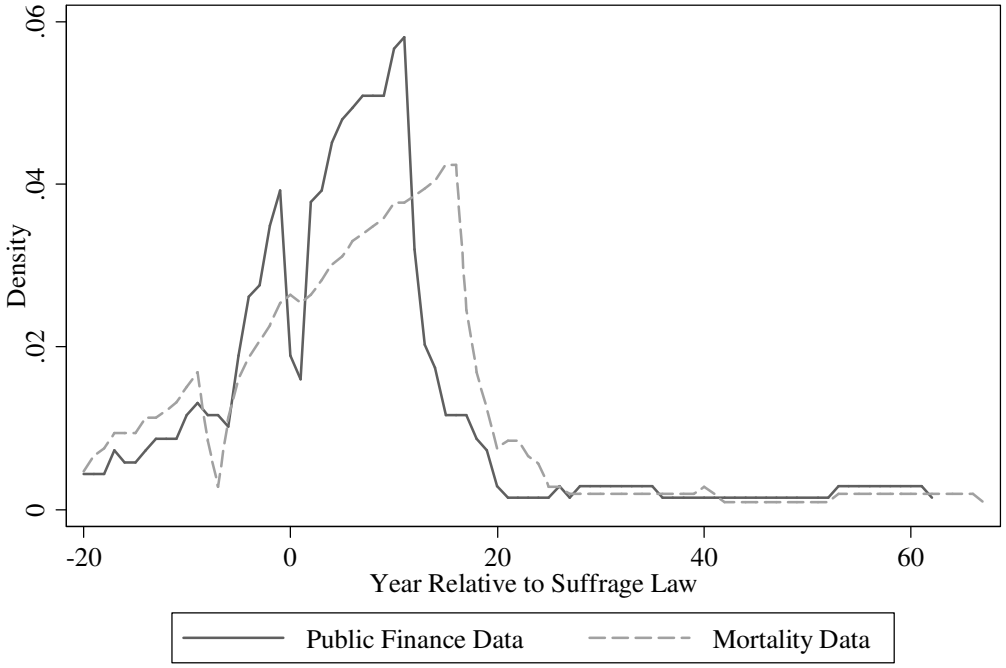


Figure 4: Residual ln(Age-Specific Mortality)
and the Timing of Suffrage Laws

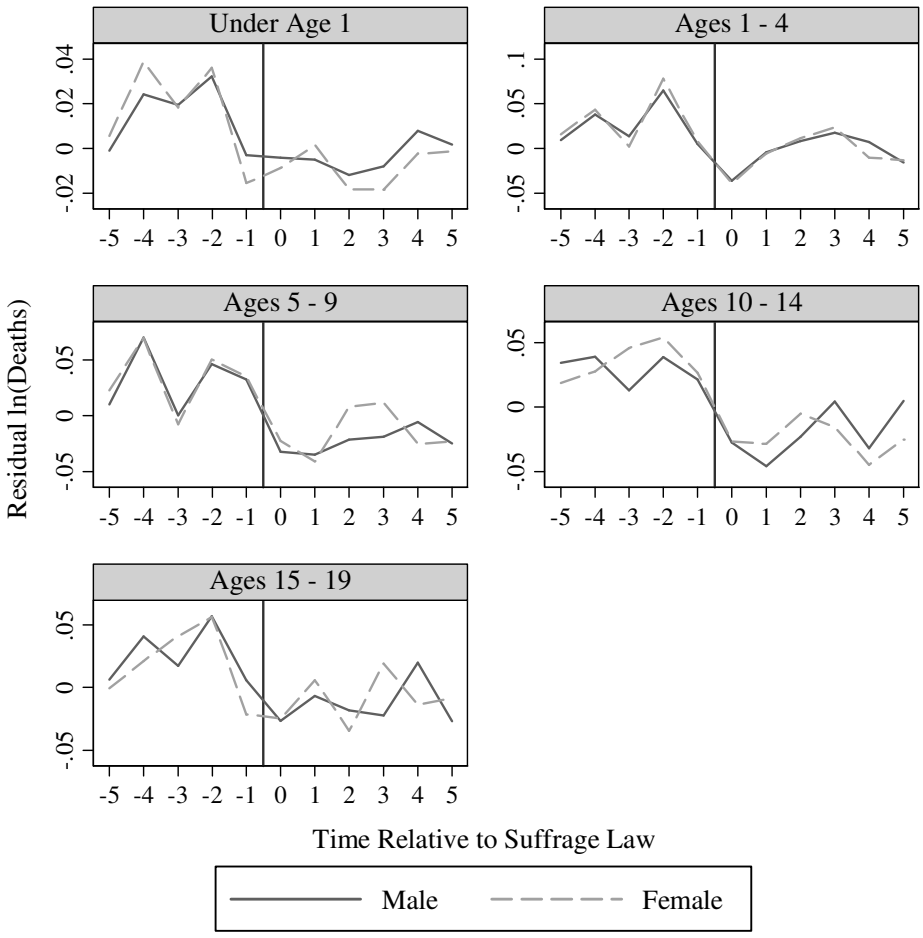
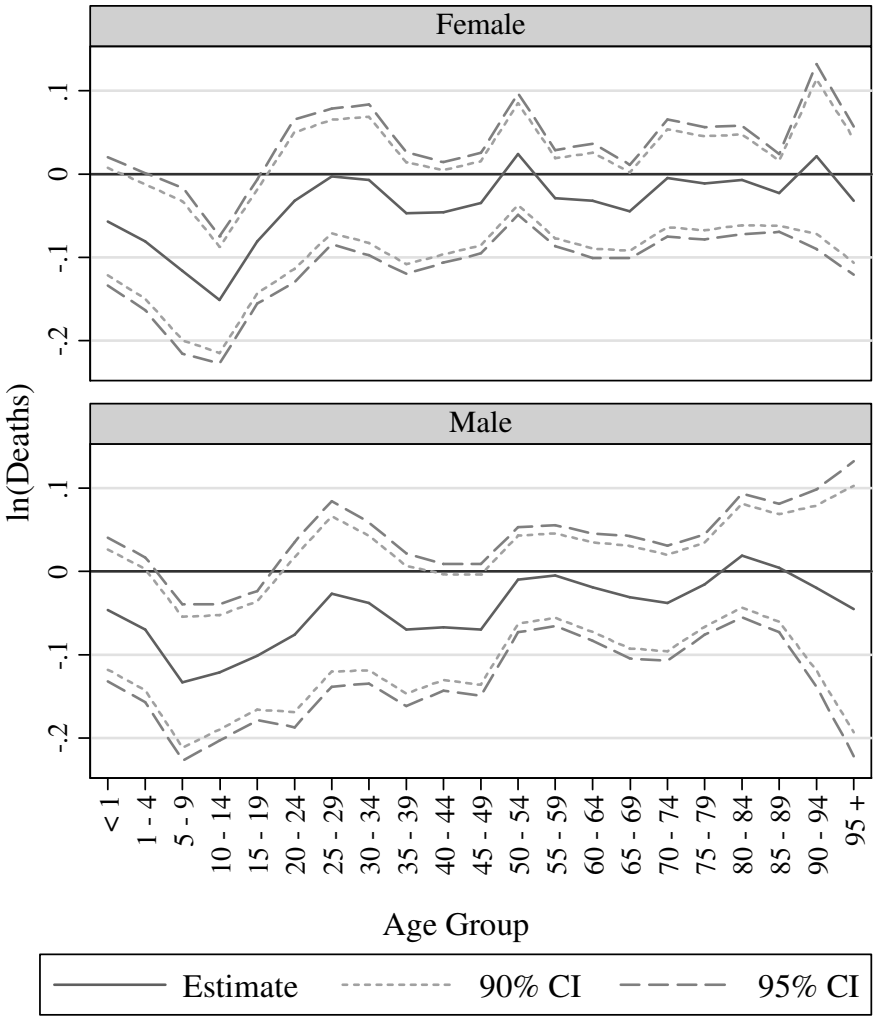
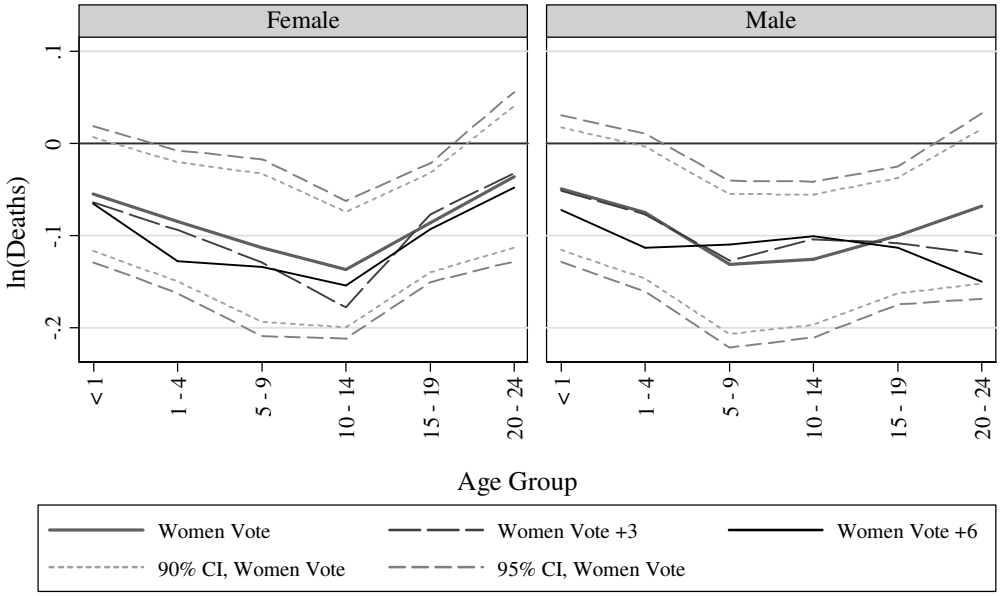


Figure 5: The Effect of Women's Suffrage Laws on Age-Specific Deaths



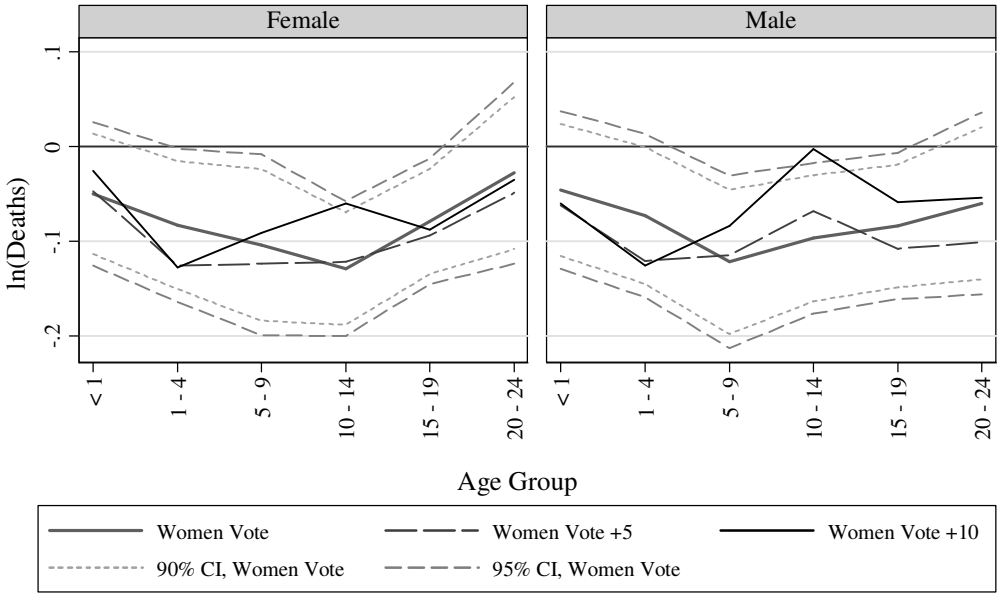
Note: Standard errors clustered at the state level.

Figure 6a: The Effect of Women's Suffrage Laws on Age-Specific Deaths
3- and 6- Year Time Lags



Note: Standard errors clustered at the state level.

Figure 6b: The Effect of Women's Suffrage Laws on Age-Specific Deaths
5- and 10- Year Time Lags



Note: Standard errors clustered at the state level.

Figure 7: Age-Specific Mortality Elasticities
with Respect to Pre-Suffrage Mortality

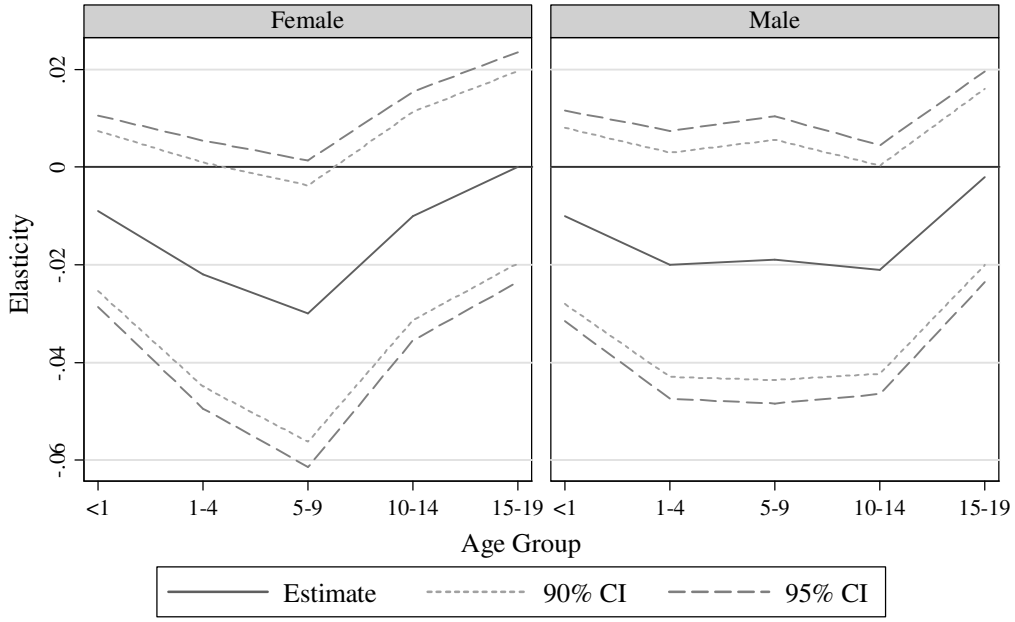


Figure 8: The Distribution of Progressive Era Events

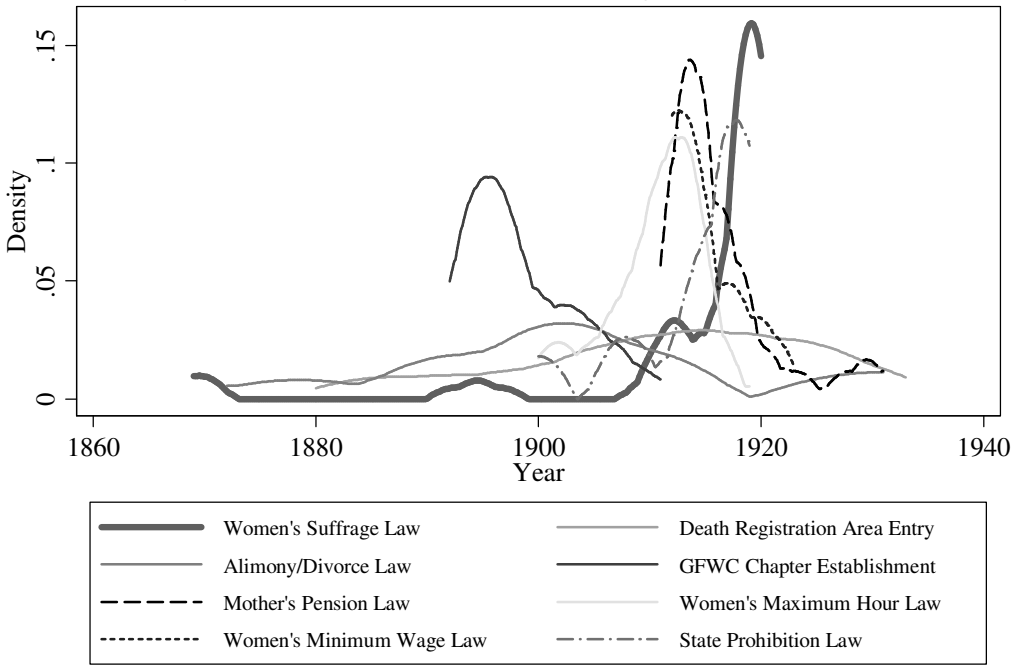
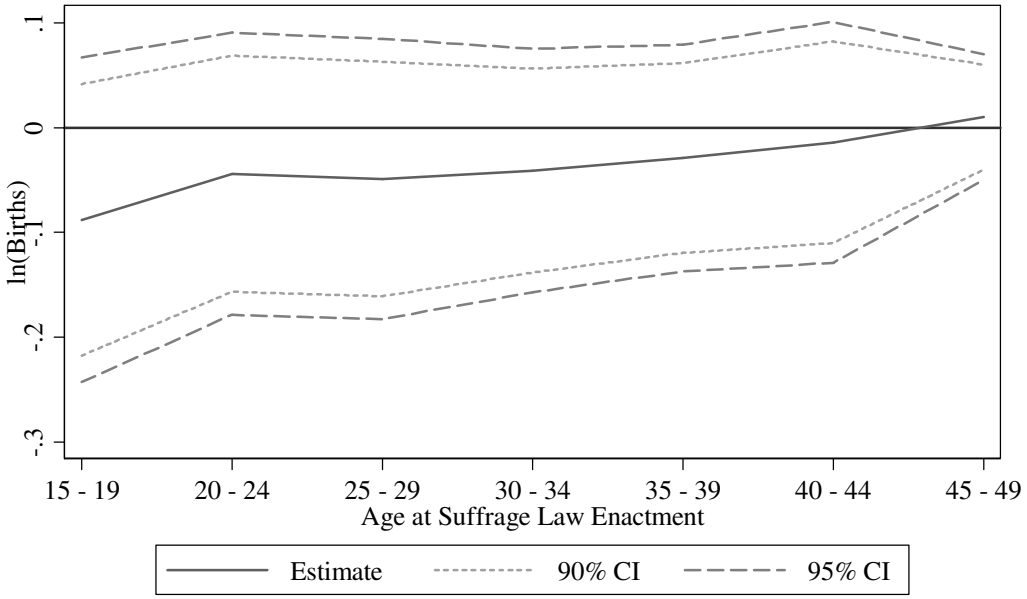


Figure 9: The Effect of Women's Suffrage Laws at Various Ages on Women's Lifetime Fertility



Note: Standard errors clustered at the state level.

Table 1: Descriptive Statistics

	1900		1910		1920		1930	
Panel A: Age-Specific Annual Mortality Rate per 1,000 in Each Age Interval in Death Registration States								
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Total	17.31	(1.97)	13.78	(3.36)	13.00	(1.52)	11.42	(1.62)
Under Age 1	163.49	(31.42)	119.89	(37.38)	95.10	(16.92)	70.82	(18.64)
Age 1-4	18.78	(4.82)	11.89	(3.79)	9.28	(1.78)	5.83	(2.17)
Age 5-9	4.49	(0.76)	3.29	(0.76)	2.84	(0.37)	1.92	(0.39)
Age 10-14	2.98	(0.26)	2.36	(0.54)	2.34	(0.27)	1.62	(0.33)
Age 15-19	4.96	(0.40)	3.68	(0.79)	4.13	(0.71)	2.95	(0.80)
Age 20-24	6.72	(0.51)	5.24	(1.13)	5.81	(1.38)	4.14	(1.39)
Age 25-29	7.53	(0.61)	5.94	(1.34)	6.65	(1.52)	4.73	(1.71)
Age 30-34	7.80	(1.06)	6.76	(1.71)	7.52	(1.49)	5.24	(1.91)
Age 35-39	8.95	(1.36)	7.83	(1.71)	8.06	(1.44)	6.23	(1.98)
Age 40-44	10.25	(1.72)	9.09	(2.05)	8.80	(1.44)	7.96	(2.27)
Age 45-49	12.04	(2.38)	11.18	(2.40)	10.32	(1.62)	10.20	(2.45)
Age 50-54	15.96	(3.78)	14.43	(3.53)	13.84	(2.12)	14.06	(3.07)
Age 55-59	22.52	(4.32)	20.53	(4.89)	19.46	(2.62)	19.47	(3.62)
Age 60-64	30.72	(4.62)	28.77	(7.00)	27.44	(3.14)	28.27	(4.14)
Age 65-69	46.13	(7.12)	42.94	(10.34)	42.12	(4.52)	42.22	(4.60)
Age 70-74	68.90	(6.69)	63.50	(14.91)	65.27	(6.50)	63.55	(6.15)
Age 75-79	103.99	(9.35)	98.47	(21.21)	98.05	(7.51)	96.42	(8.06)
Age 80-84	162.81	(10.69)	149.31	(31.09)	151.57	(9.90)	144.94	(8.93)
Age 85-89	232.45	(20.59)	210.05	(45.78)	215.75	(13.50)	205.75	(17.23)
Age 90-94	322.33	(32.18)	290.66	(78.83)	306.21	(37.45)	286.05	(33.71)
Age 95+	431.91	(43.84)	358.44	(123.09)	333.78	(52.89)	333.60	(63.28)
Panel B: Cause-Specific Annual Mortality Rate per 1,000 Total Population in Death Registration States								
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Typhoid Fever	0.30	(0.09)	0.24	(0.11)	0.09	(0.05)	0.06	(0.05)
Malaria	0.06	(0.04)	0.01	(0.01)	0.05	(0.11)	0.03	(0.08)
Smallopox	0.00	(0.00)	0.00	(0.01)	0.01	(0.02)	0.00	(0.00)
Measles	0.14	(0.11)	0.10	(0.07)	0.08	(0.04)	0.04	(0.04)
Scarlet Fever	0.08	(0.03)	0.10	(0.07)	0.04	(0.03)	0.02	(0.01)
Whooping Cough	0.12	(0.03)	0.12	(0.05)	0.13	(0.05)	0.06	(0.03)
Diphtheria	0.35	(0.13)	0.18	(0.07)	0.13	(0.05)	0.05	(0.03)
Influenza	0.37	(0.20)	0.14	(0.08)	0.75	(0.25)	0.22	(0.09)
Meningitis	0.43	(0.09)	0.14	(0.05)	0.06	(0.02)	0.04	(0.05)
Diabetes	0.12	(0.03)	0.15	(0.05)	0.15	(0.05)	0.17	(0.06)
Circulatory Disease	1.58	(0.29)	1.27	(0.57)	1.36	(0.39)	1.96	(0.56)
Pneumonia	1.47	(0.30)	1.26	(0.43)	1.30	(0.30)	0.85	(0.18)
Diarrhea under age two	1.14	(0.35)	0.83	(0.36)	0.41	(0.16)	0.23	(0.19)
Nephritis	0.82	(0.25)	0.87	(0.29)	0.87	(0.21)	0.88	(0.28)
Suicide	0.10	(0.02)	0.15	(0.05)	0.10	(0.04)	0.16	(0.07)
TB Lungs	1.64	(0.32)	1.21	(0.45)	0.99	(0.35)	0.67	(0.46)
TB Other	0.21	(0.06)	0.19	(0.06)	0.13	(0.04)	0.08	(0.03)
Cancer	0.69	(0.13)	0.72	(0.24)	0.81	(0.25)	0.91	(0.30)
Accidents and Violence	0.74	(0.14)	0.87	(0.29)	0.78	(0.12)	0.92	(0.17)
Panel C: Real Annual State Government Spending and Revenue Per Capita								
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Total Revenue	$16.51	($7.05)	$17.79	($7.69)	N/A	N/A	$43.36	($20.06)
Total Spending	$14.94	($8.12)	$18.05	($7.30)	N/A	N/A	$43.99	($15.78)
Property Tax Revenue	$3.51	($1.07)	$9.18	($10.23)	N/A	N/A	$8.91	($6.94)
Transportation Spending	$0.88	($0.70)	$2.61	($3.38)	N/A	N/A	$18.67	($9.22)
Education Spending	$2.46	($1.06)	$5.63	($3.12)	N/A	N/A	$10.79	($7.10)
Social Services Spending	$2.23	($0.96)	$2.42	($1.22)	N/A	N/A	$3.68	($1.40)

Note: Public finance data is unavailable in 1920

Table 2: The Effect of Women's Suffrage Laws on Cause-Specific Deaths

Dependent Variable	Estimate	Standard Error	N	R2
ln(Typhoid Deaths)	-0.058	(0.070)	1109	0.97
ln(Malaria Deaths)	-0.067	(0.130)	911	0.96
ln(Small Pox Deaths)	-0.237	(0.233)	690	0.55
ln(Measles Deaths)	-0.061	(0.133)	1094	0.73
ln(Scarlet Fever Deaths)	0.174	(0.162)	1107	0.89
ln(Whooping Cough Deaths)	-0.052	(0.090)	1108	0.90
ln(Diphtheria Deaths)	-0.241*	(0.125)	1106	0.95
ln(Influenza Deaths)	-0.089	(0.085)	1109	0.97
ln(Meningitis Deaths)	-0.234**	(0.097)	1107	0.93
ln(Pneumonia Deaths)	-0.050	(0.042)	1109	0.99
ln(Diarrhea Deaths Under Two)	-0.114*	(0.065)	1109	0.98
ln(TB Deaths)	-0.044	(0.042)	1109	1.00
ln(Childbirth Deaths)	0.001	(0.053)	1109	0.98
ln(Heart Disease Deaths)	-0.002	(0.030)	1109	0.99
ln(Diabetes Deaths)	0.038	(0.042)	1108	0.99
ln(Nephritis Deaths)	-0.003	(0.034)	1109	0.99
ln(Cancer Deaths)	-0.014	(0.030)	1109	1.00
ln(Accidents/Violent Deaths)	-0.022	(0.041)	1109	0.99
ln(Suicide Deaths)	-0.029	(0.030)	1109	0.99

Notes: *p<0.10, **p<0.05, ***p<0.01; Standard errors clustered at the state level shown in parentheses

Table 3: The Effect of Women's Suffrage Laws on State Government Spending and Revenue

Dependent Variable	Estimate	Standard Error	State and Year Fixed Effects	Linear State Time Trends	N	R^2
ln(Total Revenue)						
	0.398	(0.288)	Yes	No	673	0.71
	0.010	(0.084)	Yes	Yes	673	0.89
ln(Property Tax Revenue)						
	0.018	(0.352)	Yes	No	579	0.84
	0.070	(0.209)	Yes	Yes	579	0.94
ln(Total Spending)						
	0.379	(0.300)	Yes	No	688	0.69
	-0.057	(0.088)	Yes	Yes	688	0.87
ln(Highway Spending)						
	0.407	(0.386)	Yes	No	667	0.72
	0.300	(0.215)	Yes	Yes	667	0.90
ln(Education Spending)						
	0.051	(0.111)	Yes	No	689	0.71
	0.137	(0.157)	Yes	Yes	689	0.75
ln(Social Service Spending)						
	0.239***	(0.089)	Yes	No	688	0.76
	0.206***	(0.071)	Yes	Yes	688	0.84

Notes: *p<0.10, **p<0.05, ***p<0.01; Standard errors clustered at the state level shown in parentheses

Table 4: The Effect of Women's Suffrage Laws on Municipal Government Spending and Revenue

Table 5: The Elasticity of Public Spending with Respect to Pre-Suffrage Mortality

	Independent Variable, Mean 1-5 Years Before Suffrage Law									
Dependent Variable	Post×ln(Female Deaths Under 1)	Post×ln(Female Deaths 1-4)	Post×ln(Female Deaths 5-9)	Post×ln(Female Deaths 10-14)	Post×ln(Female Deaths 15-19)	Post×ln(Male Deaths Under 1)	Post×ln(Male Deaths 1-4)	Post×ln(Male Deaths 5-9)	Post×ln(Male Deaths 10-14)	Post×ln(Male Deaths 15-19)
ln(Total Revenue)	-0.001	0.003	0.004	0.006	0.007	-0.001	0.003	0.003	0.005	0.005
	(0.020)	(0.023)	(0.027)	(0.029)	(0.026)	(0.019)	(0.023)	(0.027)	(0.028)	(0.026)
ln(Property Tax Revenue)	-0.100	-0.100	-0.111	-0.110	-0.102	-0.097	-0.099	-0.111	-0.113	-0.105
	(0.105)	(0.113)	(0.130)	(0.136)	(0.126)	(0.102)	(0.111)	(0.128)	(0.136)	(0.126)
ln(Total Spending)	0.006	0.009	0.010	0.012	0.012	0.006	0.010	0.010	0.012	0.010
	(0.026)	(0.029)	(0.033)	(0.035)	(0.033)	(0.025)	(0.029)	(0.033)	(0.035)	(0.032)
ln(Highway Spending)	0.084	0.103	0.126	0.140	0.145	0.081	0.104	0.113	0.137	0.127
	(0.082)	(0.089)	(0.100)	(0.104)	(0.099)	(0.080)	(0.088)	(0.098)	(0.103)	(0.096)
ln(Education Spending)	0.033	0.041	0.047	0.049	0.045	0.031	0.040	0.048	0.049	0.049
	(0.031)	(0.035)	(0.041)	(0.041)	(0.037)	(0.029)	(0.034)	(0.041)	(0.041)	(0.040)
ln(Social Service Spending)	0.034*	0.037*	0.043*	0.046*	0.044*	0.033*	0.037*	0.043*	0.047*	0.044*
	(0.018)	(0.020)	(0.024)	(0.024)	(0.022)	(0.017)	(0.020)	(0.023)	(0.024)	(0.022)

Notes: *p<0.10, **p<0.05, ***p<0.01; Standard errors clustered at the state level shown in parentheses; each estimate and standard error obtained from a separate regression

Table 6: Pre-Suffrage Trend Breaks

	1-2 Years Before Law		1-4 Years Before Law		1-6 Years Before Law	
Dependent Variable	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
ln(Male Deaths Under 1)	-0.002	(0.028)	0.041	(0.066)	0.068	(0.070)
ln(Male Deaths 1-4)	0.038	(0.035)	0.086	(0.074)	0.114	(0.077)
ln(Male Deaths 5-9)	-0.005	(0.044)	0.033	(0.072)	0.082	(0.081)
ln(Male Deaths 10-14)	-0.024	(0.027)	-0.007	(0.069)	0.017	(0.070)
ln(Male Deaths 15-19)	-0.003	(0.030)	0.034	(0.061)	0.024	(0.047)
ln(Female Deaths Under 1)	-0.029	(0.023)	0.025	(0.063)	0.047	(0.068)
ln(Female Deaths 1-4)	0.049	(0.040)	0.083	(0.079)	0.117	(0.084)
ln(Female Deaths 5-9)	0.022	(0.043)	0.058	(0.074)	0.092	(0.092)
ln(Female Deaths 10-14)	-0.022	(0.035)	0.017	(0.068)	0.020	(0.054)
ln(Female Deaths 15-19)	-0.031	(0.027)	0.021	(0.052)	0.058	(0.042)
ln(Diphtheria Deaths)	-0.110	(0.096)	-0.049	(0.104)	0.129	(0.117)
ln(Meningitis Deaths)	0.050	(0.087)	0.058	(0.113)	0.006	(0.111)
ln(Diarrhea Deaths Under Two)	-0.056	(0.054)	0.001	(0.075)	0.119	(0.090)
ln(Social Service Spending)	0.129	(0.106)	-0.038	(0.159)	-0.053	(0.145)

Notes: *p<0.10, **p<0.05, ***p<0.01; Standard errors clustered at the state level shown in parentheses

Table 7: Correlates of Women's Suffage Law Timing

Independent Variable	Estimate	Standard Error	N	R^2
Year Joined Death Registration Area	-0.114	(0.120)	48	0.02
Population in 1000s, 1900	0.002*	(0.001)	48	0.07
Total Mortality Rate per 1000, 1900	0.071	(0.233)	10	0.01
Year of State Alimony/Divorce Law	0.184	(0.279)	11	0.05
Percent of the Native White Population 21+ Illiterate, 1900	0.449	(0.400)	45	0.03
Per Capita Capital Investment in Manufacturing, 1900	-10.297	(14.148)	45	0.47
Per Capita Wage in Manufacturing, 1900	-0.080	(0.057)	45	0.04
Year of State GFWC Chapter	-0.085	(0.337)	48	0.00
Year of State Mother's Pension Law	1.335	(0.835)	40	0.06
Year of Women's Maximum Hour Law	-0.079	(0.460)	39	0.01
Year of Women's Minimum Wage Law	1.105	(0.984)	15	0.09
Year of Prohibition	-0.162	(0.283)	48	0.01

Notes: *p<0.10, **p<0.05, ***p<0.01; GFWC: General Federation of Women's Clubs

Table 8: How the Effect of Women's Suffrage Laws on Deaths Differed between Voluntary and Mandatory States

Dependent Variable	Estimate	Standard Error	N	R^2
ln(Male Deaths Under 1)	0.000	(0.094)	1062	0.99
ln(Male Deaths 1-4)	0.021	(0.104)	1062	0.99
ln(Male Deaths 5-9)	0.135	(0.099)	1062	0.98
ln(Male Deaths 10-14)	0.079	(0.085)	1062	0.98
ln(Male Deaths 15-19)	0.024	(0.075)	1062	0.99
ln(Female Deaths Under 1)	-0.001	(0.092)	1062	0.99
ln(Female Deaths 1-4)	0.030	(0.099)	1062	0.99
ln(Female Deaths 5-9)	0.108	(0.098)	1062	0.98
ln(Female Deaths 10-14)	0.131	(0.090)	1062	0.98
ln(Female Deaths 15-19)	0.004	(0.067)	1062	0.99
ln(Diphtheria Deaths)	0.060	(0.151)	1106	0.95
ln(Meningitis Deaths)	0.167	(0.160)	1107	0.93
ln(Diarrhea Deaths Under Two)	-0.002	(0.131)	1109	0.98
ln(Social Service Spending)	0.008	(0.093)	688	0.84

Notes: *p<0.10, **p<0.05, ***p<0.01; Estimates shown for the interaction between a dummy variable for states voluntarily choosing suffrage and the presence of a women's suffrage law; Standard errors clustered at the state level shown in parentheses