# Urban Fertility Responses to Local Government Programs: Evidence from the 1923-1932 U.S.*

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**Abstract**

During the 1920s-early 1930s, U.S. fertility declined with large regional variation. Changes in age structure and foreign born populations explain only part of this. Using data for over 50 cities from 1923-1932, we show that local health education programs contributed to the declines. Fixed effects regressions indicate that cities spending in the 75th percentile experienced a 3% faster fertility decline than cities spending in the 25th percentile. The mechanisms may be related to breastfeeding, social insurance incentives or emphasis on a two child home. The results help explain the differing fertility trends, and highlight how public policy may reduce fertility.

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# 1. Introduction

During the 1920s and early 1930s, before the enactment of the New Deal, fertility in large American urban areas trended downward, with the Total Fertility Rate (TFR) dipping below modern day replacement levels (about 2.3) for likely the first time.[1] Additionally, while fertility across all large urban areas declined on average, cities varied in their fertility trajectories. This variation in declining American urban fertility levels may be due to differences in municipal investment in public health education and poverty relief programs. While there were no public programs targeting fertility specifically during this time, public health education programs were implemented with the goal of improving health outcomes and reducing infant mortality, so the programs may have also helped contribute to lower fertility rates across cities. Additionally, charitable programs were implemented across the different municipalities as a way to alleviate some of the harmful effects of poverty and may have also affected fertility. This paper will estimate to what extent differences in investment in these types of programs explain differences in fertility outcomes across a set of large urban areas in the United States.

Understanding the relationship between public health education and poverty relief spending, and fertility, is important both for understanding the 1920s-1930s declines in U.S. fertility rates as well as for informing current policy. If these public programs affected fertility in U.S. cities, they potentially offer a tool for contemporary governments looking to lower fertility rates. While the public health programs were not implemented with the explicit intent of lowering fertility within the different

[1] Estimates of the Total Fertility Rate for each census between 1800 and 1990 for the white population of the U.S. are given by Haines (2000) on page 308. These estimates are consistently above 3, but reflect both urban and rural populations, so it is possible, although unlikely, that urban fertility fell below modern day replacement levels prior to the 1920s.

cities, the leaders of the educational programs advocated the importance of birth spacing and smaller families for improvements in child health outcomes (Woodbury 1925, Lathrop 1919). A relationship between these public health education programs and fertility would indicate that individuals altered their behavior in response to the programs and that lower fertility resulted.

Additionally, public programs may cause effects that are not necessarily intended, or even to the opposite direction than intended. The public health education programs were implemented in a period of distress over falling birth rates and calls for improving the stock as well as the quality of the population (Hoffmann 1909, Newsholme and Stevenson 1906, Willcox 1911, Newmayer 1911, Meckel 1990: pp 102). Given this, it is likely that supporters of the public health education programs had in mind an element of increasing the U.S. population. However, improvements in infant mortality are closely related to reductions in fertility, so saving babies may also translate to fewer being conceived in the first place.

In terms of the period under consideration, determining whether these programs affected fertility will shed light not only on why fertility rates were declining steadily prior to the Great Depression, but also why fertility outcomes differed so much across cities in the United States. Variation in fertility across areas has been a constant feature of the United States, and continues to be the case today (U.S. Bureau of the Census 2011: Section 2, Table 82). Understanding how different levels of investment in different types of public policies can effect changes in fertility helps to illustrate how conscious policy can cause fertility rates to differ across areas.

## Historical U.S. Fertility Declines

This paper focuses on the decade between the 1920s and early 1930s, however

U.S. fertility declined for a long period prior to that. Urban and rural fertility in the United States had been declining at least since the pre-civil war period, although there is disagreement regarding both the timing and reason for the decline. Some have dated the beginning of American fertility decline to the start of the 19th century (Hirschman 1994, David and Sanderson 1987). However more recent research has argued that U.S. fertility began its decline in 1840 and that a broad reduction in marital fertility was not seen until the post-civil war period (Hacker 2003). Fertility then generally declined within the U.S. until the baby boom of the 1940s and 1950s (Jones and Tertilt 2007).

The discussions on the causes of the U.S. fertility decline typically focus on changing demographic, religious, or economic circumstances. David and Sanderson (1987) argue that U.S. fertility declined between the mid-19th and mid-20th centuries partially due to the emergence of a two child norm and a growing prevalence of fertility control among married women. Analyzing the number of children-ever-born, they attribute over half of the decline in fertility for the 1855-1859 and the 1910-1914 birth cohorts to reductions in fertility among women who used some form of birth control. This conclusion is based off using cohort parity analysis to estimate the number of women who actively controlled their fertility. This method has since been criticized, so there is some question whether active efforts to control births accounted for such a large proportion of the fertility decline (Okun 1994).

The effect of income on fertility also has a long history in the fertility theory literature. While wages and fertility are negatively related on an individual basis, fertility is also pro-cyclical, so recessions tend to depress birth rates and periods of growth see greater numbers of children (Sobotka, Skirrbekk and Philipov 2011). Related to the relationship between individual wages and fertility, economists have identified increases in income as causing reductions in fertility and increases in investment per child (Becker and Tomes 1976). Using individual-level data on the number of children-ever-born for cohorts between 1826 and 1960, Jones and Tertilt (2006) confirm this negative income-fertility relationship. The authors remain agnostic regarding the specific mechanism causing the relationship, but estimate that income as measured by occupation explains as much as 90 percent of differences in fertility across time and between groups. One potential mechanism linking the individual-level income and fertility is that by having fewer children, men, and particularly women, may focus more on capital accumulation.

Also tending to reduce fertility are reductions in mortality, specifically that of children and infants. A large theoretical literature argues that infant and child mortality can affect fertility in a number of ways. If individuals have a target for the number of children surviving to adult ages, then reducing mortality will reduce the need for both "hoarding" children (Sah 1991) as well as for "replacement" (Eckstein et. al. 1999, Doepke 2005). On the other hand, reducing infant and child mortality reduces the expected cost of raising a surviving child (Barro and Becker 1989), potentially increasing fertility.

An increase in average age at marriage also played a role in 19th century fertility reduction (Haines 2000). However mean age at marriage does not seem like a potential candidate explaining declining fertility in the early 20th century. The singulate mean age at marriage (SMAM) for females was declining through the first three decades of the 20th century; SMAM was equal to 23.8 in 1900, 23.4 in 1910, 22.7 in 1920 and 21.2 in 1930 (Haines 2000 and U.S. Bureau of the Census 1931). [2] Additionally, for at least the period between 1920 and 1930, the proportion of married

[2] The Singulate Mean Age at Marriage compares the age-specific proportions of the single population to the married population to calculate the average age at which the transition from single to married was made.

women between ages 15 and 44 was increasing across most of the 1920 Birth Registration Area (BRA). In those states for which the married population was declining, changes in the married population explained at most 10 percent of the total decline in state fertility.[3]

The 1920-1930 fertility trends are similarly unexplainable from the changes in fertility occurring during the prior decade. Figure 1 plots the ratio of children under the age of 1 to the female childbearing population for the 1910, 1920 and 1930 Decennial Censuses, as well as the 1910-20 trends forecasted into the next decade for cities over 100,000 persons in 1920.

FIGURE 1 HERE

Based off this child to mother ratio, although fertility in these large urban areas was declining between 1910 and 1920, it accelerated its decline in the following decade. From the 1910 to 1920 forecast, this ratio should have declined to about 68 by 1930. However, by 1930, it fell to 57, a number much less than that which would have been expected based off of the prior trend. So while fertility had been declining in the United States for much of the 1800s and early 1900s, something happened in the 1920s, a decade of relatively stable economic growth for urban areas, to accelerate this decline.

## A 1920's Fertility Story

In his seminal 1961 article, Richard Easterlin (1961) argued that the early 20th

[3] This was calculated using the method of decomposition by replacement where 1920 married population proportions were combined with 1930 marital fertility rates to calculate the change in fertility which would have occurred when holding the population proportions constant.

century fertility decline was driven by reductions in fertility among the foreign born and rural populations.  Changes in immigrant demographics, specifically the shift of immigrants from eastern and southern European countries to immigrants from the western and northern European countries, changes in the foreign-born sex ratio, and an aging of the female foreign-born population resulted in declines in foreign-born fertility.  Easterlin also pointed to depressed agricultural conditions as causing the lower fertility among the rural populations, and mentions the migration of individuals from high-fertility rural areas to low-fertility urban areas.

It was for these reasons, he argued, that U.S. fertility declined in the relatively prosperous 1920s.  However, fertility was declining almost universally across large urban areas as well, an observation not explainable by declines in rural fertility or rural to urban migration.  And while some areas in the U.S. did have large foreign born populations, most notably New York and Connecticut with over 26 percent of the state having been born overseas in 1920, many areas did not.  Foreign born individuals tended to concentrate in large urban areas, but most cities over 100,000 persons in 1920 had foreign born populations under 20 percent, and thus would not fully explain the decline in fertility rates.  For some areas however, changes in the demographic structure of the population may explain part of the 1920's fertility decline.

Using birth registration data, it is possible to decompose state level fertility changes into the portions explainable by changes in the population and age structure and explainable by changes in fertility.  Table 1 separates state level fertility changes by the population groups "Native white," "Foreign born white," and "Colored," for those states that were part of the 1920 BRA and had at least one city over 100,000 persons in 1920.  Colored in this instance is not the usual definition, in that it also includes Asians, Pacific Islanders, Hispanics and other minority groups.[4] So in looking at Table 1, it is important to keep in mind that the population category "colored" represents different populations for different states. For California, Oregon and Washington, this population group is dominated by Chinese and Japanese Americans. However, for almost all other states it is primarily made up of African Americans. The definition of "colored" changed slightly between 1920 and 1930. In 1920, Mexicans were enumerated as part of the "white" population, while by 1930 they had grown to represent a large enough segment of the population to deserve a separate ethnic category. So in 1930, Mexicans were counted as part of the colored population. The effect of this is most evident in the California data, where the total fertility rate for the colored population declines from 5.3 in 1920 to an unrealistic 1.21 in 1930. The statistic of 1.21 is primarily due to this changing definition combined with the substantial Mexican migration into California during the 1920s and a severe under reporting of Mexican births (Department of Commerce, 1922 pgs 4-5). The issue of the Mexican population statistics being differently enumerated between 1920 and 1930 should not cause accuracy issues for the other states listed in Table 1. California, Texas and Arizona held over 80 percent of the U.S. Mexican population in 1930, with all other states holding about 250,000 Hispanic individuals combined.

TABLE 1 HERE

Most important to take away from Table 1 is the almost universal decline in fertility across all population groups. In every state for which the calculations are possible, Native white fertility declined between 1920 and 1930. With the exception

[4] Births by age for blacks, Asians and other minority populations were pooled in 1930.

of Kansas and Nebraska, this was also true for fertility among the colored population. Fertility for the foreign born population increased in California between 1920 and 1930, but declined in all other areas for which data is available.

Although, in general, fertility was declining for each of the different population groups, it is still not clear to what extent changes in fertility at the state level are due to changes in actual fertility or to changes in the relative populations of the different groups. To answer this, we use the method of fertility decomposition by replacement developed by Andreev et. al (2002) to calculate the relative contributions of changes in fertility and changes in population structure to the overall change in state level fertility.[5] The relative contributions from each group to the overall decline are plotted in Figure 2 for each of the states in Table 1.

FIGURE 2 HERE

Figure 2 illustrates that changes in state level fertility between 1920 and 1930 were driven by changes in fertility within population groups, not by shifts in the relative size of the population groups. For those states in which changes in the population structure did play a role, this was the Easterlin story of an aging of the female foreign born population out of the fertile age range. For example, population structure accounted for about 20 percent of the fertility decline in Connecticut. This is basically due to there being fewer females between the ages of 20 and 34 for this foreign population (a decline from 62,011 in 1920 to 42,501 in 1930). However, for most of the states from Table 1, changes in the relative population sizes did not

[5] To implement the decomposition, we use the step-wise decomposition macro programmed by V.M. Shkolnikov and E.M. Andreev, available on the MPIDR website at the following address: http://www.demogr.mpg.de/en/projects_publications/publications_1904/mpidr_technical_reports/age_decomposition_of_a_difference_between_two_populations_for_any_life_table_quantity_in_excel_3838.htm

account for a large proportion of the fertility decline between 1920 and 1930. For many of these states, it was changes in Native white fertility during this time that drove the decline. In half of the states (Indiana, Kansas, Kentucky, Maryland, Nebraska, Oregon, Utah, Virginia, and Washington), changes in Native white fertility accounted for over 70 percent of the decline, while in another 4 (Wisconsin, Ohio, Minnesota, and California) it constituted over 50 percent.

For most of the states in Table 1, fertility of the foreign born population declined significantly between 1920 and 1930. This finding also appears in Figure 2, where in many areas it accounted for a large portion of the total fertility decline. For example, in Connecticut, New York and Massachusetts it explains about 60 percent of the total decline in fertility in each state. So while within-group changes were the centerpiece of the 1920's fertility story, in certain areas different groups were the drivers of the decline.

# 2. Public Programs and Changes in Fertility

While a changing population structure is not the primary mechanism for the 1920's urban fertility decline, many of the other factors which have explained previous drops in fertility through the history of the U.S. and other areas likely do play an important role. Changing behaviors, cultures, values, and a response to economic incentives have been shown to be important in other periods, and may also be responsible for much of the fertility changes during the 1920s as well. This paper does not attempt a full explanation of the early twentieth century urban fertility story, but instead looks at the interaction of these topics with local government programs. It evaluates whether some of the changes in fertility during this period could have been due to differential investment across areas in welfare and public health education efforts. We believe their role to be an important one for any telling of a 1920s fertility story, despite the programs not being explicitly intended to influence fertility.

Although there has been much work in the economics and demographic literature to understand both how individuals make fertility decisions and how the fertility trends have evolved over time, there has been relatively little work done to understand the relationship between government programs and fertility at a local level in the United States. An exception to this is the Fishback et. al (2007) paper which finds New Deal relief positively influenced fertility, bringing it back to its long term trend. Other work has looked at this relationship in developing countries. Stecklov, Winters, Todd, and Regalia (2007) find that cash transfer programs in Honduras also tended to increase fertility, but find no effect for similar programs in Mexico and Nicaragua.

Part of the reason different areas experienced different fertility outcomes during the 1920s may be due to differences in investment in public programs. During this time there existed no large scale federal relief programs, since prior to the New Deal, poverty relief, public health, and other public goods were distributed at the state, municipal, and county level. We focus on three different municipal level public programs – public health education, charity for children and mothers, and outdoor care of poor –to examine whether they may have caused fertility outcomes across cities to vary.

## Public health education programs

Public health education programs during the 1920s were directed towards women and children with the goal of reducing infant and child mortality. However, they may have also had affected fertility by either direct or indirect mechanisms. If the public health education programs achieved their goal and reduced infant mortality, which it seems they did (Fox 2011, Ewbank and Preston 1989), then through this way they reduced incentives to replace or hoard children and reduced the expected cost of raising a surviving child.[6] The effect on replacement and hoarding behavior would lead to lower fertility rates in areas with more public health education spending. In contrast, reducing the expected cost of raising a surviving child would tend to increase municipal fertility.

Additionally, changing individual perceptions about long term health outcomes may also be a method through which health education influenced fertility. If health education resulted in a perception of healthier children with higher probabilities of survival until childbearing, then the incentive to increase fertility to insure against the failure of passing on parental genes would be decreased.

Finally, public health education programs may have also affected fertility in the different cities more directly. These programs advocated the use of breastfeeding over formula, which would directly reduce fecundity in new mothers (Bongaarts 1987, John, Menken and Chowdhury 1987). Additionally, these programs believed in the importance of smaller families as a way to reduce infant mortality (Duke 1915), so the programs may have directly advocated the use of birth control or greater birth spacing among multiple child families.

## Charity for children and mothers and outdoor care of poor

Poverty relief programs also varied in their existence and intensity between

[6] Replacement and hoarding tend to occur in high infant and child mortality situations. When a child dies, parents may "replace" that child with an additional birth. Hoarding occurs when parents have a parity target in mind and have more children than necessary so that if one dies there are still some left.

urban areas in 1920’s America.  Relief programs targeted towards the poor in general and towards single mothers and children in particular, may also explain why fertility outcomes differed across areas.  Payments directed towards poor mothers and children would reduce the individual cost of a child, and may increase fertility. Conversely, a social insurance program can reduce reliance on family members during times of unemployment or old age, so may curtail the need for large families.

The decade of the 1920s is a particularly interesting time for studying fertility trends in American urban areas. Fertility differed widely across and within municipalities, and many cities experienced below replacement fertility for the first time.  Additionally, the absence of federal welfare and public health programs meant that there was great variation in both the existence and the intensity of these programs across areas.  Whether the presence of these programs caused fertility to decline to a greater extent in some cities than others, and which of these programs influenced fertility the most are empirical questions.

Because the average waiting time until pregnancy is in the range of 22-44 weeks (Bongaarts 1978) and the length of time between conception and birth is about 40 weeks, examining the effect on fertility for any of the programs will require at least a one year lag.  For the public health education programs, because it likely took some time to disseminate the information and since the programs may also have affected fertility through increased birth spacing, a two year or longer lag between expenditures and fertility changes is probably most appropriate for finding an effect. The poverty relief programs are more likely to have an immediate effect on fertility and so, for these, one year lags between expenditures and fertility is probably the most appropriate.  However, before estimating any of these relationships, it is first necessary to address the issue of measuring fertility with imperfect historical data.

# 3. Measuring Local Fertility with Historical U.S. Data

Even when fertility information is available in historical datasets, it can still be difficult to obtain the detail necessary to construct age-specific fertility rates. For this reason, in many historical studies the ratio of the total number of births to the number of women of child-bearing age is used for analysis. However, usage of this ratio, or General Fertility Rate as it is commonly referred to, can change based on the age-structure of the population. So, when possible, it is desirable to obtain age-specific fertility rates. These are typically aggregated into a single measure named the Total Fertility Rate (TFR), which has an easy interpretation in that it represents the average number of children a woman would bear if she experienced the prevailing age-specific fertility rates and survived through the end of her reproductive period. With no mortality before the end of the reproductive period, a TFR slightly greater than 2 (to account for a slightly greater frequency of male births) would correspond to the replacement level fertility where women on average replace themselves and their partner. In the United States in the 1930s, the replacement level fertility was approximately 2.3.[7]

To calculate the total fertility rate annually for each municipality, city-level information is required on the number of births, female population by age, and the distribution of births by age of the mother. City birth counts are available annually for cities in the Birth Registration Area, but female population by age is only given in

[7] The replacement level fertility is approximated by (1+SRB)/p(Am) where SRB is the sex ratio at birth and p(Am) is the probability of surviving to the mean age at childbearing. The replacement level fertility of 2.3 for the U.S. is calculated with SRB = 1.04 and p(Am) = 0.88. 0.88 was the lifetable probability of a newborn girl surviving to age 30 in year 1933 (Source: Human Mortality Database).

the Decennial Censuses and the distribution of births by age of the mother is only available at the state level. Given these limitations, we estimate the total fertility rate for each city using interpolated values of female population counts by age group and assume that the shapes of the fertility schedule in the municipalities are equivalent to those of the entire birth registration area during a given year.[8] We name this estimated version of the total fertility rate $T\hat{F}R$ and use it in the model described in Section 6.[9]

Studies of U.S. fertility series prior to 1940 have generally avoided the issue of calculating age-specific fertility rates by either using the General Fertility Rate (GFR) (Fishback et al 2007), by looking at the completed birth histories of women (Haines and Guest 2008, Jones and Tertilt 2006, David and Sanderson 1987) or simply by studying child/woman ratios (U.S. Bureau of the Census 1975: Series B, pp 67-98). As noted above, the GFR does not take age structure into account, so differences in its values over time or region may be attributable to differences in fertility or population structure.

Birth histories, in turn, summarize information on completed fertility over the whole reproductive period spanning more than 30 years, and are therefore of limited use for studies of short term variation. Using the $T\hat{F}R$ allows usage of annual variation in fertility and gives the ability to control for differences in age structure across space and time.[10]

# 4. U.S. Fertility Prior to the Great Depression

[8] See the Appendix A for a detailed discussion of how this value was calculated for each city.
[9] Appendix B estimates the coming model in Section 6 using alternative measures of fertility as dependent variables.
[10] The trends and even annual changes are very similar between $T\hat{F}R$ and the GFR, so the conclusions regarding fertility changes should not depend on which tricks were used to calculate $T\hat{F}R$.

As is evidenced in Table 1, for those areas part of the BRA fertility not only fell fairly consistently during the 1920s and early 1930s, but also exhibited substantial variation between areas.  For example, in 1920, the TFR was as high as 3.6 in Virginia but was only 2.4 in Oregon.  This may even understate the actual variation across U.S. areas during this period.  By 1920, 60 percent of U.S. states had joined the BRA, and based on fertility for later years, some of those areas not registering births in 1920 likely had rates even exceeding a TFR of 3.6.

While the BRA consisted of only 60 percent of the U.S. in 1920, the area grew throughout the decade so that by 1928 44 states were officially recording births. Figure 3 maps the BRA states in 1923 and 1928, as well as the corresponding sample cities (cities over 100,000 persons in 1920 and who had joined the BRA prior to 1928).

FIGURE 3 HERE

In the early 1920s, the Southeast and Central United States were largely underrepresented in the BRA, however by 1928 only New Mexico, Nevada, South Dakota, and Texas chose not to participate.  Figure 4 plots $T\hat{F}R$ individually for each of the BRA cities, as well as the average level of $T\hat{F}R$ in each year across those cities. With the exception of a brief increase in 1923 and 1924, average fertility across this set of cities fell consistently between 1923 and 1932.  The rates of decline, however, varied between cities.  The average level of $T\hat{F}R$ is indicated by a thick black line, and four cities with fertility at the high and low ends in 1923 (Fall River, MA; Camden, NJ; San Francisco CA; Los Angeles, CA) are labeled.  Below replacement level fertility, approximated by a TFR of 2.3 or below, is indicated by the shaded area.

FIGURE 4 HERE

With few exceptions, fertility rates in the largest American municipalities declined through the 1920s and early 1930s. However, the paths differed substantially across areas. We illustrate this variation using two examples. The first compares the two cities with the highest fertility rates in 1923, Fall River, MA and Camden, NJ. Although Camden, NJ and Fall River, MA started at similar positions in the early 1920s, their fertility outcomes by 1932 were very different. Aside from a slight increase in 1932, fertility in Fall River declined monotonically between 1923 and 1932 from almost 4 children per woman to below the replacement level of 2.3 children per woman. The story differed in Camden, NJ where fertility fluctuated above 3 children per woman with no clear trend over the study period. Fertility in Camden increased slightly between 1923 and 1924, decreased in 1925 and 1926, and rose in 1927 before falling again through 1929 and then alternated between increasing and decreasing in 1930, 1931, and 1932.

Variation in fertility trends across cities is further illustrated with the second example comparing cities at the bottom of the fertility distribution in 1923; San Francisco, CA and Los Angeles, CA. While fertility rates in San Francisco decreased fairly consistently at a mild pace throughout the 1920s and early 1930s, fertility in Los Angeles decreased rapidly. Whereas at the beginning of the decade, these cities were far apart in their fertility rates, by the early 1930s they were very close and both below a $T\hat{F}R$ of 1.5. Remarkably, Portland, OR, and Kansas City, MO also had fertility rates below 1.5 by 1932 while San Francisco hit this threshold as early as 1929.

During the 1920s and early 1930s most American urban areas underwent the transition from above to below replacement fertility.  This occurred during a period of generally stable economic conditions across the cities and with high income relative to the previous two decades.

In addition to the overall decline, some areas experienced much more rapid descents than others, even within the same geographic area. Camden, NJ and Philadelphia, PA are located on opposite sides of the same river, yet fertility in Philadelphia fell by over 30 percent between 1923 and 1932 while fertility in Camden dropped by 10 percent over the same period.  In some cases, these differences between cities rivaled that of the urban/rural fertility difference.  1920 fertility in Fall River, MA was nearly 70 percent higher than fertility in San Francisco during that year.  In 1920 the rural child/woman ratio was 58 percent greater than the urban child/woman ratio (Haines 2000).  Based on rural birth counts of 745,665 infants, and estimates of the rural female population between the ages of 15 and 44 of about 6.9 million, the scaled General Fertility Rate in U.S. rural areas was just over 3.2.[11]  Five cities (New Bedford, MA, 3.22; Bridgeport, CT, 3.32; Hartford, CT, 3.34; Youngstown, OH, 3.52; Fall River, MA, 3.49) had fertility rates that exceeded this level during that year.

No matter which way the data is cut, for large U.S. cities during the 1920s, fertility accelerated its decline from the 1910s, with substantial differences in both levels and trends.  That investment in the different types of public programs increased for some of these cities over the same period may simply be a coincidence.  On the other hand, it may help clarify this 1920s fertility story, and help to explain why

[11] This is the GFR multiplied by 30/1,000 so that it is comparable with the TFR.  Rural birth counts were obtained from the 1920 Birth Statistics for the Birth Registration Area.  Estimates of the rural female population between 15 and 44 were calculated for each state in the Birth Registration Area by multiplying the ratio of women between the ages of 15 and 44 by the total female population located in that states' rural areas.  Population counts by age and the gender distribution by urban and rural areas for each state were obtained from the 1920 U.S. Census.

fertility declined so rapidly during a period of relative prosperity. Using a ten year panel of municipalities between 1923 and 1932 we test whether this was the case.

# 5. Data

We evaluate the relative and absolute effects of the public health education and poverty relief programs on fertility, for a set of American municipalities that had populations over 100,000 in 1920 and were part of the Birth Registration Area in a given year. The period under consideration is 1923 to 1932, chosen both for data availability reasons and to eliminate the effect of any New Deal programs enacted after 1932. Information on the amount of spending distributed to these types of programs is obtained from the *Financial Statistics of Cities* volumes (U.S. Department of Commerce (1925-1936). These volumes also contain data regarding city expenditures on sanitation, health, and education. Per capita summary statistics adjusted to 2007 dollars for each of the spending variables are given in the top panel of Table 2. Population data were collected from the Decennial Censuses (U.S. Bureau of the Census 1931; U.S. Bureau of the Census 1921) and interpolated for the intercensal years.

TABLE 2 HERE

Three municipal spending variables are of primary interest: the spending on public health education in a city, the spending on charity for children and mothers, and the spending on outdoor care of poor.

Spending on public health education includes expenditures on the medical inspection of school children, education about proper hygiene, milk preparation techniques, and other things that could be done to conserve child life. Money distributed under the "medical inspection for school children" category helped pay for physician and nurse visits to distribute information and perform physical examinations. School children were not treated, but parents were informed if any defects were found.

Spending on welfare for children and mothers includes spending on mothers' pensions, funding for almshouses and orphanages, and other charitable spending for children. Mothers' pensions distributed transfer payments to widows with dependent children. Charitable spending for children was directed towards children in institutions or towards care of those without parents.

Outdoor care of poor differed in its administration across cities, but typically involved relief to individuals or families who, due to unemployment, illness, accident, or other reasons, were temporarily dependent. It also sometimes involved the giving of aid more or less permanently, when it seemed desirable to keep a family together instead of scattering its members among institutions (Smith 1932, Lancaster 1937). It was through outdoor care of poor that that cities distributed relief to individuals unemployed during the Great Contraction between 1929 and 1932. Unemployment is known to be correlated with fertility (Sobotka, Skirrbekk and Philipov 2011), so it will be important to examine to what extent the relationship estimated between outdoor care of poor and fertility is a result of the relationship between economic conditions and fertility.

Adjusted to 2007 dollars, an average city in the dataset spent about $3.41 per person on health programs for children, about $5.17 on charity for children and mothers and about $12.70 per person on outdoor care of poor. The size of the mean per capita outdoor care of poor spending value is due to significant growth at the end of the period.  To illustrate this, figures 5, 6 and 7 plot the per capita spending trends of public health education, charity for children and mothers, and outdoor care of poor respectively.  Spending in all three categories increased throughout the 1920s and early 1930s, and outdoor care of poor substantially so.  The sizable increases between 1929 and 1932 were likely a result of the fact that until the full implementation of the Social Security Act, outdoor care of poor payments were used as unemployment insurance in many municipalities.

FIGURE 5 HERE

It is possible to see from Figure 5 that every city in the panel spent at least a small amount on public health education each year. This was not the case for the spending on charity for children and mother, or outdoor care of poor. Twelve cities in the data set distributed no money towards spending on charity for children and mothers over the entirety of the panel.

FIGURE 6 HERE

Another ten cities had periods of zero spending, although in at least one year during the panel distributed some money through this category.  Between 1923 and 1932, every city in the panel spent at some amount on outdoor care of poor, however some cities did have periods with no spending.  For instance, Kansas City, Ks and Scranton, PA waited until 1928 and 1930 respectively to start investing in outdoor care of poor.  Between 1923 and 1932, seven cities had periods of zero spending in this category.

FIGURE 7 HERE

Cities which spent more on public health education, charity for children and mothers, and outdoor care of poor potentially experienced different trends in fertility than those that spent less. Figures 8 through 10 stratify the sample cities between those in the top quartile and those in the bottom quartile for each of those three spending categories and plot the mean-differenced trends for the top and bottom quartiles. Figure 8 plots the annual mean-differenced fertility trends within cities in the top and bottom quartiles of aggregate health education spending between 1923 and 1932.

FIGURE 8 HERE

At the beginning of the panel, cities in the top quartile of health education, on average, had higher than average fertility rates, while fertility in cities in the bottom quartile was below average. However, fertility declines within those cities at the top quartile of health education spending caused the gap to narrow considerably by 1932. Extending this analysis through the 1930s would show that by 1937 cities in the top quartile had lower than average fertility while cities in the bottom quartile experienced higher than average fertility.

FIGURE 9 HERE

This pattern did not hold for cities in the top and bottom quartiles in spending on charity for children and mothers, given in Figure 9. Cities in the bottom quartile of spending towards charity for children and mothers, on average, had slightly higher fertility than average, while cities in the top quartile generally had lower fertility than average. Aside from the three years 1927 through 1929, the gap between the two mean-differenced trends stayed fairly constant.

FIGURE 10 HERE

Figure 10, which plots the annual mean-differenced fertility trends within cities in the top and bottom quartiles of aggregate outdoor care of poor spending between 1923 and 1932, displays a similar story to Figure 8,. Cities in the top quartile of outdoor care of poor spending had fertility rates much higher than average, while cities at the bottom had lower than average fertility. As fertility fell relative to the average in cities in the top quartile, fertility rose relative to the average in cities in the bottom quartile and by 1932 the gap had narrowed.

Figures 8 through 10 suggest that cities which spent more on public health education and outdoor care of poor experienced faster fertility declines relative to the average, while the opposite was true for cities which spent less. Cities that spent little on charity for children and mothers did not appear to perform differently than cities in the top quartile of spending in this category. These figures also indicate that cities which had higher fertility relative to the average were also those which spent more on public health education and outdoor care of poor.

Given this, basic correlations between public program expenditures and fertility will be biased. While usage of the panel structure of the data can help solve this, it is also important to control for any other factors jointly correlated with changes in fertility and expenditures for the different public programs. Things such as educational spending or a city's demographic structure may fall into this category, and will need to be present in our model.

So other data in addition to that collected from the *Financial Statistics of Cities* volumes is necessary. Information on income and wealth in the different cities is of particular importance. Personal income information is unavailable at the city level prior to 1940, so we use average annual earnings from the manufacturing sector instead as a proxy. These are obtained from the Biannual Census of Manufactures volumes (U.S. Department of Commerce 1926-1936).[12] Using manufacturing wages in the different cities will help control for differences in economic conditions that may confound the relationship between outdoor care of poor and fertility.

From Table 2, average manufacturing wages adjusted to 2007 dollars were about $15,800. Although this seems low, it was close to the level of $1,500 nominal dollars seen as the middle-class threshold by child advocates (Duke 1915). To control for differences in the distribution of income, an additional measure of the number of tax returns filed in a year was collected from a series published by the U.S. Bureau of Internal Revenue (U.S. Bureau of Internal Revenue 1923-1932). This gives the number of jointly filing couples in each city with incomes above $5,000 (about $60,000 in 2007 dollars), and individual filers with incomes over $2,000 (about $24,000 in 2007 dollars). Typically only about 6.5 percent of the population in the different cities filed taxes. The city with the highest proportion of filers was Los Angeles, with over a fifth of its population filing returns in 1923.

The demographics of a city are also possibly correlated with both public health and poverty relief spending and fertility. The foreign born population generally had

[12] For the odd numbered years we use a weighted interpolation between the closest even numbered years, using state per capita income as the weights. See Appendix C for details.

much higher fertility than did the native population, and also typically experienced worse health and economic outcomes (Duke 1915, Dempsey, 1919, Hughes 1923). To control for changes in the population structure and other possible confounding demographic variables, municipal demographics for women of childbearing age were collected from the decennial censuses and interpolated for the intercensal years. These include information on population density, minority concentrations for women between the ages of 15 and 44 and literacy rates for individuals over the age of 10. Decennial demographic information is from the U.S. Census Bureau (1921; 1931; 1942) and interpolated for annual estimates. Lastly, information on the number of manufacturing workers employed in each city, as well as the proportion of adults in manufacturing was collected from the Census of Manufactures volumes.

# 6. Model and Results

Figures 8 through 10 indicate that there is likely selection between the extent to which cities chose to participate in the different public programs and their starting level of fertility. Cities with high mortality may simply have chosen to invest more in public health, or alternatively, a more complicated intersection of culture and beliefs may have affected both the levels of fertility and the extent to which investments in public health and poor relief were made. We can observe and therefore control for higher levels of mortality affecting both spending and fertility, but differences in culture and beliefs, especially at local levels, are more difficult to measure.

Because of this selection, basic correlations, even conditional correlations obtained from an ordinary least squares regression, may be biased. Given this, it is important to control for unobserved factors that potentially influence both fertility and the spending on public programs in the different municipalities. Assuming that these unobserved factors that vary jointly with fertility and expenditures are not trending through time, a reasonable assumption since the period is only 10 years, it is possible to identify the relationship between these public programs and fertility using variation in the variables within cities. Exploiting the panel structure of the data, we utilize this within variation through the use of a fixed effects model, defined below.[13]

$$\begin{aligned} T\hat{F}R_{i,t} &= \beta_1 PHE_{i,t-2} + \beta_2 CCM_{i,t-1} + \beta_3 COut_{i,t-1} + \beta_4 IMR_{i,t-1} + \beta_5 F_{i,t}^{1910-20} \\ &+ \sum_{j=1}^{J} \beta_{j+5} X_{j,i,t-1} + \gamma_1 C_i + \gamma_2 Y_t + \varepsilon_{i,t} \end{aligned} \tag{1}$$

The dependant variable is the estimated total fertility rate, $T\hat{F}R_{i,t}$, in city $i$ and year $t$. The first independent variable, $PHE_{i,t-2}$ is the second lag of public health education spending, as it likely took some time to implement the knowledge which was distributed. $CCM_{i,t-1}$ is the amount of per capita spending on charity for children and mothers in city $i$ and year $t-1$ and $COut_{i,t-1}$ is the amount of per capita spending on outdoor care of poor in city $i$ and year $t-1$.[14] To control for any influence mortality may have had on public program spending and fertility, the lagged infant mortality rate, $IMR_{i,t-1}$ is included. $F_{i,t}^{1910-20}$ is the forecasted fertility based off of trends established between 1910 and 1920. Fertility was estimated using the ratio of children under the age of 1 born to women aged 15 to 44 in both 1910 and 1920, and then extrapolated over the sample period 1923 to 1932. $\sum_{j=1}^{J} \beta_{j+5} X_{j,i,t-1}$ is a set of J covariates that include the city demographic variables for the proportion of women between the age of 15 and 44 who were black or foreign born, the proportion

[13] By estimating the dependent variable, there is necessarily some level of measurement error. It is possible this error is correlated with some of the dependent variables, so alternative specifications using the General Fertility Rate and state-level age specific fertility rates were also estimated. The results are given in Appendix B and are essentially the same.
[14] For estimates from a model containing the first and second lags for all of the covariates, see Appendix B.

of illiterate individuals over the age of 10, and the population density of the surrounding county. Also included in $X$ is the amount of prior year per capita spending on sanitation, hospitals, education, and health other than child health. In addition, $X$ contains the income and income distribution measures, as well as the proportion of adults working in manufacturing.

Certainly there are other factors influencing fertility that are not controlled for with the above set of covariates. If these are jointly correlated with the spending variables of interest and fertility, then the model will not be identified. For example, if the religious composition of a city is changing, and these changes are positively associated with both poverty relief spending and fertility, there will be a positive bias on the coefficient for outdoor care of poor. Time-varying omitted variables can still confound estimates from the above fixed effects model. However, anything that is constant through time will be controlled for by the set of city fixed effects, represented in the model by $C_i$. In the case of a city's religious composition, at least for the proportion of Roman Catholic church membership, the average annual change between 1916 and 1936 for the counties corresponding to cities in the sample was about -.6 percent (U.S. Bureau of the Census 1919; 1930; 1941). So usage of the city-fixed effects in combination with the other demographic variables will mitigate its effect.[15] Nationwide shocks common to all cities in the sample, due to changes in national optimism, shocks to national income, or other factors, are controlled for with period effects, represented by $Y_t$. Figure 4 suggests a common positive shock to fertility across most of the different cities in 1924, so controlling for these period effects will be important. The errors are assumed to have conditional mean zero and are the unobserved characteristics affecting fertility in city *i*, year *t*. In the estimation,

[15] A model which includes the county proportion of Roman Catholic Church membership is estimated in Appendix B. Estimates from this model are equivalent to those yielded from equation (1).

these are clustered at the census region level to account for regional differences in climate, geography and economy. Estimates from this model, as well as simpler models nested within the key model (1) are given in Table 3.

TABLE 3 HERE

In addition to the full model (1) given in Column 5 of Table 3, four other permutations are also given in Table 3. The first column contains only the spending variables for public health education, charity for children and mothers, and outdoor care of poor, as well as the city and year fixed effects. The second column includes all of the covariates, less the infant mortality rate and fertility trend variable. Column 3 adds in the infant mortality rate to the analysis and Column 4 removes the economic variables controlling for average manufacturing wages and the proportion of adults working in manufacturing. Additional models which test for the robustness of the estimates are included in Appendix B. These include different models which restrict the sample, include a city-specific trend tern, experiment with different dependent variables, add in a variable controlling for the proportion of Roman Catholic church membership, add additional lags, and include an instrumented lagged dependent variable are contained in Appendix B.

The first model given in Table 3 includes only the key spending variables and city and year fixed effects. From this baseline model, the coefficients on the second lag of public health education spending and on outdoor care of poor are negative, while the estimated coefficient on charity for children and mothers is positive. However, only the coefficient on outdoor care of poor is statistically significant at the 10 percent level. Model 2 adds in the covariates from equation 1, less the infant mortality rate and 1910 to 1920 fertility trends. Including these covariates attenuates the coefficient on outdoor care of poor spending and is no longer significant. The coefficient for public health education expenditures grows slightly and is more precisely identified once the different covariates are controlled for. Comparison of columns 2 and 3 in Table 3 shows the effect of inclusion of the infant mortality rate in the analysis. Exclusion of the infant mortality rate only marginally affects the coefficient on public health education. This suggests that the public health education programs did not affect fertility through their effects on infant mortality; adding the lagged value of the infant mortality rate only attenuated its coefficient by about 0.0004.

The importance of the economic variables (average manufacturing earnings and the proportion of adults in manufacturing) for the interpretation of the relationship between outdoor care of poor and fertility is illustrated by columns 3 and 4. Inclusion of these variables (column 3) diminishes the coefficient on outdoor care of poor by nearly 80 percent, bringing it to a point where it is neither economically nor statistically significant. The inclusion of these economic variables also attenuates the coefficient on public health education expenditures by about 25 percent, however it remains important.

Column 5 contains the full model (1), with infant mortality rate, economic variables and fertility trend variable $F_{i,t}^{1910-20}$. Comparing Column 5 to Column 3, the coefficients for the spending variables of interest are not particularly affected by inclusion of $F_{i,t}^{1910-20}$. Additionally, although its positive sign indicates that annual decreases in fertility predicted from the 1910-1920 trend generally corresponded to annual decreases in fertility that actually occurred, it was not statistically significant and only had a p-value of about 0.26. This is likely a result of cities such as

Bridgeport, CT or Wilmington, DE which had increasing fertility during the 1910-20 period, but experienced significant fertility declines during the sample period.

Across all of the different specifications which contain the set of covariates, the coefficient on public health education spending was negative and significant. This indicates that through either improved perceptions of long term health outcomes, declines in mortality, encouragement of breast feeding and smaller families, and possibly increased access to fertility control, the public health education programs implemented across many of the different cities led to significant decreases in fertility throughout the 1920s. For an estimate of the economic significance of these public health education programs, Table 4 converts the coefficients given in the fifth column of Table 3 into the change necessary to deliver a 0.1 unit decrease in $T\hat{F}R_{i,t}$. Also displayed in Table 4 are the conversions for the other financial variables. Coefficients significant at the 0.1 level are given in bold.

TABLE 4 HERE

Approximately \$4.66 dollars of per capita health education spending was associated with reducing $T\hat{F}R_{i,t}$ by 0.1. Average annual per capita public health education expenditures were about \$3.41, so this coefficient estimate translates to an average annual fertility reduction of about 0.073. Comparing the coefficient to the distribution of health education spending, the coefficient implies that cities spending in the 75$^{th}$ percentile on health education experienced a faster average annual fertility decline than cities spending in the 25$^{th}$ percentile on the order of about 0.06 units, or about 0.6 units over the entire sample period.

Other statistically significant financial variables are spending on other health, spending on sanitation, spending on schools and libraries, manufacturing wages, the proportion of adults in manufacturing and the proportion of the population that filed taxes. All of the coefficients on the personal income/economic outcome variables are statistically significant and positively related to fertility. From Table 4, an increase in average annual manufacturing wages by about $2,400 is associated with increasing $T\hat{F}R_{i,t}$ by about 0.1. This is about a 15 percent increase from the average value of manufacturing wages given in Table 2. The proportion of adults in manufacturing is also positive and significant. Increases in this proportion represent a combination of more adults in manufacturing and fewer adults being unemployed. So positive changes in the labor environment lead to increases in fertility during the 1920s. This finding that fertility was pro-cyclical in cities during the 1920s is consistent with the recent empirical literature (Sobotka, Skirbekk, and Philipol, 2011).

After controlling for the economic variables and other covariates, neither charity directed towards children and mothers, nor outdoor care of poor, appears to affect fertility in the different municipalities. In terms of charity for children and mothers it is not particularly surprising that the coefficient is not statistically significant given the specifics of this type of charity. Charity for children was directed at children in almshouses and those without support from their families, and mothers' pensions were payments distributed towards widows with children. If fertility is based off of individual or family expectations, then unless expectations of paternal loss or child abandonment exist, it is unlikely the extent of spending on these programs would substantially affect fertility.[16]

For those cities which have outdoor care of poor programs, the level of

[16] Including an indicator for whether or not a city distributes any payments towards mothers' pensions at all (fourteen cities in the sample do not during some period in the sample) is statistically significant and negative.

spending is likely a function of economic conditions at the time. So year-to-year changes should more closely reflect the number of people who have become unemployed, not necessarily the generosity of the payments. This reasoning is supported by the fact that once average annual manufacturing wages and the proportion of adults in manufacturing are controlled for, the significance of the outdoor care of poor coefficient disappears.

The coefficient on the infant mortality rate is economically significant, yet explains only a small portion of the fertility decline. Across all of the cities, infant mortality declined from an average of 78.5 deaths per thousand live births in 1923 to an average of 55.9 deaths per thousand live births in 1932. The average annual decline of the Infant Mortality Rate then being about 2.25, the estimated coefficient of 0.0027 implies a 0.0061 reduction in $T\hat{F}R_{i,t}$ (about -0.23% from the 1923 average $T\hat{F}R_{i,t}$ of 2.59).

Manufacturing wages are positively related to fertility, but would on average effectively need to increase by 75 percent to create a 0.5 increase in $T\hat{F}R_{i,t}$. Conversely, a 20 percent change in the proportion of people filing taxes would increase the TFR by about 0.51. From Table 3, a 0.1 unit change in the female proportion of African Americans between the ages of 15 and 44 of would tend to increase fertility by about 0.2 points. A similar change could result from increasing the proportion of illiterate individuals over the age of 10 by about 0.05 units. Spending on schools and libraries is also positively related to municipal fertility, consistent with fertility theories regarding changes in the expected cost of raising a child. For a sense of the magnitude, the largest year to year change in educational spending for any city in the sample between 1923 and 1932 was about $83. Ceteris paribus, this translates into about a 0.14 unit decrease in the total fertility rate.

# 8. Conclusion

Aside from the baby boom of the 1940s and 50s and the slow fertility increase starting in the 1970s,[17] fertility in the United States has been declining since at least the mid-1800s. A variety of reasons for this overall negative trend have been offered, many centered around the ideas of migration from high-fertility rural areas to low-fertility urban areas in the nineteenth and early twentieth centuries, and on the changing proportion of high-fertility non-natives in the childbearing population particularly in the years preceding the New Deal. However, these fail to explain why fertility trends within large American urban areas differed so substantially, and why the fertility decreases accelerated during the 1920's. Figure 4 demonstrated the substantial variation across areas between 1923 and 1932, and this has continued to be the case in the United States. Differences in investment in certain types of public programs, specifically public health education, offer one potential reason why different cities experienced different fertility outcomes in the 1920s and early 1930s.

Although these programs were not instituted as a means for reducing fertility, it appears that was one of their effects. Fixed effects estimates indicate that expenditures on public health education were significantly related, both statistically and economically, to reductions in fertility. Adjusted to 2007 dollars, approximately $4.66 per capita spent on public health education was associated with reducing the Total Fertility Rate by 0.1. For cities part of the Birth Registration Area, over 100,000 persons in 1920, and in the top quartile of average per capita public health education spending (about $4.23), this translated to an annual reduction in fertility of about 4.7 percent. For cities in the bottom quartile (about $1.69 per capita), the

[17] Myrskyla, Kohler and Billari (2009) document recent increases in fertility rates for highly developed countries

average annual fertility reductions occurring from public health education expenditures are estimated at about 1.03 percent. The differences in investment in this public program help to understand why a city such as Camden, NJ, which invested below average amounts in public health education, experienced little difference in its fertility rate throughout the 1920s, while Fall River, MA, a city in the top quartile, saw a much steeper descent in its fertility rate.

Interestingly, these educational programs were instituted as a way to combat high mortality, particularly that of infants. The programs were not explicitly intended to reduce fertility, and in fact were likely implemented, in part, to grow the U.S. population. However, investment in these programs across U.S. municipalities helped to accelerate the urban fertility decline in America during the 1920s.

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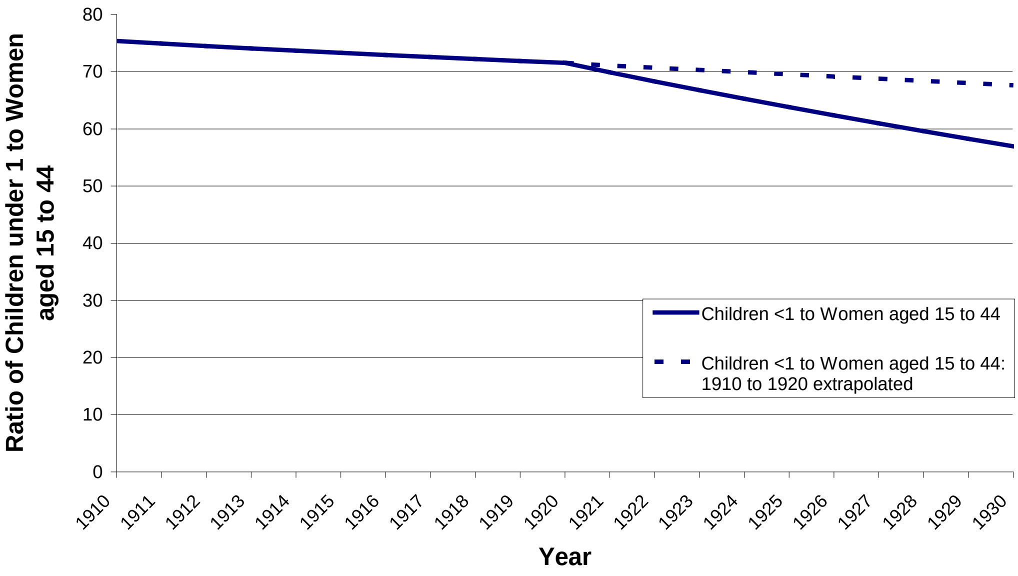
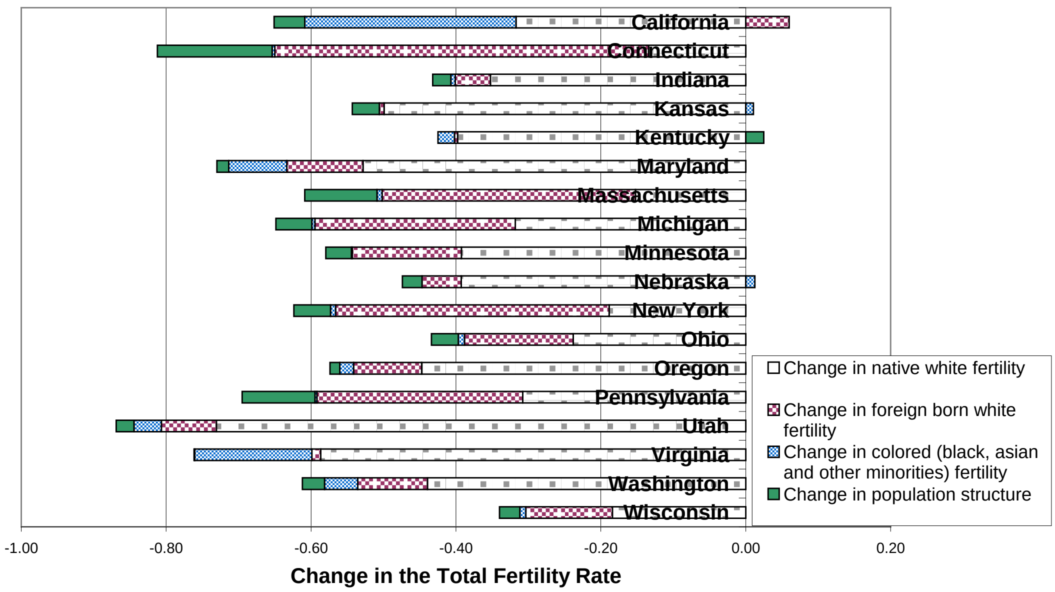
# Figure 1

**Fertility Trends in U.S. Cities over 100,000: 1910 to 1930**



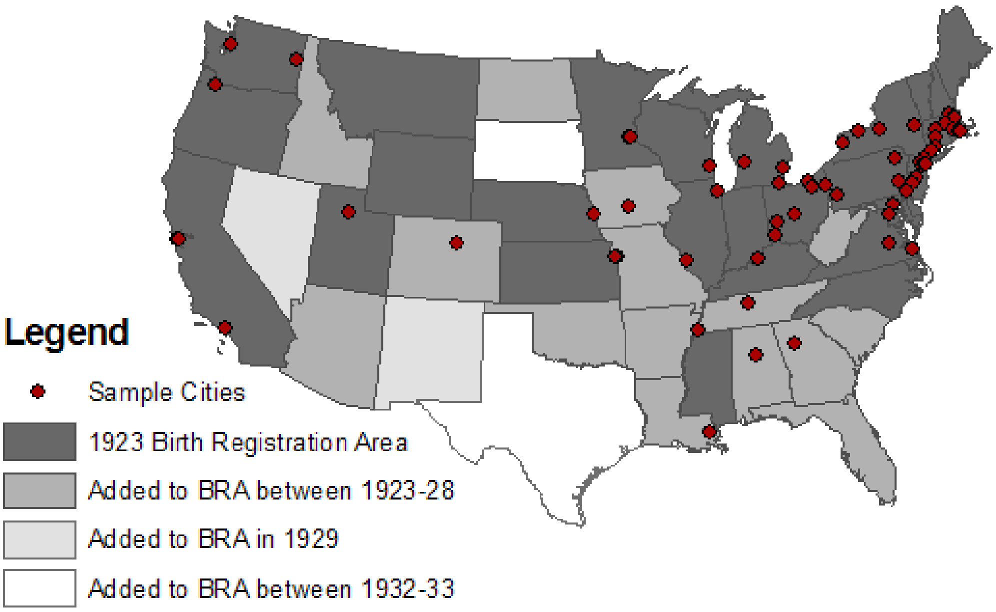

# Figure 2

**Decomposition of Fertility Changes by BRA State 1920 to 1930**



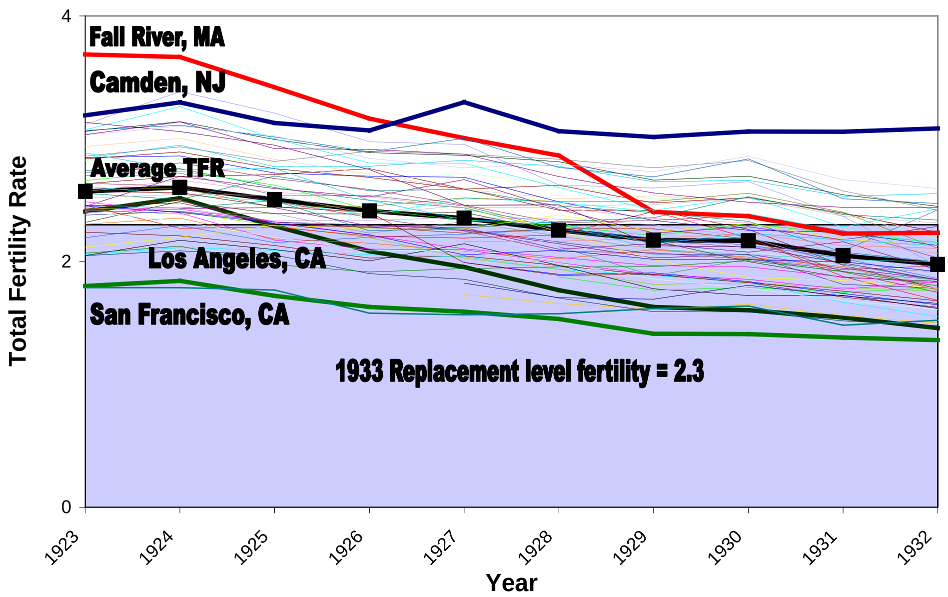
# Figure 3

Changes in the Birth Registration Area from 1923 on

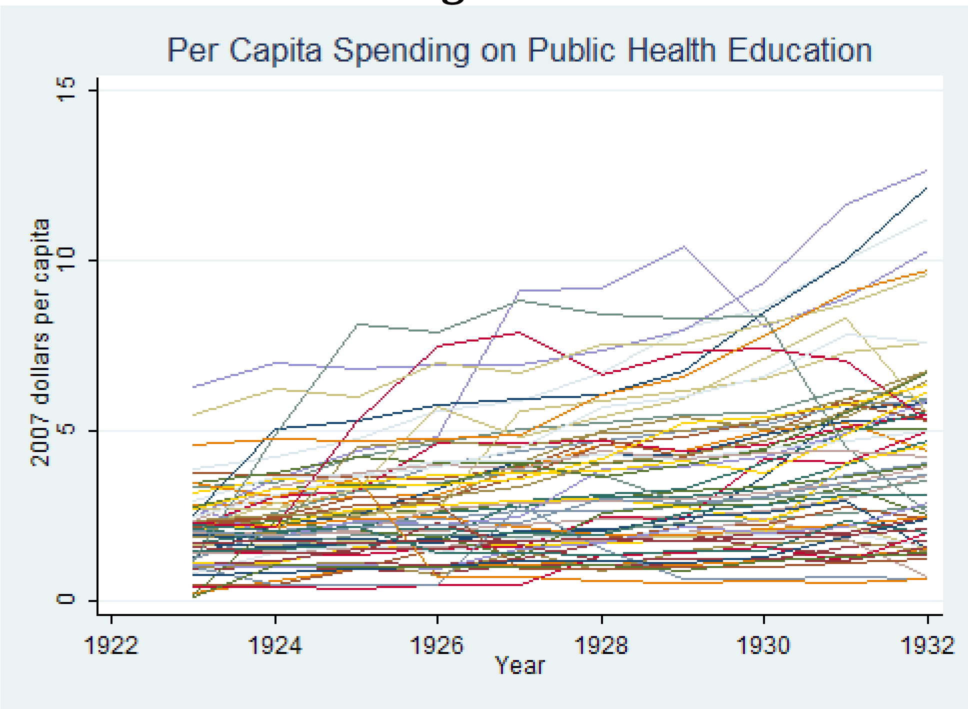



# Figure 4

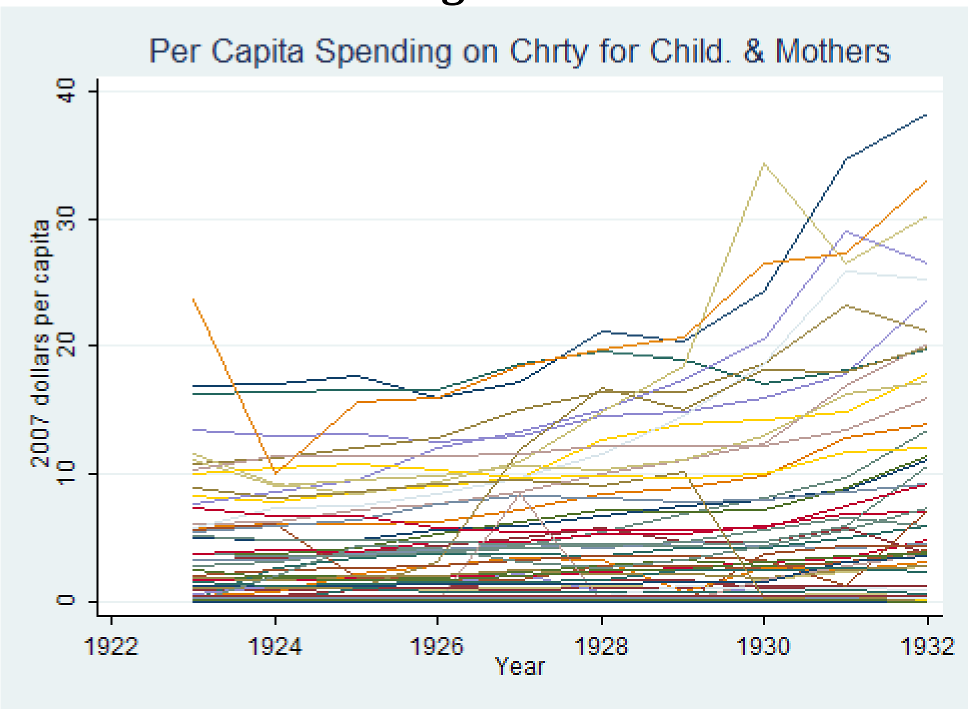
Total Fertility Rate Trends by City



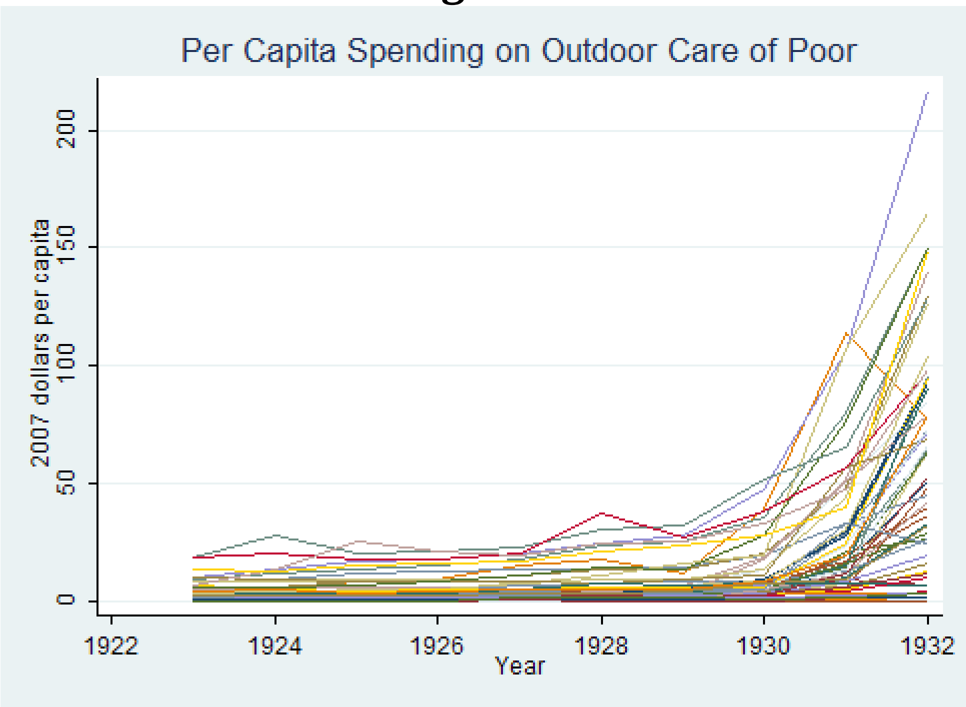
# Figure 5




# Figure 6

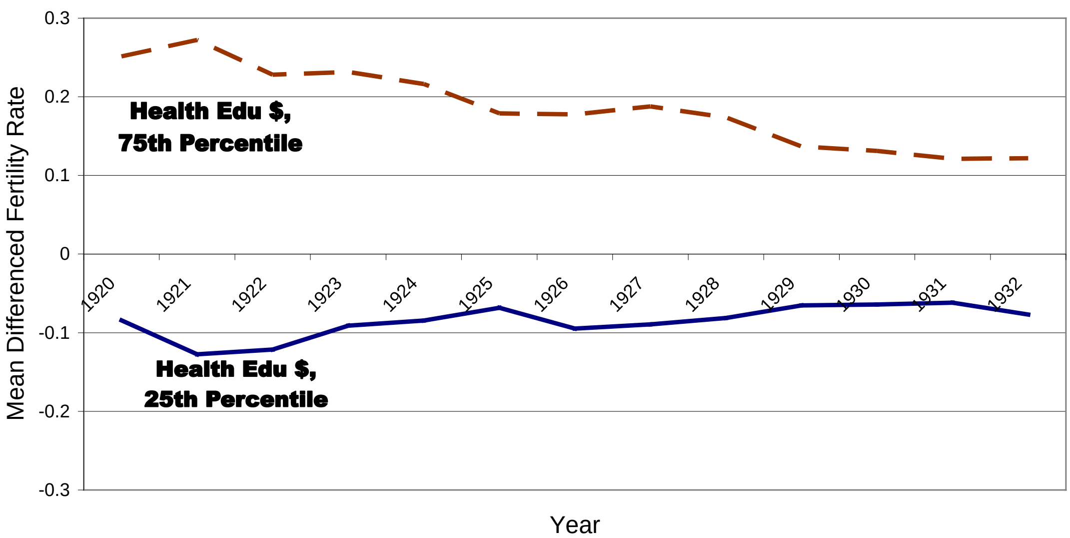


# Figure 7



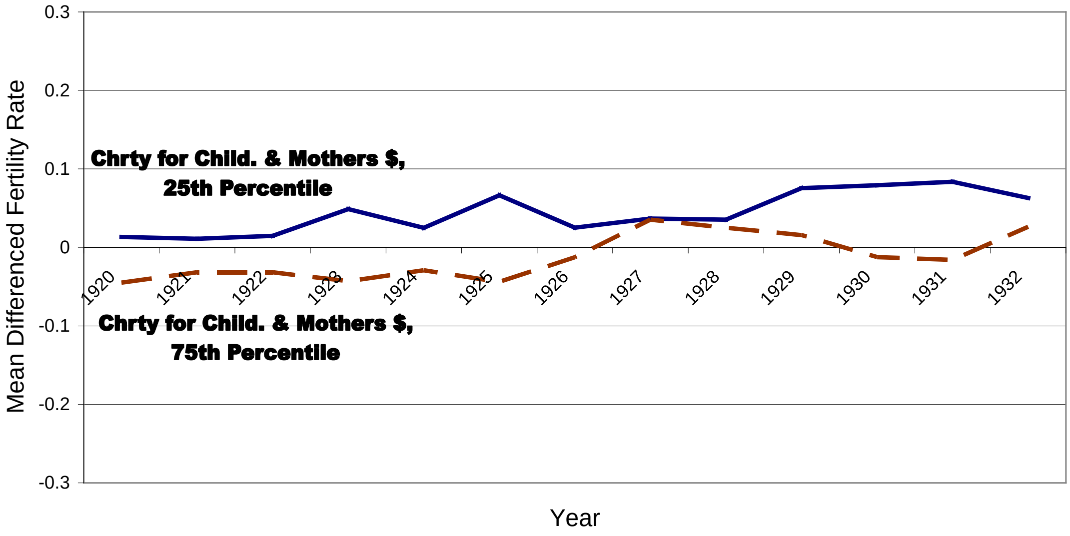

# Figure 8

**Total Fertility Rate Trends in Cities with More and Less Public Health Education Spending**



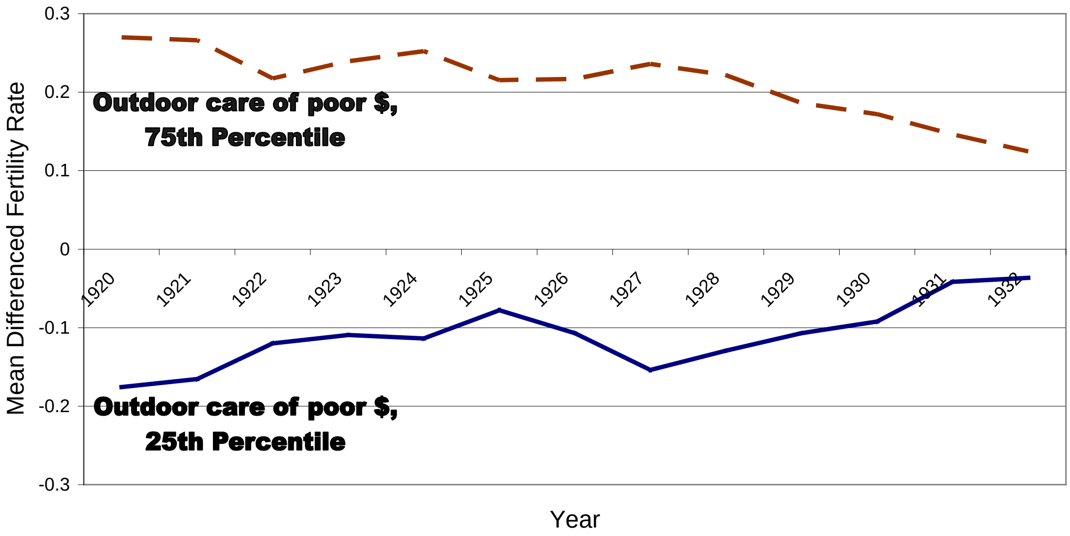
# Figure 9

**Total Fertility Rate Trends in Cities with More and Less Charity for Children and Mothers Spending**




# Figure 10

**Total Fertility Rate Trends in Cities with More and Less Outdoor Care of Poor Spending**



# Table 1

Total fertility rate by population group in 1920 and 1930: BRA sample states

| State | Native white | | | Foreign born | | | Colored | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1920 | 1930 | Change | 1920 | 1930 | Change | 1920 | 1930 | Change |
| 18 State avg. | 2.59 | 2.18 | -0.40 | 3.92 | 2.72 | -1.19 | 2.82 | 2.11 | -0.71 |
| California | 2.03 | 1.62 | -0.41 | 3.55 | 4.17 | 0.62 | 5.30 | 1.21 | -4.09 |
| Connecticut | 2.11 | 1.91 | -0.20 | 4.48 | 2.81 | -1.67 | 2.80 | 2.65 | -0.15 |
| Indiana | 2.74 | 2.36 | -0.38 | 4.40 | 3.46 | -0.94 | 1.95 | 1.82 | -0.13 |
| Kansas | 2.82 | 2.28 | -0.54 | 3.93 | 3.84 | -0.09 | 1.98 | 2.24 | 0.26 |
| Kentucky | 3.53 | 3.09 | -0.44 | 2.92 | 2.24 | -0.67 | 1.96 | 1.75 | -0.21 |
| Maryland | 2.86 | 2.17 | -0.69 | 3.98 | 2.40 | -1.58 | 3.06 | 2.61 | -0.45 |
| Massachusetts | 2.15 | 1.92 | -0.22 | 3.77 | 2.63 | -1.14 | 2.80 | 2.30 | -0.49 |
| Michigan | 2.92 | 2.50 | -0.42 | 4.33 | 2.93 | -1.41 | 2.22 | 2.07 | -0.15 |
| Minnesota | 2.81 | 2.35 | -0.46 | 3.67 | 2.63 | -1.04 | 3.01 | 2.92 | -0.09 |
| Nebraska | 2.88 | 2.46 | -0.42 | 3.87 | 3.03 | -0.84 | 2.25 | 3.03 | 0.79 |
| New York | 2.09 | 1.81 | -0.28 | 3.50 | 2.29 | -1.21 | 2.02 | 1.87 | -0.15 |
| Ohio | 2.45 | 2.17 | -0.28 | 4.00 | 2.67 | -1.33 | 2.20 | 2.03 | -0.16 |
| Oregon | 2.28 | 1.78 | -0.50 | 3.08 | 1.95 | -1.14 | 4.09 | 2.73 | -1.36 |
| Pennsylvania | 2.76 | 2.37 | -0.39 | 4.93 | 3.17 | -1.76 | 2.23 | 2.21 | -0.03 |
| Utah | 3.64 | 3.34 | -0.30 | 3.83 | 4.21 | 0.38 | 3.53 | 2.91 | -0.62 |
| Virginia | 3.64 | 2.81 | -0.83 | 3.83 | 2.86 | -0.97 | 3.53 | 2.98 | -0.55 |
| Washington | 2.34 | 1.82 | -0.52 | 2.89 | 2.31 | -0.57 | 5.37 | 3.36 | -2.01 |
| Wisconsin | 2.71 | 2.50 | -0.22 | 3.75 | 2.87 | -0.88 | 3.29 | 2.07 | -1.22 |

Notes:

"Colored" includes black, Asian, American Indian, other minorities and in the case of 1930, Mexican

Mexican births were severely under reported 1930 and likely also 1920. In 1920 Mexicans were generally enumerated under "White," however in 1930 they became a large enough group to warrant their own category and are enumerated under "Other." The large difference in the CA TFR for the group of "Other" results from this under reporting and change in enumeration.

# Table 2

## Summary Statistics

| Variable | Mean | Min | Max | Cities with no spending |
|---|---|---|---|---|
| TFR hat | 2.31 | 1.36 | 3.69 | |
| Municipal Spending Variables | | | | |
| Municipal health and welfare spending | | | | |
| Health education | $3.41 | 0.07 | 12.64 | 0 |
| Charity for children and mothers | 5.17 | 0 | 38.30 | 12 |
| Outdoor care of poor | 12.70 | 0 | 216.36 | 0 |
| Other health | 10.65 | 1.43 | 39.29 | 0 |
| Other municipal cost payments | | | | |
| Sanitation | $34.00 | 8.16 | 102.92 | 0 |
| Hospitals | 10.58 | 0.00 | 92.14 | 8 |
| Schools and libraries | 199.09 | 80.07 | 384.30 | 0 |
| Personal income/Economic outcome variables | Mean | Min | Max | |
| Manufacturing wages per worker | $15,812.71 | 10,504.83 | 24,370.13 | |
| Proportion of adults in manufacturing | $0.18 | 0.02 | 0.51 | |
| Population proportion filing taxes | 0.0657 | 0.0117 | 0.2346 | |
| Municipal demographics | Mean | Min | Max | |
| For women aged 15 to 44 | | | | |
| Proportion black | 0.0813 | 0.0011 | 0.4434 | |
| Proportion foreign born | 0.1705 | 0.0062 | 0.465 | |
| For persons over 10 | | | | |
| Proportion illiterate | 0.0327 | 0.0064 | 0.097 | |
| Other | | | | |
| County population per square mile | 2,897.86 | 82.03 | 24,140.80 | |
| Infant mortality rate | 67.074 | 33.722 | 110.00 | |

Notes:

All spending variables are in per capita terms and adjusted to 2007 dollars.

Infant mortality rate is the number of infant deaths per 1,000.

Sources:

U.S. Department of Commerce (1925-1936) Financial Statistics of Cities, 1923-1932. Government Printing Office, Washington D.C.

U.S. Department of Commerce (1926-1936) Biennial Census of Manufactures, 1923-1933. Government Printing Office, Washington D.C.

U.S. Bureau of Internal Revenue (1923-1932) Statistics of Income. United States Treasury Department.

U.S. Bureau of the Census (1921) Fourteenth Census of the United States Taken in the Year 1920. Government Printing Office, Washington, D.C.

U.S. Bureau of the Census (1931) Fifteenth Census of the United States Taken in the Year 1930. Government Printing Office, Washington, D.C.

# Table 3

Fixed effects regression of total fertility rate (TFR hat) on municipal health and welfare spending

| Dependent var: TFR hat | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Municipal health and welfare spending | | | | | |
| Public health education (2 yr lag) | -0.02101 | -0.02169* | -0.0213* | -0.0284** | -0.02145* |
| | (0.0122) | (0.0084) | (0.0078) | (0.0080) | (0.0078) |
| Charity for children and mothers | 0.00293 | 0.00246 | 0.00274 | -0.00172 | 0.00308 |
| | (0.0028) | (0.0037) | (0.0033) | (0.0031) | (0.0034) |
| Outdoor care of poor | -0.0028+ | -0.000698 | -0.0004 | -0.00199+ | -0.00054 |
| | (0.0013) | (0.0006) | (0.0005) | (0.0009) | (0.0006) |
| Infant mortality rate | | | 0.00276** | 0.0031** | 0.0027** |
| | | | (0.0007) | (0.0007) | (0.0007) |
| 1910-1920 Fertility Trend (current yr) | | | | | 0.101437 |
| | | | | | (0.0843) |
| Other spending variables | | | | | |
| Other health | | -0.007098* | -0.008** | -0.00628 | -0.00802** |
| | | (0.0022) | (0.0021) | (0.0034) | (0.0022) |
| Sanitation | | 0.0013+ | 0.0012* | -0.000048 | 0.00114+ |
| | | (0.0007) | (0.0005) | (0.0011) | (0.0005) |
| Hospitals | | 0.000957 | 0.000355 | 0.0049** | 0.000326 |
| | | (0.0025) | (0.0021) | (0.0014) | (0.0020) |
| Schools and libraries | | 0.00187** | 0.00175* | 0.00163* | 0.0017* |
| | | (0.0005) | (0.0005) | (0.0007) | (0.0005) |
| Personal income/Economic out. Vars | | | | | |
| Mfg wages per worker | | 0.00004* | 0.000042* | | 0.000042* |
| | | (0.000016) | (0.000016) | | (0.000015) |
| Propor. of adults in mfg | | 2.135** | 2.078** | | 2.013** |
| | | (0.2887) | (0.2767) | | (0.3008) |
| Population propor. filing taxes | | 2.375* | 2.572** | 3.312** | 2.5433** |
| | | (0.7182) | (0.6693) | (0.7346) | (0.6714) |
| Municipal | | | | | |
| For women aged 15 to 44 | | | | | |
| Proportion black | | 1.6009+ | 2.1263** | 1.2439 | 2.0015** |
| | | (0.7069) | (0.5720) | (0.8812) | (0.5351) |
| Proportion foreign born | | 1.3910 | 1.376 | 2.4658* | 1.42476 |
| | | (0.9718) | (0.8872) | (0.9106) | (0.8766) |
| For persons over 10 years old | | | | | |
| Proportion illiterate | | -3.798* | -3.731+ | -0.9988 | -4.251+ |
| | | (1.5145) | (2.0061) | (2.7626) | (2.1671) |
| Other | | | | | |
| County population density | | -0.00004+ | -0.00004* | -0.000029* | -0.000038+ |
| | | (0.000018) | (0.000017) | (0.000011) | (0.000017) |
| Constant | 2.544** | 0.7168+ | 0.5226 | 1.2892** | 0.349469 |
| | (0.0459) | (0.3761) | (0.3311) | (0.1783) | (0.3442) |
| City fixed effects | Y | Y | Y | Y | Y |
| Year fixed effects | Y | Y | Y | Y | Y |
| Observations | 486 | 486 | 486 | 486 | 486 |
| Adjusted R-squared | 0.9166 | 0.9435 | 0.9457 | 0.9328 | 0.9458 |

Standard errors clustered at the Census region are in parantheses

** p<0.01, * p<0.05, + p<0.1

TFR hat is an estimated version of the Total Fertility Rate using age-specific fertility rates from the Birth Registration Area

Model specifications:

Model 1: Includes city and year fixed effects and spending on public health education, charity for children and mothers and outdoor care of poor

Model 2: Model 1 plus controls for county population density, proportion of illiterates over 10, proportion of foreign born women between 15 and 44, proportion of black women between 15 and 44, manufacturing wages per worker, proportion of adults in manufacturing, proportion of population filing taxes, and spending on other health, sanitation, hospitals and schools and libraries

Model 3: Model 2 plus the infant mortality rate

Model 4: Model 3 minus manufacturing wages per worker and the proportion of adults in manufacturing

Model 5: Model 3 plus the variable controlling for the 1910 to 1920 fertility trend.

Unless otherwise stated, all variables are set at one year lags. Government expenditures are per capita and adjusted to 2007 dollars

# Table 4

Change necessary for a 0.1 unit decrease in TFR hat

| | |
|---|---|
| Municipal health and welfare spending | |
| Public health education (2 yr lag) | **$4.66** |
| Charity for children and mothers | -$32.43 |
| Outdoor care of poor | $186.63 |
| Infant mortality rate | **-37.037** |
| Other spending variables | |
| Other health spending | **$12.47** |
| Sanitation spending | **-$87.72** |
| Hospital spending | -$307.07 |
| Spending on schools and libraries | **-$58.82** |
| Personal income/Economic outcome vars | |
| Manufacturing wages per worker | **-$2,380.95** |
| Proportion of adults in manufacturing | **-0.0497** |
| Population proportion filing taxes | **-0.0393** |

Notes:

Estimates are based off of the coefficients given in Table 4, Column 5

Unless otherwise noted, the relationships are between the estimated Total Fertility Rate and the 1 year lag of the different variables

Bolded values indicate a statistically significant relationship at the 0.1 level

# Appendices

## A. Calculation of municipal level age-specific birth rates

In order to calculate $T\hat{F}R^{i,t}$, it is necessary to estimate age specific birth rates at the municipal level. The finest level of disaggregation births by age exist is at the state level, so some assumptions are necessary for city level detail. For the Birth Registration Area as a whole, it is possible to calculate an age-specific birth rate ${}_nF_x^{BRA,t}$, where $n$ is the length of the age group (in this case 5 years), $x$ is the age group (15 to 19, 20 to 24, 25 to 29, 30 to 34, 35 to 39, or 40 to 44), $BRA$ indicates that this is for the entire Birth Registration Area and $t$ is the time period reference. Because of the expansion of the BRA between 1920 and 1933, different years will see different sets of participating states. See Table B1 for an accounting of BRA entry for each of the different states. Then, the age specific birth rate for those areas participating in the BRA can be expressed as

$$ {}_nF_x^{BRA,t} = \frac{{}_nB_x^{BRA,t}}{{}_nP_x^{BRA,t}} \tag{A1} $$

Where ${}_nB_x^{BRA,t}$ is the number of births in a specific age group and ${}_nP_x^{BRA,t}$ is the female population within that age group. These age specific fertility rates are then used to create a proportion ${}_n\lambda_x^{BRA}$, where

$$ {}_n\lambda_x^{BRA} = \frac{{}_nB_x^{BRA,t}}{\sum_{y=\alpha}^{\beta-n} {}_nF_y^{BRA,t}} \tag{A2} $$

Where $\alpha$ is the minimum age at childbearing (assumed to be age 15) and $\beta$ is the maximum age at childbearing (assumed to be 44). ${}_n\lambda_x^{BRA}$ can then be used to estimate age specific births for each city *i*:

$$ {}_n\hat{B}_x^{i,t} = {}_nB^{i,t} * {}_n\lambda_x^{BRA,t} \tag{A3} $$

Using ${}_n\hat{B}_x^{i,t}$, it is then possible to calculate $T\hat{F}R^{i,t}$:

$$ T\hat{F}R^{i,t} = n * \sum_{x=\alpha}^{\beta-n} \frac{{}_n\hat{B}_x^{i,t}}{{}_nP_x^{i,t}} \tag{A4} $$

# B. Sensitivity Analyses

This section goes through alternative models to identify the effect of the different public programs. The model given in Section 6 is changed in five different ways. The first is by limiting the sample, the second by controlling for city-specific trends and the third by experimenting with different methods of calculating the total fertility rate. To check to see whether changes in the lag structure affect the results, a fourth model is estimated including the first and second lags for each of the different covariates included in equation (1). And lastly, because there may be some dynamic effects not controlled for by the fixed effects, a fifth model uses the dynamic panel method outlined in Arellano and Bond (1991).

## Limiting the Sample

The sample is limited both by excluding those cities which entered the Birth Registration Area after 1923 and also by omitting the final two years, 1931 and 1932 from the analysis. Cities which entered the BRA post 1923 were concentrated in the

South and East, generally had higher fertility and invested less in public programs. To determine whether those cities may be driving the results in tables 3 and 4, a model is estimated which balances the panel, limiting the sample to only those areas for which birth information exists for the entire period between 1923 and 1932. The estimates from this limited sample are given in the first column of Table B1.

TABLE B1 HERE

The coefficient on public health education spending, while marginally attenuated, is not particularly affected by exclusion of these different cities.

The second cutting of the sample is done by excluding the last two years of the panel, 1931 and 1932, to eliminate any effects on fertility from the Great Contraction of 1929 and subsequent economic struggles across the United States. 1930 remains because Black Thursday did not occur until October 24$^{th}$, so most of the fertility decisions that would affect the number of children born in 1930 had already been made by the time the stock market took its initial dive. Additionally, excluding the last two years from the ten year panel is already asking a lot from a small number of observations; eliminating a third of all observations would make identification even more difficult. Estimates from this model are given in the second column of Table B1. In this selected sample, the coefficient on public health education expenditures is attenuated and while no longer statistically significant at the 10 percent level, has a p-value of 0.112. So exclusion of the final two years of the panel reduces the strength of the relationship between public health education and changes in municipal fertility. However, the estimated coefficient still indicates about $7.62 of per capita public health education spending is associated with reducing fertility by 0.1 points and the p-value is still very close to 0.1. Additionally, related to this is the decline in observations from 486 to 358. Exclusion of the first two years from the sample also eliminates enough observations to make precise identification of the public health education coefficient not possible. But even after accounting for this loss of precision, public health education spending remains economically, and very nearly statistically, significantly related to declining fertility.

## Including city-specific trends

The second robustness check for the strength of the results checks the sensitivity to the inclusion of city-specific trends. The variable $g_{i,}t$ is added to the model in Section 6 to control for the different fertility trends within cities. Controlling for the trend in this manner differs from using the trend variable discussed in Section 6. In this case, the average trend in fertility between 1923 and 1932 is estimated for each of the different cities, with identification of the coefficients coming off of the deviations from these average trends. The trend variable in Section 6 instead controls for fertility trends established in the 1910s. Because this variable controlling for fertility trends in the 1910s is linear in time, it must be omitted from any model including $g_{i,}t$. Other variables which must be removed from the analysis include the municipal demographic variables percent black, percent foreign born and percent illiterate. These are calculated for the decennial censuses and interpolated for the intercensal years, so are strongly collinear with $g_{i,}t$. Estimates from the model including this random trend variable are given in Table B2. Column 1 includes only the spending variables of interest, city and year fixed effects and the random trend variable and Column 2 includes the full set of covariates, less those which are linear in time.

TABLE B2 HERE

From Column 2, inclusion of the city specific trends attenuates the coefficient on public health education spending. However, the estimated relationship is still economically and statistically significant. From this model, it is estimated that about $6.14 dollars of per capita public health education spending are associated with reducing fertility by 0.1 points. As it did in Table 3, Column 5, Charity for children and mothers in this model has an estimated positive coefficient. Inclusion of the city specific trends however, leads to a larger coefficient estimate and one that is statistically significant at the 10 percent level. With the exception of manufacturing wages, all of formerly significant coefficient estimates are attenuated and in some cases no longer statistically significant. The coefficients on the infant mortality rate, other health spending, manufacturing wages and the proportion of adults in manufacturing remain statistically significant at the 10 percent level. The coefficient on outdoor care of poor continues to be estimated as not significantly affecting fertility in the different cities once manufacturing wages and the proportion of adults in manufacturing are included in the model.

## Changing the dependent variable

The third group of sensitivity tests involves calculating the dependent variable $T\hat{F}R_{i,t}$ in two different ways. The current method of calculation, as described in Appendix A, uses age-specific fertility rates from the Birth Registration Area as a whole to distribute municipal level births into the different age groups. Since this introduces some measurement error into the dependent variable, it is desirable to check the sensitivity of the results when it is calculated differently. The first alternative dependent variable is a scaled version of the General Fertility Rate (GFR). This estimates the model given in Section 6, but uses the number of children per woman aged 15 to 44 multiplied by 30 as the dependent variable. Typically, construction of the General Fertility Rate involves multiplying the ratio of children to women by 1,000, however here it is multiplied by 30 to allow comparison to the estimates in Table 3.

The second recalculation of the Total Fertility Rate goes the opposite direction and uses a finer level of detail than $T\hat{F}R_{i,t}$. In this case, state-level age-specific fertility rates are used in place of rates from the entire Birth Registration Area. So for this method, age-specific birth counts ${}_n\hat{B}_x^{i,t}$ are calculated using a $\lambda$ calculated at the state level. Specifically,

$${}_n\hat{B}_x^{i,t} = {}_nB^{i,t} * {}_n\lambda_x^{s,t}$$ , where $s$ is the state in which city $i$ lies.

The age-specific birth counts are then used to estimate a new version of the Total Fertility Rate, which we label $TFR_{i,t}^*$. Estimates from the models using the scaled General Fertility Rate and $TFR_{i,t}^*$ are given in Table B3.

TABLE B3 HERE

For both models, the coefficient estimates are very similar to those given in Table 3. The estimates are marginally closer between the $TFR_{i,t}^*$ and $T\hat{F}R_{i,t}$ models, however are also close enough to the GFR model so that it makes no difference in the coefficient estimates which of the three dependent variables is used in the model given in Section 6.

## Controlling for a changing religious composition

This model includes the proportion of Roman Catholic Church membership in a county into equation (1) to try to control for changes in religious composition during the 1920s and early 1930s.  The Roman Catholic Church was by far the largest church for the majority this period (membership in the Negro Baptist Church exceeded Roman Catholic membership in 1936), so provides a good index for whether other religious groups were becoming a larger part of a city's social structure.  This ratio is calculated using by dividing the total number of church members in 1916, 1926, and 1936 for each county, obtained from the Census of Religious Bodies for each of those years, by the number of Roman Catholic Church members.  These ratios are then interpolated for the intercensal years to obtain annual estimates.  Estimates from this model including the proportion of Roman Catholic Church members are given in Table B4.

TABLE B4 HERE

Inclusion of the variable controlling for the proportion of Roman Catholic Church membership in a county, although statistically significant, does not materially affect of the coefficients for the other variables.  Most importantly, the coefficients on spending for public health education, outdoor care of poor spending and spending on charity for children and mothers remain essentially the same as in Table 3.

## Distributed Lags

To make sure the lag structure is not causing the results given in Table 3, here the model is estimating including both the first and second lags for every variable except the 1910 to 1920 fertility trend covariate. Specifically, the following model is estimated:

$$\begin{aligned}\hat{TFR}_{i,t} &= \beta_1 PHE_{i,t-1} + \beta_2 PHE_{i,t-2} + \beta_3 CCM_{i,t-1} + \beta_4 CCM_{i,t-2} + \beta_5 COut_{i,t-1} + \beta_6 COut_{i,t-2} \\ &\quad + \beta_7 IMR_{i,t-1} + \beta_8 IMR_{i,t-2} + \beta_9 F_{i,t}^{1910-20} + \sum_{j=1}^{J} \beta_{j+9} X_{j,i,t-1} \sum_{k=1}^{K} + \beta_{k+J+9} X_{j,i,t-2} \\ &\quad + \gamma_1 C_i + \gamma_2 Y_t + \varepsilon_{i,t}\end{aligned} \qquad \text{(B1)}$$

Estimates for the key spending variables $PHE_i$, $CCM_i$, and $COut_i$ are given in Table B5.

TABLE B5 HERE

Including the both lags for each of the independent variables did slightly attenuate the coefficient on public health education, although only slightly. And not surprisingly, the precision of the coefficient estimate was also slightly reduced. However, at -0.019 the coefficient for the second lag of public health education spending remains statistically and economically significant while the coefficients for the welfare variables continue to be neither.

## Arellano-Bond Dynamic Panel Model

So far the effect of prior period fertility has been controlled for using the extrapolated fertility trend between 1910 and 1920 and a random trend variable $g_{i,}t$. Inclusion of either of these did not substantially affect the coefficient on public health education expenditures. Another method of controlling for prior trends is the inclusion of an autoregressive term $y_{i,t-1}$. Because use of the lagged dependent variable necessarily introduces endogeneity, unbiased coefficient estimates require an IV approach. A natural set of instruments to use in this case are the set of independent variables, set at an additional lag. This method of instrumentation for a dynamic panel data model was first introduced by Arellano and Bond (1991). Model (1) from Section 6 with the instrumented lagged dependent variable is given here:

$$\begin{aligned} T\hat{F}R_{i,t} &= T\hat{F}R_{i,t-1} + \beta_1 PHE_{i,t-2} + \beta_2 CCM_{i,t-1} + \beta_3 COut_{i,t-1} + \beta_4 IMR_{i,t-1} \\ &\quad + B_5 F_{i,t}^{1910-20} + \sum_{j=1}^{J} \beta_{j+5} X_{j,i,t-1} + \gamma_1 C_i + \gamma_2 Y_t + \varepsilon_{i,t} \end{aligned} \tag{B2}$$

Where

$$\begin{aligned} T\hat{F}R_{i,t-1} &= \beta_1 PHE_{i,t-3} + \beta_2 CCM_{i,t-2} + \beta_3 COut_{i,t-2} + \beta_4 IMR_{i,t-2} \\ &\quad + \beta_5 F_{i,t-1}^{1910-20} + \sum_{j=1}^{J} \beta_{j+5} X_{j,i,t-2} + \gamma_1 C_i + \gamma_2 Y_{t-1} + \varepsilon_{i,t-1} \end{aligned} \tag{B3}$$

Results from the Arellano-Bond model are given in Table B6. Inclusion of the instrumented lagged dependent variable caused many of the coefficients to differ from the estimates produced in Table 3. However, the coefficient on public health education was only attenuated by about 15 percent and remains negative and significant, both economically and statistically.

TABLE B6 HERE

The coefficient on the lagged dependent variable was positive and statistically significant, indicating that a city with negative change in fertility one year was likely to see a negative change in fertility the next. As it was in the model controlling for city-specific trends, the coefficient on charity for children and mothers was positive and statistically significant.  So it may very well be that this spending was associated with positive changes in fertility, however this result does not persist across all of the model specifications.  Other coefficients affected by the lagged dependent variable included the infant mortality rate, spending on sanitation, spending on schools and libraries, the population proportion filing taxes, and the proportion of women aged 15 to 44 who were black.  In Table 3 the coefficients for these variables were positive and statistically significant, but do not remain so in the dynamic panel data model. Other coefficients affected were those for the percent illiterate and the county population density, which are attenuated and not statistically significant.

# Table B1

Sensitivity Analyses: Limiting the sample

| Dependent var: TFR hat | Balanced panel | Limited to 1923-30 |
|---|---|---|
| Municipal health and welfare spending | | |
| Public health education (2 yr lag) | -0.02136* | -0.01312 |
| | (0.0084) | (0.0072) |
| Charity for children and mothers | 0.00335 | 0.00795* |
| | (0.0036) | (0.0027) |
| Outdoor care of poor | -0.00050 | -0.00448 |
| | (0.0007) | (0.0038) |
| Infant mortality rate | 0.0026** | 0.00209* |
| | (0.0007) | (0.0006) |
| 1910-1920 Fertility Trend (current yr) | 0.100 | 0.26862* |
| | (0.0835) | (0.0896) |
| Other spending variables | | |
| Other health spending | -0.00819** | -0.0098** |
| | (0.0022) | (0.0020) |
| Sanitation spending | 0.0013* | 0.00174+ |
| | (0.0005) | (0.0009) |
| Hospital spending | 0.00009 | -0.00537* |
| | (0.0021) | (0.0021) |
| Spending on schools and libraries | 0.0018* | 0.00111 |
| | (0.0006) | (0.0006) |
| Personal income/Economic outcome vars | | |
| Manufacturing wages per worker | 0.000043* | 0.000074** |
| | (0.0000) | (0.0000) |
| Proportion of adults in manufacturing | 1.9505** | 1.643** |
| | (0.3388) | (0.4616) |
| Population proportion filing taxes | 2.495** | 1.4387+ |
| | (0.6738) | (0.6464) |
| Municipal | | |
| For women aged 15 to 44 | 1.9313* | 3.235** |
| Proportion black | (0.6062) | (0.7188) |
| | 1.335 | 2.8246** |
| Proportion foreign born | (0.9768) | (0.6990) |
| For persons over 10 years old | | |
| Proportion illiterate | -3.366 | -7.4267** |
| | (2.4937) | (1.6150) |
| Other | | |
| County population density | -0.000038* | -0.000026* |
| | (0.0000) | (0.0000) |
| Constant | 0.3466 | -0.4108 |
| | (0.3493) | (0.3614) |
| City fixed effects | Y | Y |
| Year fixed effects | Y | Y |
| Observations | 448 | 358 |
| Adjusted R-squared | 0.9422 | 0.9450 |

Standard errors clustered at the Census region are in parantheses

** p<0.01, * p<0.05, + p<0.1

TFR hat is an estimated version of the Total Fertility Rate using age-specific fertility rates from the Birth Registration Area

Unless otherwise stated, all variables are set at one year lags. Government expenditures are per capita and adjusted to 2007 dollars

The balanced panel excludes all cities which entered the Birth Registration Area after 1923. See Table A4 for the dates of BRA entry for each city in the sample

# Table B2

## Sensitivity Analses: City specific trend model

| Dependent var: TFR hat | (1) | (2) |
|---|---|---|
| Municipal health and welfare spending | | |
| Public health education (2 yr lag) | -0.0215** | -0.01629** |
| | (0.0049) | (0.0045) |
| Charity for children and mothers | 0.006762 | 0.00983+ |
| | (0.0043) | (0.0050) |
| Outdoor care of poor | -0.00265** | -0.00037 |
| | (0.0006) | (0.00035) |
| Infant mortality rate | | 0.0018** |
| | | (0.0004) |
| Other spending variables[1] | | |
| Other health spending | | -0.00638+ |
| | | (0.0029) |
| Sanitation spending | | 0.00094 |
| | | (0.0018) |
| Hospital spending | | -0.003 |
| | | (0.0018) |
| Spending on schools and libraries | | -0.00045 |
| | | (0.0004) |
| Personal income/Economic outcome vars | | |
| Manufacturing wages per worker | | 0.000052** |
| | | (0.0000) |
| Proportion of adults in manufacturing | | 1.4055* |
| | | (0.4205) |
| Population proportion filing taxes | | 0.8028 |
| | | (0.6549) |
| Other | | |
| County population density | | 0.0000203 |
| | | (0.0000) |
| Constant | 2.788** | 1.3274** |
| | (0.0583) | (0.2742) |
| City specific trend | Y | Y |
| City fixed effects | Y | Y |
| Year fixed effects | Y | Y |
| Observations | 494 | 486 |
| Adjusted R-squared | 0.9597 | 0.9674 |

Notes:

Standard errors clustered at the Census region are in parantheses

** p<0.01, * p<0.05, + p<0.1

TFR hat is an estimated version of the Total Fertility Rate using age-specific fertility rates from the Birth Registration Area

Unless otherwise stated, all variables are set at one year lags.

Government expenditures are per capita and adjusted to 2007 dollars

# Table B3

Sensitivity Analses: New dependent variables

| Dependent var: | Scaled GFR | TFR* |
|---|---|---|
| Municipal health and welfare spending | | |
| Public health education (2 yr lag) | -0.02122* | -0.0213* |
| | (0.0081) | (0.0079) |
| Charity for children and mothers | 0.00287 | 0.00328 |
| | (0.0035) | (0.0034) |
| Outdoor care of poor | -0.00057 | -0.00056 |
| | (0.0007) | (0.0006) |
| Infant mortality rate | 0.0028** | 0.00269** |
| | (0.0007) | (0.0007) |
| 1910-1920 Fertility Trend (current yr) | 0.0488 | 0.11431 |
| | (0.0891) | (0.0843) |
| Other spending variables | | |
| Other health spending | -0.0083** | -0.00802** |
| | (0.0023) | (0.0022) |
| Sanitation spending | 0.0013* | 0.00122* |
| | (0.0005) | (0.0005) |
| Hospital spending | 0.00058 | 0.00018 |
| | (0.0021) | (0.0020) |
| Spending on schools and libraries | 0.0017* | 0.00175* |
| | (0.0005) | (0.0005) |
| Personal income/Economic outcome vars | | |
| Manufacturing wages per worker | 0.000045* | 0.0000421* |
| | (0.0000) | (0.0000) |
| Proportion of adults in manufacturing | 2.0325** | 2.022** |
| | (0.3213) | (0.2949) |
| Population proportion filing taxes | 2.7001** | 2.541** |
| | (0.6962) | (0.6734) |
| Municipal | | |
| For women aged 15 to 44 | | |
| Proportion black | 1.9003** | 2.119** |
| | (0.5385) | (0.5224) |
| Proportion foreign born | 1.775+ | 1.3884 |
| | (0.9410) | (0.8755) |
| For persons over 10 years old | | |
| Proportion illiterate | -4.125+ | -5.347* |
| | (2.202) | (2.151) |
| Other | | |
| County population density | -0.00004+ | -0.000039* |
| | (0.000019) | (0.000017) |
| Constant | 0.4222 | 0.3358 |
| | (0.3635) | (0.3402) |
| City fixed effects | Y | Y |
| Year fixed effects | Y | Y |
| Observations | 486 | 486 |
| Adjusted R-squared | 0.9440 | 0.9453 |

Standard errors clustered at the Census region are in parantheses

** p<0.01, * p<0.05, + p<0.1

TFR* is the total fertility rate estimated using state level age-specific fertility rates

Unless otherwise stated, all variables in this category are set at one year lags. Government expenditures are per capita and adjusted to 2007 dollars

The scaled GFR is the General Fertility Rate multiplied by 30/1,000 so that it is on the same scale as the Total Fertility Rate

# Table B4

Sensitivity Analses: Controlling for the county proportion Roman Catholic church membership

| Dependent var: TFR hat | |
|---|---|
| Municipal health and welfare spending | |
| Public health education (2 yr lag) | -0.0222* |
| | (0.008) |
| Charity for children and mothers | 0.00504 |
| | (0.003) |
| Outdoor care of poor | -0.000617 |
| | (0.001) |
| Proportion county Roman Catholic church membership | -2.521** |
| | (0.443) |
| Infant mortality rate | 0.00276** |
| | (0.001) |
| 1910-1920 Fertility Trend (current yr) | 0.0980 |
| | (0.086) |
| Other spending variables | |
| Other health | -0.00949** |
| | (0.002) |
| Sanitation | 0.00129* |
| | (0.001) |
| Hospitals | 0.00053 |
| | (0.002) |
| Schools and libraries | 0.00173* |
| | (0.001) |
| Personal income/Economic out. Vars | |
| Mfg wages per worker | 0.000043* |
| | (0.000014) |
| Propor. of adults in mfg | 2.1538** |
| | (0.318) |
| Population propor. filing taxes | 2.3189** |
| | (0.618) |
| Municipal | |
| For women aged 15 to 44 | |
| Proportion black | 2.432** |
| | (0.445) |
| Proportion foreign born | 1.350 |
| | (0.908) |
| For persons over 10 years old | |
| Proportion illiterate | -4.052 |
| | (2.644) |
| Other | |
| County population density | -0.000067* |
| | (0.000021) |
| Constant | 1.5558** |
| | (0.283) |
| City fixed effects | Y |
| Year fixed effects | Y |
| Observations | 486 |
| Adjusted R-squared | 0.948 |

Standard errors clustered at the Census region are in parantheses

** p<0.01, * p<0.05, + p<0.1

TFR hat is an estimated version of the Total Fertility Rate using age-specific fertility rates from the Birth Registration Area

Unless otherwise stated, all variables are set at one year lags. Government expenditures are per capita and adjusted to 2007 dollars

# Table B5

Sensitivity Analses: Distributed Lags

| Dependent var: | TFR hat |
|---|---|
| | |
| Municipal health and welfare spending | |
| Public health education | |
| 1st lag | 0.006748 |
| | (0.0075) |
| 2nd lag | -0.018857+ |
| | (0.0084) |
| Charity for children and mothers | |
| 1st lag | 0.00369 |
| | (0.0034) |
| 2nd lag | 0.002007 |
| | (0.0031) |
| Outdoor care of poor | |
| 1st lag | 0.000135 |
| | (0.0007) |
| 2nd lag | -0.000360 |
| | (0.0017) |
| | |
| Constant | 0.08073009 |
| | -0.30131981 |
| | |
| Observations | 477 |
| Adjusted R-squared | 0.9489 |

Notes:

Both the first and second lags for all of the other covariates are also included in the estimated model, however their coefficient estimates are excluded for the sake of brevity

Standard errors clustered at the Census region are in parantheses

** p<0.01, * p<0.05, + p<0.1

TFR hat is an estimated version of the Total Fertility Rate using age-specific fertility rates from the Birth Registration Area

Government expenditures are per capita and adjusted to 2007 dollars

# Table B6

## Sensitivity Analyses: Arellano Bond

| Dependent var: | TFR hat |
|---|---|
| | |
| Lagged dependent variable | 0.43029878** |
| | (0.1268) |
| Municipal health and welfare spending | |
| Public health education (2 yr lag) | -0.018419** |
| | (0.0058) |
| Charity for children and mothers | 0.00635* |
| | (0.0029) |
| Outdoor care of poor | -0.00024 |
| | (0.0008) |
| Infant mortality rate | 0.000838 |
| | (0.0009) |
| 1910-1920 Fertility Trend (current yr) | 0.100019 |
| | (0.1292) |
| Other spending variables | |
| Other health spending | -0.00756** |
| | (0.0025) |
| Sanitation spending | -0.000341 |
| | (0.0015) |
| Hospital spending | -0.00052 |
| | (0.0022) |
| Spending on schools and libraries | -0.000018 |
| | (0.00058) |
| Personal income/Economic outcome vars | |
| Manufacturing wages per worker | 0.0000347** |
| | (0.0000) |
| Proportion of adults in manufacturing | 0.82139* |
| | (0.3744) |
| Population proportion filing taxes | 0.86512 |
| | (0.6150) |
| Municipal | |
| For women aged 15 to 44 | |
| Proportion black | -0.32244 |
| | (1.1869) |
| Proportion foreign born | 0.97971 |
| | (1.1501) |
| For persons over 10 years old | |
| Proportion illiterate | -2.2983 |
| | (3.8924) |
| Other | |
| County population density | 0.0000134 |
| | (0.000017) |
| Constant | 0.2926 |
| | (0.3605) |
| | |
| City fixed effects | Y |
| Year fixed effects | Y |
| | |
| Observations | 422 |
| Number of panelid | 64 |

Robust standard errors are in parantheses

** p<0.01, * p<0.05, + p<0.1

TFR hat is an estimated version of the Total Fertility Rate using age-specific fertility rates from the Birth Registration Area

Unless otherwise stated, all variables are set at one year lags. Government expenditures are per capita and adjusted to 2007 dollars

# C. Data Appendix

The dataset contains annual information on a set of 68 cities between 1923 and 1932. These are cities over 100,000 persons in 1920, that being the same cutoff used in the publication for much of the necessary financial and Census data. For a list of those cities which were part of the analysis, along with the other states which did not contain a sample city, see Table C1. Each city is given, along with its entry date into the Birth Registration Area.

TABLE C1 HERE

The start date of 1923 was chosen for data availability reasons. The financial statistics for cities were first published by the Department of Commerce in 1906, however were unfortunately not published in 1920 due to all available Census workers being focused on the national census. Additionally, in an effort to save costs in 1921 and 1922, the Bureau tried sending out questionnaires to the different cities. Some of the necessary financial detail is missing for those years, and that which exists is of a questionable quality. 1923 was the first year for which there is reliable financial information and the public health programs show up in government outlays.

Manufacturing earnings were entered from the Biannual Census of Manufactures volumes to help control for municipal income. Since the Census of Manufactures was published every other year, state per capita income, estimated by Robert Martin (1939), was used to interpolate.[1] The interpolation formula used was:

[1] Martin (1939) does not give a good description of how he came to his estimates. Fishback and Kachanovskaya (2010) ran regressions for each state with the BEA state income data as a function of the Martin data without an intercept over the period from 1929 to 1938 when the two sets of series.

$$\mathrm{MW}_{i,t} = \mathrm{SPCI}_t \left( \frac{1}{2} \frac{\mathrm{MW}_{i,t-1}}{\mathrm{SPCI}_{t-1}} + \frac{1}{2} \frac{\mathrm{MW}_{i,t+1}}{\mathrm{SPCI}_{t+1}} \right) \tag{C1}$$

Where $SPCI_t$ is state per capita income in year $t$. The number of workers, also taken from the Biannual Census of Manufactures is used to calculate average annual wages on a per worker basis. A simple interpolation is used to calculate the number of workers for off-census years.

In order to calculate population densities (population per square mile), the land area of the different counties was determined from the Decennial Censuses. When information on the land area of a county was missing, it was determined by the next closest date in the future for which the information was available. For instance, if the land area was missing for 1920, the 1930 value was used. If it was missing for 1930 also, then the 1940 value was used, and so on. In most cases the cities did not expand, however there were some exceptions such as Orleans Parish in Louisiana and Fulton County in Georgia. The county population for the city of New York has been set to the city population density. This is because New York City is constituted by 5 different counties, New York, Bronx, Kings, Queens and Richmond.

The financial statistics and manufacturing wages are inflated to 2007 dollars. This was done using the CPI calculations performed by Lawrence Officer (2011) available on the MeasuringWorth website. Although there was very little change in the price index during the first part the 1920s, there was some level of depreciation towards the end and into the early 1930s.

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The $R^2$ s from each of the regressions were all above 0.98. When they ran correlations of the growth rates for the overlap periods, they are all over 0.6 and most are over 0.9.

# Table C1

List of Sample Cities

| City Name | State | Year entered BRA | City Name | State | Year entered BRA |
|---|---|---|---|---|---|
| Birmingham | AL | 1927 | Akron | OH | 1917 |
| Los Angeles | CA | 1919 | Cincinnati | OH | 1917 |
| Oakland | CA | 1919 | Cleveland | OH | 1917 |
| San Francisco | CA | 1919 | Columbus | OH | 1917 |
| Denver | CO | 1928 | Dayton | OH | 1917 |
| Bridgeport | CT | 1915 | Toledo | OH | 1917 |
| Hartford | CT | 1915 | Youngstown | OH | 1917 |
| New Haven | CT | 1915 | Portland | OR | 1919 |
| Washington D.C. | DC | 1915 | Philadelphia | PA | 1915 |
| Wilmington | DE | 1921 | Pittsburgh | PA | 1915 |
| Atlanta | GA | 1928 | Reading | PA | 1915 |
| Chicago | IL | 1922 | Scranton | PA | 1915 |
| Indianapolis | IN | 1917 | Providence | RI | 1915 |
| Des Moines | IO | 1924 | Memphis | TN | 1927 |
| Kansas City | KS | 1917 | Nashville | TN | 1927 |
| Louisville | KY | 1917 | Salt Lake City | UT | 1917 |
| New Orleans | LA | 1927 | Norfolk | VA | 1917 |
| Boston | MA | 1915 | Richmond | VA | 1917 |
| Cambridge | MA | 1915 | Seattle | WA | 1917 |
| Fall River | MA | 1915 | Spokane | WA | 1917 |
| Lowell | MA | 1915 | Milwaukee | WI | 1917 |
| New Bedford | MA | 1915 | | | |
| Springfield | MA | 1915 | **Other States Not Listed** | | |
| Worcester | MA | 1915 | Arizona | AZ | 1926 |
| Baltimore | MD | 1916 | Arkansas | AR | 1926 |
| Detroit | MI | 1915 | Florida | FL | 1924 |
| Grand Rapids | MI | 1915 | Idaho | ID | 1926 |
| Minneapolis | MN | 1915 | Maine | ME | 1915 |
| St. Paul | MN | 1915 | Mississippi | MS | 1921 |
| Kansas City | MO | 1927 | Montana | MT | 1922 |
| St. Louis | MO | 1927 | Nevada | NV | 1929 |
| Omaha | NE | 1920 | New Hampshire | NH | 1915 |
| Camden | NJ | 1921 | New Mexico | NM | 1929 |
| Jersey City | NJ | 1921 | North Carolina | NC | 1917 |
| Newark | NJ | 1921 | North Dakota | ND | 1924 |
| Paterson | NJ | 1921 | Oklahoma | OK | 1928 |
| Trenton | NJ | 1921 | South Carolina | SC | 1928 |
| Albany | NY | 1915 | South Dakota | SD | 1932 |
| Buffalo | NY | 1915 | Texas | TX | 1933 |
| New York | NY | 1915 | Vermont | VT | 1915 |
| Rochester | NY | 1915 | West Virginia | WV | 1925 |
| Syracuse | NY | 1915 | Wyoming | WY | 1922 |
| Yonkers | NY | 1915 | | | |

Notes:

Source: Birth, Stillbirth, and Infant Mortality Statistics for the Continental United States, the Territory of Hawaii, The Virgin Islands: 1933