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Abstract

Public educators and philanthropists in the late 19th century United States promoted the establishment of kindergartens in cities as a remedy for the social problems associated with industrialization and immigration. Between 1880 and 1910, more than seven thousand kindergartens opened their doors in the United States, serving both a social and educational function. We use newly collected city-level data on the roll-out of the first kindergartens to evaluate their impact on household outcomes. We find that in cities with a larger kindergarten exposure, families significantly reduced fertility, with the strongest decline appearing in families that were economically disadvantaged and with an immigrant background. Households reduced fertility because kindergarten attendance increased returns to education, but it also led to higher opportunity costs for raising children. Indeed, we show that children exposed to kindergartens were less likely to work during childhood and, instead, stayed longer in school, had more prestigious jobs, and earned higher wages as adults. Finally, we find that exposure to kindergartens particularly helped immigrant children from non-English-speaking countries to gain English proficiency. Their attendance also generated positive language spillover effects on their mothers, illustrating the importance of early childhood education for the integration of immigrant families.

JEL Classification: N31, J13, I25, O15

Keywords: Kindergarten Education, Family size, Fertility Transition, Returns to Preschool Education, Quantity-quality trade-off

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Abstract: Public educators and philanthropists in the late 19th century United States promoted the establishment of kindergartens in cities as a remedy for the social problems associated with industrialization and immigration. Between 1880 and 1910, more than seven thousand kindergartens opened their doors in the United States, serving both a social and educational function. We use newly collected city-level data on the roll-out of the first kindergartens to evaluate their impact on household outcomes. We find that in cities with a larger kindergarten exposure, families significantly reduced fertility, with the strongest decline appearing in families that were economically disadvantaged and with an immigrant background. Households reduced fertility because kindergarten attendance increased returns to education, but it also led to higher opportunity costs for raising children. Indeed, we show that children exposed to kindergartens were less likely to work during childhood and, instead, stayed longer in school, had more prestigious jobs, and earned higher wages as adults. Finally, we find that exposure to kindergartens particularly helped immigrant children from non-English-speaking countries to gain English proficiency. Their attendance also generated positive language spillover effects on their mothers, illustrating the importance of early childhood education for the integration of immigrant families.

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I. Introduction

A number of influential studies highlight the importance of early childhood education for future success in school and adult outcomes, especially for disadvantaged children (Currie and Thomas, 1995; Heckman, 2006; Knudsen et al., 2006; Campbell et al., 2014).[1] Today, about two-thirds of 3- to 5-year-old children are enrolled in preprimary programs in the United States, which include kindergarten and preschool programs. In some OECD countries, the enrollment rate even exceeds 90 percent (OECD, 2019). While the literature on early childhood programs mainly focuses on evaluating recent interventions, such as the prominent Head Start or the HighScope Perry Preschool Program (e.g., Garces et al., 2002; Heckman et al., 2010), comparatively little is known about the socioeconomic effects of early childhood education programs for historical economic growth and development.

This paper focuses on a large-scale early childhood intervention, the establishment of the first kindergartens in American cities in the last decades of the 19th century. The idea of an institutionalized education program for little children goes back to Friedrich Froebel, a German educational reformer, who invented the kindergarten in Bad Blankenburg, Thuringia, in 1837. Froebel's concept of teaching young children was based on utilizing specially designed educational toys (so-called "gifts"), occupations, games, and songs that aimed to promote the development of cognitive and social skills during early childhood (Lascarides and Hinitz, 2000, pp. 100–105; Allen, 2017, p. 27). American educators saw in the Froebelian method a remedy to the social challenges that rapid industrialization and urbanization brought to traditional family life in the late 19th century. In 1873, William T. Harris, superintendent of schools in St. Louis, Missouri, initiated the first large-scale involvement of a public-school system in kindergarten education in the United States. Harris, like a number of American philanthropists and school superintendents in other cities, was alarmed by the increasing number of children growing up in poverty and regarded the kindergarten as a general "child-saving agency" which served a socializing and educational function (Troen, 1972; Shapiro, 1983; Klein, 1992; Beatty, 1995).

Over the next decades (1880–1910), more than 7,000 kindergartens opened their doors in various American cities. Contemporary observers such as Nina C. Vandewalker, a kindergarten specialist for the U.S. Bureau of Education in the 1920s, regarded the roll-out of kindergartens as one of the most fundamental movements in American education (Vandewalker, 1908). The kindergarten movement gained ground at a time when American cities were experiencing an unprecedented increase in immigration (Ward, 1971). While some of the early kindergartens catered only to children of well-to-do households for a fee, hundreds of free and publicly funded

[1] We refer the reader to the reviews of Almond and Currie (2011), Duncan and Magnuson (2013), and Almond, Currie and Duque (2018) for a detailed overview of the economics literature on early childhood education programs.

kindergartens were established in the 1880s to mitigate the problems of poor children growing up in the slums of American cities.[2] The public widely acknowledged the work of kindergartens in the deprived neighborhoods and demanded more public support for kindergarten education at the turn of the 20th century (Vandewalker, 1908; Ross, 1976; Shapiro, 1983; Klein, 1992). Many superintendents of schools followed the example of St. Louis and integrated kindergartens into the public school system. By 1912, more than 850 cities offered a public kindergarten program, which contributed to universal access to kindergarten education for all social classes, as indicated by the rapid surge in enrolled children from around 9,000 in 1880 to more than 350,000 in 1912 (Report of the Commissioner of Education, 1897/98; U.S. Bureau of Education, 1914, Table 1).

As in modern kindergartens, teachers prepared mainly 5- to 6-year-old children for primary school, socializing children by teaching them morals and values, and fostering children's development of practical and cognitive skills that would benefit them later in life. Besides teaching pupils in classroom, kindergarten teachers regularly arranged home visits and mothers' meetings, where they lectured working-class mothers on the importance of child rearing, home economics, and the general significance of early childhood education (Ross, 1976; Shapiro, 1983; Berg, 2004). Results from contemporaneous surveys suggest that kindergarten children were overall better prepared for primary school; there is also anecdotal evidence emphasizing the social benefits of mothers' meetings and teachers visiting the children's homes (Palmer, 1915; Waite, 1926; Berg 2004). Yet, rigorous quantitative studies evaluating the socioeconomic impact of the kindergarten movement on mothers and their children during the late 19th and early 20th centuries—a period of rapid industrial growth and social change in the United States—are lacking.[3]

In this paper, we study how the roll-out of the first kindergartens in American cities affected households in different dimensions. We start by evaluating how the establishment of kindergartens affected household fertility. Studying how households' fertility decisions responded to the availability of kindergartens is appealing in our context for two main reasons. First, in order to explain the potential mechanisms that could trigger a fertility response, we consider the effects of kindergarten instruction on exposed children and their mothers. This holistic approach

[2] The primary forms of kindergarten sponsorship were private sponsors, associations and public schools. We refer the reader to Section II.B for a detailed description of how kindergartens in the 19th century U.S. were organized and sponsored.

[3] The only other empirical study on the kindergarten movement in the United States we are aware of is an unpublished PhD thesis chapter by Haimovich (2015). For a linked 1900/1910–1940 sample of males, Haimovich finds positive long-term effects of exposure to public kindergartens on schooling and occupation-based earnings in 1940. Further evidence on positive long-term effects of large-scale preschool or childcare programs in the United States comes from Cascio (2009a) who evaluates the introduction of state funding for public school kindergartens during the 1960s and 1970s, and Herbst (2017) who studies the long-term consequences of the Lanham Act of 1940--a universal child care policy that operated during WWII. Studies of other countries also reveal beneficial long-term effects from the introduction or expansion of universal childcare or preschool programs, see e.g., Havnes and Mogsted (2011a) for Norway or Rossin-Slater and Wuest (2020) for Denmark.

provides us with important insights on how the kindergarten movement affected families in American cities at the turn of the 20th century. In fact, we show that exposure to kindergartens significantly reduced fertility because it raised the return to schooling and resulted in higher opportunity costs of child rearing.

Second, the roll-out of kindergartens occurred at a time when American cities experienced the fertility transition, a process regarded as crucial for the transition to modern economic growth (Guinnane, 2011). Proponents of unified growth theory emphasize the importance of human capital to the fertility transition during the second phase of the industrial revolution (Galor and Weil, 1999, 2000; Galor, 2005). Empirical evidence showing that increased returns to education contributed to the fertility transition supports this theory (Bleakley and Lange, 2009; Aaronson et al., 2014). Yet, relatively little is known about what type of education mattered for the transition from high to low fertility in much of Europe and North America during the 19th and early 20th centuries. Our results suggest that the availability of kindergarten education in American cities played an important role, especially for the fertility choices of families that were economically disadvantaged and with an immigration background.

We begin our empirical analysis with a case study that explores the public school kindergarten experiment in St. Louis, the first publicly sponsored kindergartens in the United States. This case study provides a quasi-natural experiment setting to investigate the effect of the roll-out of kindergartens on fertility at a very disaggregated level since the first public kindergarten started, literally, as an experiment to study "the practical effects of Froebel's system" (St. Louis School Report, 1874, p. 195). The annual reports of the Board of public schools in St. Louis contain detailed information about the location of kindergartens, starting in 1874.[4] We geo-referenced the locations of every kindergarten and determined the exact date each one was established between 1874 and 1886. We then used that information in an event study design along with the fertility history of every 18- to 44-year-old white woman living in St. Louis in 1880.[5] Our event study design exploits the different timing of kindergarten openings across enumeration districts and the fact that women gave birth at different points in time. This structure allowed us to test whether and to what extent the fertility pattern of women changed after the opening of kindergartens in different enumeration districts. The estimates reveal a striking pattern: Women in treated enumeration districts gradually reduced fertility after a kindergarten opened, while there were no fertility differences between treated and untreated

[4] The first public kindergarten at the Des Peres school in St. Louis opened its doors on the first Monday of September 1873 (St. Louis School Report, 1874, p. 195), which falls into the school year 1873/74 (at that time the school year in St. Louis ended on August 1). By 1886, 52 kindergartens operated within the city borders of St. Louis. Lowell is the only kindergarten we could not locate.

[5] We could not perform the analysis using the fertility history of women listed in the 1890 Census, since the individual census records were destroyed in a fire.

women before the event occurred. We obtained similar results if we considered proximity to the closest kindergarten instead of the enumeration district as the treatment criterion. Women that lived in close proximity to a kindergarten (within 250 meters) gradually declined fertility compared to women living further away (between 250 to 1,000 meters) but only after the kindergartens began operating. This finding is consistent with the notion that kindergarten exposure is also related to households' local proximity to kindergartens.

Next, we address the question of external validity. Starting in the 1870s, the U.S. Commissioner of Education's annual report contains, for most years, information about the number of kindergartens, kindergarten teachers, and enrolled children at the city level. We digitized the kindergarten statistics of these reports to test whether exposure to kindergartens led 18- to 44-year-old white women to reduce fertility in other American cities also. Combining city-level variation of kindergarten exposure with complete count U.S. Census microdata for the decades 1880–1910, we found that women exposed to kindergartens significantly reduced fertility; this was particularly true for young women (aged 18–34) and households that already had a child of kindergarten age (5 to 6). Since the kindergarten movement specifically targeted disadvantaged children and their families, one would expect that low-income and immigrant households experienced the strongest decline in fertility. Our results suggest that this was indeed the case: For foreign-born women in our sample, the roll-out of kindergartens explains about 11 percent of the overall decline in fertility that immigrant families experienced over the period of 1880 to 1910.

Which potential mechanisms could explain the negative effect of kindergarten exposure on fertility? We argue that our results are consistent with the predictions of a quantity-quality trade-off model in which households reduce fertility in response to an increase in the return to education and higher direct and indirect costs of having children (Galor, 2011).[6] To substantiate this claim, we took a standard quantity-quality model of fertility but explicitly allowed households to invest in preschool education besides regular schooling. The key insight of this augmented model is that parents would unambiguously reduce fertility if complementarities between preschool education and schooling exist. Because the Census records in our sample period provide insufficient information to test whether such complementarities were in place, we turned to the Goldin-Katz sample of 1915 Iowa State Census that contains information about years of schooling and earnings at the individual level. Adding the exact opening dates of the first kindergartens in the sampled towns/cities of Iowa, we could assess whether individuals who were of kindergarten age around the opening date of the first kindergarten in a city/town stayed longer

[6] A number of empirical studies provide compelling evidence that a quantity-quality tradeoff during (or even before) the demographic transition existed; see, for example, Bleakley and Lange (2009), Becker et al. (2010), Aaronson et al., (2014), Murphy (2015), Fernihough (2017), Klemp and Weisdorf (2019), and Ager et al. (2020).

in school compared to individuals who were slightly too old to attend. We found that potentially exposed children stayed about four months longer in school, which supports our claim that complementarities between kindergarten education and schooling at that time existed. Kindergarten exposure also had beneficial long-term effects: We show that potentially exposed children had higher earnings and worked in more prestigious occupations later in life. Overall, these results suggest that the availability of kindergarten education contributed to the accumulation of human capital in the United States at the beginning of the 20th century (Goldin and Katz, 1999; 2008).

While the results from Iowa suggest that kindergarten exposure generally increased the return to education, we also show that access to kindergarten education specifically benefitted children of immigrant families. A number of economists have argued that English proficiency is a crucial factor for immigrants' success in the workplace (e.g., McManus et al., 1983; Tainer, 1988; Bleakley and Chin, 2004). The 1900 and 1910 Census records contain information about whether an individual speaks English and the year of arrival for immigrants to the United States. We exploited this information for a subset of 10- to 15-year-old children from non-English speaking households. In particular, we compared children of the same age and birthplace who lived in the same city in the Census year but arrived in the United States at different points in time. Using this identification strategy, we found that eligible children (i.e., those who arrived early enough to obtain a kindergarten education in the United States) were more likely to speak English in cities with a higher exposure to kindergartens.

We also unveil positive language spillover effects of kindergarten attendance on mothers from non-English-speaking immigrant households that might have contributed to a faster assimilation of culturally distant immigrant families. In this case, we exploit the differential effect that kindergarten attendance might have had on mothers and fathers within the same family. Our identification strategy rests on the assumption that mothers, when compared with fathers, were more directly affected by the children's kindergarten attendance because of the stronger relationship with the child and the interactions with the kindergarten teacher during home visits and mothers' meetings. Our estimates indicate that having a child attending a kindergarten reduced the gap in English proficiency between mothers and fathers between 10 to 18 percent.

The roll-out of kindergartens in American cities during the late 19th and early 20th centuries increased the return to education, but it also affected the direct and indirect costs of child rearing. We considered the following reinforcing mechanisms that could lead women to reduce fertility after kindergartens were in place: lower household income from child labor and better labor market opportunities for affected women. Our results reveal that both mechanisms were at play. We found that 10- to 15-year-old children were less likely to work when they were

exposed to kindergartens during their childhood. The reduced household income from child labor increased the direct costs of having children and reinforced parents' decision to substitute quantity for quality. The kindergarten movement also started to improve the labor market conditions of white women in American cities at the turn of the 20th century. A significant increase in female labor force participation could also have triggered the observed fertility decline since it increased the opportunity costs of having children (Galor and Weil, 1996).[7] We show that the roll-out of kindergartens in American cities led to a statistically significant increase in female labor force participation. For younger women, the increased participation in the labor market in cities with higher kindergarten exposure is reflected in a significant delay of marriage.[8] In terms of maternal labor supply, we found significant increases for 18- to 44-year-old white women with at least one child, in particular for mothers with a 5- to 6-year-old but no younger children, in cities with a higher kindergarten exposure rate. While our estimates reveal that the kindergarten movement contributed to rising labor force participation rates of married white females at the beginning of the 20th century (Goldin 1990), we show that it cannot explain away the negative effect of kindergarten exposure on fertility. This is in line with recent empirical evidence that finds no systematic relationship between fertility and female labor supply in the U.S. before WWI (Aaronson et al., 2020, forthcoming).

II. Historical Background

In this section, we describe the historical context of our study, beginning with how kindergartens spread in the United States during the last decades of the 19th century. We then provide a brief account of their organization and primary forms of sponsorship. Finally, we discuss the socioeconomic effects that kindergarten education was expected to have on enrolled children and their mothers, according to contemporary public educators, and relate that to our main findings.

A. The Spread of the Kindergarten Movement in the United States

The kindergarten as an institution of early childhood education goes back to the educational reformer Friedrich Wilhelm August Froebel (1782–1852). In 1837, Froebel founded "an institution for the education of little children" in Bad Blankenburg (Thuringia, Germany) that he termed three years later *Kindergarten*. Froebel realized that the first years in a child's life were the most important for their future development. His principle of educating little children rejected

[7] According to Galor and Weil (1996), increases in the relative wage of women during the 19th and 20th centuries led eventually to a rise in female labor force participation which resulted in a fertility decline because of the higher opportunity costs of having children.

[8] A number of studies based on modern data investigate the effect of access to public school kindergartens on maternal labor supply with generally mixed evidence depending, for example, on marital status or different eligibility criteria (e.g., Gelbach, 2002; Cascio, 2009b; Havnes and Mogsted, 2011b; Fitzpatrick, 2012; Bauernschuster and Schlotter, 2015).

traditional didactic education and focused instead on children's interests and needs. Froebel developed specially designed educational toys ("gifts"), prescribed activities ("occupations"), games, and songs to stimulate the manual and cognitive abilities of young children. Froebel's teaching methods aimed to educate 3- to 6-year-old children and were applicable to all children independent of their social background. With daily sessions of three to four hours, Froebel's kindergarten concept represented a compromise between family-based and fully institutionalized child rearing (Allen, 1988, p. 25; Klein, 1992, pp. 268–69; Lascarides and Hinitz, 2000, pp. 97–104; Allen, 2017, p. 27). During the 1840s, Froebel's pedagogy gained popularity among progressive German educators, who established forty-four kindergartens in 1848 alone (Allen, 1988, p. 26). However, this success was relatively short-lived, as the political climate changed after the failed German revolutions in 1848–49. Several German states banned kindergartens, including Prussia in 1851; others, like the Kingdom of Saxony, strictly regulated their operations (Allen, 2017, p. 44).[9]

Since Froebel's pedagogy was closely associated with the liberal movement in Germany, his kindergarten concept was transplanted to the United States when a number of highly educated liberal political leaders (so-called "Forty-Eighters") fled from Germany as a consequence of the political oppression following the failed revolution (Allen, 2006).[10] One of them was Margarethe Schurz, an enthusiastic advocate of Froebel's teaching methods, who opened the first kindergarten on American soil in Watertown, Wisconsin, in 1856 (Allen, 2017).[11] Between the late 1850s and the early 1870s, a few other German-speaking kindergarten pioneers followed Schurz to the United States, set up more kindergartens and trained instructors according to the Froebelian principles (Beatty, 1995, pp. 54–57). Teaching young children in kindergartens appealed primarily to German American communities during the early phase of the movement, which Vandewalker (1908) referred to as the period of the German kindergartens in the United States.

In the 1850s, the Froebelian concept of teaching young children also awakened the interests of American educators. The most important pioneer in American kindergarten education at that time was Elisabeth Peabody, who learned about Froebel's principles from interactions with Margarethe Schurz.[12] After being introduced to Froebel's ideas, Peabody

[9] The Prussian government lifted the kindergarten ban in 1860; other Germans states also reversed their bans thereafter (Allen, 2017, p. 45). See Bauernschuster and Falck (2015) for further insights on the early spatial diffusion of kindergartens in Germany.

[10] The Forty-Eighters became influential supporters of the anti-slavery movement in the United States before the Civil War and influenced local enlistments for the Union Army (Dippel and Heblich, 2020).

[11] Schurz's kindergarten was small-scale (only six children, including her own daughter, attended) and it closed just a few years later when the Schurz family moved away from Watertown (Beatty, 1995, pp. 53–54).

[12] Peabody met Schurz during a visit to Boston in 1859 and was intrigued by Schurz's well-behaved daughter, whose behavior Schurz attributed to kindergarten education (Beatty, 1995).

established the first English-speaking kindergarten in Boston in 1860 (Beatty, 1995). In 1867, Peabody visited a number of European model kindergartens and met a number of German Froebelians, whom she invited to visit the United States to help in setting up further kindergartens and in teaching the first generation of American kindergarten teachers (Vandewalker, 1908, p. 17; Allen, 2006). Peabody also toured the country giving lectures about kindergarten teaching. She founded and published the *Kindergarten Messenger*, which contained articles of leading kindergarten advocates at that time, and corresponded with leading educational and political figures which paved the way for the universal acceptance of kindergartens in the following decades (Beatty, 1995, pp. 56–64).

One of the prominent figures Peabody interacted with was William T. Harris, the Superintendent of Schools in St. Louis from 1868–1880 and later U.S. Commissioner of Education (1889–1906). Harris, who supervised the St. Louis public school system, was confronted with the social problems of a typical growing industrial city during the late 19th century. Children of working-class families in St. Louis often spent only three years, or fewer, in school because they started working in factories when they were as young as ten years old (Troen, 1972; Klein, 1992). Harris regarded kindergarten education as a possibility for extending the years of schooling. He hoped it would keep slum children away from just roaming the streets and teach them the virtues of American citizenship. Harris also believed that kindergarten instruction would prepare children for primary school and instill in them the skills necessary to become industrious persons later in life (St. Louis School Report, 1876, pp. 79–119; Klein, 1992; Lascarides and Hinitz, 2000, p. 201). In 1873, Harris appointed Susan E. Blow, an enthusiastic kindergarten teacher and advocate of Froebel's teaching methods, to operate in St. Louis the first public kindergarten in the United States.[13]

The establishment of a public kindergarten system in St. Louis was a major step towards the universal acceptance of kindergartens in the United States. Harris and Blow described their experiences with the kindergarten system in the St. Louis annual school reports, which were distributed nationally and read by leading educators of the country (Vandewalker, 1908, p. 34; Troen, 1972).[14] In the following years, St. Louis became a center from which the kindergarten movement spread across the country. Other school superintendents regarded St. Louis as a role model for operating and managing public kindergartens, and people trained in St. Louis introduced or supervised the work in public kindergartens that opened up in other American

[13] We refer to Section IV.A for more details about the public kindergarten movement in St. Louis.

[14] Harris continued disseminating his knowledge about kindergartens at the meetings of the National Education Association and later as a Commissioner of Education (see for example Chapter XIX of the 1896/97 report of the Commissioner of Education on the early history of the kindergarten in St. Louis, MO).

cities over the next decades.[15] The case of St. Louis demonstrated that kindergartens can be successfully integrated into the public school system (Troen, 1972; Klein, 1992, pp. 306–310; Lascarides and Hinitz, 2000, p. 245).

Although a public kindergarten system was established in St Louis, kindergartens were far from being widely accepted as an integral part of the public school system during the late 19th century (Klein 1992, pp. 305–06). During this time of rapid urbanization and industrial growth, cities and industrial towns attracted a massive number of immigrants, who crowded into downtown districts where housing was cheap and close to their workplaces. Immigrant households had higher birth rates, were culturally different, and often not accustomed to urban life. Their massive inflow accelerated the development of urban slums (Ward, 1968, 1971; Beatty, 1995, Chapter 5). A number of philanthropists and the socially concerned were alarmed by the increasing number of slum children roaming in the street, exposed to poverty, ignorance, and crime. Regarding the kindergarten as a general "child-saving agency" which served a socializing and educational function, they started sponsoring tuition-free kindergartens through charity associations (Lascarides and Hinitz, 2000, p. 249).[16]

The free-kindergarten associations became the engine of the movement during the 1880s, when kindergarten instruction was still in a rather experimental phase (Vandewalker, 1908, p. 55). During this period, kindergartens became widely recognized as an institution of the urban slum and the work of the kindergarten associations further familiarized the public with the general principles of kindergartens. Social reformers regarded kindergartens as a tool to "save" slum children from the evils of the street and instill them the virtues of citizenship (Lazereson, 1971a; Lascarides and Hinitz, 2000, pp. 249–50). By 1890, about 15,000 children were enrolled in the schools of 115 free kindergarten associations (Shapiro, 1983, p. 98). While the number of free kindergarten associations peaked just before the turn of the 20th century with over 500 associations (Report of the Commissioner of Education, 1897/98; p. 2545), free kindergartens in the 1890s started struggling to meet the public needs of kindergarten education due to lack of funding and organizational resources (Klein, 1992, Chapter 12).

Leaders of the free-kindergarten associations called for public support and successfully campaigned together with philanthropists, municipal reformers, and editors of the liberal press for public school sponsorship of kindergartens (Klein, 1992, pp. 299–305). In 1891, the National Education Association passed a resolution at their meeting for supporting and maintaining kindergartens at public expense (Vandewalker, 1908; pp. 183–208). Starting in the late 1880s,

[15] For the establishment dates of public kindergartens in several American cities during the 1880s, see Vandewalker (1908, p. 190).

[16] One such example is Pauline Agassiz Shaw, a philanthropist, who sponsored a network of kindergartens in the Boston area starting in 1877 (Beatty, 1995, pp. 73–74).

Boston and many other larger cities gradually incorporated free kindergartens into the public school system.[17] The adoption of kindergartens into the public school system shifted the focus from the social and urban reform function of free kindergartens to granting universal access to kindergarten education with a focus on the Americanization of immigrant children and a general education function of preparing children for primary school (Lazerson, 1971a; Beatty, 1995, Chapter 6; Klein, 1992, Chapter 12).

The public school adoption of kindergartens fueled the expansion of the kindergarten movement between 1890 and 1910. The number of cities with publicly sponsored kindergartens increased from 137 in 1892 to 867 in 1912. Nationwide, kindergarten enrollment rates went up from close to zero in 1880 to approximately 9% in 1912 (Report of the Commissioner of Education, 1901/02, Chapter LI; United States Bureau of Education, 1914, Tables 1–2). While enrollment rates, overall, were still low in 1912, it is worth mentioning that the kindergarten movement was an urban phenomenon with very limited coverage in the sparsely populated rural areas (e.g., Allen, 2017, p. 134; Vandewalker, 1925, pp. 16–17).[18] This is reflected in the relatively high enrollment rates in cities. By 1910, the attendance rate of 5- to 6-year-olds in cities stood at approximately 60 percent. At this time, most urban public school systems had integrated the kindergarten as a (voluntary) first class of the elementary school (Allen, 1988). Almost 90% of kindergartens were publicly funded and 85% of the enrolled children attended a public kindergarten (United States Bureau of Education, 1914, p. 5). Overall, the number of kindergartens increased from as few as 42 kindergartens with 1,252 enrolled pupils in 1873 (the first year of kindergartens reporting to the Bureau of Education) to 7,557 kindergartens with 353,546 pupils enrolled in 1912.

B. Organization and Sponsorship of Kindergartens

Kindergartens established during the early phase of the kindergarten movement were mainly tuition-based private institutions. The classes were relatively small (around 20–25 enrolled pupils) and lasted between 3–4 hours per day. Most of the kindergarten teachers closely followed Froebel's pedagogy and applied his gifts and occupations, or some modifications of them, in the classroom (Report of the Commissioner of Education, 1880, Table V). Overall, the private kindergartens mainly served an educational function, focusing on preparing children for primary school. Only privileged children from wealthy families attended private kindergartens because they could afford to pay the tuition fees, which covered the salaries of the kindergarten teachers

[17] For example, Pauline Agassiz Shaw handed fourteen free kindergartens over to the Boston school authorities in 1888 (Lascarides and Hinitz, 2000, p. 251).

[18] The Board of Education in Massachusetts argued that the kindergarten is "hardly practicable in rural communities, outside of the villages, since the children are few and widely separated" (Massachusetts Board of Education (1903), p. 94).

and the teaching equipment (Klein, 1992, Chapter 9).[19] While public instructors, such as Harris, believed that children from rich homes would benefit from kindergarten education by saving them from indulgence and family mismanagement (Troen, 1972, pp. 227–228), the private kindergartens served only a very small and exclusive segment of the society and were far from being as universal as the advocates of the kindergarten movement had hoped (Lazerson, 1971a).

The base of the kindergarten movement started to expand with the establishment of *free* kindergartens during the 1870s, which were regarded as a child saving agency.[20] Philanthropists, churches, and other charitable societies established and funded kindergarten associations which offered tuition-free kindergarten classes for the children of the poor. The associations sponsored the salary of kindergartners, rented classrooms and paid for teaching material. Similar to private kindergartens, classes were offered from Monday–Friday for some 3–4 hours a day (Berg, 2004), but the class size in free kindergartens, at about 50 pupils, was about twice as large (Report of the Commissioner of Education, 1886–87, Table 29). Social reformers regarded free kindergartens as a remedy for the social problems in cities associated with industrialization and immigration (Beatty 1995, Chapter 5). Created as an institution of the urban slum, the free kindergarten served not only an educational purpose, but it also fulfilled a social function by saving slum children from the dangers of the street, providing food and clothing, and teaching them morals and values to prevent delinquency (Lazerson, 1971b; Klein, 1992, Chapter 10).

One important innovation of the kindergarten associations was the additional provision of community services, such as home visits and the teaching of cleanliness and discipline to children (Shapiro, 1983). Teachers of free kindergartens reached out to the deprived homes of their pupils, explaining to mothers how to engage with their offspring using the games and songs learned in class (Lazerson, 1971b, p. 122). These home visits catered to the needs of the children and their families and included "lectures" about hygiene, nutrition, and child rearing (Ross 1976, p. 29). Kindergarten associations also offered mothers' meetings in which they communicated the importance of motherhood to the working-class mothers (Shapiro, 1983, p. 101). The home visits and mothers' meetings were regarded as an impetus of the urban reform movement towards the end of 19th century and popularized the kindergarten as a child-saving institution in the slum districts of cities. The work of the kindergarten associations broadened the base of the kindergarten movement, changing the former perception of kindergartens as an exclusive institution for the cultured and affluent, and ultimately leading to the integration of kindergartens

[19] For example, the average annual tuition fee to attend a private kindergarten in 1886/87 was 40 US dollars corresponding to approximately 1,120 US dollars in 2019 (Report of the Commissioner of Education, 1886–87; Table 29; https://www.measuringworth.com/calculators/uscompare/relativevalue.php).

[20] The Centennial Exposition in Philadelphia (1876), where a model kindergarten with orphan children was set up in the Women's Pavilion of the exposition, marked an important event in popularizing the kindergarten as an early-childhood education institution for the poor (Vandewalker, 1908, pp. 18–19).

into the public-school system (Vandewalker, 1908, Chapter V; Shapiro, 1983; Klein 1992, Chapter 10; Lascarides and Hinitz, 2000, pp. 249–50; Berg, 2004).

Public schools were the third primary sponsor of kindergartens in the United States at this time. Public school sponsorship of kindergartens started to emerge in the 1880s (with the exception of St. Louis) and, accompanied by the integration of free kindergartens into the public school system, expanded rapidly across American cities over the next two decades (Shapiro, 1983). While both private and free kindergartens served a specific segment of the society, public school sponsorship contributed to the universal provision of kindergarten education. Compared to the multiple functions of free kindergartens, public school administrators saw the kindergarten's focus on the child in school. A report of the United States Bureau of Education (1914, p. 10) describes the mission of the public kindergarten "[…] as a mediating element, in which it is sought to provide for the children of the people the best kind of nurturing and scientific care, to give them the best kind of physical, mental, social, and spiritual training" which aimed at preparing children for primary school. For children of immigrant households, the public kindergarten served also a socialization function. Public educators regarded the kindergarten as an important instrument to Americanize children of non-English-speaking families, who arrived in large numbers in American cities at the turn of the 20th century. Classroom activities included singing English songs, reading English stories, learning American cultural customs, and the teaching of English, which all aimed to accustom immigrant children to the "American" way of life (Klein, 1992, Chapter, 12; Berg, 2004; Allen, 2017, p. 111).

According to Foos (1909), public kindergartens usually offered one session during weekday mornings, in which one or two teachers instructed, on average, 25 children per room for about three hours. Typically, the public kindergartens were funded through regular and local school funds; few states allowed school districts/county boards to charge extra taxes to cover the additional costs of maintaining a kindergarten (Schofield, 1916). While the public school system contributed to broadening the access to kindergarten education, attendance was not compulsory and enrollment rates in rural areas were rather low. The relatively high maintenance costs of kindergartens were one main reason why the spread of public kindergartens occurred gradually and coverage was not universal.[21] For example, Lazerson (1971b, p. 130) documents that cities in Massachusetts faced increasing costs per pupil in kindergartens between 1890 and 1910, which even exceeded the expenditures per pupil in primary school.[22] Reasons for the relatively high costs per pupil in kindergartens was a low teacher-to-child ratio and the specific materials and

[21] Another reason was that some state laws did not permit the allocation of school funds to children below legal school age (Vandewalker, 1908, pp. 187–88).

[22] In the school year 1901–02, total costs for kindergartens in Massachusetts accounted for about two percent of the total expenditure for all school purposes (Massachusetts, Board of Education, 1903).

toys required for instruction (Klein 1992, Chapter 12). As a response to the increasing cost pressure, many city school systems introduced double sessions: one session in the morning and another in the afternoon, usually with a different group of children. Double sessions allowed kindergartens to adjust to capacity problems because more children could be enrolled without having larger classes. Since public school kindergarten instructors were often required to teach in both sessions, there was less time left for home visits (Palmer, 1915).[23]

One important social function that the free kindergarten associations provided was institutionalized and evolved into the Parents and Teachers Association: the mothers' meetings (Klein 1992, p. 318). At these meetings, mothers learned about the significance of early childhood education; received information about child-rearing and home economics; and were familiarized with songs, stories, and materials used in class (Fisher, 1905, p. 703; Berg, 2004). Overall, public kindergartens turned their focus away from the child in the slum home and towards the slum child in school; this was considered a far easier and cheaper way of educating the urban poor (Lazerson 1971b, p. 137). The preparation for first grade and the social integration of children from poor and immigrant families became the primary goals of public kindergarten education, while the social service function that popularized the work of kindergarten associations diminished in importance over time (Ross, 1976; Shapiro, 1983; Klein, 1992, Chapter 12).

While all kindergarten sponsors pursued different goals and served different segments of the society (i.e., private kindergartens served children of the wealthy; free kindergartens cared for the urban poor; and public kindergartens aimed for universal coverage with a specific focus on the social integration of children, especially from immigrant households), the kindergarten curriculum seemed to have largely followed Froebel's teaching methods. For example, the director of public kindergartens in Boston, Laura Fisher, describes the daily program as rather similar in many kindergartens, consisting of gifts and occupations, circle games, free play, songs, and talks (Fisher, 1905, p. 718). Davis (1925) analyzed the teaching schedules of 137 kindergartens across 34 states and found that kindergarten teachers devoted 33 percent of their time in sessions to work with materials, 36 percent to physical education (such as games and plays), 9 percent to language, 6 percent to music, and 16 percent to general assemblies. Two immediate questions are how beneficial kindergartens were for participating children and how their emergence affected family planning. We turn to those questions in the next section.

[23] Kindergarten teachers often opposed the introduction of double sessions because of the negative impact on teaching quality and the provision of community services outside the classroom, such as home visits (Palmer, 1915, pp. 21–36).

C. The Socioeconomic Effects of Kindergarten Education

One mechanism that can explain the observed fertility decline associated with the roll-out of kindergartens is that kindergarten attendance increased the return to education. This would induce parents to invest more in the education ("quality") of their children thus triggering a quantity-quality trade-off. In this subsection, we provide anecdotal evidence that supports our theoretical prediction and empirical evidence, outlined in Section IV.C, that complementarities between preschool education and schooling existed.

Towards the end of the 19th century, American educators generally acknowledged the importance of education in the child's first years of life. Kindergarten advocates argued that kindergarten education was important for the child's development of the practical, cognitive, and social skills which helped the young child in preparing for primary school but also for the work life as an adult (Lazerson, 1971b, pp. 117–18; Berg, 2004; Allen, 2017).[24] To offer children from immigrant families a fair start, free and public kindergarten teachers also considered the socialization function of the kindergarten, in particular teaching use of the English language, as a key aspect of their work (Berg, 2004, pp. 150–55; Abbot, 1923; Waite, 1926). Exposing the children to the English language at such an early age would prepare them better for later schoolwork.[25] For example, a primary teacher from Norfolk (VA) noticed that children with a foreign background who had kindergarten training had a much better command of English and responded more quickly to all the demands of the schoolroom than other children (United States Bureau of Education, 1914, p. 96).

More generally, several surveys documented contemporaneous observations from primary school teachers and superintendents about the beneficial effects of kindergarten training. Holden's (1905) survey on the effects of kindergarten training for primary school revealed that teachers regarded kindergarten training as good preparation for school studies. An inquiry from the U.S. Commissioner of Education sent to supervisors of schools, primary supervisors, and first-grade teachers in 127 cities revealed overwhelmingly positive sentiments towards kindergarten training (United States Bureau of Education, 1914, p. 93). For example, the response of J. V. Brennan, a school superintendent from Ironwood (MI), illustrates the beneficial effects of public kindergarten education in a city with a large immigrant community:

> This community consists of many nationalities and the people are practically all workers in the iron mines or about the iron mines. Families are usually large and the kindergarten here is a second home to the majority of the children. It is a place for

[24] For example, kindergarten teachers made visits with their classes to tradesmen or discussed industrial occupations or the traditional work of farmers, bakers or carpenters in class (Berg, 2004, pp. 118–19).

[25] Waite (1926, p. 37) highlighted in her summary of several surveys about kindergarten training in city schools that the inability of using the English language is a serious cause of slowing later schoolwork.

> the children to live as well as to learn. Very many of the children learn to speak the English language in the kindergarten. The kindergarten gives these children a right attitude toward schools and schoolwork. In fact, without the kindergarten as an adjunct to the home, school progress here would be considerably retarded. The children who enter the grades from the kindergarten do much better work, as an average, than those who do not get this training. (pp. 98–99)

Nellie Walton Ford, a primary teacher in St. Paul (MN), compared children with and without kindergarten education and found that

> […] children who come into the first-grade classes from the kindergarten possess greater self-control, are more mature, less timid, pay better attention, take commands more intelligently, do better handwork, and have a larger vocabulary. The last is especially true of foreigners. (p. 112)

These observations also resonate with Palmer's (1915) survey, which contains responses from superintendents, principals, and primary teachers on whether children attending kindergartens are better prepared for school. One of the most common observations was that children with kindergarten training have better soft skills, such as the powers of observation, concentration and attention; are more fluent in language; and are better to work with others. Overall, the historical narrative suggests that the kindergarten training offered in many American cities at the turn of the 20th century increased the return to schooling.

While higher return to schooling for kindergarten children induced parents to invest more in child quality, the kindergarten movement also directly affected family planning through frequent interactions between kindergarten teachers and mothers. Home visits and mothers' meetings were intended to enlighten immigrant mothers about general child-rearing principles, the value of kindergarten education, and home economics. Home visits allowed kindergarten teachers to socialize with families from the urban slums and the mothers' meetings aimed to elevate the social status of mothers (Klein, 1992; Beatty, 1995; Berg, 2004). The Bureau of Education Kindergarten Circular emphasized the importance of these services as being "[…] instrumental in helping foreign mothers to understand and appreciate the customs and standards of the new country"(Kindergarten Circular, 1918, p. 1) and stated that "the kindergarten teacher can render service to the immigrant mother in helping her plan for the education of her children, in showing the advantages of keeping the children in school regularly, and of having them continue their studies, in keeping her informed on the kinds of employment available for her children" (Kindergarten Circular, 1919, p. 5*)*. One positive side effect of the home visits and mothers' meetings is that they might have improved the English proficiency of immigrant mothers. In Section IV.D, we test whether such spillover effects existed.

Overall, the historical narrative suggests that the interaction between kindergarten teachers and mothers was a crucial element of the kindergarten pedagogy. It implies that the kindergarten treatment, besides the 3 to 4 hours per day in the classroom, also involved the kindergarten teachers' work with the mothers of enrolled children. Kindergarten teachers provided mothers with information about child-rearing practices and conveyed the value of early childhood education and schooling which presumably affected mothers' perception about the return to schooling and the costs of raising children. Hence, the kindergarten movement also affected households' budget constraints by altering the time costs of raising children (Galor, 2011). In Section IV, we show that households adjusted fertility broadly consistent with the prediction of a quantity-quality model of fertility.

One might wonder whether the establishment of kindergartens provided incentives for families to have more children. This seems unlikely. Even if free kindergartens did not charge a tuition fee and public schools financed the kindergarten mainly via local school funds, it does not imply that kindergarten attendance for poor households was costless. Kindergarten enrollment increased childrearing costs, such as expenditures for proper clothes, shoes, and hygiene; it meant foregoing household income from child labor if the child stayed in the school system; and busy mothers needed to spend extra time with the kindergarten teacher (e.g., Lazerson, 1971b; Berg, 2004; Allen, 2017). It is also important to note that if strong complementarities between kindergarten education and schooling exist, households will reduce fertility even if the unit cost of preschool investment per child declines (see Section IV.C for more details).

The roll-out of kindergartens could have also stimulated female labor force participation (e.g., Cascio, 2009b). There is historical evidence of a few businesses, such as the National Cash Register Company (Dayton, OH), the Colorado Fuel and Iron company (Pueblo, CO), and a handful of southern cotton mill owners, providing company kindergartens for their workforce (Vandewalker 1908, pp. 112–24). More generally, the time children spent in the classroom could have freed up the maternal labor supply (albeit the historical narrative suggests that mothers simply left children unattended in the streets while being at work). Indeed, we find that the roll-out of kindergartens contributed to a sizable increase in maternal labor supply. While the increase in maternal labor supply could explain some of the fertility decline during our sample period (Galor and Weil, 1996), we show that it was not the primary driving force (Appendix Table 4).

III. Data

Our goal is to evaluate how the roll-out of the first kindergartens in American cities affected households in different dimensions. We began by digitizing a series of official education reports that contained detailed information about kindergartens. For our case study, we drew on annual

reports of the St. Louis public school board for the years 1873 to 1886. These reports contain, among other things, enrollment numbers and the exact location and opening date of every public kindergarten in the city. We geo-referenced the locations of the kindergartens operating between 1873 and 1886.[26]

Our city-level analysis is based on newly digitized kindergarten records collected by the U.S. Commissioner of Education for the years 1874, 1880, 1886/87, 1890/91, and annually from 1895/1896 to 1909/1910.[27] Data for 1912 were retrieved from Bulletin No. 6 of the United States Bureau of Education in 1914. While the reports before 1890 listed detailed information per kindergarten and their corresponding sponsor (associations, public or private kindergartens), the later reports usually contain only information about the total number of public kindergartens, teachers, and pupils in cities with more than 4,000 inhabitants. Exceptions are the reports for the years 1886/87, 1890/91, 1897/98, 1901/02, and 1912, which contain detailed data about the location and number of free kindergartens operated by charity organizations. The location of private kindergartens at the city level was only reported in detail before 1890 and in 1912. The reports for the years 1874 (all), 1880 (all), 1886/1887 (all), 1890–91 (associations and public), and 1912 (public) also contain information about the year of the first establishment of a kindergarten in a city.[28] We used the available information to construct a city-level kindergarten panel dataset covering the years 1874–1880 and 1887–1912.

The second main data source is the Integrated Public Use Microdata Series (IPUMS), which provides a digitized collection of historical complete-count U.S. Census records (Ruggles et al., 2020). These data contain detailed information on socioeconomic characteristics at the individual and household level, such as age, measures of fertility, marital status, place of residence, state or country of birth, labor force status, occupation, literacy, and school attendance. Our main sample consists of repeated cross-sections of about 8.5 million 18- to 44-year-old white women, who are listed as household head or spouse in the Census and resided in American cities during the period 1880–1910.[29] We also used the complete-count Census data to study the outcomes of children that likely attended a kindergarten. Other secondary datasets are introduced in the relevant sections of the empirical analysis below. We merged the individual-level data with the city-level kindergarten panel data, based on year and location. IPUMS provides a city identifier (CITY) which is comparable across Census years. One drawback of using the

[26] We thank Adele Heagney from the St. Louis Public Library for helping us with identifying the exact locations of the St. Louis kindergartens.

[27] The reports of the Commissioner of Education do not contain detailed kindergarten statistics between 1887 and 1890 and between 1892 and 1895.

[28] The information in parentheses indicate for which kindergarten sponsor the establishment date was available.

[29] The year 1890 is omitted from the analysis since the census records were lost in a fire.

information about city residence from IPUMS is that not all cities are identified across all years; as a result, we ended up with 220 cities in 1880 and around 600 cities in 1900 and 1910.

Appendix Table 1 reports the summary statistics. In our sample, the number of own children under age 5 in the household (which is our main dependent variable) decreased by about 23 percent from 0.79 in 1880 to 0.61 in 1910. While up to 15 percent of the U.S. population was foreign-born at the turn of the 20th century, the average share of foreign-born in our sample is 25 percent, reflecting the fact that immigration at this time was mainly an urban phenomenon (Ward, 1971). Moreover, an increasing number of 5- to 6-year-old children in the sampled cities attended school between 1900 and 1910 (the attendance rate was 0.29 in 1900 compared to 0.59 in 1910).[30]

IV. The Effect of Kindergartens on the American Family

A. The Kindergarten Movement in St. Louis -- A Quasi-Natural Experiment

Our empirical analysis begins with a case study that evaluates the roll-out of the first publicly sponsored kindergartens in the United States: the kindergarten "experiment" in the St. Louis public school system. American educators became increasingly concerned about the virtues of children growing up in the slums of large cities such as St. Louis, one of the main commercial and industrial centers in the American Midwest during the late 19th century. In the late 1860s, a survey of St. Louis' neighborhoods revealed that children of the levee and factory districts attended school for no more than three years (Troen, 1972; Lascarides and Hinitz, 2000). The initiator of this survey, William T. Harris, school superintendent in St. Louis (1868–1880) and later U.S. Commissioner of Education (1889–1906), was alarmed about these children's short school life and suggested that the Board of Education introduce the Froebelian kindergarten concept as a solution to this problem. He believed that kindergarten education could facilitate entry into the public school system, increase the years of schooling, and avoid the early transition to child labor. Kindergarten education, Harris argued, would remove slum children from the street, build the character of these children, and train them in the necessary skills to become industrious persons later in life (St. Louis School Report, 1876, pp. 79–119; Klein, 1992).

In September 1873, Susan E. Blow, an enthusiastic kindergarten teacher and advocate of Froebel's teaching methods, opened the first American public kindergarten, with Harris's support, in the Des Peres School, which was located in the outskirts of St. Louis. This kindergarten started as an experiment to study "the practical effects of Froebel's system" (St. Louis School Report, 1874, p. 195). After the experience was deemed successful "beyond

[30] For 1900, we constructed school attendance based on the IPUMS variable "SCHLMNTH." For 1910, we used the IPUMS variable "SCHOOL". The complete-count data in 1880 contain no information on school attendance.

expectations", in the next year "it was resolved to try the experiment in two schools near the centre of the town" (St. Louis School Report 1875, p. 95). By 1875, kindergarten education was already offered in seven schools with about 450 pupils regularly attending (St. Louis School Report 1875, p. 98).[31] Impressed by the pupils' progress, the school Board ended the experimental stage of the kindergartens in 1878 and integrated them permanently into the public school system (Troen, 1972). Consequently, enrollment increased from 68 pupils in 1873 to 7,828 children in 1880 (St. Louis School Report 1880, pp. 152–53). At that time, most schools were already involved in kindergarten work; by 1886 about 50 kindergartens operated within the city borders of St. Louis (Troen, 1972; Lascarides and Hinitz, 2000).

The public kindergarten movement in St. Louis provides an interesting case in point to study the effect that kindergarten exposure had on fertility. The annual reports of the Board of public schools in St. Louis documented in detail the roll-out of kindergartens since 1873. These reports contain for every kindergarten in operation, the number of teachers, the number of enrolled children, and in the appendix of some reports the location of the kindergarten. We assigned each kindergarten listed in the reports to its corresponding enumeration district in the 1880 Census.[32] The kindergarten statistics were then compiled at the enumeration district level and merged with the complete count U.S. Census data in 1880 provided by IPUMS. The Census data contain the exact location of households in St. Louis together with other important information on socioeconomic characteristics at the individual and household level, such as age, sex, enumeration district, occupation, birthplace, and the number of children. Figure 1 depicts the location of the public kindergartens by 1886 together with geo-referenced households and enumeration districts in St. Louis as reported in the 1880 Census.

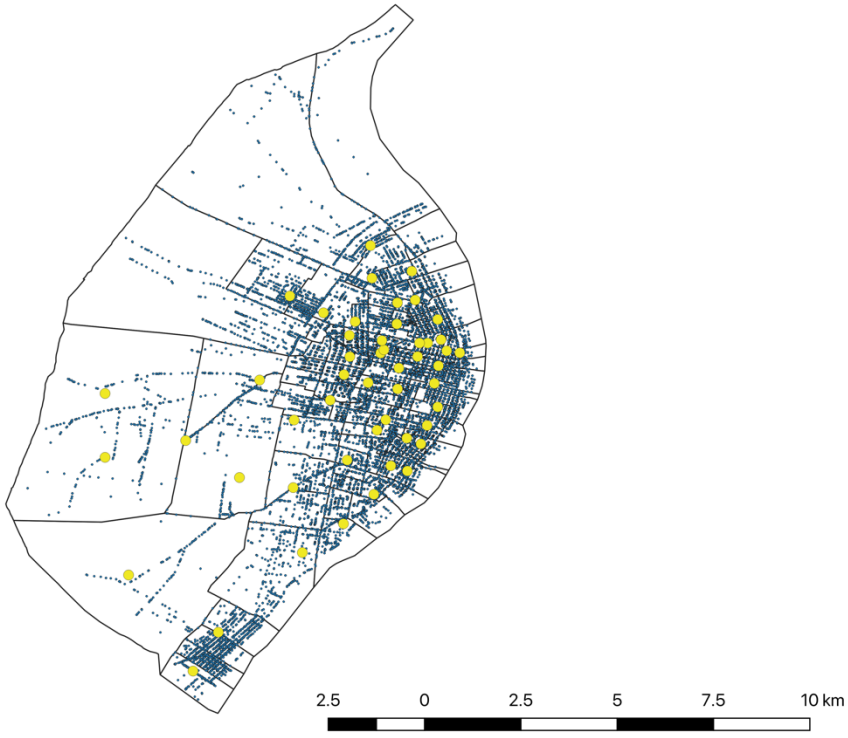
The sample consists of every 18- to 44-year-old white woman listed as a household head or spouse who resided in a given enumeration district in St. Louis in 1880. By listing every child in a household together with the household head (and spouse), the structure of the U.S. Census allowed us to reconstruct the detailed fertility history of every woman in the sample. Since the Census reports the age for every enumerated person, it is straightforward to calculate the respective birth year of every child listed together with their mother in a household and to compile a quasi "mother panel".[33] We limited the analysis to children of age 15 or younger in 1880 to avoid potential issues associated with children leaving their parents' household. Our goal, then, was to obtain the cumulative fertility history by calculating the number of children before

[31] In order to finance the expansion of the kindergarten system, a quarterly fee of one dollar was charged, except from the indigent, starting in the school year of 1876–77; charges were dropped again in 1878 (Troen, 1972).
[32] We used the website https://stevemorse.org/census/unified.html?year=1880 of Steven Morse and Joel Weintraub to assign the location of every kindergarten to its corresponding enumeration district. Note that a kindergarten can border with multiple enumeration districts depending on the exact location of the kindergarten; see also Figure 1.
[33] We only consider own children in the household. These are indicated in IPUMS by the variable RELATE == 3.

1870 and subsequently adding the births between 1870 and 1880 for every woman in the sample.[34] Consequently, the "mother panel" spans the period from 1870 to 1880 varying by woman and year. We further required women to be at least 18 years old at the time when they were having a child.

For the cross-sectional analysis, we used the number of children below age 5 (NCHLT5) from IPUMS in 1880 as the outcome variable when analyzing the effect of kindergarten exposure on fertility. The number of children below age 5 has been frequently used in the economic history and demography literature as a measure of fertility (e.g., Bleakley and Lange, 2009; Wanamaker, 2012; Ager et al., 2020).

Figure 1: Location of Public Kindergartens and Households in St. Louis 1880



Notes: This map displays households together with the 1880 enumeration districts of St. Louis (see the Urban Transition Historical GIS project at https://s4.ad.brown.edu/Projects/UTP2/ncities.htm for further details). The kindergarten locations in 1886 (yellow dots) are based on the historical map of St. Louis in 1882 (https://collections.leventhalmap.org).

We first present a balancing test that shows whether there are any substantial mean differences in observable characteristics of interest for women in the sample by treatment status, i.e., if a woman's enumeration district had a kindergarten in 1880. The mean values presented in Table 1 reveal that women in enumeration districts with and without a kindergarten in 1880 were of

[34] We calculated the existing number of children before 1870 by subtracting the total number of births between 1870 and 1880 from the number of own children (NCHILD) a woman reported in the 1880 Census. Children-mother pairs are identified using the variable MOMLOC. See the variable descriptions from IPUMS for further details.

similar age and foreign background. Women in enumeration districts with a kindergarten were somewhat less likely to work but were more likely to be German immigrants. Their husbands had a somewhat higher occupational income score, were more likely to be foreign-born, but less likely to work in blue-collar skilled occupations or as day laborers.[35] It is therefore important to account for these baseline differences by including individual fixed effects in the empirical analysis below.

Table 1: Balancing Test

		No Kindergarten in 1880		*Has Kindergarten in 1880*	*t-test*
VARIABLES	N	Mean/SE	N	Mean/SE	Difference
Mother Characteristics					
Age	24946	31.88	13206	31.80	0.080
		[0.043]		[0.050]	
==1 if in labor force	24946	0.042	13206	0.037	0.004**
		[0.001]		[0.002]	
==1 if foreign-born	24946	0.521	13206	0.525	-0.004
		[0.003]		[0.004]	
==1 if German	24946	0.271	13206	0.297	-0.026***
		[0.003]		[0.004]	
Father Characteristics					
Ln(Occupation Score)	24946	2.988	13206	3.026	-0.039***
		[0.007]		[0.009]	
==1 if white-collar	24946	0.264	13206	0.287	-0.023***
		[0.004]		[0.004]	
==1 if skilled blue-collar	24946	0.247	13206	0.226	0.021***
		[0.003]		[0.004]	
==1 if day laborer	24946	0.138	13206	0.120	0.018***
		[0.002]		[0.003]	
==1 if foreign-born	24946	0.603	13206	0.614	-0.011**
		[0.003]		[0.004]	

Notes: The values displayed for *t*-tests are the differences in means across the groups. Standard errors are reported in brackets. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

According to the prediction of a standard quantity-quality framework of fertility (e.g., Galor 2005, 2011), one would expect that access to kindergarten education, by increasing both the return to education and the direct costs of having children (e.g., by higher child-rearing cost and reduced household income from child labor), should incentivize parents to reduce the optimal number of children. We tested this prediction using a difference-in-differences setting, which exploits the fact that kindergartens opened their doors in different enumeration districts at different points in time. One potential threat to identification would be if the fertility pattern of mothers in treated enumeration districts would have already evolved differently before the

[35] The definition of white-collar occupations and blue-collar skilled occupations follows Katz and Margo (2014) and is based on the OCC1950 variable from IPUMS.

establishment of kindergartens. Since we know the exact establishment date of every kindergarten in the sample, we conducted an event study to observe the dynamic effects of kindergarten exposure on fertility and, at the same time, to test whether the coefficient of interest showed any sign of existing pre-trends.

More formally, we used the following estimation equation to evaluate the dynamic effects of kindergarten exposure on fertility:

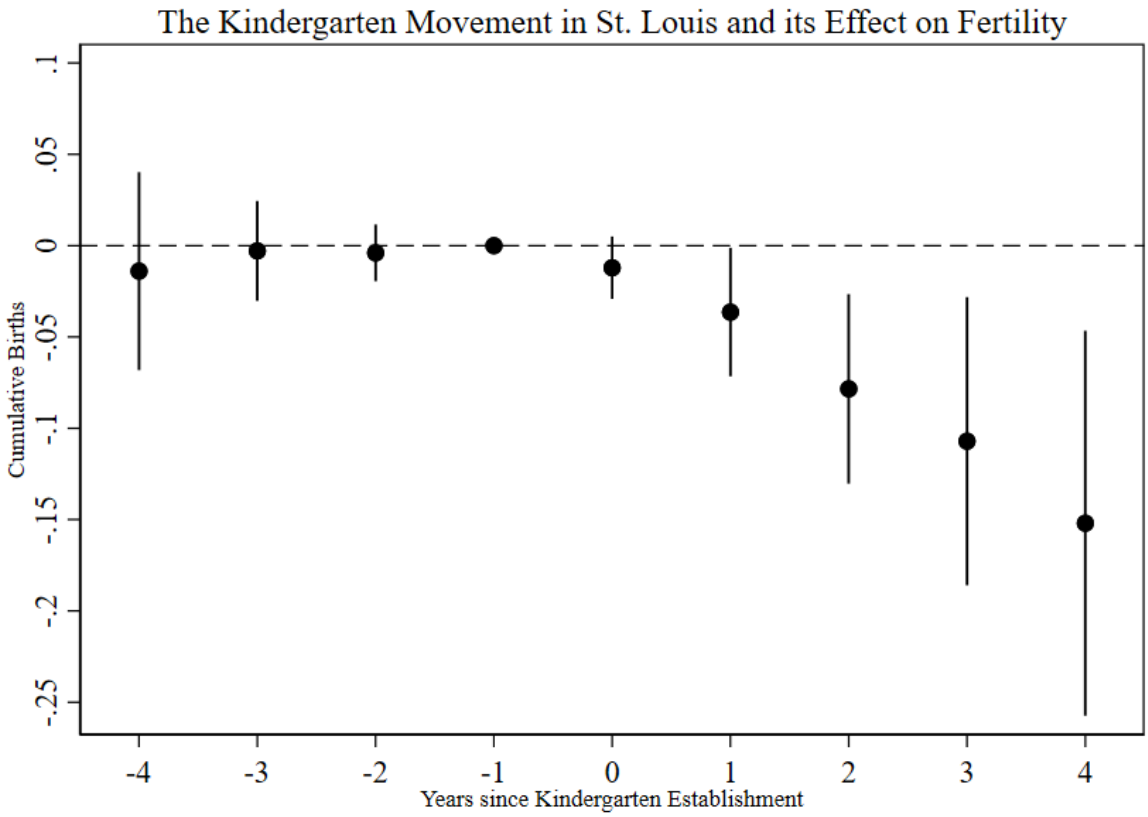
$$y_{iet} = \alpha_i + \alpha_t + \sum_{j \in T} \beta_j \, Kindergarten_{et}^{\tau+j} + \Gamma X_{iet} + \epsilon_{iet} \qquad (1),$$

where $T = \{-4, ..., -2, 0, ..., 4\}$. We omit $j = -1$ (the base year) such that the post-treatment effects are relative to the year before the kindergarten was established in a given enumeration district *e*. The outcome variable, y_{iet}, denotes the cumulative number of births of a woman residing in enumeration district *e* in a given year *t*. The parameter τ refers to the year in which the kindergarten opened its doors in enumeration district *e*. $Kindergarten_{et}^{\tau+j}$ is an indicator equal to 1 when $t = \tau + j$ and 0 otherwise. In order to capture the fertility response four and more years prior (after) the kindergarten opening, we define an indicator $Kindergarten_{et}^{\tau-4} = 1$ if $t \leq \tau - 4$ ($Kindergarten_{et}^{\tau+4} = 1$ if $t \geq \tau + 4$) and 0 otherwise. The estimated coefficients β_j trace out the effect of kindergartens on fertility, relative to the omitted category (the year before the kindergarten opening). The set of controls, X_{iet}, contains fixed effects for women's age and the years since an enumeration district had access to a district school. We further control for individual fixed effects, α_i, which account for unobserved time invariant heterogeneity across women, such as cultural traits or preferences for child quality which are slow moving over time, and year fixed effects, α_t, which account for year-specific macroeconomic shocks common to all women in the sample. Standard errors are Huber robust and clustered at the enumeration district level.

The event study is depicted in Figure 2 and the corresponding estimates are reported in Appendix Table 2. We found that for all j < 0, $\beta_j \approx 0$, which supports the identifying assumption of common pre-trends. For the periods after the event, the estimated coefficients become negative and statistically significant. From Figure 2, it is also apparent that the fertility decline occurred gradually, which seems reasonable as it takes some time until mothers fully internalize the benefits of kindergarten education for their children. We obtained similar results if we considered proximity to the closest kindergarten instead of the enumeration district as the treatment criterion. Appendix Figure 2 shows that the negative effect on fertility is driven by households that were living in close proximity (less than 250 meters away) to the kindergarten

compared to households living up to 1 kilometer away from the kindergarten.[36] This result suggests that exposure is closely connected to households' proximity to kindergartens.

Figure 2: Event Study



Notes: This figure shows the dynamic effects of the kindergarten roll-out on fertility in St. Louis. The x-axis measures the number of years since the kindergarten opened in an enumeration district *e*. The dots depict the estimated coefficients of kindergarten exposure on fertility relative to the base year (i.e., the year before the opening). The solid lines indicate 95% confidence intervals.

We present further evidence that uses the number of own children under age 5 as the outcome variable. Using this fertility measure, we needed to rely on the cross-sectional variation in kindergarten exposure across St. Louis' enumeration districts in 1880. This measure of kindergarten exposure captures the kindergarten capacity based on enrollment rates in the previous five years (1875–1879) which is calculated as:

$$Kindergarten\ Exposure_e = \frac{1}{5}\sum_{k=1}^{K=5} \frac{Enrollment_{e,t-k}}{Children\ Age\ 5\ to\ 6_{e,t-k}} \qquad (2).$$

The enrollment numbers in the St. Louis kindergartens for the previous 5 years was retrieved from the annual reports of the public school Board and the target population (children aged 5–6)

[36] The map in Appendix Figure 1 provides an illustration of the identification strategy based on households' distance to the kindergarten.

was obtained retrospectively by using information on the age of every individual in the 1880 complete count data from the U.S. Census. For a given enumeration district, *e*, kindergarten exposure reflects for a woman of childbearing age the expanded opportunity of sending a child to a kindergarten at the time when she conceived a child.[37] For the 1880 cross-section of 18- to 44-year-old white women, we estimate:

$$y_{ie} = \alpha + \beta Kindergarten\ Exposure_e + \Gamma X_i + \epsilon_{ie} \quad (3),$$

where the set of controls, X_i, include fixed effects for age and birthplace, years since the enumeration district had access to a district school, a dummy whether a woman was working, and control variables for husband's income (occupational income score), occupation status, and his nativity status, as shown in Table 1.

The results reported in Table 2 are based on a least squares regression of equation (3). Column (1) shows that there is a statistically significant negative association between kindergarten exposure and fertility. Quantitatively, the effect is modest, as a unit change in kindergarten exposure leads to a fertility decline of -0.031 which is about 3.5 percent of the sample mean. Columns (2)–(5) show that the fertility decline is larger for immigrant households and households where the main breadwinner pursued an unskilled occupation. This finding is consistent with the notion that the return to kindergarten education was larger for children from disadvantaged households.

Table 2
The St. Louis Kindergartens and Fertility -- Evidence from the 1880 Full Count Data

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable: Number of Children below age 5				
VARIABLES	Full Sample	Skilled	Unskilled	U.S. Born	Foreign-Born
Kindergarten Exposure	-0.031***	-0.031***	-0.049***	-0.019	-0.032**
	(0.010)	(0.011)	(0.018)	(0.012)	(0.014)
Observations	38,139	19,872	14,609	11,217	16,146
R-squared	0.144	0.111	0.103	0.131	0.110

Notes: This table shows the impact of kindergarten exposure on fertility. The dependent variable is the number of own children in the household under age 5. The variable of interest, kindergarten exposure, is calculated as described in equation (2). All specifications include fixed effects for age and birthplace, controls for the years since the enumeration district had a district school, husband's income (occupation score), occupation status (omitted in columns 2 and 3), nativity status (omitted in columns 4 and 5), and whether the woman was working. Robust standard errors are clustered at the enumeration district level in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

[37] Aaronson et al. (2014) use a similar concept to capture how the expanded schooling opportunities due to the establishment of Rosenwald schools affected the fertility of women of childbearing age.

Finally, Appendix Figure 3 presents a permutation test based on 1,000 replications of the specification presented in column (1) of Table 2. The treatment unit is randomly reshuffled for enumeration districts with kindergartens (Panel A) and for all enumeration districts (Panel B). Reassuringly, both estimates are located in the far-left tail of the distribution and are highly statistically significant.

B. The Kindergarten Movement in American Cities Between 1880–1910

This subsection provides external validity to the previous results that kindergarten exposure led to a decline in household fertility in American cities during the late 19th and early 20th centuries. We started the empirical analysis in 1880, the decade referring to the onset of the kindergarten movement, and we terminated the analysis in 1910 before the disturbances associated with the outbreak of World War I and the takeoff of the high school movement occurred (Goldin and Katz, 2008). The main sample consists of repeated cross-sections of every 18- to 44-year-old white woman listed as household head or spouse in a given city *c* for the census years 1880, 1900 and 1910. The main specification resembles equation (3), but we additionally exploit temporal and spatial variation across cities in the intensity of kindergarten exposure.

The econometric model follows a difference-in-difference strategy which we outline by the following equation:

$$y_{ict} = \alpha_c + \alpha_t + \beta Kindergarten\ Exposure_{ct} + \Gamma X_{ict} + \epsilon_{ict} \qquad (4).$$

The main outcome variable, y_{ict}, is a woman's number of own children under age 5 (NCHLT5). Our measure of interest, *Kindergarten Exposure*, is calculated context specific. For the main specification, we construct kindergarten exposure as:

$$Kindergarten\ Exposure_{ct} = \frac{1}{5}\sum_{k=1}^{K=5} \frac{Kindergarten\ Capacity_{c,t-k}}{Children\ Age\ 5\ to\ 6_{c,t-k}} \qquad (5).$$

For a given city *c* and census year *t*, this measure reflects for a woman of childbearing age the expanded opportunity for sending a child to a kindergarten at the time when she conceived a child. *Kindergarten Capacity* denotes the average number of kindergartens in a given city over the five previous years before the Census enumeration occurred multiplied with the average enrollment number of kindergarten pupils.[38] The capacity is normalized by the target population

[38] For the 1900 and 1910 censuses, we used 50 pupils as the average capacity for public kindergartens and associations and 25 pupils for private kindergartens, reflecting their smaller scale. These numbers are based on the

(children aged 5–6) for the five years preceding the Census. The target population was obtained retrospectively based on the age of the children at the time of the Census year. Modifications of kindergarten exposure are introduced in the empirical analysis below. All regressions include fixed effects for city, α_c, and year, α_t. In general, we exploit city-by-year variation in kindergarten exposure. However, in some specifications, we were able to exploit also variation *within cities* which allowed us to control for city-by-year fixed effects. Our standard set of control variables, X_{ict}, include fixed effects for birthplace and age.

a. Kindergarten Attendance

We started the empirical analysis by checking whether our kindergarten exposure measure, as defined in equation (5), is related to actual attendance of kindergarten-age children. One would expect that kindergarten exposure is positively correlated with the probability of kindergarten-age children attending kindergarten ("attending school").

The regression analysis is based on estimating equation (4) and our estimation method is least squares. The dependent variable is a dummy variable whether a white child attends school. As already mentioned in the data section (see footnote 29), data limitations restrict the analysis for school attendance to the census years 1900 and 1910. Besides the standard set of controls, the specifications further contain a dummy for gender and the following information about the children's parents: the occupational income scores (in logs) of the father and mother,[39] fixed effects for mother's and father's birthplace, and a dummy variable for the literacy status of each parent.

Table 3 presents the estimates of the association between kindergarten exposure and school attendance of white children aged 5 to 6, who, also according to the official school reports, are considered the main target of kindergartens in our analysis. The baseline estimate presented in column (1) shows that there is a strong positive association between kindergarten exposure and the likelihood of a 5- to 6-year-old attending kindergarten. The estimated coefficient on kindergarten exposure is slightly larger for boys than girls, but the difference is quantitatively small (columns (2)–(3)). Columns (4)–(7) present separate results for children aged 4 to 7. It turns out that the association between kindergarten exposure and actual attendance is the strongest for children aged 5 and 6, our main target group.

Overall, these results show a statistically significant and positive association between the average kindergarten capacity in the five years before the census enumeration and actual

average enrollment rates over the period 1887 to 1912 by kindergarten type. For the 1880 census, we used 30 pupils as the average capacity based on the reports from 1874 and 1880.

[39] Since the census did not collect individual income/wage data before 1940, we proxy husbands' income by the occupational income score variable OCCSCORE from IPUMS. The occupational income score has been used in the literature as an approximation for income over longer periods of time (e.g., Jones and Tertilt, 2008).

kindergarten attendance. Having a higher kindergarten capacity in a city at the time when a woman conceives a child therefore implies that there is a higher likelihood of a 5- to 6-year-old attending a kindergarten and supports the view that the roll-out of kindergartens across American cities strongly affected parents' decision to invest more in the education of their children.

Table 3: Kindergarten Exposure and Attendance of Children Age 5–6

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent Variable: == 1 if attends school						
VARIABLES	All	Boys	Girls	Age 4	Age 5	Age 6	Age 7
Kindergarten Exposure	0.249***	0.254***	0.244***	0.058***	0.363***	0.133***	0.024***
	(0.005)	(0.008)	(0.008)	(0.004)	(0.007)	(0.008)	(0.007)
Observations	2,141,099	1,073,458	1,067,628	1,103,602	1,071,888	1,069,200	1,032,639
R-squared	0.245	0.247	0.245	0.020	0.170	0.177	0.189

Notes: This table shows the impact of kindergarten exposure on attendance for the years 1900 and 1910. The dependent variable is a dummy whether a child attends school. The variable of interest, kindergarten exposure, is calculated as described in equation (5). All specifications include fixed effects for city and year. Further controls are a dummy for gender (not included in columns 2–3), fixed effects for age (only in columns 1–3) and birthplace, the occupational income scores of each parent, fixed effects for mother's and father's birthplace, and a dummy variable for the literacy status of each parent. Robust standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

b. Kindergarten Exposure and Household Fertility

In this section, our goal is to demonstrate the external validity of our case study result: a negative effect of kindergarten exposure on marital fertility. The outcome variable is the number of children under age 5 in the own household. The estimates are based on the full-count sample of 18- to 44-year-old white women (spouses or household heads) who resided in American cities during the period 1880–1910. We estimated equation (4) through ordinary least squares. Besides the set of baseline controls, all fertility regressions further include city-by-birthplace and city-by-age fixed effects, the occupational income score (in logs) of the husband, a dummy variable whether the husband is foreign-born, a dummy variable whether the husbands' occupation was still not classified by IPUMS[40] and a dummy variable whether the husband was absent at the time of the Census enumeration.

The baseline results are presented in column (1) of Table 4. The estimated coefficient on *Kindergarten Exposure* is negative and highly statistically significant. A one unit increase in kindergarten exposure results in a 0.03 decline in the number of children below age 5, which is approximately four percent of the sample mean—a similar magnitude when compared to the estimates obtained for the case study of St. Louis. Columns (2) and (3) present sample splits by

[40] The complete-count data for the Census years 1900 and 1910 still contain some occupation strings that IPUMS has not yet classified for the variable OCC1950 (code 979). We flag these observations in all our regressions.

women's age. Younger women might face higher opportunity costs of raising children compared to older women because the roll-out of kindergartens could have improved their labor market conditions or they themselves benefitted from kindergarten education.[41] We split the sample at age 34 since the older cohort (ages 35–44) was most certainly too old to attend a kindergarten during our sample period. The younger cohort of women (below age 35) responded to the kindergarten roll-out with a relatively strong fertility decline while the estimated coefficient for the older cohort is rather small and only marginally statistically significant (*p*-value 0.06). One potential reason for the weaker fertility response of older cohorts could be due to opposing effects along the extensive and intensive margins (Aaronson et al. 2014). The remainder of Table 4 is devoted to addressing this issue in more detail.

Table 4: Kindergarten Exposure and Fertility in American Cities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Dependent Variable:				
	Children below age 5			*== 1 if has a child*		*Children below age 5*		*Births*
VARIABLES	All	Age 18-34	Age 35-44	Age 18-34	Age 35-44	Age 18-34	Age 35-44	Mother panel
Kindergarten Exposure	-0.030***	-0.044***	-0.012*	-0.006*	0.014***			-0.043***
	(0.005)	(0.007)	(0.006)	(0.003)	(0.003)			(0.003)
Kindergarten x == 1 if child age 5-6						-0.173***	-0.056***	
						(0.007)	(0.008)	
Observations	8,576,149	5,056,233	3,512,469	5,056,233	3,512,469	3,718,347	2,869,162	40,441,631
R-squared	0.151	0.094	0.126	0.082	0.053	0.125	0.172	0.937

Notes: This table shows the impact of kindergarten exposure on fertility in American cities between 1880 and 1910. The dependent variable in columns (1)–(3) and (6)–(7) is the number of own children below age 5; in columns (4)–(5) it is a dummy whether a women had at least one child; and in column (8) it is the cumulative number of births. In columns (1)–(7), the variable of interest, kindergarten exposure, is calculated as described in equation (5). In columns (6)–(7), kindergarten exposure is interacted with a dummy variable whether a woman has a child age 5–6 (the main effect is absorbed by city-by-year fixed effects). In column (8), kindergarten exposure refers to the kindergarten capacity normalized by children age 5 to 6 in the year a woman gave birth. The specifications in columns (1)–(7) include fixed effects for city, year, birthplace, age, city-by-birthplace, and city-by-age. Further controls are the husband's occupational income score; a dummy whether a husband is foreign-born; a dummy whether the husband's occupation is not yet classified; and a dummy whether the husband is absent. Columns (6)–(7) further include city-by-year fixed effects, a dummy if a woman has a child age 5–6, and a dummy if a woman has any children older than six. Column (8) includes fixed effects for mothers, year, years in the U.S., and age at birth. Robust standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Columns (4)–(5) provide more insights about fertility adjustments along the extensive margin. To capture such adjustments, we constructed a dummy variable whether an 18- to 44-year-old woman has any own children.[42] Consistent with the prediction of an augmented quantity-quality model that allows for the option to remain childless (Aaronson et al., 2014), we show that, in

[41] A similar argument is made by Aaronson et al. (2014) showing that women adjust fertility differently depending on whether they benefitted from increased schooling opportunities themselves or not.

[42] The dummy variable is based on the NCHILD variable from IPUMS.

cities with higher kindergarten exposure, the younger cohort of women was more likely to remain childless due to the increased opportunity costs of rearing children (albeit the estimated coefficient is quite small and only statistically significant at the 10-percent level). The opposite is the case for the older cohort: The higher return to schooling from kindergarten education significantly increased the likelihood of older women having at least one child. The estimated coefficient is quantitatively sizable and statistically significant at the 1-percent level.

Columns (6)–(8) present results for the intensive margin using two different estimation methods, which also intend to address potential threats to identification. First, we studied whether there is a differential effect of kindergarten exposure on "eligible" households; these are families with a 5- to 6-year-old child. For eligible households, we expect a stronger fertility response to increased kindergarten exposure, since they can directly observe the benefits from kindergarten education and should consequently adjust their fertility behavior along the intensive margin (i.e., having fewer children below the age of 5). In order to capture this differential effect, we interact our kindergarten exposure measure with a dummy variable which equals 1 for households with a 5- to-6-year old child. We restricted this sample to 18- to 44-year-old white women that had at least one child.

One important advantage of this modified specification is that we can include city-by-decade fixed effects and thereby exploit only the variation in kindergarten exposure between different types of households (with and without 5- to 6-year old children) within the same city and census year. In this way, we account for any city-specific time trends which capture possible confounding factors that could potentially mimic the timing of the kindergarten roll-out.[43] This also implies that the direct effect of kindergarten exposure is absorbed due to the inclusion of city-by-year fixed effects. Hence, any remaining threat to identification would need to differentially affect households with and without 5- to 6-year-old children. Besides the interaction term and the inclusion of city-by-decade fixed effects, it is important to note that we always control for the direct effect of having a 5- to 6-year-old child in the household and we further include a dummy variable if the household has any children that are of age 7 or older.

Columns (6) and (7) report our results for eligible households by cohort. In line with our priors, eligible households with a given exposure to kindergartens show a larger fertility decline compared to families facing the same exposure but without a 5- to 6-year-old child in the household. This is the case for both younger and older cohorts of women. The fertility decline is sizable, especially for the younger cohort of women. The estimated coefficient on the interaction term in column (6) reveals that a one unit increase in kindergarten exposure for eligible

[43] One such concern could be that our results are driven by unobserved city specific characteristics, such as a higher demand for skilled labor which could result in an expansion of the kindergarten system and a decline in fertility.

households results in a 0.17 decline in the number of children below age 5, which is approximately 14 percent of the sample mean.[44] The estimates also reveal that households with a 5- to-6-year-old child in general tend to have more children below age 5 (not reported).

In column (8), we present an alternative way of measuring the impact of kindergarten exposure on fertility. As already described in Section IV.A, we can construct a "mother panel" containing the fertility history of women for every census year. We started by calculating the number of children a woman had 10 years before the census enumeration and then subsequently added her births in a given year starting in *t-9* up to the census year *t*.[45] For every woman, we obtained ten observations per census year (e.g., the cumulative fertility history of a woman listed in the 1900 Census would consist of her number of children in 1890 plus all subsequent births between 1891 and 1900). We considered only white women (spouses or household heads) who had at least one child to capture only fertility adjustments along the intensive margin. We further restricted the sample to the 1900 and 1910 Censuses and required a woman to be between age 18–44 at the time when she was having a child. Consequently, the "mother panel" spans the period between 1891 and 1910. There are three reasons for this sample restriction. First, the kindergarten movement accelerated between 1891 and 1910 due to the involvement of public school sponsorship. Second, the 1890 Census individual records were lost in a fire, preventing the construction of similar fertility histories between 1881 and 1890. Finally, in order to restrict the sample to women with at least on child, we needed to rely on information about all surviving children a woman had on a Census day; the Census only reported these in 1900 and 1910.

Compared to the kindergarten exposure measure used in the previous specifications, the structure of the "mother panel" allows us to exploit annual variation in kindergarten exposure for a given year of birth. Identification comes from within-mother variation in the number of births in a given year due to differences in kindergarten exposure across cities. Column (8) shows that women with at least one child ended up with fewer children in cities with higher kindergarten exposure. The estimated coefficient is statistically significant at the 1-percent level.

Overall, the roll-out of kindergartens across American cities between 1880 to 1910 led to a significant decline in household fertility. The younger cohort of women reduced fertility along the extensive and intensive margin likely because the availability of kindergarten education increased the opportunity costs of raising children. The older cohort of women responded to the potential benefits of having a kindergarten education for their prospective children by substituting quality for quantity. They decided to have at least one child (i.e., a positive response

[44] The average number of children below age 5 for this sample is 1.19.

[45] For every Census year, we calculated the existing number of children 10 years before the enumeration by subtracting the total number of births between *t-9* and *t* from the number of children who were still living on the census day (CHSURV). Children-mother pairs are identified using the variable MOMLOC. Note, there is no overlap of birth events across Census years since we only considered births between *t-9* and *t*.

along the extensive margin) but overall, they had smaller families (consistent with a fertility decline along the intensive margin).

Table 5 presents a series of sample splits to evaluate whether the fertility decline associated with the roll-out of kindergartens was driven by households that were economically disadvantaged and with an immigration background. Columns (1)–(2) split the sample by literacy (only available for the 1900 and 1910 Censuses), columns (3)–(4) report results by the skill level of the husband's occupation,[46] and the final columns of Table 5 consider fertility responses of women by place of birth (born in the U.S. or abroad). These sample splits are motivated by the historical narrative (see Section II for details): Contemporary school reports reveal that kindergarten education was mainly targeted to children from economically disadvantaged households. Given the potentially higher return to education for these children and the more stringent budget constraint for poorer households, it is plausible to expect larger fertility reductions for women in poor and immigrant households.

Table 5: Kindergarten Exposure and Fertility by Socioeconomic Status

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable: Number of children below age 5					
VARIABLES	Literate	Illiterate	High Skilled	Low Skilled	U.S. born	Foreign-born
Kindergarten Exposure	-0.027***	-0.049	-0.021***	-0.046***	0.004	-0.075***
	(0.006)	(0.033)	(0.006)	(0.009)	(0.005)	(0.009)
Observations	6,811,465	481,805	4,562,527	2,480,741	5,293,501	3,281,398
R-squared	0.142	0.173	0.166	0.130	0.121	0.157

Notes: This table shows the impact of kindergarten exposure on fertility between 1880 and 1910 by socioeconomic status. The dependent variable is the number of own children below age 5. In columns (1)–(2), the sample is split by literacy; in columns (3)–(4) by the skill level of the husband's occupation, in columns (5)–(6) by nativity. The variable of interest, kindergarten exposure, is calculated as described in equation (5). The specifications include fixed effects for city, year, birthplace, age, city-by-birthplace, and city-by-age. Further controls are the husband's occupational income score; a dummy whether a husband is foreign-born; a dummy whether the husband's occupation is not yet classified; and a dummy whether the husband is absent. Robust standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

The results outlined in Table 5 show that this was the case: The fertility decline was larger in cities with a relatively higher kindergarten exposure for women who were illiterate (although not statistically significant), whose husbands worked in a low-skilled occupation, and who were foreign-born. The stronger fertility decline for foreign-born women is particularly important since we will show in Subsection C that children of households from non-English-speaking countries experienced large returns from kindergarten education in terms of gaining English proficiency.

[46] We refer to white-collar and skilled blue-collar occupations as high-skilled jobs (IPUMS variable OCC1950 codes 0-595) and to occupations classified as operatives, service workers and laborers as low-skilled jobs (IPUMS variable OCC1950 codes 600-970).

For the socioeconomic groups most affected by kindergarten exposure, the estimates presented in Table 5 are quantitively sizeable: For example, in the case of foreign-born women (column 6), the roll-out of kindergartens explains about 11 percent of the overall decline in fertility of this group over the sample period.[47]

Overall, we found an economically significant negative effect of kindergarten exposure on fertility. Our result is consistent with the notion that kindergarten education increased both the return to education and the opportunity costs of having children, which, according to a quantity-quality trade-off framework, would result in a fertility decline. In the next subsection, we provide a series of additional robustness checks to support our finding of a negative causal effect of kindergarten exposure on fertility.

c. Robustness Checks

In Appendix Table 3, we present results where we decompose our kindergarten exposure measure, as defined in equation (5), into the three primary types of sponsorship: private, associations, and public kindergartens (columns 1–3). The estimates reported in column (1) reveal that kindergartens contributed to the fertility decline independently of their sponsorship. Based on the historical narrative (see Section II.B), one would expect that public and free kindergartens played an important role in the fertility decline in poor and immigrant households. Indeed, this was the case for women whose husbands worked in a low-skilled occupation (column 2) and women who were born abroad (column 3). The estimated coefficient on private kindergarten exposure is, however, statistically insignificant. This is not surprising, since these households could not afford to enroll their children in the tuition-based private kindergartens. We further show that our results are not sensitive to scaling kindergarten capacity by the number of 18- to 44-year-old women instead of 5- to 6-year-old children (columns 4–6). Column (7) presents a placebo test for the "mother-panel" (see Table 4, column 8), where we backdate our kindergarten exposure measure for 10 years to test whether fertility responds in anticipation to actual kindergarten exposure.[48] This approach restricts the sample to the years 1891 to 1900. Reassuringly, our placebo kindergarten exposure measure is quantitively small and statistically insignificant. Finally, our results also hold when using a balanced panel of cities or dropping the year 1880 (not reported).

[47] For the mean kindergarten exposure in this sample, fertility would decline by 0.01 (the mean kindergarten exposure in this sample is 0.126, such that $-0.076 \times 0.126 = -0.01$). The average number of children below age 5 for foreign-born women in the sample fell from 0.915 in 1880 to 0.830 in 1910.

[48] We cannot perform a similar placebo test for the repeated cross-section because of missing census data in 1890.

C. Mechanisms

So far, we have provided extensive evidence on how the roll-out of kindergartens across American cities contributed to a decline in household fertility over the period 1880–1910. Our results suggest that kindergarten exposure had a larger effect on poor and immigrant households. In what follows, we study the mechanisms that could explain the negative effect of kindergarten exposure on fertility. Overall, our results are broadly consistent with a standard quantity-quality trade-off mechanism according to which households reduce fertility in response to an increase in the return to education and the higher direct and indirect costs of having children. We developed a quantity-quality trade-off model as outlined in Galor (2011) but allowed explicitly for investments in preschool education. According to the augmented model, parents would unambiguously reduce fertility if complementarities between preschool education and schooling exist. Our empirical evidence from the Iowa 1915 Census presented below reveals that this was the case. We further show that children from non-English-speaking countries benefited from kindergarten education in terms of higher English proficiency. Kindergarten exposure also significantly reduced child labor and improved the labor market opportunities of women which reinforced the quantity-quality trade-off mechanism. Finally, we unveil language spillover effects of kindergarten attendance on mothers from immigrant households.

a. Theoretical Framework

In this section, we set up a simple quantity-quality model of fertility with two types of potentially complementary investments, preschool and other investments in human capital (e.g., schooling), to illustrate how and why increased access to kindergarten education might negatively affect fertility. Let's consider a utility function of the following form:

$$U = (1-\gamma)\ln(c) + \gamma\ln(n) + \delta\ln h(p,s) \qquad (6),$$

with household budget $c = y - n(\tau + \phi p + \sigma s)$, where c is consumption, y is income, n is the number of children, τ is the cost of one child with no quality investment (possibly dependent on y), p is preschool investment per child (e.g., kindergarten education), s is investment in schooling (or other forms of investments in human capital of children), ϕ is the unit cost of preschool investment per child and σ is the unit cost of schooling per child.

We obtain the optimal number of children, $n^* = \gamma y/(\tau + \phi p + \sigma s)$, from solving the household's optimization problem with respect to n. Treating p and s as endogenous variables which are affected by the unit cost of preschool investment, ϕ, results in:

$$\frac{dn}{d\phi} = -\frac{\gamma y\left(\frac{dp}{d\phi}\phi + p + \sigma\frac{ds}{d\phi}\right)}{(\tau + \phi p + \sigma s)^2} \tag{7}$$

If fertility falls due to a decline in preschool costs, one needs to assume that $\frac{dn}{d\phi} > 0$. This would require that $\frac{dp}{d\phi}\phi + p + \sigma\frac{ds}{d\phi} < 0$. If there is no complementarity between preschool and schooling (i.e. $\frac{ds}{d\phi} = 0$), then this condition would amount to $\frac{dp}{d\phi}\frac{\phi}{p} < -1$. That is, the elasticity of preschool investment with respect to preschool costs must be greater than 1 in absolute terms. If this is the case and the unit cost of preschool per child declines, the associated increase in the demand for preschool would increase ϕp which causes a decline in fertility. This result is similar to the one outlined in Galor (2011, Chapter 4) for changes in the cost of child quality. Even if a decline in ϕ *decreases* ϕp, fertility may still decline if $\frac{ds}{d\phi}$ is sufficiently negative. This would be the case if strong complementarities between preschool education (p) and formal schooling (s) exist, such that an increase in the preschool investment per child will induce parents to increase schooling, which then increases the costs of having a child. This effect is absent from Galor's (2011) baseline model.

b. Schooling and Labor Market Outcomes

Does exposure to kindergarten education positively affect later schooling outcomes? As the historical narrative already indicates (see Section II.C), if complementarities between kindergarten education and schooling in our sample period indeed existed, the observed fertility decline would be in line with the prediction of the augmented quantity-quality model of fertility outlined in the previous section. One issue in addressing this question is data limitations. There are no systematic individual Census data on years and type of schooling available before 1940. The one exception is the 1915 Iowa State Census, since it includes information on individuals' education and earnings which allows us to test whether a positive return to kindergarten education during our sample period existed. Our analysis is based on the ICPSR file 28501, which contains the digitized Goldin-Katz sample of individual-level records from Iowa's city and rural population in 1915 (Goldin and Katz, 2010). We focused on cities/towns in Iowa with kindergartens in our sample: These are Des Moines, Dubuque, Marshalltown, Carroll, Coon Rapids, and Rock Rapids.[49]

[49] While the only other city in the sample, Davenport, had no public kindergarten at that time, we add the relevant cohorts from Davenport as an additional control group to the analysis.

In order to test whether kindergarten exposure affected adult outcomes, we compared cohorts which happened to be slightly too old to benefit from kindergarten education when the first kindergarten was established in a city/town to cohorts which happened to be just eligible for enrollment at the opening date. In particular, we defined an individual as "exposed" to a kindergarten if she or he turned four in the *five years after* the first kindergarten was established. An individual is considered as "pre-exposed" if she or he turned six in the *five years before* the first kindergarten was established.[50] Adult outcomes such as schooling, income, and occupational status are then regressed on the kindergarten exposure dummy, controlling for years in Iowa and fixed effects for city, age, gender, birthplace, and parents' birthplace. For this exercise, identification relies on the assumption that differences in exposure to kindergarten across cohorts are only due to random establishment years. To invalidate our identification strategy, we would need an event which occurred in the exact same year and which differentially affected exposed children.

Table 6: Kindergarten Exposure and Schooling -- Evidence from the Iowa 1915 Census

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Dependent Variable:					
	Schooling	*Common & Grammar School*		*High School*		*College*	
VARIABLES	Years	Dummy	Years	Dummy	Years	Dummy	Years
Exposed	0.322**	-0.000	0.078	0.056**	0.181**	0.013	0.063
	(0.134)	(0.005)	(0.063)	(0.023)	(0.082)	(0.017)	(0.054)
Observations	6,525	6,525	6,525	6,525	6,525	6,525	6,525
R-squared	0.153	0.179	0.243	0.136	0.134	0.060	0.061

Notes: This table shows the impact of kindergarten exposure on schooling. The dependent variable in column (1) is the total years of schooling; in columns (2), (4), and (6) a dummy whether an individual attended at least common and grammar school; high school; or college; in columns (3), (5) and (7) the years in common and grammar school; high school; or college. The variable of interest, *exposed*, is described in the second paragraph on page 34. The specifications also control for years in Iowa and fixed effects for city, age, sex, birthplace, and parents' birthplaces. Robust standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Table 6 summarizes our results for various schooling outcomes. The point estimate presented in column (1) shows that kindergarten exposure had a positive effect on the years of schooling.[51] We found that cohorts exposed to kindergarten education stayed about 0.32 more years in school compared to cohorts that were just too old to attend when the first kindergarten in a city/town opened its door. The remaining specifications of Table 6 explore the educational outcomes in more detail. The positive effect of kindergarten education on years of schooling is driven by a higher likelihood to end up in high school. The estimates reveal that exposed children were not only more likely to attend high school, but they also spent more time there (columns 4–5). Both

[50] An additional constraint for an individual to be "exposed" is to reside in Iowa at least since the first kindergarten was established. We also exclude individuals that turn 4 or 6 in the establishment year of the kindergarten.
[51] Years of schooling is the sum of years in common school, grammar school, high school and college.

estimates are statistically significant at the 5-percent level. There are no significant differences between the exposed and pre-exposed cohorts in terms of attending common and grammar school (columns 2–3) or college (columns 6–7). The magnitude of the kindergarten effect on schooling is also economically relevant and plausible: If we consider the baseline result presented in column (1), exposure to kindergarten increased schooling by approximately four months, which corresponds to 3.5 percent of the sample mean of schooling.

Table 7:
Kindergarten Exposure and Adult Outcomes -- Evidence from the Iowa 1915 Census

	(1)	(2)	(3)
		Dependent Variable	
		==1 if	== 1 if
VARIABLES	ln(Earnings)	White-Collar	Professional
Exposed	0.071**	0.065**	0.040**
	(0.035)	(0.031)	(0.019)
Observations	3,765	4,062	4,062
R-squared	0.355	0.114	0.104

Notes: This table shows the impact of kindergarten exposure on earnings and occupational choices. The dependent variable in column (1) is the total log earnings in an occupation in 1914; in columns (2)–(3) it is a dummy whether an individual works in a white-collar occupation or as a professional. The variable of interest, *Exposed*, is described in the second paragraph on page 34. The specifications include a control for years in Iowa and fixed effects for city, age, sex, birthplace, and parents' birthplaces. Robust standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

In Table 7, we test the effect of kindergarten exposure on earnings and occupational choices later in life. Column (1) of Table 7 shows the effect that kindergarten exposure had on earnings later in life (in logs). We found that exposure to kindergarten during childhood increased future earnings by about 7 percent. The estimated coefficient is statistically significant at the 5-percent level.[52] In columns (2) and (3), we test whether exposure to kindergarten had an effect on an individual's occupational choice. Indeed, we found that individuals exposed to kindergarten education during childhood more likely ended up in a white-collar occupation or even as a professional worker.[53] Overall, our estimates based on the Goldin-Katz sample of the 1915 Iowa State Census provide strong support for the notion that kindergarten education had a positive effect on schooling and later-life economic outcomes, such as earnings and occupational status. In the following section, we show that kindergarten education especially helped children of non-English-speaking immigrant households acquire English proficiency.

[52] We also backdated the opening dates of the kindergartens by 10 years and created a "placebo" exposed measure following the same logic as outlined on page 34. Reassuringly, for both outcomes, *placebo exposed* is not statistically significant at any conventional level (not reported).

[53] "Earnings" refer to the total earnings in 1914 from an occupation. We refer to individuals having a white-collar job if they reported an occupation with code 1-300 (excluding farmers) and as professionals if they reported an occupation code 1-45.

c. Language Proficiency

One major goal of the kindergarten movement in the United States was to facilitate the integration of immigrant children by teaching English through songs, rhymes, and stories (see Section II.C). Since the 1900 and 1910 Censuses provide information on whether an individual 10 years of age and over is able to speak English (see variable SPEAKENG from IPUMS for further details), we can test whether exposure to kindergarten education increased the likelihood of immigrant children from non-English-speaking countries speaking English.

We restricted the sample to 10- to 15-year-old immigrant children from non-English-speaking countries. The estimating equation is (4) and the method of estimation is least squares, but the dependent variable is now a dummy variable whether an individual speaks English. We modified our kindergarten exposure measure to capture the capacity of kindergartens at the time when these children were of kindergarten age. That is, kindergarten exposure in a given city for the 10- to 15-year old cohort in 1900 (1910) refers to the average kindergarten capacity per 5- to 6-year-olds over the period 1890–1895 (1900–1905). We included the same set of control variables as in Table 3 and added a dummy variable whether an individual's occupation was still not classified by IPUMS.

Table 8 summarizes the effect that kindergarten exposure had on the probability of foreign-born children speaking English. In column (1), we restrict the sample to children from non-English-speaking countries who arrived in the United States early enough to be exposed to kindergarten education. That is, a child in our sample is regarded as "eligible" if he/she arrived at age six or earlier in the United States. The result reveals that, if these children were exposed to kindergarten education in the United States when they were 5- to 6-years-old, they were significantly more likely to speak English. The point estimate implies that a unit change in kindergarten exposure increased the probability of children from non-English-speaking countries speaking English by 4.5 percentage points, which is about five percent of the sample mean.

In columns (2)–(3), we relax the constraint that children from non-English speaking countries needed to arrive early enough to be exposed to kindergarten education in the United States. The sample includes now also children who could not have benefitted from kindergarten exposure because they were too old when they arrived. For these specifications, we interact our kindergarten education variable with an indicator variable for "eligibility", which equals 1 if the individual arrived in the U.S. early enough to be exposed to a kindergarten (see above). This means that we can increase the number of observations and, more importantly, that we can add city-by-year fixed effects as additional controls since we can now exploit variation between treated and non-treated children from non-English-speaking countries within the same city.

The following example illustrates the identification strategy we have in mind. Consider two Italian immigrant children, Luigi and Mario, who lived in the same city *c* in 1910. Both are 10 years old. Luigi arrived in the United States when he was four and consequently he could have been exposed to kindergarten education in the United States (i.e., an eligible individual), while Mario arrived at age seven and consequently was too old to benefit from kindergarten education (i.e., a non-eligible individual). If the city had some kindergartens at the time when Luigi was of kindergarten age, we would expect a positive effect on his likelihood of speaking English compared to Mario. Importantly, we always control for the direct effect of arriving in the U.S. earlier in life (i.e., the indicator variable for eligibility).

Table 8: Kindergarten Exposure and English Proficiency

	(1)	(2)	(3)
	Dependent Variable: ==1 if speaks English		
VARIABLES	Eligible	All	All
Kindergarten Exposure (cohort)	0.046***	-0.000	
	(0.013)	(0.014)	
Kindergarten Exposure (cohort)		0.042***	0.042***
x (== 1 if eligible)		(0.011)	(0.011)
Observations	203,262	415,789	415,775
R-squared	0.121	0.129	0.136

Notes: This table shows the impact of kindergarten exposure on the English proficiency of 10- to 15-year-old immigrant children from non-English-speaking countries for the years 1900 and 1910. The dependent variable is a dummy variable whether an individual speaks English. The variables of interest, *kindergarten exposure (cohort)*, and the interaction term with an "eligible" person is described in Section IV.C.c. See the notes to Table 3 for a description of the controls. Robust standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

In column (2), we add the indicator variable for eligibility and the interaction term between eligible individuals and kindergarten exposure to estimating equation (4). The main variable of kindergarten exposure now captures the English proficiency of children who were not eligible when they arrived in the United States and serves also as a placebo test. While the point estimate of kindergarten exposure is literally zero and statistically insignificant, the effect of kindergarten exposure on the eligible children is positive and statistically significant at the 1-percent level. Column (3) further adds city-by-year fixed effects to estimating equation (4), which means that the main effect of kindergarten exposure is absorbed. Reassuringly, the effect of the interaction term on the likelihood of speaking English is similar to column (2). The point estimate implies that a one-unit change in kindergarten exposure increases the likelihood of an eligible child speaking English by around four percentage points. Finally, the indicator variable for eligibility captures the direct effect of speaking English for children who arrived at a relatively early age in

the United States. As expected, these children are more likely to speak English due to the longer time spent in the United States (not reported).

d. Reinforcing Mechanisms

In this section, we analyze whether exposure to kindergartens also affected the direct and indirect costs of rearing children. Lower household income from child labor and better labor market opportunities for women would reinforce parents' decision to substitute quantity for quality.

Table 9 summarizes the results of potential reinforcing mechanisms. In column (1), we show that exposure to kindergartens reduced the likelihood of child labor. This finding is based on the IPUMS complete-count census data, which reported the occupation of individuals 10 years of age and over. In particular, we focus our attention on 10- to 15-year-old children in the 1900 and 1910 Censuses, whose parents were either born in the U.S. or immigrated to the U.S. early enough such that the child could potentially have been exposed to kindergarten education. The estimating equation is (4) and the method of estimation is least squares. The dependent variable is now a dummy variable whether a 10- to 15-year-old child works. Otherwise, we use the same measure of kindergarten exposure and set of controls as in Table 3. Consistent with the results on schooling for Iowa, we found that exposure to kindergartens when these children were of kindergarten age significantly reduced their probability of working as a child. This finding reveals a positive side-effect of kindergarten education by deterring children's entry into the labor market at young ages. It also corroborates the belief of contemporary public educators, such as William T. Harris, that kindergarten education could extend the otherwise low number of years of education for children from poor and immigrant households.

In columns (2)–(4), we assess the link between kindergarten exposure and marriage. The 1900 and 1910 Censuses asked currently married persons how long they had been married to the present husband or wife (see IPUMS variable DURMARR for details). Consequently, we can test whether women exposed to kindergartens married at a later age. We restricted the sample to women between the ages of 18 and 44 who were currently married and residing in American cities in 1900 and 1910. The estimating equation is (4) and the method of estimation is least squares. We used the same measure of kindergarten exposure and set of control variables as in Table 4. The estimates reveal that, in cities with higher kindergarten exposure, women married at a later age; however, this only applies to the young cohort of women (columns 3–4). Better labor market opportunities would increase the opportunity costs of having children and would be one likely reason why younger women married at a later age. The result presented in column (5)

shows that this was indeed the case. Exposure to kindergarten significantly increased the labor force participation rate of women aged 18–34 in our sample.[54]

Table 9: Reinforcing Mechanims

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Dependent Variable:					
		Age at Marriage			== 1 if woman works		
VARIABLES	Child labor	All	Age 18-34	Age 35-44	Age 18-34	At least one child	Has 5 to 6-year-old
Kindergarten Exposure (cohort)	-0.006***						
	(0.002)						
Kindergarten Exposure		0.101***	0.171***	-0.028	0.024***	0.021***	0.025***
		(0.031)	(0.031)	(0.063)	(0.002)	(0.002)	(0.005)
Observations	5,482,660	6,767,880	4,098,765	2,661,719	4,303,184	5,558,466	559,190
R-squared	0.164	0.157	0.197	0.042	0.175	0.156	0.193

Notes: This table shows the impact of kindergarten exposure on child labor, i.e., whether a 10- to 15-year-old works (column 1); women's age at marriage (columns 2–4); and female labor force participation (columns 5–7) for the years 1900 and 1910. The variable of interest is *kindergarten exposure* as defined in equation (5), except for column (1), where it is *kindergarten exposure (cohort)*, which is described in Section IV.C.c. For a description of the controls for column (1) see the notes to Table 3 and the notes to Table 4 for columns (2–7). Robust standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

The remainder of Table 9 considers the effect of kindergarten exposure on maternal labor supply. In column (6), we restricted the sample to 18-to-44-year-old white women who had at least one child, while we further constrained the sample to mothers having a 5- to 6-year-old but no children below age 5 in column (7). These are the mothers for whom one would expect the strongest effect of kindergarten exposure on maternal labor supply. We found that kindergarten exposure significantly increased the likelihood of mothers working, and that this effect was somewhat larger for the subsample we consider in column (7). Given the relatively low level of female labor force participation in American cities in our sample period (see Appendix Table 1), the effect of kindergarten exposure on female labor force participation is economically important. A one-unit change in kindergarten exposure, as reported in column (6), is associated with a 2.1 percentage point increase in labor participation, which is about 40 percent of the sample mean (0.051).

One immediate question is whether the delay of marriage and/or the increased female labor force participation of affected mothers can explain away the effect of kindergarten exposure on fertility. Appendix Table 4 shows that, once we added duration of marriage or a dummy variable whether a woman was working to the baseline specification presented in column (1) of Table 4, they explain very little of the baseline effect.

[54] For symmetry, we also restricted the sample in columns (5)–(7) to the census years 1900 and 1910. Results are similar if we consider the 1880–1910 period (available upon request).

D. Spillover Effects

The results presented in Table 8 reveal that kindergarten education increased the English proficiency of immigrant children from non-English-speaking countries. In this section, we investigate whether spillover effects from children attending kindergarten to their mothers existed. The historical narrative emphasizes frequent interactions between mothers and kindergarten teachers through home visits and mothers' meetings (see Section II.C for details). It is therefore plausible to assume that mothers could have been indirectly affected by the kindergarten education of their children. We focus on one particular spillover: Did kindergarten education of children from non-English-speaking households enhance their mother's ability to speak English? In order to establish the existence and magnitude of spillover effects, we exploit the differential effect that kindergarten *attendance* can have on the mother of the child. In particular, we assumed that spillover effects, if they exist, were larger for mothers than for fathers. This assumption is based on the notion that mothers are relatively more "exposed" to the kindergarten compared to fathers, for example, because of frequent interactions with the kindergarten teacher and the predominant role of women in child rearing at that time.

We can therefore estimate a model with household fixed effects which has the advantage of accounting for time-invariant family characteristics like preferences for education. Analogous to the specifications reported in Table 8, we constrained the sample to immigrant households from non-English-speaking countries in 1900 and 1910. We imposed the following additional constraints: We considered only eligible households, i.e., parents must have a 5- to 6-year-old child, both parents need to be younger than 50 years, and they must have been at least 14 years of age or over when they arrived. This avoids the possibility that both parents may have themselves benefited from being educated in the United States.

We estimated separate regressions for the year 1900 and 1910 by exploiting within-family variation between mothers and fathers as outlined in the following model:

$$y_{if} = \alpha_f + \beta mother_i + \gamma\left(mother_i \times \left(== 1\ if\ child\ attends_f\right)\right) + \epsilon_{if} \qquad (8),$$

where the dependent variable is a dummy variable which equals 1 if the parent speaks English. We include family fixed effects, a mother dummy, and we control for literacy status and age fixed effects for both parents. In equation (8), treatment refers to the own 5- to 6-year-old child *attending* kindergarten. The coefficient of interest is γ, which captures the effect of kindergarten attendance on mother's English proficiency compared to the father (the main attendance effect is absorbed).

Table 10: Language Spillover Effects to Immigrant Mothers

	(1)	(2)
	Dependent Variable: ==1 if speaks English	
VARIABLES	1900	1910
Mother	-0.113***	-0.190***
	(0.001)	(0.002)
Mother x (== 1 if child attends)	0.023***	0.020***
	(0.002)	(0.002)
Observations	305,858	414,722
R-squared	0.739	0.803

Notes: This table shows the spillover effects of kindergarten attendance on the likelihood of an immigrant mother from a non-English speaking country speaking English. The dependent variable is a dummy variable if a parent speaks English. The variable of interest, *Mother x (== 1 if child attends)*, denotes the effect on mothers if her 5 to 6-year-old child attends kindergarten (the direct attendance effect is absorbed). Both specifications include family fixed effects, dummy variables for the literacy status and age fixed effects for both parents. Robust standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Table 10 presents the results on language spillover effects from kindergarten attendance. The estimates in columns (1) and (2) reveal that mothers per se are between 11–19 percentage points less likely to speak English compared to fathers. Yet, the gap in the likelihood of speaking English language is reduced by about 2 percentage points if the child attended a kindergarten. The estimated coefficient is statistically significant at the 1-percent level. Overall, these results suggest that the home visits or the classroom experiences that the children brought to their homes, such as songs and games (Berg, 2004), generated positive language spillover effects for immigrant mothers.[55]

V. Conclusion

What was the socioeconomic impact of preprimary school institutions when they were introduced for the first time? Historians of education vividly describe the influence on young children and their parents of introducing education and childcare programs, but rigorous quantitative evidence on the role of preprimary institutions for historical development is still scarce. We made use of a unique historical experiment in which, towards the end of the 19th century, some thousand kindergartens opened their doors in various American cities within less than thirty years. At that time, public educators and philanthropists were increasingly alarmed about the fundamental changes that industrialization and rapid urbanization were bringing to traditional family life and regarded kindergartens as a child-saving agency serving a socializing and educational function.

[55] Our finding relates also to a debate whether immigrant parents "lean" or "learn" from the human capital acquisitions of their children (such as learning English in school); see Kuziemko (2014).

Evaluating how potential access to kindergarten education changed the family structure in American cities requires a holistic approach, relating outcomes of affected mothers and children. Charity and public kindergartens, in particular, aimed at targeting poor and immigrant children and their mothers since the unfavorable living conditions in the urban slums made them one of the most disadvantaged groups in the American society of the late 19th century. The kindergartens' impact on these families was fundamental: Our empirical analysis revealed that exposure to kindergartens led to a fertility decline in American cities which was driven by families with immigrant background and low socioeconomic status. Since these households constituted a substantial part of America's city population, the effect is economically relevant and contributed to the fertility transition that occurred in American cities during the late 19th and early 20th centuries.

We argued that the observed fertility decline is broadly consistent with a quantity-quality tradeoff mechanism, according to which households changed their fertility behavior in response to an increase in the return to education and the higher direct and indirect costs of having children. In particular, we found that children exposed to kindergarten education stayed longer in school and worked in higher paid and more prestigious occupations as adults. We showed, theoretically, that if such complementarities between kindergarten education and regular schooling exist, affected parents will reduce fertility. Kindergarten attendance also reduced the likelihood of child labor and helped immigrant children learn English. These children were the greatest beneficiaries of kindergarten education, corroborating the results from modern studies of high economic returns from early childhood education for children from disadvantaged families (Heckman, 2006; Knudsen et al., 2006).

While the goal of this paper was to understand the contribution of kindergartens for historical development, some of our findings are also relevant for policymakers today. For example, the establishment of kindergartens in developing countries can potentially reduce population pressure if targeted to economically disadvantaged families. Our result that kindergarten exposure increased English proficiency of immigrant children and their mothers from non-English-speaking countries also indicates that preschool institutions can play an important role in promoting the integration of immigrants.

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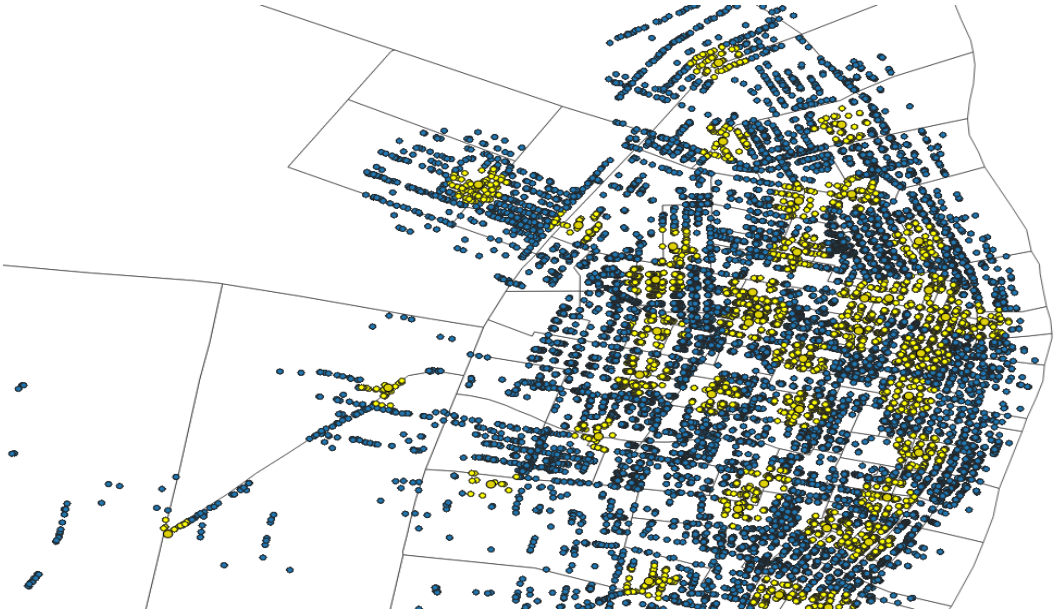
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ONLINE APPENDIX

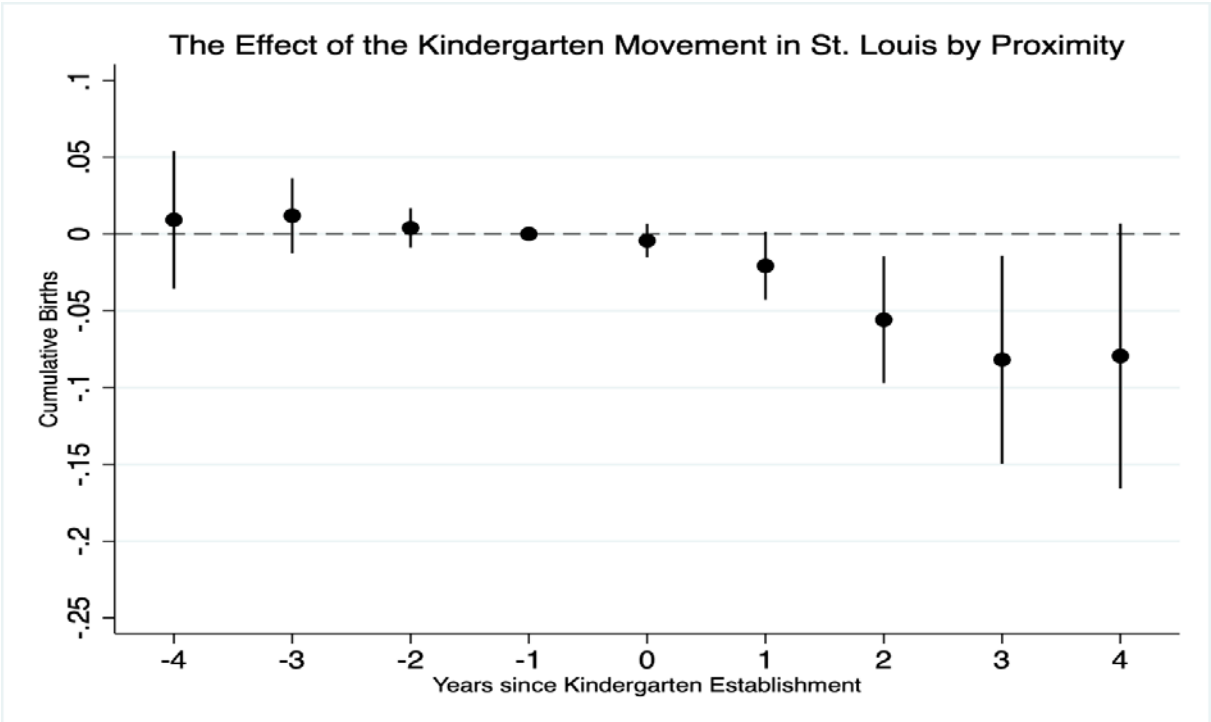
A. Figures

Appendix Figure 1: Kindergarten and Household Locations



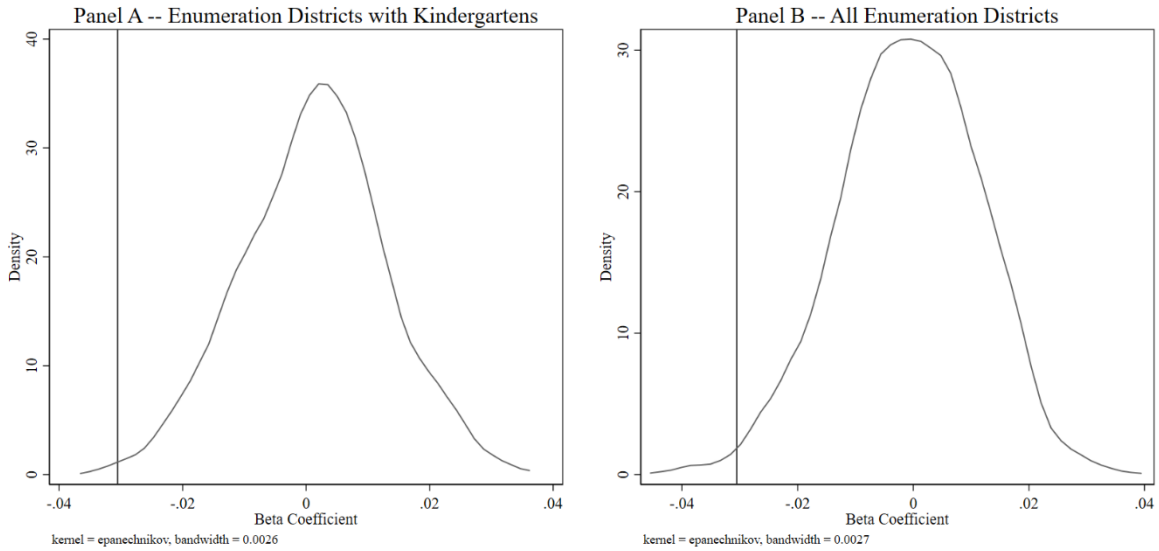
Notes: This map displays an excerpt of the sample of households within 1,000 meters radius from the closest kindergarten in St. Louis together with the 1880 enumeration districts. The households in yellow are located within 250 meters of a kindergarten and are considered as "treated" group while households between 250–1,000 meters serve as "control" group.

Appendix Figure 2: Event Study St. Louis – Distance to Closest Kindergarten



Notes: This figure shows the dynamic effects of the kindergarten roll-out on fertility in St. Louis by households' proximity. The x-axis measures the number of years since kindergarten establishment. Households are considered as treated if they are located within 250 meters of a kindergarten, while households between 250–1,000 meters serve as control group. The dots depict the estimated coefficients of kindergarten exposure on fertility relative to the base year (i.e., the year before the opening). The solid lines indicate 95% confidence intervals.

Appendix Figure 3: Permutation Tests



Notes: Permutation test based on 1,000 replications. Panel A displays the permutation test based on 1,000 replications for enumeration districts with kindergartens and Panel B for all enumeration districts in the sample. The vertical line denotes the estimated coefficient reported in column (1) of Table 2. In both cases our estimate lies far outside the 95% confidence intervals.

B. Tables

Appendix Table 1: Summary Statistics

VARIABLES	Sample	(1) N	(2) Mean	(3) SD
Complete Count Data				
==1 if 5- to 6-year-old attends	1900–1910	2,141,099	0.455	0.498
Number of own children below age 5	1880–1910	8,576,149	0.704	0.863
Number of Births (Mother Panel)	1891–1910	40,441,631	2.070	1.847
==1 if speaks English (aged 10–15 non-English-speaking countries)	1900–1910	415,789	0.863	0.343
==1 if 10 to 15-year-old works	1900–1910	5,482,660	0.080	0.271
Age at Marriage	1900–1910	6,640,051	22.153	4.636
==1 if woman aged 18–44 with at least 1 child works	1900–1910	4,303,184	0.051	0.218
==1 if mother speaks English (non-English countries)	1900	305,858	0.800	0.400
==1 if mother speaks English (non-English countries)	1910	414,722	0.616	0.486
Iowa State Census 1915				
Years of Schooling	1915	6,525	9.181	2.740
Earnings (in logs)	1915	3,765	6.416	0.661

Notes: This table shows descriptive statistics of our main variables of interest.

Appendix Table 2: Estimates of St. Louis Event Study (Figure 2)

VARIABLES	(1) *Dependent Variable* Births
Kindgarten Exposure (t-4)	-0.026
	(0.027)
Kindgarten Exposure (t-3)	-0.006
	(0.013)
Kindgarten Exposure (t-2)	-0.007
	(0.008)
Kindgarten Exposure (t-1)	--
Kindgarten Exposure (t)	-0.010
	(0.009)
Kindgarten Exposure (t+1)	-0.030*
	(0.018)
Kindgarten Exposure (t+2)	-0.076***
	(0.026)
Kindgarten Exposure (t+3)	-0.103**
	(0.040)
Kindgarten Exposure (t+4)	-0.146***
	(0.053)
Observations	369,595
R-squared	0.918

Notes: This table reports the estimated coefficients of the event study that is displayed in Figure 2. The omitted category (base year) is t-1. Standard errors are Huber robust and clustered at the enumeration district level. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Appendix Table 3: Further Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent Variable:						
	Children below Age 5			*Children below Age 5*			*Births*
VARIABLES	All	Low-skilled	Foreign-born	All	Age 18–34	Age 35–44	Mother Panel
Kindergarten Exposure (public)	-0.063***	-0.052***	-0.091***				
	(0.008)	(0.016)	(0.015)				
Kindergarten Exposure (associations)	-0.199***	-0.321***	-0.384***				
	(0.023)	(0.048)	(0.048)				
Kindergarten Exposure (private)	-0.062**	0.096	0.054				
	(0.030)	(0.064)	(0.065)				
Kindergarten Exposure (women 18–44)				-0.261***	-0.357***	-0.152**	
				(0.057)	(0.081)	(0.077)	
Kindergarten Exposure							-0.044***
							(0.005)
Placebo Kindergarten Exposure							0.006
							(0.005)
Observations	5,835,299	1,676,629	2,283,264	8,576,149	5,056,233	3,512,469	17,273,476
R-squared	0.152	0.133	0.159	0.151	0.094	0.126	0.935

Notes: This table presents robustness tests based on the specification used in Table 4. In columns (1)–(6), the dependent variable is the number of own children below age 5; in column (7) it is the cumulative number of births. In columns (1)–(3), the variable of interest, kindergarten exposure, is decomposed by sponsor (public, associations and private). In columns (4)–(6), the denominator of kindergarten exposure as calculated in equation (5) is women aged 18–44 instead of children aged 5–6. Robust standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Appendix Table 4: Controlling for Maternal Labor Supply and Age at Marriage

	(1)	(2)	(3)
	Dependent Variable: Number of Children below Age 5		
VARIABLES			
Kindergarten Exposure	-0.029***	-0.023***	-0.023***
	(0.006)	(0.006)	(0.006)
Extra Controls	Age at Marriage	== 1 if works	Both
Observations	6,767,880	6,767,880	6,767,880
R-squared	0.137	0.140	0.141

Notes: This table shows the impact of kindergarten exposure on fertility, controlling for age of marriage and female labor force participation. The dependent variable is the number of own children below age 5. The variable of interest, kindergarten exposure, is calculated as described in equation (5). The sample is restricted to married women age 18–44. All specifications include fixed effects for city, year, birthplace, age, city-by-birthplace, and city-by-age and controls for the husband's occupational income score; a dummy whether a husband is foreign-born; a dummy whether the husband's occupation is not yet classified; and a dummy whether the husband is absent. Additional controls are indicated in the table row "extra controls". Robust standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level.