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Protection through Proof of Age.
Birth Registration and Child Labor in Early 20th Century USA.

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A birth certificate establishes a child's legal identity and is the sole official proof of a child's age. However, quantitative estimates on the economic significance of birth registration are lacking. Birth registration laws were enacted by the majority of U.S. states in late 19th and early 20th centuries. Controlling for state of birth and cohort effects, the differential timing of birth registration laws across US states is used to identify whether birth registration changed the effectiveness of child labor legislation between 1910 and 1930. The incidence of child labor declined significantly in the early 20th century. The study finds that if a birth registration law had been enacted by the time a child was born, the effectiveness of minimum working age legislation in prohibiting under-aged employment more than doubled. This effect was stronger for children residing in non-agricultural areas.

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1 Introduction

For any law with an age requirement to fulfill its purpose, credible formal proof of age is required. Whether or not this exists, depends on whether the birth of the individual was officially registered, and whether a certificate exists, or can be requested from an official file.

According to Article 7 of the United Nations Convention on the Rights of the Child (1989)[1] "A child shall be registered immediately after birth…". In most developed countries today, the registration of births is taken for granted. However, in many developing countries, the births of a significant proportion of children go unregistered.[2] Birth certificates establish a person's legal identity and function as official proof of age (see e.g. Todres, 2003). According to a report by UNICEF (2005), without a birth certificate, children are unlikely to hold formal proof of age, and cannot necessarily be considered legally under-aged for certain activities, such as marriage, work, or prosecution. In several countries, access to health care and education can be denied without a birth certificate. Birth registration generates accurate figures on the population and is therefore also considered important for the planning of economic and social policies.

Despite the potential significance of birth registration from an economic and welfare perspective, the study of birth registration has been neglected by economists. There is little existing statistical evidence on the economic significance of birth registration. Quantitative estimates are missing on the extent to which the lack of a birth certificate, or legal identity, constrains the economic and social opportunities of an individual, denies individuals of their legal rights, or how the lack of birth registration might inhibit social and economic planning at a national level.

In order to understand more about the potential economic significance of birth registration, this study takes a historical approach. It focuses on the early 20th century when state-level birth registration was gaining prominence in the United States, and where the timing of the enactment of registration laws varied across states. At this point in time, if births were registered, this generally happened early in the child's life. Whether a child had a birth certificate depended on whether there were mandatory laws on birth registration, procedures for registration and filing of records, and whether uniform birth certificates were provided.

The question addressed is whether minimum working age legislation is more effective in combating under-aged employment when birth certificates are available as proof of age. This question is also relevant to today's developing world, where according to UNICEF estimates for 2010, one in six children aged between 5-14 are engaged in child labor[3]. At a more general level, this is a study on the importance of birth registration as an institution for the enforcement of any law that specifies a minimum age.

Child labor in the USA declined significantly in the early 20th century and this has received attention in economic research. Studies have examined the role played by child labor laws in either educational attainment, or the incidence of child labor (e.g. Osterman, 1979, Brown et al., 1992, Margo and Finegan, 1996, Moehling, 1999, Lleras-Muney, 2001, Manacorda, 2006, Goldin and Katz, 2008). The evidence on the relevance of the laws is somewhat mixed, although more recent econometric studies find that they were relevant for raising education levels, or reducing child

1 http://www2.ohchr.org/english/law/crc.htm

2 According to estimates for 2006, the share of children under the age of five, whose births were registered, was as low as 7% in Ethiopia, 41% in India, 70% in Cameroon in 2006 and 88% in Vietnam in 2006. Source: UNICEF. See http://www.childinfo.org/birth_registration_tables.php

3 See http://www.childinfo.org/labour.html

employment.

Birth registration did feature in policy discussion on child labor in early 20th century USA and concern was expressed towards the practice of accepting a parent's testimonial as proof of age when granting work permits. Registration practices improved significantly with the enactment of state birth registration laws.

This study utilizes individual-level data from 1 percent samples of three U.S. censuses; for 1910, 1920 and 1930. The analysis focuses on the significance of birth registration laws for the enforcement of child labor laws, namely the laws on minimum working age, which varied across states and time. Whether a child was born with a registration law in place depended on their year of birth and state of birth.

The results show that minimum working age legislation reduced the tendency of under-aged children to work. However, it was significantly more effective when children had been born during, or after the year, when their state of birth enacted a birth registration law. On average between 1910 and 1930, under-aged children born with a registration law were over 8 percentage points less likely to work than work-eligible children. However, under-aged children born before a registration law, were around 3-4 percentage points less likely to work. In general, birth registration at least doubled the effectiveness of minimum working age legislation in prohibiting under-aged employment.

The results imply that the relevance of such legislation for the under-aged was compromised when the age of children could not be officially verified. The direct relevance of minimum age requirements is more questionable in the agricultural sector, as the use of work permits was unlikely. A further analysis reveals that registration laws improved the effectiveness of minimum age legislation less in areas where agriculture was the dominant economic activity. This strengthens the conclusion that birth registration affected under-aged employment by improving the ability to ascertain a child' true age in the process of granting work permits.

The paper is organized as follows. Section 2 discusses the developments in birth registration in the USA. Section 3 discusses the existing literature on the effectiveness of child labor laws, in particular in the U.S. context and Section 4 discusses the relevance of birth registration for minimum working age legislation. Section 5 describes the data and Section 6 discusses the econometric methodology and reports the results. Section 7 concludes.

2 Birth registration in the USA

The roots of modern birth registration systems in the USA are reported to lie in the need for accurate statistics on births and deaths in the face of rapid urbanization in the 19th century, spread of epidemics and associated mortality (see Hetzel, 1997). Proponents of sanitary reform advocated for accurate statistics on the incidence of births and deaths to further their cause.

Massachusetts is described as the first state to pass a "modern" state-level law requiring that births and deaths are registered. It was strengthened in 1844 to include full details on associated fees, penalties for late registration, and requirements on the information on the causes of death. Uniform birth and death certificates were to be issued throughout the State, a state-wide file of copies of the records was created and steps were taken to enforce the legislation. Massachusetts did have some procedures for birth registration prior to this law, but these earlier laws requiring town clerks to record births were not regarded as successful and there were no state-wide systems, or centralized

records.[4] (see Shapiro, 1950).

According to Hetzel (1997), "between 1850 and 1860, registration was functioning only in a few cities and in two States." The Census Bureau became the primary body involved in developing an annual system of collection of vital statistics data, aiming to produce comparable statistics on a national basis. It played an advocacy role, but the process by which states enacted birth registration laws was a gradual one. Through time, the initial recording of births and deaths became a regular health department function. However, according to Hetzel (1997) "in some States, the boards of health had to be educated to the need, before the citizens of that State could approach the legislature. In others, the legislatures were apathetic, in spite of strong pressures…"

According to Nichols (2009), states may have had some practices for recording births before state-level birth registration laws were passed in certain counties, or certain cities. However, registration was not required by a state law, practices and items recorded were not uniform, and it is uncertain whether the records played any role as proof of age. Whilst a share of births may have been recorded at the local, or at the level of counties, sometimes the records may have been destroyed by the time a state law came into force, making it impossible to obtain copies of records for any births prior to the registration law (e.g. Kentucky, or Alabama, see Clopper, 1918 for latter). The aim of state-level procedures and laws was to unify systems, within, and gradually also between states, establish central files for birth certificates, which would facilitate their use, and above all ensure that births were registered. Enforcement of these state-level registration laws was not perfect to begin with. Some early state laws did not include penalties and were therefore potentially less effective in registering the population.

Significant progress in the enactment of registration laws is considered to have been made after a model registration bill was passed in 1907. According to Shapiro (1950), this Model Vital Statistics Act specified the "central authority of the State boards of health over registration matters, provided for the establishment of a strong local apparatus, fixed responsibility for registering births on the attendant at birth (physician, midwife), called for rigid enforcement of the law, and listed a minimum set of items for inclusion on State certificates[5]". The intention was to set uniform standards for birth and death registration across states. Pennsylvania adopted a draft version of this bill in 1905 and according to Shapiro (1950), the improvements in birth registration were "immediate". Other states adopted similar Acts shortly after, or amended existing laws to conform to it.

The National Birth Registration area was established in 1915. Ten states (in north-eastern and north central parts) and the District of Columbia were included. The criteria for the initial inclusion are somewhat unclear (Shapiro, 1950), but from thereafter states were included when they had an adequate state-level birth and death registration law in place and when 90 percent of births were estimated to be registered. From 1915 onwards, annual birth statistics were gathered for the expanding birth registration area (see Hetzel, 1997).

Regulation, or procedures for delayed birth registration were missing, or slow, complex and non-uniform, which significantly inhibited late registration at this point in time. According to estimates, in 1940 the births of nearly 55 million Americans had never been registered (see Hetzel, 1997 and for details on Virginia, see Landrum, 2010).[6] Hetzel (1997) explains that only in 1941, did the

4 For the purposes of the regression sample used in this study, it is irrelevant whether 1842 or a previous date is held as the year when birth had to registered by law.

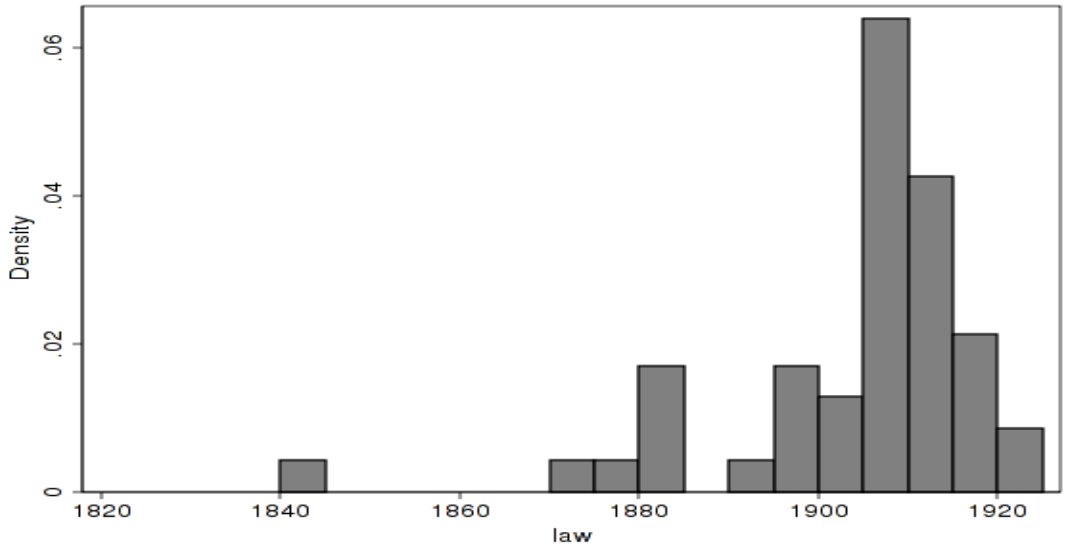
5 See Hetzel (1997), p. 28 for a Table on the content of a U.S. standard birth certificate by year since 1900.

6 The total US population in 1940, including foreign born individuals, was 132,164,569. Source: *1990 Census of Population and Housing*, "1990 Population and Housing Unit Counts: United States", (CPH-2).

Census Bureau design a manual on procedures for delayed registration, which were then adopted by a large number of states. This implies that if a child was not registered at birth, or shortly after, he, or she was far less likely to be registered later in life, until early 1940s.[7] Differences in registration rates remained with respect to race and urban versus rural location for some time. Estimates in 1940 showed that whilst 94% of white births were estimated to be registered, the corresponding figure was 81.5% for black births. There was also an urban-rural differential of 9.5% in favor of urban, likely to be driven by the lower rates of hospital births in rural areas (see Shapiro, 1950).

Figure 1 below presents a histogram on the timing of the state-level birth registration law across U.S. States and Figure 2 presents a map of the timing. Table 1 shows the year in which the state-level birth registration law was passed, the year in which the state was incorporated into the National Birth Registration area and the year from which onwards the State Office of Vital Statistics currently holds records of births. This last item is discussed in Appendix 1 together with a discussion on data sources and decisions made in a few cases of uncertainty.

Figure 1 Histogram: Timing of enactment of birth registration law across U.S. states.



Data source: Nichols (2009). States are those in the regression analysis.

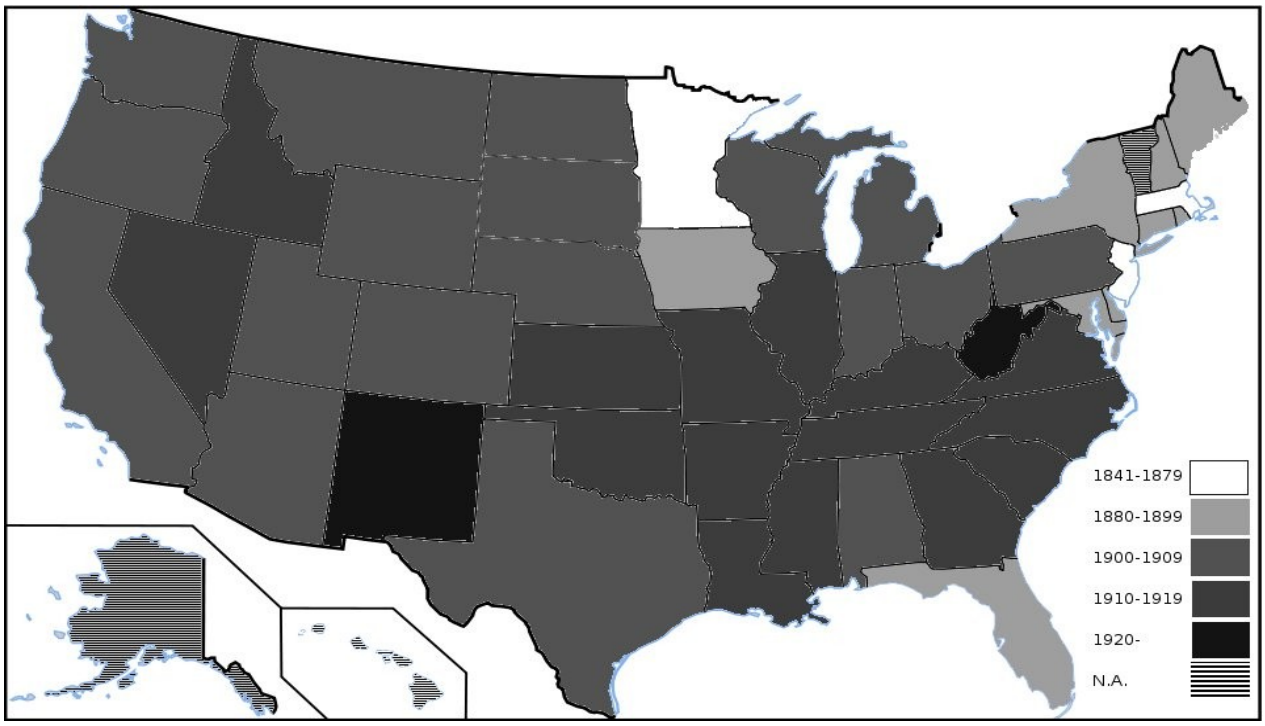
7 See for instance http://chicagogenealogy.com/chicago-delayed-birth-index.html for an index of births that were only recorded in the 1940s, but happened earlier.

Table 1 Timing of enactment of birth registration laws across U.S. states.

State	Year of birth registration law	Part of birth registration area (established 1915)	Starting point for birth records at State Vital Statistics office
Alabama	1908	1927	January 1908
Arizona	1909	1926	July 1909
Arkansas	1914	1927	February 1914
California	1905	1919	July 1905
Colorado	1907	1928	1910
Connecticut	1897	1915	not available
Delaware	1881	1921	State office: only from 1938, previous ones in state archive
Florida	1899	1924	January 1917
Georgia	1919	1928	January 1919
Idaho	1911	1926	July 1911
Illinois	1916	1922	January 1916
Indiana	1908	1917	October 1907
Iowa	1880	1924	July 1880
Kansas	1911	1917	July 1911
Kentucky	1911	1917	January 1911
Louisiana	1918	1927	not available
Maine	1892	1915	1892
Maryland	1898	1916	August 1898
Massachusetts	1841	1915	State office: 1916 onwards previous ones in state archive
Michigan	1906	1915	1906
Minnesota	1872	1915	January 1900
Mississippi	1912	1921	November 1912
Missouri	1910	1927	January 1910
Montana	1907	1922	Late 1907
Nebraska	1904	1920	Late 1904
Nevada	1911	1929	July 1911
New Hampshire	1883	1915	1640
New Jersey	1878	1921	1901
New Mexico	1920	1929	1920
New York	1880	1915	1881
North Carolina	1914	1917	October 1913
North Dakota	1907	1924	1870
Ohio	1909	1917	20 December 1908
Oklahoma	1917	1928	October 1908
Oregon	1903	1919	1903
Pennsylvania	1906	1915	January 1906
Rhode Island	1896	1915	not available
South Carolina	1915	1919	January 1915
South Dakota	1905	1932	July 1905
Tennessee	1914	1927	January 1914
Texas	1903	1933	1903
Utah	1905	1917	1905
Vermont	not defined	1915	1909
Virginia	1912	1917	June 1912
Washington	1907	1917	July 1907
West Virginia	1925	1925	January 1917
Wisconsin	1908	1917	October 1907
Wyoming	1909	1922	1909

Source: Dates for birth registration laws are from Nichols (2009). See Appendix 1 for discussion. Dates for the birth registration area come from Hetzel (1997, p. 58) and the dates from which the state offices have records of births are from the National Center for Health Statistics (2011).

Figure 2 Map: Timing of enactment of birth registration law across U.S. states.



Source of map: Wikimedia Commons. GNU Free Documentation Licence.

This study takes as its starting point the assumption that birth registration had the potential to function effectively only once state-level laws on registration were enacted, including access to copies of individual birth certificates. Some time passed until full registration coverage of births was reached. The correlation between the year of the birth registration law and year the state was included in the Birth Registration Area is 0.42. Table 1 shows that it took longer for some states than others to reach close to full registration coverage. Alabama and Indiana are recorded as having passed the law in 1908, but Indiana entered the birth registration area 10 years prior to Alabama. As can be seen from Figure 1, a majority of the states passed a state-level birth registration law in the early part of the 20th century. In 74% of U.S. states[8], the law was passed after 1900, in 68% of the cases, after the Model Vital Statistics Act came into force. The map suggests that geography might play a role in the timing.

The account on the enactment of birth registration laws implies that the process might be affected by factors such as the state of health care and the degree of urbanization. The econometric analysis in Section 6 will exploit variation both across and within states, given that the data sample covers children born in different years. The models can therefore control for fixed characteristics of the state of birth and for factors such as the degree of urbanization, or state of the health care system in the state of birth. However, one might still suspect that within state, trends in child labor vary across pre- and post-registration birth cohorts due to unobserved factors. Then the timing would have coincided with, or been determined by changes, that might also affect child employment.

In order to analyze whether the year of enactment correlates with the levels, and specifically with trends, of core economic and social indicators at the state-level, a simple OLS regression model is estimated. The analysis relies on a state-level data set constructed using 1% samples from the U.S. censuses for 1870 and 1900. Core variables that depict the socioeconomic status are chosen; share of black population, share of adult workforce in manufacturing, degree of urbanization, share of

8 Analysis excludes Alaska, District of Columbia and Hawaii. Alaska and Hawaii were not states at the time and District of Columbia is excluded due to its special nature. The data source for child labor laws excludes data for these.

immigrants, average age and the average occupation score of the household head.[9] The last one approximates for wealth, given that data on incomes are not yet available in these census samples. Summary statistics for the variables can be found in Table A1 in Appendix 2, which also includes variable definitions.

In the regression model, the dependent variable is the year when the birth registration law came into force. First, an OLS model is estimated using the 1870 census, with a set of state-level variables as explanatory variables. For most of the states, 1870 refers to a "pre-registration law" period. This is followed by a model that includes changes in the core variables between 1870 and 1900 as explanatory variables. The degree of correlation between the levels of the explanatory variables is relatively high, whereas the correlation in the trends of the variables between 1870-1900 is not.

Table 2 Correlates of birth registration laws

Dependent variable: Year when birth registration required by law, Method: OLS.

	(1)	(2)
1870 Levels		
Share urban	-12.21	
	(15.87)	
Share of adult workforce	-61.80	
in manufacturing	(35.40)+	
Share black	-18.22	
	(12.79)	
Share of literate adults	-27.31	
	(17.44)	
Share born outside USA	-37.56	
	(19.18)+	
Mean occupational	1.57	
score for adult workers	(1.46)	
Mean age	-0.76	
	(1.11)	
Change between 1870-1900		
Δ Share Urban		0.22
		(22.98)
Δ Share of adult workforce		-48.67
in manufacturing		(68.53)
Δ Share black		-9.17
		(73.02)
Δ Share of literate adults		41.11
		(20.40)+
Δ Share born outside USA		-25.43
		(32.15)
Δ Mean occupational		0.16
score for adult workers		(1.46)
Δ Mean age		-0.25
		(0.65)
Constant	1916.88	1898.96
	(15.88)**	(9.72)**
Obs	46	46
R^2	0.50	0.18

**,*,+ significant at 1, 5 and 10% levels respectively. Standard errors in parentheses, corrected for heteroskedasticity. The sample excludes Alaska, Hawaii, District of Columbia, Vermont and Oklahoma (the last one did not have data for 1870) and the others are excluded in the regression analysis.

9 The last one is a variable that assigns the person's occupation a value that represents the median total income of all individuals with that occupation in 1950 (in hundreds of 1950 dollars).

The results of the regression analysis are shown in Table 2. The results reveal that the explanatory variables chosen are mostly statistically insignificant. The share of adults working in manufacturing and the share of adults born outside the USA have a weakly statistically significant positive connection with the timing of the birth registration law. The changes in the chosen variables are not associated with the timing of the law, with the exception of the share of literate adults, which is weakly statistically significant and positive.

In the regression analysis in Section 6, any potential state-level characteristics driving registration laws at that point in time will be controlled for by the state effects. Whilst the models will also include state-specific trends, these are linear trends. Therefore, it is comforting that the results in Table 2 imply that the changes in socioeconomic circumstances in the pre-registration period largely did not coincide with the enactment of the registration laws.

3 What do we know about the effectiveness of child labor laws?

Economists tend to view child labor as a reflection of poverty. In a review of child labor, Edmonds and Pavcnik (2005) explain that child labor tends to fall with improvements in household living standards and that a child's tendency to work is affected by unexpected changes in the family's economic environment. Thus, economists have analyzed child labor in the context of family welfare optimization, considering returns from child work as opposed to adult work, or returns from schooling as opposed to work. However, the review by Edmonds and Pavcnik also discusses studies highlighting credit market imperfections or the lack of educational opportunities as causes of child labor.

How do laws banning child labor affect the prevalence of child labor? Basu (2005) examines household welfare optimization with the assumption that children only work to meet a subsistence level of consumption. He shows that if laws impose fines on firms that use child labor, firms will reduce child wages to cater for the costs. This in turn would imply that more children will be working to achieve subsistence consumption. However, other studies show that when welfare optimization takes into account the future earnings ability of the child, a ban on child labor becomes welfare improving (for example when bequests are zero or there are capital market imperfections, see Baland and Robinson, 2000 or in the context of technological progress, see Hasan and Berdugo, 2002). In the end, it is an empirical question.

There is limited empirical evidence on the effectiveness of child labor laws. There are rather few existing studies on today's developing countries (see e.g. Fasih (2007) for a study on Pakistan). However, studies have analyzed the effects of the enactment of child labor laws in the USA. In the early 20th century, the legal minimum working age varied across U.S. states and time. The research on the question has been combined with an analysis of compulsory schooling laws, and the studies have focused on child labor, or educational attainment, as the outcomes of interest, with an emphasis on the latter.

Earlier research suggested that child labor laws had little impact on the decline in child labor in the late 19th century. Technological change, immigration and wealth were among some of the factors identified as decisive for the decline (see e.g. Osterman, 1979, Goldin, 1979, Brown et al., 1992).

Published econometric studies on the effectiveness of child labor legislation on the incidence of child labor in the USA are limited. An influential study is the one by Moehling (1999), which examines whether minimum age requirements for manufacturing employment reduced the tendency of white children in non-agricultural households to have a gainful occupation between 1880-1910.

She utilizes a differences in differences estimation framework and concludes that the minimum working age limit mostly did not influence children's occupational choices between 1880 and 1900, but was somewhat more effective between 1900 and 1910. She does show that significant progress was made in the enactment of child labor legislation only in the first decade of the 20th century. In 1880, 17 states had enacted minimum age limits for manufacturing whereas in 1900-10, this had been done by 43 states. Goldin and Katz (2008) also note that the laws became significantly more effective after 1910. Therefore, there might be plausible reasons why child labor laws were not yet effective prior to early 20th century. The incidence of child labor still declined significantly between 1900 and 1920 [10]

Manacorda finds that there is a connection between child labor laws and child employment using the 1920 census. The study investigates the impact of a child's employment on the labor supply of parents and siblings, but relies on a child labor law indicator to construct an instrumental variable for child labor. Simple OLS estimates show that in 1920 for 10-16 year old children, minimum working age laws reduced child labor by approximately 5.5 percentage points.

The time that children can devote to work is connected with whether they attend school and thus, econometric studies have also focused on the effects of child labor laws on schooling and educational attainment. These studies have analyzed child labor laws in conjunction with compulsory schooling laws.

Angrist and Krueger (1991) demonstrate how due to compulsory education laws, the quarter of an individual's birth affects educational attainment and school enrollment for children born between 1930s and 1960s. With a similar methodological approach, Margo and Finegan (1996) introduce child labor laws as an additional component to the study on compulsory schooling laws and enrollment using the 1900 census. They find that compulsory schooling laws were more effective in six states that combined them with a law on minimum working age.

Lleras-Muney (2002) extends the analysis in earlier studies by considering a range of indicators for child labor and schooling laws. Like the study by Angrist and Krueger, this is a retrospective study as Lleras-Muney relies on the 1960 census and examines educational attainment of adults. She finds that laws that required children to spend more years in school, succeeded in raising educational attainment; one additional required year would have raised education by about 0.05 years. However, the impact was confined to whites.

Goldin and Katz (2008) use state-level data for 1910-1938 to analyze the impact of child labor laws and schooling laws on secondary school enrollment at the state-level. They find that these laws did affect attainment, but only explain about 5 percent of the increase. They confirm this finding with individual-level data on adult attainment with the 1960s census.

To conclude, the econometric literature does suggest that child labor laws did have at least some effect on employment, or education, but that the effect may not have been a large one. The literature has assumed that once a rigorous modeling strategy is adopted, the impact of child labor laws and compulsory schooling laws can be identified. This study relies on the same assumption. Lleras-Muney (2001) investigates the correlates of child labor and schooling law indicators and concludes that endogeneity may not be a significant concern. These laws have been used in previous published

10 There is also a more technical reason to be cautious with Moehling's results. Moehling estimates a binary choice model, where the effect of child labor laws is derived from several interacted coefficients. In such a case, neither the estimated marginal effects nor their standard errors are correctly estimated (see Ai and Norton, 2003). Therefore, there is uncertainty over the conclusions to be drawn from her analysis.

literature as instrumental variables, for instance for child labor, or education (Acemoglu and Angrist, 2001, Manacorda, 2006).

Few other issues should be discussed in relation to the literature on child labor laws in the U.S. According to Ogburn (1912), by 1909, 34 states had enacted provisions for special inspectors to enforce child labor laws. According to Goldmark (1907), an even larger number of states had penalties in place for employers and parents for the employment of under-aged children, generally in the form of fines or imprisonment. There were also penalties for obstructing the entry of factory inspectors, whose duty was to ensure that no children without work permits, or under-aged children were working.

The data source for child labor laws in this study (Goldin and Katz, 2008) includes one age limit for obtaining a work permit for work during school hours for each state in each year (see Section 5). However, one might expect minimum working age legislation to be less effective, or less relevant, in rural areas, where a large share of children worked in agriculture, and on family farms. For example, Riney-Kehrberg (2001) notes that around 1920 in New Mexico and Utah child labor laws only covered the mining industry. On the other hand, in Alabama, all under 14-year olds were prohibited from "any gainful occupation at any time, or in any employment or service during school hours."' In Illinois, under 14-year olds were prohibited from "any gainful occupation in, or in connection, with factories, canneries, stores, etc., at any time, or in any work for compensation during the school term." Some states had exemptions for hardship, especially in the South (see Hindman, 2009, p. 483), or for children working in establishments owned by their parents. On the other hand, according to Goldmark (1907), already around the publication year there were several states where anyone below 14 years of age was prohibited from all employment during school hours.[11] The distinction between urban and rural areas will be analyzed in the study.

4 Birth registration and minimum working age legislation

Several pieces of historical writing suggest that birth certificates were regarded as relevant for the effective enforcement of minimum working age legislation in the early 20th century. According to Shapiro (1950), especially post World War I, "the birth record in some places became the primary document for verifying age in entering school and in obtaining work permits." Hetzel (1997) notes that "...after World War I...birth certificates began to be used extensively in the enforcement of regulatory laws dealing with child labor and compulsory education."

According to Goldmark (1907), at the time of publication there were 17 states that required documentary proof of age for the granting of a work permit, 17 states that required no proof of age and 14 that accepted an affidavit, or oath, by a parent, or a guardian.[12] More states would require proof of age as time passed. When documentary evidence was required, if a birth certificate was unavailable, a baptismal record or a school (graduation) certificate was demanded, and that failing a physical examination may have been carried out to establish approximate age.[13]

11 Such states were Colorado, Connecticut, Illinois, Massachusetts, Minnesota, Missouri, Montana, New Hampshire, New York, North Dakota, Ohio, Oregon, South Dakota, Vermont , Wisconsin, Washington.

12 There is some overlap in the original list in Goldmark (1907) and it also includes Alaska, District of Columbia, Hawaii and Indian Territory. After a few adjustments for the overlap, the following states can be considered to have asked for documentary proof: California, Connecticut, Illinois, Maine, Maryland, Massachusetts, Minnesota, Missouri, Montana, Nebraska, New York, New Jersey, Ohio, Oregon, Rhode Island, Washington, Wisconsin.

13 According to Goldmark (1907), at the time of publication the authority that issued "working papers" varied by state. She lists school officials, health officers, factory inspectors or judges as the options.

New York state is one example where written evidence suggests that birth certificates were used in early 20th century as the primary proof of age for the purpose of granting work permits. According to Minor (1910), in 1909 75% of the 30,000 employment certificates in New York City were based on birth certificates as the proof of age. In New York, the formal requirement was that if a birth certificate could not be presented, the applicant had to convince the officers that their birth had not been recorded. Similarly, in Wisconsin, already in 1903 did laws list birth certificates as the primary form of proof of age required for obtaining a work permit (see e.g. McLogan, 1935).

As another example, take Alabama, where a state birth registration law came into force in 1908. According to Copper (1918), all previous county records of birth had been destroyed, and in 1918, the lack of birth certificates still caused problems. Those nearing the minimum working age of 14 had been born before the birth registration law was enacted. Clopper (1918) concludes that "the only satisfactory solution to the proof of age difficulty is an adequate birth registration law properly administered". He explains that the problem for Alabama at the time was inadequate resourcing as birth registration was carried out by county health officers.

The examples above illustrate that birth certificates were regarded as important for the enforcement of minimum age legislation and certificates were used to issue work permits where required. However, it is evident that for child labor laws requiring documentary proof of age to be effective, birth registration should be functioning at the state-level and copies of certificates accessible, preferably in a uniform format.[14] This was unlikely without state-level laws on birth registration procedures, so can explain why many states did not require documentary proof of age if there was no state-level registration law. Out of the states that Goldmark (1907) lists as requiring documentary proof of age for working papers, 76% had passed a state-level birth registration law by 1907. Out of the remainder that required no proof, or accepted a parent's affidavit, only 37% had a state birth registration law in place by 1907.[15] In addition to the potential to deny work permits from the under-aged, the prevalence of birth certificates could be expected to prove useful for a factory inspector, or a truant officer (the latter were also involved in enforcing child labor laws, see e.g. Goldmark, 1907 for examples).

Figure 3 Effectiveness of minimum working age limit

	State demands birth certificate	State does not demand birth certificate
Born with registration law	**(1) Effective**	**(2) Ineffective.** Less likely case.
Born without registration law	**(3) Less effective**	**(4) Ineffective**

The economic and econometric studies on child labor have so far not recognized the role of birth registration in the enforcement of minimum age legislation.[16] The purpose of a minimum age limit is to prohibit under-aged employment. What is the role of birth registration in the effectiveness of minimum working age legislation? With some simplified assumptions, the relevant cases can be

14 Even if some delayed certificates were issued to children in some states, they would have been based on affidavits or written evidence (see e.g. Landrum, 2010), clearly weakening credibility.

15 According to data in Moehling (1999), many states did have minimum working age laws in place prior to the enactment of a birth registration law. For instance, in 1900, 24 states had a minimum age limit for manufacturing employment. However, only 11 states had enacted a birth registration law prior to 1900, which implies that they were less likely to be able to demand birth certificates as official proof of age.

16 One exception is an unpublished paper by Puerta (2007), that records data on whether states required documentary proof of age for children to work.

illustrated with the diagram in Figure 3. It concerns those children who wish to work.[17]

First consider the case where the child was born with a registration law, and the state only accepts birth certificates as proof of age (1). Assume that the child has access to a certificate. Age can be verified and the minimum working age legislation is effective in prohibiting under-aged employment.

Then consider the cases (2 and 4) where the state does not demand birth certificates. The discussion above suggests that this is more likely to be the case when the state does not have a birth registration law, or it is very recent and working aged children do not generally possess certificates. Case (2) can therefore be considered less likely, especially for children born in their state of residence. The expected outcome in both cases is that the minimum age limit is not officially verified and legislation is ineffective in prohibiting under-aged employment.

Finally, consider the case where births are not registered, but the state demands a birth certificate (3). Children may have been born prior to the enactment of birth registration laws, were not registered because the registration coverage was initially imperfect, or were born in a different state without registration laws. Assume that they are asked to confirm officially that their birth was not recorded. If they confirm this, they can provide alternative documentary proof (but not parent's affidavit). Alternative proof may be false, or subject to manipulation, and some under-aged children are likely to be provided permits.

The discussion above has abstracted from the possibility that in case (3) some work-eligible children might not receive permits, because they cannot prove their age. The historical discussion (referred to above) suggests that the concern at the time was mainly the practice of states accepting false proof of identity rather than work-eligible individuals being denied their right to work, because their births were not registered. This hypothesis is also tested in the regression analysis below.

5 Data

The study focuses on the period between 1910 and 1930. It relies on data from the publicly available 1 percent samples of the U.S. census for 1910, 1920 and 1930 (IPUMS-USA, Ruggles et al. 2010).[18] The variables used in this study can be considered largely comparable across census years.

There are several reasons for focusing on the chosen period. Whilst some states had registration laws in place before 1900, the share of children covered by registration laws in the samples rose significantly only between 1910 and 1930. Therefore, 1910 is considered the first census year for which where there is enough variation in the birth registration variable for the age group analyzed. The share of children who reported an occupation also declined significantly between 1910 and 1930. By 1940, the share of children who were employed was small and all states had birth registration laws in place. The data on the child labor laws come from Goldin and Katz (2008) and are available for the period 1910-1939.

The variable of interest is whether the child is employed. For the purposes of this study, the main variable is whether the child reports an occupation or not, based on the current occupational codes,

17 It is possible that if child labor laws induce wage effects, they affect willingness to work, but I abstract from this.
18 The samples for these years are unweighted, in other words the weight for all sample cases is the same.

excluding individuals who are institutional inmates and thus not available for work.[19] This reflects occupation more precisely at the relevant point in time than occupation based on the 1950 classification, which is the other possible option. Precise occupational codes are not comparable between 1910-20 and 1930. However, the codes can be used for the purpose of identifying simply whether someone has an occupation or not. A robustness check is conducted with the 1950 occupation code.[20] Everyone with an occupation code is assumed to be working, whilst those with "no occupation reported" are assumed not to be working.

Data on age at the time of the census (used to define year of birth) and state of birth are used to define whether a child was born with a birth registration law in place. Information on the month of birth, and in most cases the month of the enactment of the law are not available.

With respect to child labor law, the variable of interest in this study is "the minimum legal age for obtaining a work permit for work during normal school hours". Appendix 1 includes a brief description of the data source. In a large number of the states the minimum age was 14. However, it ranges between 12 and 16 years across states and time. In 1910, 8 states did not yet have a minimum working age law. In 1920 only 2 states did not have such a law and by 1930 all had a minimum working age law. The relevance of compulsory schooling laws for the regression analysis will be discussed in Section 6 and for this purpose an indicator for whether the child falls within the age range of compulsory schooling is used (see Appendix 1 for precise indicator).

In some states, the minimum school leaving age was higher than the minimum working age. However, states tended to waive the requirements on minimum schooling for working children against some minimum educational requirement. Minimum working age laws may have specified that children were allowed to work when they had completed a minimum of years of education, or were simply able to read, or write. In addition, many states exempted also non-working children from a maximum schooling requirement if they had met a certain amount of schooling (in years).

As Goldin and Katz (2008) state, the binding constraint for much of the 1910-1939 period, for which they have data, was the age at which a youth could obtain a work permit. Their data set on schooling and child labor laws also includes a variable on the minimum years of education required for a work permit, if such was specified. For instance, in 1910, of the states with data, 18 states only required children to be able to read and write, 19 had no minimum education requirements and 3 explicitly specified a number of years. Together with a variable on the legal school entry age, this variable could be used to construct an alternative indicator for minimum working age. However, it requires making the assumption that all children entered school at the legal minimum entry age, which may have varied by their age, and completed the minimum schooling requirement. Such an indicator will be used in a robustness check (similar to the one used in Goldin and Katz, 2008 and Manacorda, 2006, see Appendix 1).

The regression analysis focuses on children between the age of 12 and 15. This choice is discussed in more detail in Section 6 below. Table 3 reports employment rates for children between 12 and 15 as well as 6 and 18 separately for each of the census samples. The study focuses on individuals who

19 1920 codes are used for 1910 and 1920 and 1930 codes for 1930. Those for whom the code is "blank" or "missing" are classified as not working. Those for whom the code was illegible or inconsistent are excluded. Between 1910-1930, occupation was reported also by persons who were temporarily unemployed. According to IPUMS: "the 1920 classification incorporates function as well as setting and sector, and is very detailed. By 1930, the census generally equated occupation with workers' functions, and relegated work setting and economic sector to a separate industry variable."

20 There is a small number of cases who have been classified as not having an occupation code with the current classification, but having one with the 1950s classification.

were born in the U.S. as there is no direct information about birth registration in the census. Therefore the statistics are reported for this group. The figures show a significant decline in child labor over the period, in particular between 1910 and 1920. Child labor was more prevalent in rural than in urban areas. A significant share of children employed in rural areas in the 12-15 age group was working as unpaid laborers on the family farm (between 65-70% in 1910-1930)[21].

Table 3 Prevalence of child labor

	Age: 6-18		Age: 12-15			
Year	Obs.	Working (%)	Obs.	Working (%)		
				All	Rural	Urban
1910	228722	20.3	69176	22.0	27.9	12.0
1920	260145	13.6	77888	11.2	13.1	8.6
1930	302283	10.5	91503	6.3	9.3	3.0

Includes children born in the USA, residing in the 47 states included in the regression analysis

6 Regression analysis

A logit model is used to estimate the effect of birth registration laws on a child's likelihood of having an occupation (working). The main models rely on a pooled data set of all three census years. The full model specification takes the following form

$$(1)\quad W_i = F(\alpha_0 + \alpha_1 R_{sc} + \alpha_2 C_{say} + \alpha_3 R_{sc} C_{say} + \boldsymbol{X_i}\boldsymbol{\beta} + \delta_c + \gamma_a + \psi_s + \tau_y + \varepsilon_i)$$

where i refers to individual, s to state of birth, c to birth cohort, a to age and y to census year. W_i refers to whether, or not, the child reports an occupation. F is a logistic function. R_{sc} refers to a dummy variable, which takes a value of 1 if the child is born after, or during, the year when the birth registration law was enacted. C_{say} refers to a dummy variable for whether the child is too young to obtain a work permit (value 1) and $R_{sc}C_{say}$ is an interaction effect between the dummy variables for the minimum working age and the registration law. (See Appendix 1 for definitions). R_{sc} varies between states and between cohorts within a state. For one specific census, C_{say} varies between states and age groups within states, and in the pooled sample it also varies by census year, as minimum age laws changed over time. $\boldsymbol{X}_i$ refers to a set of control variables, in most models dummy variables for gender and race. Standard errors in all models are clustered at the state and cohort-level, given that this is the level at which the laws are defined in each year.

The models also include a set of dummy variables as controls. ψ_s refers to a set of dummy variables for the state of birth. In order to control appropriately for the state effects, the main specification only includes children who live in the same state as the one they were born in.[22] As a robustness check, the same models are estimated for a sample that also includes children who live in a different state than the one they were born in. δ_c refers to a set of dummy variables for the child's birth cohort (birth year). γ_a refers to age dummies and the τ_y to census year dummies. The models are estimated only for individuals who have been born in the U.S. As the estimation controls for state, cohort, survey and age effects, factors such as the characteristics of the cohorts, or time-invariant characteristics of the states do not influence the estimated coefficients.

21 Based on 1950 occupation codes.

22 This reduces the observations by 14%. Controlling for both state of birth and state of residence effects leads to collinearity and complicates the estimation of the marginal effects due to the increased number of parameters. The conclusions would remain similar had all US-born individuals been included in a model with state of birth effects (See Table 7).

The core models are deliberately kept simple as far as control variables are concerned to reduce concerns with endogeneity. However, as a robustness check, models are estimated with a set of control variables.

The interpretation of the coefficients on the legal variables merits some discussion. Theoretically, birth registration could have the following effects:

a) Only affects the work-eligible:
$\alpha_1 \neq 0,\ \alpha_1 + \alpha_3 = 0$

b) Similar effect on under-aged and eligible:
$\alpha_1 \neq 0, \alpha_3 = 0$

c) Only affects the under-aged:
$\alpha_1 = 0, \alpha_3 \neq 0$

d) Affects both, but differentially:
General case: $\alpha_1 \neq 0$ and $\alpha_3 \neq 0$ and $\alpha_1 + \alpha_3 \neq 0$
Opposite effects:
i) $\alpha_1 > 0$ and $\alpha_1 + \alpha_3 < 0$
ii) $\alpha_1 < 0$ and $\alpha_1 + \alpha_3 > 0$

The expected effect based on the hypotheses discussed in Section 4 is c) with $\alpha_3 < 0$. However, d)-i) was also mentioned as a possibility if birth registration increases the likelihood that the under-aged are denied work permits, but also facilitates the granting of work permits to the eligible. b) would seem a more plausible hypothesis if registration affected employment through some other mechanism than the granting of work permits.[23] a) and d(ii) appear unlikely, or counter-intuitive.

The analysis is restricted to children between the age of 12 and 15. There are several reasons for this. Firstly, this is the age range for which there is most variation in the three censuses in the combination of the core variables: minimum working age law and the registration law dummies. Table 4 illustrates this by cross-tabulating the two variables for the following age groups: 6-11, 12-15 and 16-18. Secondly, the share of children working in the age group of 6-11 is low (between 1-4% in different censuses), and also for this reason it is more sensible to focus on 12-15 year olds, for whom the share working in the regression sample varies between 7-23%. Finally, as age is an important determinant of a child's tendency to work, results on the variables of interest should be more precise for a narrower age range. All this being said, the core results would remain qualitatively the same had the models been estimated for a wider age range, such as 6-18 year olds.

23 It might be speculated that birth registration improved educational planning and led to an expansion in school availability. This could be expected to have a general effect on all children, but the author has not found support from historical writings for this in the U.S. context. As mentioned earlier, it is also possible that birth registration helped to define school-aged children more accurately, especially at the school entry stage. How this matters for current employment status, and whether the effect would differ for work-eligible and under-aged children, is uncertain. Data on school attendance is far from ideal in the sample as it does not capture regular attendance, but only whether the child had been to school any time since a specific time in the past (which changes from census to census). Such attendance rates are rather high for the children in the sample (90 percent).

Table 4 Cross-tabulation of birth registration law and child labor law variables for different age groups and census samples.

1910			1920			1930		
Age: 6-11, N = 108,206			**Age: 6-11,** N = 128,983			**Age: 6-11,** N = 145,092		
	Registration law			**Registration law**			**Registration law**	
Child labor law	0	1	**Child labor law**	0	1	**Child labor law**	0	1
0	14,681	2,801	0	380	340	0	0	0
1	65,826	24,898	1	37,056	91,207	1	2,832	142,260
Age: 12-15, N=69,527			**Age: 12-15,** N = 77,835			**Age: 12-15,** N = 92,016		
	Registration law			**Registration law**			**Registration law**	
Child labor law	0	1	**Child labor law**	0	1	**Child labor law**	0	1
0	37,765	7,198	0	23,943	15,850	0	5,455	4,388
1	17,051	7,513	1	18,987	19,055	1	3,159	49,014
Age:16-18, N = 51,617			**Age:16-18,** N = 53,161			**Age:16-18, N =** 66,799		
	Registration law			**Registration law**			**Registration law**	
Child labor law	0	1	**Child labor law**	0	1	**Child labor law**	0	1
0	41,410	10,207	0	38,537	14,624	0	15,500	51,299
1	0	0	1	0	0	1	0	0

Child labor law = Dummy variable that takes a value of 1 when child is below minimum working age (1). Registration law = dummy variable that takes a value of 1 when the child was born during, or after, the year of the birth registration law (1). The sample includes the states used in the regression analysis.

The interpretation of the coefficients of the logit models requires the computation of marginal effects. Two issues need to be noted in this connection. Most of the explanatory variables are dummy variables. It is logical in this situation to estimate average marginal effects rather than marginal effects at the means.[24] Secondly, the models include the estimation of an interaction effect and a separate procedure has to be adopted for estimating the average marginal effect and its standard error (see Ai and Norton, 2003 for details).

The first step is to estimate a set of models for a pooled data set consisting of all three survey samples, for 1910, 1920 and 1930. The results are shown in Table 6. Summary statistics for the variables used in the regression analysis are presented in Table 5.

24 The marginal effects are estimated with Stata using the "margins" command.

Table 5 Summary statistics

	1910	1920	1930
Core variables		**Means**	
Male*	0.51	0.50	0.50
Black*	0.146	0.128	0.105
Other non-white*	0.004	0.003	0.005
Reports an occupation*	0.23	0.12	0.07
Reports an occupation* (1950)	0.24	0.12	0.07
Registration law applies*	0.21	0.45	0.91
Child labor law applies*	0.35	0.48	0.57
Obs.	59385	66727	78355
Additional controls			
Both parents foreign*	0.17	0.17	0.18
No mother*	0.10	0.09	0.08
No father*	0.16	0.14	0.13
Head literate*	0.87	0.89	0.92
Occupational score of head	19.65	20.34	21.39
Age of head	46.36	46.22	45.84
Female head*	0.10	0.09	0.09
Number of individuals in hh	6.78	6.67	6.43
ln(Population of place)	8.16	8.31	8.66
Urban*	0.36	0.39	0.45
Obs.	59115	65331	76071

* Refers to a dummy variable. Sample is the one in the regression models in Table 6.
'Child labor law' = Dummy variable for whether child is below minimum working age. 'Registration law' = dummy variable for whether the child was born during, or after, the year of the birth registration law.
'Other non-white' includes all ethnicities other than black and white. The racial categories are based on the "Race" variable. Blacks include negros and mulattos.
'Head literate' refers to whether the head can both read and write. 'Head works' refers to whether the head is part of the labor force. 'Number of individuals in hh', where 'hh' refers to household, excludes outlier values above 15. 'Occupational score' is available for individuals who have an occupation and takes a value up to 80. It is a variable that assigns the person's occupation a value that represents the median total income of all individuals with that occupation in 1950 (in hundreds of 1950 dollars). 'Population of place' is a categorical variable for municipalities with the smallest value being 500 (for population below 1000 or unincorporated municipality) and the largest value being 2 000 000 (for population of 2 million or above). There is a strong correlation between size of location and urban location. As size of location is more detailed, the regression models only include this variable.

Table 6 Core regression results: pooled samples 1910-1930
Dependent variable: Child reports an occupation, Age group: 12-15 years

	Pooled: 1910, 1920, 1930				
	(1)	**(2)**	**(3)**	**(4)**	**(5)#**
Male	0.089	0.089	0.089	0.089	0.089
	(0.003)**	(0.003)**	(0.003)**	(0.003)**	(0.003)**
Black	0.082	0.081	0.081	0.081	0.046
	(0.003)**	(0.003)**	(0.003)**	(0.003)**	(0.003)**
Other non-white	0.002	0.0001	0.0004	-0.003	-0.017
	(0.015)	(0.015)	(0.015)	(0.016)	(0.014)
Registration law	-0.008	-0.007	0.010	0.022	0.018
	(0.008)	(0.008)	(0.011)	(0.015)	(0.014)
Child labor law		-0.051	-0.037	-0.027	-0.029
		(0.007)**	(0.009)**	(0.009)**	(0.010)**
Child labor law			-0.049	-0.058	-0.057
× Registration law			(0.012)**	(0.014)**	(0.014)**
Other controls					
Foreign born parents					0.034
					(0.004)**
No mother					0.016
					(0.003)**
No father					0.057
					(0.005)**
Head literate					-0.029
					(0.002)**
Age of head					-0.0004
					(0.0001)**
Female head					-0.017
					(0.004)**
Head's occupational score					-0.003
					(0.0001)**
Ln(size of place)					-0.002
					(0.001)+
Number of persons in household					0.005
					(0.0003)**
Obs	204467	204467	204467	204467	200517
State trends				YES	YES

**,*, + significant at the 1, 5 and 10 percent levels respectively. The coefficients in the table are average marginal effects. All models include cohort dummies, state dummies, age dummies and census year dummies. Standard errors (in parentheses) are clustered at the state and cohort level. All models include only children who reside in the same state as the one they were born in. A Wald test is used to test for statistical significance.
Model (4) with a range of control variables. Head's occupational score gets a value of 0 when the individual does not have an occupation. The zeros are included in the model, and a "missing dummy" is included to control for these missing values. The values in Table 5 for this variable include the zeros.

The first column (1) of Table 6 shows the results of a basic model with control variables for gender and race and the dummy variable for whether the child was born before, or after, the registration law was passed. Gender and race are highly statistically significant. The registration law alone does not have a statistically significant effect on child employment. This implies that the birth registration law does not have a common effect on all children.

The second column introduces the minimum working age law dummy to the model. The coefficient is highly statistically significant and implies that those to whom the minimum age law applied were

approximately 5 percentage points less likely to work than those to whom it didn't apply. The magnitude is similar to that reported for instance by Manacorda (2006) with a simple OLS regression. The coefficient on the birth registration law variable changes little.

Column 3 reports the results of the inclusion of an interaction term between the child labor law dummy and the birth registration law dummy. The interaction term has a highly statistically significant coefficient with a negative sign. The coefficient on the registration law dummy remains statistically insignificant. This implies that as expected, hypothesis c) above is valid. Birth registration laws did not affect the employment of the work-eligible children, and that the coefficient on the interaction term can be interpreted in relation to the employment of the under-aged. For children born before the registration law, those who were below the minimum age limit were 3.7 percentage points less likely to work than work-eligible children. However, when the children had been born with a birth registration law in place, those who were below the minimum age limit were 8.6 percentage points less likely to work.

Column 4 replicates model (3) with the addition of cohort trends for each state. There are as many cohort trend indicators as there are state dummies. They control for unobserved state-specific linear trends that could explain differences in the developments in the incidence of child labor across states. The interaction term remains statistically significant, and the coefficient grows in magnitude, The results show that with birth registration laws, children below minimum working age were 8.5 percentage points less likely to work than work-eligible children. For those born without registration laws, the likelihood of employment is only 2.7 percentage points lower. This is the most rigorous model specification so far. In column 5, a range of household and individual-specific control variables are added to model (4). This changes the coefficients on the legal variables very little and does not alter the conclusions.

The results of several robustness checks are presented in Table 7. The results should be compared with those in Column 4 of Table 6.

Column 1 shows the results of a model with an alternative child labor law indicator (see Appendix 1), which incorporates the minimum education requirement for receiving a work permit when such was specified. This has little impact on the coefficients and the conclusions remain the same.

The next two robustness checks relate to versions of the model with an alternative dependent variable (Column 2) and the inclusion of also those children who reside in a different state than the one they were born in (Column 3). The alternative dependent variable is a binary employment variable based on the 1950 occupation classification. The results remain robust to these alternatives.

Column 4 shows the results of the model specification in Column 4 of Table 6 with the addition of a dummy variable for whether the child's age is below the maximum compulsory schooling age for non-working children in their state of residence ('school law') (see Appendix 1 for a discussion). These are shown mainly to demonstrate that the exclusion of such a variable does not lead to omitted variable bias, or that the child labor law variable is not simply reflecting schooling law. The coefficients on the child labor law dummy and the interaction term change little, and the conclusions remain unchanged. However, the majority of children in the 12-15 age group are below the maximum compulsory schooling age, especially in 1920 and 1930 (see notes to Table 7). A further investigation reveals that the age range chosen is too narrow for examining the impact of compulsory schooling legislation, which explains why the schooling law variable has the unexpected positive coefficient.[25]

25 The unexpected result is driven by the 1920 census. The correlation between the child labor law indicator and

Table 7 Robustness checks

Dependent variable: Child reports an occupation, Age group: 12-15 years

	Pooled: 1910, 1920, 1930			
	(1)	**(2)**	**(3)**	**(4)**
Male	0.089	0.094	0.089	0.089
	(0.003)**	(0.003)**	(0.003)**	(0.003)**
Black	0.081	0.085	0.079	0.081
	(0.003)**	(0.003)**	(0.003)**	(0.003)**
Other non-white	-0.003	-0.008	0.002	-0.003
	(0.016)	(0.016)	(0.015)	(0.016)
Registration law	0.023	0.021	0.021	0.023
	(0.014)	(0.015)	(0.013)	(0.014)
Child labor law	-0.024	-0.028	-0.029	-0.026
	(0.008)**	(0.009)**	(0.007)**	(0.009)**
Child labor law	-0.057	-0.059	-0.052	-0.057
× Registration law	(0.012)**	(0.014)**	(0.012)**	(0.013)**
School law				0.015
				(0.007)*
Obs	204467	205287	236904	204467
State trends	YES	YES	YES	YES

**,*, + significant at the 1, 5 and 10 percent levels respectively. The coefficients in the table are average marginal effects. All models include cohort dummies, state dummies, age dummies and census year dummies. Standard errors (in parentheses) are clustered at the state and cohort level. All models, except (3) include only children who reside in the same state as the one they were born in. A Wald test is used to test for statistical significance.

(1) Model (4) in Table 6 with alternative child labor law indicator (Appendix 1). The average value for this indicator in the regression sample is 0.35 in 1910, 0.53 in 1920 and 0.65 in 1930.

(2) Model (4) in Table 6 with an alternative dependent variable based on occupational codes for 1950.

(3) Model (4) in Table 6 including individuals not living in their state of birth. The model controls for state of birth dummies and state of birth cohort trends (as well as age, cohort and census year dummies).

(4) Model 4 in Table 6 including dummy variable for compulsory schooling law (See Appendix 1). The average value for this indicator in the regression sample is 0.60 in 1910, 0.81 in 1920 and 0.76 in 1930.

In conclusion, the results support the hypothesis that birth registration improved the effectiveness of minimum working age legislation, making it at least twice as effective in reducing under-aged employment.

Table 8 shows the results of basic model specifications estimated for each census year separately. Two models are estimated for each year. The first one includes basic control variables and the legal variables. The second one includes additionally the interaction term between the child labor law and the birth registration law dummy variables. The regression models in Table 6 were based on a pooled data set of census samples for three different years. Given that the age range in the sample is narrow (12-15), there is less cohort variation within state in the registration law variable when the models are estimated separately for each census sample. Therefore, only dummy variables for nine US regions as opposed to separate dummy variable for each state, can be included. Trends are also omitted. It is now possible that the legal variables capture some state-specific effects. In one census, most of the variation in the registration law variable is across state variation. These census-specific models are estimated primarily for an indication of whether effects are stronger in a specific year.

schooling law indicator is 0.45. The sign of the coefficient for the compulsory schooling dummy would not change to negative had the dummy variables for the other legal variables been excluded.

Table 8 Regression results separately for each census sample

Dependent variable: Child reports an occupation, Age group: 12-15 years

	1910		1920		1930		1910 – Documentary proof required
Male	0.153	0.153	0.080	0.080	0.049	0.049	0.089
	(0.008)**	(0.006)**	(0.004)**	(0.004)**	(0.005)**	(0.005)**	(0.008)**
Black	0.151	0.150	0.096	0.098	0.078	0.078	0.031
	(0.010)**	(0.009)**	(0.009)**	(0.008)**	(0.006)**	(0.006)**	(0.023)
Other non-white	-0.051	-0.051	-0.021	-0.023	0.031	0.032	-0.002
	(0.032)+	(0.032)	(0.026)	(0.025)	(0.023)	(0.023)	(0.042)
Registration law	-0.074	-0.057	-0.032	-0.017	-0.003	-0.0005	-0.030
	(0.019)**	(0.027)*	(0.010)**	(0.015)	(0.009)	(0.011)	(0.022)
Child labor law	-0.112	-0.102	-0.063	-0.048	-0.012	-0.004	0.024
	(0.017)**	(0.021)**	(0.008)**	(0.013)**	(0.008)	(0.018)	(0.024)
Child labor law		-0.052		-0.044		-0.009	-0.075
× Registration law		(0.029)+		(0.017)*		(0.017)	(0.022)**
Obs	59385	59385	66727	66727	78355	78355	24036

**,*, + significant at the 1, 5 and 10 percent levels respectively. Coefficients are average marginal effects. All models include age dummies and region dummies. Standard errors (in parentheses) are clustered at the state and cohort-level. All models include only children who reside in the same state as the one they were born in. Samples includes children between age 12-15. A Wald test is used to test for statistical significance.

The results in Table 8 show that the significance of the child labor law and the interaction with the birth registration law is stronger in 1910 and 1920 than in 1930, although the interaction term is only statistically significant at the 10 percent level for 1910. Interestingly, the coefficient on the registration law itself is also statistically significantly negative in 1910 even when the interaction term is included. This implies that birth registration had a common negative effect on all children irrespective of the age limit, but that it also had an additional negative effect on the under-aged. There is no simple intuitive explanation for a negative effect on the work-eligible[26] and we must keep in mind that it is now likely that the legal variables capture unobserved state-specific factors as state effects are not controlled for. The registration law dummy is no longer statistically significant in 1920 when the interaction term is included in the model.

In 1910, for children born before the registration law, those below minimum working age were around 10 percentage points less likely to work than work-eligible children. For children born with registration law, those below minimum working age were around 15 percentage points less likely to work than work-eligible children. In 1920, for children born before the registration law, those below the minimum working age were 4.8 percentage points less likely to work, but this likelihood almost doubles when children were born with the registration law in place. By 1930 the incidence of child labor had fallen to low levels and 91 percent of the children in the sample had been born with a birth registration law in place. This is likely to explain why the legal variables are no longer statistically significant.

The final column of Table 8 shows the results of a model for 1910 only for states that officially required documentary proof of age for work permits in 1907 according to Goldmark (1907). The number of states asking for documentary proof will have changed over time, so the regression models are only estimated for 1910, which is the year closest to 1907. This is the set of states where in particular birth certificates could be expected to be used to verify age (see footnote 12 for the states). It is uncertain to what extent they might have been used at this point in time in other states.[27]

26 Unless birth registration for instance had an impact on schooling in this age group.

27 In these other states, most children between 12-15 had been born before a state registration law was passed, and due to the lack of variation, it is not meaningful to analyze these separately.

The results suggest that in states that officially required documentary proof, minimum working age legislation was only effective if the child had been born with a birth registration law in place. In the sample, this applies to almost half of the children. The result implies that although documentary proof was required, birth certificates could not be used effectively to prove age when children had been born prior to a birth registration law. Other less reliable proof was likely to be resorted to, and the minimum age limit will have been less relevant for employment decisions.

Table 9 Falsification test (sample: children born prior to registration laws)
Dependent variable: Child reports an occupation, Age group: 12-15 years

	Pooled 1910-1930			
	3 years earlier	**4 years earlier**	**5 years earlier**	**6 years earlier**
Male	0.146	0.146	0.146	0.146
	(0.004)**	(0.004)**	(0.004)**	(0.004)**
Black	0.113	0.113	0.113	0.113
	(0.005)**	(0.005)**	(0.005)**	(0.005)**
Non-white	-0.031	-0.031	-0.031	-0.031
	(0.025)	(0.025)	(0.025)	(0.025)
Registration law	-0.048	-0.024	-0.006	0.028
	(0.020)*	(0.022)	(0.014)	(0.018)
Child labor law	-0.053	-0.050	-0.049	-0.049
	(0.012)**	(0.013)**	(0.013)**	(0.013)**
Child labor law	0.022	-0.007	-0.017	-0.009
× Registration law	(0.025)	(0.024)	(0.021)	(0.020)
Obs	90891	90891	90891	90891
State trends	YES	YES	YES	YES
Share born with "false"registration law	19.5	23.9	27.3	31.9

**,*, + significant at the 1, 5 and 10 percent levels respectively. The coefficients are average marginal effects. All models include cohort dummies, state dummies, age dummies and census year dummies. The sample includes children aged 12-15 residing in their state of birth. Standard errors (in parentheses) are clustered at the state and cohort-level. A Wald test is used to test for statistical significance.

The identification of the effect of the birth registration law relies on the assumption that the dummy variable for children born during, or after the year of the registration law, truly represents this year and not a general trend for children born around the same time period. Table 9 reports the results of a 'falsification' test, which is performed to analyze the sensitivity of the results to the year of the birth registration law. It focuses on whether the effect could be capturing a "pre-enactment" trend in child employment. The sample is restricted to individuals born before the birth registration law was enacted. This guarantees that there are no individuals in the sample who in reality were already affected by the registration law. It is then assumed that the birth registration law in each state in the sample was enacted three, four, five, or six years before its actual date. These years were chosen to be sufficiently, but not too close, to the actual year, so that a sufficient share of individuals can be considered affected by the false registration law. The main regression specification (same as model in Column 4 in Table 6) is then estimated for this sample of the pooled data set for 1910-1930. Unless the registration law dummy captures a "pre-enactment" trend for the cohorts, one would expect no meaningful results for the registration law nor its interaction effect. This is largely confirmed. Neither the coefficient on the registration law, nor on the interaction term, is statistically significant, with one exception in Column 1.

Finally, I turn to analyzing the potential urban-rural distinction. Some of the previous studies on child labor in the USA have restricted attention to non-agricultural households or urban households. As discussed earlier, child labor laws may not have included agricultural activities, although the

coverage did vary across states to an extent. In rural areas and agricultural households, children may have worked on the family farm, and would not be expected to have work permits. Thus, the focus on the use of birth certificates as a proof of age for obtaining work permits may not be relevant. However, farm labor was not the only gainful activity that children could engage in in rural areas. In some areas in particular, children worked for instance in cotton mills or fruit canneries. However, the data does suggest that especially in many southern states, the majority of children who worked in rural areas, worked in agriculture, and often on family farms. Thus, especially in such rural areas where most child employment was on farms, one might expect the minimum age limit be less relevant. This dimension is explored further in Table 10 below.

Table 10 Urban/rural and racial differences
Dependent variable: Child reports an occupation, Age group: 12-15 years

			Pooled 1910-1930			
	Urban	**Rural**	**Agr. counties**	**Non-agr. counties**	**White**	**Black**
Male	0.031	0.129	0.155	0.051	0.083	0.131
	(0.002)**	(0.004)**	(0.014)**	(0.003)**	(0.003)**	(0.006)**
Black	0.035	0.104	0.121	0.042		
	(0.005)**	(0.004)**	(0.010)**	(0.005)**		
Other non-white	0.027	-0.009	-0.008	0.005		
	(0.031)	(0.020)	(0.029)	(0.014)		
Registration law	0.002	0.013	0.002	0.002	0.017	0.018
	(0.008)	(0.010)	(0.008)	(0.005)	(0.013)	(0.014)
Child labor law	-0.028	-0.016	-0.018	-0.031	-0.032	0.017
	(0.008)**	(0.007)*	(0.007)**	(0.007)**	(0.009)**	(0.012)
Child labor law	-0.022	-0.040	-0.018	-0.028	-0.047	-0.017
× Registration law	(0.008)**	(0.011)**	(0.010)+	(0.007)**	(0.011)**	(0.017)
Obs	84546	119921	75428	129039	178229	25322
State trends	YES	YES			YES	YES

**,*, + significant at the 1, 5 and 10 percent levels respectively. The coefficients are average marginal effects. All models include cohort dummies, state dummies, age dummies and census year dummies. Standard errors (in parentheses) are clustered at the state and cohort-level. All models include children between age 12-15 who reside in the same state as the one they were born in. A Wald test is used to test for statistical significance.

The first two columns in Table 10 report the results of the core models (Column 4 in Table 6) for the pooled sample separately for urban and rural individuals. In urban areas, under-aged children born before the registration laws were 2.8 percentage points less likely to work, and in rural areas, 1.6 percentage points less likely to work than work-eligible children born before registration laws. However, for children born with registration laws in place, the minimum age limit had a similar effect in both urban and rural areas. It reduced the tendency of the under-aged to work in relation to the work-eligible by 5.6 percentage points in rural and by 5 percentage points in urban areas. This may appear surprising given that the minimum age limit was assumed to be less well enforced, or irrelevant for agricultural work.

To investigate the urban-rural division further, the sample is divided into two depending on the average share of all employed individuals who worked in agriculture in the child's county of residence in 1910.[28] The core model (Column 3, Table 6) is then re-estimated for these samples.[29] "Agricultural counties" are those where the share working in agriculture is 50 percent or above, and the remainder are classified as "non-agricultural" counties. In the former category, 71 percent of

28 Based on 1950 industry codes.
29 The models do not include state trends as they could not be estimated with such.

working children in the regression sample worked as “unpaid family workers on farms”, whereas the corresponding share is only 17 percent in the latter. Columns 3 and 4 show that the minimum age limit affected employment in agricultural counties less than in non-agricultural counties. The interaction effect is also smaller and less statistically significant in agricultural counties. In agricultural counties, children below the minimum age limit were 1.8 percentage points less likely to work if they were born without registration laws, but 3.6 percentage points less likely to work if they were born with birth registration laws. In non-agricultural counties, children below the minimum age limit were 3.1 percentage points less likely to work if they were born without registration laws, but 5.9 percentage points less likely to work if they were born with birth registration laws. It should be noted that by dividing the sample into two, the coefficients for the control variables (such as age and cohort effects) are allowed to vary, which can explain why the effect of the minimum age limit is smaller in the models in Table 10 than in the models in Table 6.

These results support the explanation that birth registration laws improved the enforcement of minimum working age legislation through the provision of official proof of age when employment certificates were applicable. In counties where agriculture was a dominant activity, children were far more likely to be employed in agriculture and family farms, where work permits were often not relevant. Thus, minimum working age legislation was less relevant for employment decisions than in non-agricultural areas.

Black children worked predominantly in agriculture, and may have potentially been neglected in law enforcement, or due to weaker of access to health care, were less likely to be registered. The last columns in Table 10 show that the minimum age limit had no effect on the employment of black children, regardless of registration laws. It did affect the employment of whites, and was more effective for children born with a birth registration law.

7 Conclusions

This study has analyzed the role of state birth registration laws in the effectiveness of minimum working age legislation between 1910 and 1930. It relies on individual-level census data pooled across three census years. The timing of the enactment of birth registration laws varied across U.S. states. Over the time period studied, the coverage of these laws varied not just across states, but also within states depending on the child's age, or birth cohort.

Identification of the legal effects relies on an econometric framework that controls for state of birth, age, birth cohort and survey year effects. Additionally state-specific cohort trends are included. Therefore, the models can control for any state-level and cohort-specific characteristics that might correlate with the timing of the birth registration laws. A simple state-level regression analysis on the correlates of the birth registration laws suggests that “pre-enactment” trends in core socioeconomic variables are mostly not associated with the timing.

The economic effects of birth registration have received little interest, especially in the form of statistical evaluation. The results show that state-level laws on birth registration improved the effectiveness of child labor laws in reducing the incidence of child employment in early 20th century USA. Full birth registration coverage was not reached immediately after the laws were enacted. However, the existence of these laws made birth registration mandatory and resulted in uniform procedures for recording births. Copies of birth certificates were filed centrally, and birth certificates could be demanded as proof of age for work permits, or to verify the age of working children. Indeed, there was a connection between whether a state had enacted a state birth registration law and whether it required documentary proof for issuing work permits to children by

1907.

The results show that between 1910 and 1930, minimum working age laws reduced employment of 12-15-year old children by approximately 5 percentage points. With a few exceptions, the results indicate that birth registration laws did not have a common effect on the employment of all children, or affect the employment of the work-eligible. Their main effect was to enhance the effectiveness of minimum working age legislation in prohibiting under-aged employment. The likely explanation is the improved ability to deny work permits from the under-aged.

On aggregate, between 1910 and 1930, children below the minimum age were over 8 percentage points less likely to work than work-eligible children when they had been born with a birth registration law in place. When they had been born prior to a birth registration law, under-aged children were only 3-4 percentage points less likely to work than work-eligible children. Birth registration improved the enforcement of minimum working age legislation with respect to under-aged employment. The effect of birth registration laws was stronger in 1910 and 1920. The incorporation of birth registration as an additional dimension might explain why some previous studies on child labor laws in the USA have not confirmed a relationship with child employment, or found a weak relationship.

A further investigation suggests that the impact that birth registration laws had on the effectiveness of minimum age legislation was larger in counties, where the majority of individuals worked outside agriculture. In such states, working children were also much more likely to engage in non-agricultural activities, where work permits were required. This supports the conclusion that the channel of effect was the use of birth certificates to ascertain a child's true age in the process of granting, and verifying work permits. The minimum working age limit did not affect the employment of black children, and birth registration did not enhance the effectiveness of the minimum working age legislation for black children.

This is a historical study, but the findings are relevant for today's world as well at a general level. Birth registration rates are low in many developing countries and in several the enactment of birth registration laws has been a recent phenomenon (see e.g. Cody, 2009 for some specific examples). Although there may be a birth registration law in place, its enforcement has often been poor with limited access to registration services and a lack of resources. Child labor is still prominent in developing countries. Similarly to the USA in early 20th century, a large share of this employment is agricultural, on family farms. However, a share of children also work for a salary in manufacturing or services, and this varies by country.[30]

Child labor laws are evidently only one factor that reduced child employment. However, the results of this study imply that minimum age legislation is more likely to be effective when a functioning birth registration system is in place. This study has focused on child labor, but it suggests that there is reason to belief that age limits in other areas, such as the right to marry, or school entry, might function more effectively with strong birth registration systems. These are questions for further study.

30 See for instance the ILO "International Programme on the Elimination of Child Labour" for country-specific reports. http://www.ilo.org/ipec/ChildlabourstatisticsSIMPOC/Questionnairessurveysandreports/lang--en/index.htm

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Appendix 1 Data and variables

Birth registration laws

The data on state birth registration laws are obtained from Nichols (2009), which is an electronic article available on the *ProGenealogists* website.
(http://www.progenealogists.com/unitedstatesvitalrecords.htm).

The article is a reprint, with minor edits, of an article that originally appeared in the September 1979 issue of the *Genealogical Journal*. In this publication, the data on laws were gathered by contacting the Bureau of Vital Statistics in each state and the District of Columbia. Initial information collected through a phone survey was mailed to the bureaus to be verified and signed and returned. The author had a 100 percent response rate. The dates refer to the date when a state-wide law was passed making birth registration mandatory at the state-level. In most cases, simply the year is included. A few cases include the month of the year.

The National Center for Health Statistics publishes an on-line report called "Where to Write for Vital Records"[31]. For most states this includes a date since when the state office of vital statistics currently holds records of births and other events. In many cases, the month of the year is reported. [32] This does not necessarily mean that this is the date when a state-level birth registration law came into force. Sometimes some records from a non-compulsory period of registration that predates the law (generally county/town records) are available and sometimes records are not available from the very beginning of the year of enactment of the law. However, for a majority of the states, the year mentioned coincides with the year reported in Nichols for when birth registration was required by law (see Table 1).

Nichols presents the years for birth registration laws in a table, but also includes a brief additional discussion separately for each state. There are a few cases where this information is used to decide the timing of the birth registration law as opposed to using the date in the table. These are discussed below.

For Minnesota, the table in Nichols (2009) shows 1908 as the year when birth registration was required by law at the state-level. However, the further discussion on Minnesota suggests that the first law was passed in 1872, but it was not very effective. The state office for vital statistics has records starting from 1900. However, as there was a state law in place prior to 1908, the date for Minnesota is recorded as 1872.

In the state of New York, the state procedures did not cover New York City, or Albany, Buffalo and Yonkers prior to 1914, which had their own registration procedures. However, as the census data does not include information on the place of birth, other than the state, this aspect cannot be taken into account. The table in Nichols shows 1915 as the year when birth registration was required by law at the state-level. However, the discussion states that a state-level registration law was enacted already in 1880. However, it did not include penalties, and was therefore less effective. The 1915 the law included penalties. However, as the first state law was enacted in 1880, this year is used in the analysis.

31 http://www.cdc.gov/nchs/w2w.htm
32 However, even if this information could be used to construct an indicator for birth registration laws, data on the month, or quarter, of birth are not available in the 1910-1930 censuses.

For South Dakota, the table in Nichols shows 1920 as the year when birth registration was required by law at the state-level. However, the discussion notes that a state law was also passed in 1905, but it did not include penalties for non-compliance and was not very effective. However, as in the case of New York, 1905 is used as the relevant year in this study.

Vermont is described as a state where state-wide records of birth and deaths were reasonably complete already by 1800. Records from towns were passed to the state-level. However, it is unclear when registration at the state-level became mandatory, and when birth certificates might have been issued. Therefore Vermont is excluded from the analysis. It is a small state and the regression results would not change if it were included, with the assumption that the birth registration law applied to everyone aged 12-15 born in Vermont (in all 3 census samples).

A few other states require a mention. In the case of North Dakota, the discussion suggests that a state registration law was passed in 1893, but it is unclear whether any certificates as such were issued. The date coded in the Nichols' table is 1907 when North Dakota passed the Model Vital Statistics Act, which requires individual birth certificates to be issued. This is the year used in this study. In the case of Nebraska, it is somewhat unclear whether any type of birth certificates were issued prior to 1912. The discussion implies that such birth records may not have included the child's name, but sex and parent's name(s). The state office is reported to have records from late 1904. This study uses 1904 as the year, which is the year in Nichols' table.

Indiana, North Carolina, Ohio and Wisconsin are among the few states for which Nichols' table includes a month for the law. In these four states, the law seems to have become active from late in the year (October-December). For these states, it is assumed that the law became effective for children born in the following year.

It must be noted that the conclusions from the regression analysis would remain valid even if the year for all the states would be as stated in Nichols' table. In the end, these modifications result in only minor changes to the dummy variable that captures whether the child was born with a birth registration in place or not.

The article by Nichols (2009) also shows the year when the state entered the National Birth Registration Area. These correspond with those in the source used in this study (Hetzel, 1997).

Child labor and compulsory schooling laws

These data are from Goldin and Katz (2008) and can be accessed through Goldin's website (http://www.economics.harvard.edu/faculty/goldin/data). They represent work by several researchers. The values for each state represent those that applied to the majority of the population, as sometimes there were exemptions or differences between areas in a state. These data are available for 1910-1939 for child labor law indicators, and 1900-1939 for schooling law indicators. The data set excludes Alaska, Hawaii and District of Columbia.

The child labor law indicator in this study is based on the "Age at which youth can obtain a work permit for work during normal school hours". The 'child labor law' variable in the regression models is a dummy variable that takes a value of 1 when the child is below minimum working age, and 0 otherwise.

An alternative version of the child labor law indicator, similar to the one used for instance by Goldin and Katz (2008) and Manacorda (2006), would take into account the minimum level of education (in years) required to obtain a work permit. The data contain no information on education levels attained. Assuming that the child lived in his, or her, current state of residence when he, or she reached school entry age, a value for the legal entry age (also in data set) can be assigned to each individual depending on state of residence and age. An alternative indicator for the minimum working age (used in Column 1, Table 7) can be obtained by adding the required number of years of education at the census date in the state of residence to the school entry age. It takes the form

Max{minimum age for work permit; minimum school entrance age + years of education required for obtaining a work permit}

If there was no legal school entry age, or no minimum schooling requirement for a work permit, the minimum age for a work permit is used (if such existed). As it is difficult to assign a number of years to a "read and write" requirement, in such a case also the minimum age for a work permit is used. If a variable takes a value of 0 in data set, it is assumed that no minimum age laws were in place, or there were no minimum education requirements.

A compulsory schooling law indicator (used in Column 4, Table 7) is constructed using the following variables:

1) Minimum school entrance age (as above),
2) Maximum age of compulsory schooling,
3) Education (in years) required for an exemption from the maximum age of compulsory schooling.

A modified indicator for the maximum compulsory schooling age, similar to the one in Goldin and Katz (2008), is constructed as follows

Min{maximum age of compulsory schooling; minimum school entrance age + years of education required for an exemption from maximum age rule}

If there was no legal school entry age, or the schooling requirement for an exemption was not specified (including the "read and write" requirement), the maximum age of compulsory schooling is used, if it existed. The "school law" indicator (used in Table 7) is a dummy variable that takes a value of 1 when the child's age is below the constructed maximum schooling age, and 0 otherwise. This schooling requirement was generally not a binding constraint for working children.

Appendix 2 Statistical tables

Table A1 Summary statistics for state-level analysis on the correlates of birth registration laws

	1870 levels	1870-1900
	Mean	Mean change
Share urban	0.32 (0.19)	0.14 (0.11)
Share of adult workforce in manufacturing	0.14 (0.11)	0.03 (0.04)
Share black	0.12 (0.18)	-0.006 (0.02)
Share of literate adults	0.87 (0.12)	0.10 (0.12)
Share born outside USA	0.20 (0.14)	-0.05 (0.11)
Mean occupational score for adult workers	19.6 (2.58)	1.69 (1.25)
Mean age	25.69 (2.47)	2.03 (2.16)

"Share of literate adults" and "share born outside USA" include everyone above 15 years. "Adults workers" are those between 15 and 60 years of age. Occupational score is available for individuals who have an occupation and takes a value up to 80. Standard deviations are in parentheses.