Child Labor Legislation: Effective, Benign, Both or Neither?

Federico A. Bugni*
Department of Economics
Duke University
email: federico.bugni@duke.edu

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ABSTRACT. Between 1880 and 1930, the employment rate of children ages 10 to 15 decreased by over 75% in the U.S. economy. During this period, several U.S. states dictated state-wide child labor legislation that imposed minimum age restrictions for employment in the manufacturing sector. The objective of this paper is to characterize whether this child labor legislation contributed to the decline in children labor market participation.

Previous literature on this topic, such as Moehling [10] and Moehling [11], has utilized difference-in-difference estimation techniques to study the effectiveness of the child labor legislation in reducing child labor. We contribute to this literature in two ways. First, we show that, under the presence of general equilibrium effects such as the ones described by Basu and Van [3], difference-in-difference estimation techniques can provide a misleading measure of the effectiveness of the legislation. Second, in addition to evaluating whether the legislation was effective or not, we analyze the labor market mechanism by which this takes place. This analysis may allow us to establish if the legislation constituted a benign policy or not, that is, whether the legislation imposed constraints to the behavior of children (not benign) or whether it generated a change in labor market equilibrium (benign).

We find that child labor legislation was effective in reducing general employment levels for boys and girls. Moreover, we find that the legislation was benign for general employment level for girls. We also show that the legislation was ineffective in reducing child labor participation in the manufacturing sector.

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1 Introduction

In 2002, the International Labor Organization's Statistical Information and Monitoring Program on Child Labor [14] estimated that 211 million children, or 18% of the children ages 5 to 14 in the world were economically active[2]. According to Edmonds and Pavcnik [6], the majority of these children lived in low income countries and only 2% lived in what we refer to as developed countries. These figures reveal that a working child in contemporary U.S. would also be extremely unusual. This has not always been the case. Until the end of the nineteenth century, child labor was both common and legal in developed economies. According to U.S. census data from 1880 (see Carter and Sutch [5]), 32% of boys and girls ages 10 to 15 declared having a gainful occupation. This rate fell significantly between 1880 and 1930: according to 1930 census data, the employment rate for children ages 10 to 15 was only 2%.

Among the reasons of such phenomenal decline, one can mention the growing opposition to child labor which ultimately materialized into a body of legislation restricting employers from hiring children[3]. According to Moehling [10], Moehling [11] and Basu [2], various degrees of resistance against child labor had always existed in the U.S., but this opposition developed into a well-organized social movement in the 1880s and 1890s. Between 1880 and 1920, this movement was successful in enacting state-wide child labor legislation in many U.S. states. Typically, these laws took the form of state-wide prohibition for children of less than a certain age (typically, 14 years old) to be employed in the manufacturing sector. By 1910, child labor activists realized that employers had influence over certain state legislatures which limited the progress that could be made at the state level. Therefore, they decided to shift lobbying efforts from a state to a federal child labor legislation. After several unsuccessful attempts, the Fair Labor Standards Act was enacted in 1938. This is the federal law that currently prohibits employment of minors in occupations considered oppressive.

The objective of this paper is to characterize the effect caused by child labor legislation on child labor participation during the period 1880-1900. This issue is not of exclusive interest to economic historians: as the I.L.O. figures reveal, child labor is still a problem in certain parts of the world.

Existing literature has focused only on studying the effectiveness of the legislation, that is, whether the legislation managed to reduce child labor participation or not. This paper will revisit some of these results focusing on certain methodological criticisms. Moreover, we will also focus on what the labor market mechanisms by which the child labor legislation affected child labor are. By taking these into account, we may be able to establish if the legislation constituted a benign policy or not, that is, whether the legislation imposed constrains to the behavior of children (not benign) or whether it generated a change in the labor market equilibrium (benign). We argue that this novel analysis can help provide a new perspective on previous results.

It is not obvious that child labor legislation reduced child labor. Existing literature, most notably, Nardinelli [12] for the U.K. and Moehling [11] for the U.S., explain that the passing of such legislation could be followed by a reduction on child labor demand generated by external factors (e.g. change in technology or inflow of immigrants).

[2] A child is economically active if he or she works for wages (cash or in-kind), works in the family farm in the production and processing of primary products for the market, barter or own consumption, or is unemployed and looking for these types of work.

[3] For a description of the evolution of the legislation body against child labor, see Ogburn [13] and Moehling [11].

The effectiveness of the law in curtailing child labor during this period has been previously studied in the literature, most notably by Moehling [10] and Moehling [11]. In her dissertation, Moehling [10] uses a difference-in-differences estimation procedure to estimate the effect of child labor legislation using exclusively 1900 U.S. census data. She estimates a binary choice model and computes the difference in the labor market participation of younger and older 14-year-olds (group difference), between states that did and did not issue child labor legislation (spatial difference). Her estimation reveals that child labor laws imposed constraints on children participation in the labor market. Moehling [11] incorporates observations from the 1880 and 1910 U.S. census to study the same problem. The new dataset allows her to use a difference-in-difference-in-differences estimator to evaluate the effectiveness of the legislation. She computes the difference in labor market participation between 13 and 14-year-olds (group difference), between 1900 and 1880 (and also 1910 and 1900) (time difference) and between states that did and did not issue child labor legislation (spatial difference). Her conclusion is that child labor laws were ineffective in reducing child labor. Moehling states: "Although the predicted probabilities for the treatment group– 13-year-old boys living in the states that enacted the age minima of 14– fell substantially between 1880 and 1900, so too did the predicted probabilities for the control groups".

Even though Moehling [10] and Moehling [11] provide a very detailed study of this problem, we believe there are two problems with their differencing estimation procedure. The first issue is that in non-linear models, like the ones required to model binary explanatory variables such as (child) labor participation, differencing estimator procedures do not identify the object of interest. The second issue is that differencing estimators assume that there is only one labor market equilibrium at the end of the nineteenth century. In the presence of multiplicity of equilibria, such as the one described by Basu and Van [3], differencing estimators may underestimate the effect of the legislation.

Other papers in the literature have studied the determinants for child labor market participation and their relationship with child labor legislation. Sanderson [16] uses a cross section of data to compare employment rates between states with and without child labor legislation. This data will be affected by state fixed effects, which one can control for with panel data. Based on anecdotal evidence, Osterman [15] provides a detailed description of changes in the unskilled labor market (which includes child labor) at the end of the nineteenth century. Brown, Christiansen and Philips [4] study how changes in economic conditions and in the legislation impacted child labor in the U.S. fruit and vegetable canning industry. Goldin [7] studies the determinants of child labor using 1880 Philadelphia census data. Margo and Finegan [8] examine the effect of compulsory schooling laws and child labor laws on school attendance.

The rest of the paper proceeds as follows. In section 2, we discuss the inadequacy of differencing methods in identifying the effect of the legislation on child labor. Section 3 develops a simple but formal model to analyze the effect of the legislation. Section 4 defines the econometric procedure for estimation and inference and section 5 presents the results. Section 6 concludes.

2 Discussion

Our objective is to study the effect of the U.S. state-wide child labor legislation on the behavior of the working children at the end of the nineteenth century. By 1880, arguably none of the U.S. states had established any serious body of legislation, and by 1900, a significant subset of the U.S. states had already established state-wide prohibition for children to be employed in the manufacturing sector. If child labor legislation is considered an exogenous event, we can analyze this situation using the *natural experiment framework*[4]. In the jargon of this literature, the effect of the legislation on child labor is called *treatment effect*, children in states where the legislation was imposed are the *treatment group*, children in states where the legislation was not imposed are the *control group*, 1880 is a *pre-treatment* year and 1900 is a *post-treatment* year.

2.1 Differencing in non-linear models

Moehling [10] and Moehling [11] use differencing estimation techniques to estimate the treatment effect of the child labor legislation on child labor participation. In this section, we argue that this estimation method will not identify the treatment effect, precisely because the dependent variable of interest is non-linear.

Consider the following setup. There are two periods: period 1 and period 2. During period 1, no state had issued child labor legislation and, by period 2, some states had issued child labor legislation. We refer to those states that had such laws by period 2 as B states (treatment group) and we refer to the remaining states as A states (control group).

	Period 1	Period 2
A states	No C.L.L.	No C.L.L.
B states	No C.L.L.	C.L.L.

It is natural to allow for time fixed effects and state fixed effects to affect children employment. Time fixed effects are time-specific factors affecting all the states and state fixed effects are state-specific factors affecting each state in both periods. In order to identify the treatment effect of the legislation, we assume that the legislation is the only factor affecting exclusively B states in the second period.

The household's decision of sending a child to work is modeled with a binary response model. Denote by w the binary variable of interest that takes value of one if the child is employed and zero otherwise. Denote by $d2$ the binary variable that takes value of one if the observation corresponds to the second period and zero if it corresponds to the first period. Denote by dB the binary variable that takes the value of one if the observation corresponds to any of the B states and zero if it corresponds to any of the A states. Naturally, the interaction of these two variables is given by $d2dB$. Finally, denote by x the vector of the remaining variables that affect the decision. The structure of the binary response model is,

$$w = \begin{cases} 1 & \text{if} \quad \alpha_1 d2 + \alpha_2 dB + \alpha_3 d2dB + \beta x \geq \varepsilon \\ 0 & \text{if} \quad \alpha_1 d2 + \alpha_2 dB + \alpha_3 d2dB + \beta x < \varepsilon \end{cases}$$

where ε denotes an unobserved random term with a known continuous distribution, whose cumulative distribution function is denoted by F. From this model, we deduce the following equation,

$$P\left(w = 1 | d2, dB, d2dB, x\right) = \mathbb{E}\left(w | d2, dB, d2dB, x\right) = F\left(\alpha_1 d2 + \alpha_2 dB + \alpha_3 d2dB + \beta x\right)$$

[4] For a rigorous treatment of these issues, see Meyer [9] or Woodridge [17].

The object of interest, which we will refer as "treatment effect", is the change in the probability of employment caused by issuing child labor legislation while keeping state effects, time effects and controls constant. By assuming that the child labor legislation is the only factor affecting exclusively B states in the second period, the effect of child labor legislation can be represented by going from $d2dB = 0$ to $d2dB = 1$, while keeping $d2$, dB and x constant. Formally, the treatment effect is given by,

$$TE\left(d\bar{2}, d\bar{B}, \bar{x}\right) = P\left(w = 1 | d\bar{2}, d\bar{B}, d2dB = 1, \bar{x}\right) - P\left(w = 1 | d\bar{2}, d\bar{B}, d2dB = 0, \bar{x}\right)$$

where $d\bar{2}, d\bar{B}$ and $\bar{x}$ are the relevant values that are used to evaluate the treatment effect.

When the model is linear, i.e., when F is the identity function, we deduce the following conclusions about the treatment effect,

1. The treatment effect is constant and coincides with α_3, the coefficient of the interaction term,

$$TE\left(d\bar{2}, d\bar{B}, \bar{x}\right) = \mathbb{E}\left(w | d\bar{2}, d\bar{B}, d2dB = 1, \bar{x}\right) - \mathbb{E}\left(w | d\bar{2}, d\bar{B}, d2dB = 0, \bar{x}\right) = \alpha_3$$

2. The treatment effect is equivalent to the difference-in-differences estimator,

$$DD\left(\bar{x}\right) = \left\{ \begin{array}{c} \left[\mathbb{E}\left(w | d2 = 1, dB = 1, \bar{x}\right) - \mathbb{E}\left(w | d2 = 0, dB = 1, \bar{x}\right)\right] + \\ -\left[\mathbb{E}\left(w | d2 = 1, dB = 0, \bar{x}\right) - \mathbb{E}\left(w | d2 = 0, dB = 0, \bar{x}\right)\right] \end{array} \right\} = \alpha_3$$

When the model is non-linear, the treatment effect is given by,

$$TE\left(d\bar{2}, d\bar{B}, \bar{x}\right) = F\left(\alpha_1 d\bar{2} + \alpha_2 d\bar{B} + \alpha_3 + \beta\bar{x}\right) - F\left(\alpha_1 d\bar{2} + \alpha_2 d\bar{B} + \beta\bar{x}\right) \tag{2.1}$$

and the two previous conclusions are no longer valid because of the nonlinearity of the model. The treatment effect is neither a constant (i.e. it does not coincide with the coefficient of the interaction term, α_3)[5] nor does it coincide with the difference-in-differences estimator,

$$DD\left(\bar{x}\right) = \left[F\left(\alpha_1 + \alpha_2 + \alpha_3 + \beta\bar{x}\right) - F\left(\alpha_1 + \beta\bar{x}\right)\right] - \left[F\left(\alpha_2 + \beta\bar{x}\right) - F\left(\beta\bar{x}\right)\right] \tag{2.2}$$

In fact, it is relatively straightforward to construct examples where difference-in-differences and the treatment effect have opposite signs[6].

Therefore, a difference-in-difference procedure will not identify the treatment effect in a non-linear model (such as the one we required in our analysis). The same conclusion applies to the difference-in-difference-in-differences estimator proposed by Moehling [11]. The treatment effect can be consistently estimated by plugging in the estimates for the parameter of the model into equation (2.1).

One might also consider estimating the differences in treatment effects between the treatment and control groups. If we denote by $\left(d\bar{2}_Y, d\bar{B}_Y, \bar{x}_Y\right)$ the vector of covariate values for young children (treatment group) and by $\left(d\bar{2}_O, d\bar{B}_O, \bar{x}_O\right)$ the vector of covariate values for old children (control group), then the

[5] Nevertheless, the treatment effect and the coefficient α_3 will share the sign.

[6] For example, consider $F(x) = \Phi(x)$ (probit model), and set $\bar{x} = d\bar{2} = d\bar{B} = 0$, $\alpha_1 = 0.1$, $\alpha_2 = -1.5$, $\alpha_3 = 0.1$. Since $\alpha_3 > 0$, then $TE(0,0,0) > 0$, but calculations reveal that $DD(0,0,0) < 0$.

difference in treatment effects is given by,

$$DTE = TE\left(d\bar{2}_Y, d\bar{B}_Y, \bar{x}_Y\right) - TE\left(d\bar{2}_O, d\bar{B}_O, \bar{x}_O\right) \tag{2.3}$$

If our object of interest is the treatment effect for young children, the difference in treatment effect will identify it if and only if the treatment effect for old children is zero. In the next subsection, we will explain why multiplicity of equilibria can cause the treatment effect for old children to be different from zero.

2.2 Differencing with multiplicity of equilibria

In a seminal paper, Basu and Van [3], developed a reduced form model of child labor. The model is based on two main assumptions or axioms. The first one is the *luxury axiom*, by which a family will send the children to work only if the family's income from non-child labor sources is sufficiently low. Children have very important opportunity costs of working, such as not receiving education or not enjoying their leisure. As decision makers, the parents are forced to send their kids to work when the family income is so low that the work of every member of the household is necessary for survival. The second axiom is the *substitution axiom*, by which from a firm's point of view, adult and child labor are substitutes.

When these assumptions are incorporated into a household decision model where the main source of family income is labor, the model can present a downward sloping supply of aggregate labor. If the wage is very low, then families are forced to send their children to work, generating a high aggregate labor supply. If the wage is very high, then working parents can support their entire household by themselves and avoid sending their children to work, generating a low amount of labor supply. When combined with a downward sloping demand for labor, this model has the possibility of generating multiplicity of equilibria.

We can adopt the Basu and Van [3] model to analyze the equilibrium of the labor market in the U.S. at the end of the nineteenth century. Consider a situation where there are young and old children. The separation between young and old occurs at 14 years of age, which is precisely the cutoff imposed by the child labor legislation.

Suppose labor market conditions are such that there is only one equilibrium in which every household decides to send its children to work. When child labor legislation is imposed, young children are removed from the labor market and old children keep working. In this case, looking at the difference in treatment effects between young and old children correctly identifies the effect of the law. This is the reasoning followed by Moehling [10] and Moehling [11].

Instead, suppose that the labor market is such that there are two stable equilibria described by Basu and Van [3]. In this case, a ban on young child labor may generate a change from the equilibrium with high child labor to one with low child labor. Young child labor is directly reduced by the prohibition, but general equilibrium forces cause an increase in wage that justifies overall reduction in child labor. In this case, child labor legislation is extremely effective, in the sense that it reduces the labor participation of all children, and not only young children covered by the law. Moreover, the legislation is benign, because instead of constraining the behavior of economic agents, it causes a change to an equilibrium where agents voluntarily respect the law. In this case, the difference in treatment effects will fail to identify the effect of the law. Even though the law is extremely effective in reducing young child labor, it also reduces old child labor and hence, the effectiveness of the law is underestimated by the difference in treatment effects. It is possible that this could explain Moehling [11] finding: "Although the predicted probabilities for the treatment group–13-year-old boys living in the states that enacted the age minima of 14– fell substantially between 1880 and 1900, so too did the predicted probabilities for the control groups".

3 Economic model

In this section, we consider a structural model of the economy along the lines of Basu and Van [3].

3.1 Setup

Consider the following overlapping-generations model. Each household in the economy is composed of two individuals: a parent and a child. An agent in the economy lives four periods. He is a young child in the first period, an old child in the second period, a young adult in the third period and an old adult in the fourth period. In the first two periods of his life, the individual lives under the supervision of the adult, who makes all decisions in the household. At the end of the second period, the old adult dies, the old child becomes a young adult and gives birth to a young child. For the two remaining periods of his life, he will be the decision maker in his household.

The flow utility of the adult is given by,

$$u\left(c_{i,a}, c_{i,k}, l_{i,k}\right) = u\left(c_{i,a} + c_{i,k}, \left(\psi + \delta 1\left[i = y\right]\right)\left(1 - l_{i,k}\right)\right)$$

where $i \in \{o, y\}$ denotes the age of the household, $c_{i,a}$ refers to the adult's consumption, $c_{i,k}$ refers to the child's consumption and $l_{i,k} \in \{0, 1\}$ is a binary variable indicating whether the child works or not. The indicator variable $1\left[i = y\right]$ takes a value of one if we are referring to a young household (which includes a young child) and zero otherwise.

In this model, an adult is altruistic in two ways: he cares about his child's consumption and his child's leisure[7]. When an old child works, his parent suffers a disutility of $\psi > 0$. When a young child works, his parents suffers a disutility of $(\psi + \delta)$, where $\delta > 0$ represents the extra cost of forcing a young child to work. We assume that the utility function is weakly increasing in both coordinates. Moreover, we assume that the household has a subsistence consumption level, denoted by $\bar{C}$, such that if the household consumes less than this amount, the adult only cares about maximizing consumption and child leisure becomes irrelevant[8]. These features imply that adult's preferences satisfy the leisure axiom in Basu and Van [3].

A household's wealth is given by labor income. Households are subject to period budget constraints, and we assume, for simplicity, that there is no borrowing or lending,

$$c_{i,a} + c_{i,k} = w_a + w_k l_{i,k}$$

[7] Preference towards children's leisure could also be representing taste for kid's education.

[8] This feature is not necessary to get the main results of the model, but it helps to strengthen the intuition.

where w_a represents the equilibrium wage for the employed adult and w_k represents the equilibrium wage for the employed child[9].

In every period $2N$ simultaneous families coexist: N young families and N old families. At the end of each period, each young family becomes an old family and each old family becomes a young family (the old adult dies, the old child becomes a young adult and gives birth to a young child)[10].

We now model the production sector in this economy. There is a continuum of perfectly competitive firms, each producing the unique manufactured good according to the following production function,

$$f\left(L_a^d, L_k^d, K\right) = F\left(L_a^d + \frac{L_k^d}{\mu}, K\right)$$

where F is a strictly increasing, marginally decreasing and homogeneous of degree one function. Labor input is measured in adult labor equivalent units, $L_a^d + L_k^d/\mu$, where L_a^d and L_k^d are the amounts of adult and child labor demanded, respectively. Implicit in the equation is that adults and children are perfect substitutes in production: one working adult produces the same amount as $\mu\,(> 0)$ working children[11]. This introduces the substitution axiom by Basu and Van [3].

Capital for production is provided by wealthy capitalist families, who own certain amount of physical capital and offer it to the firms in a fixed supply. We denote this fixed supply by $\bar{K}$. In return, these families earn a rental rate of capital given by r.

3.2 Optimal Decisions

Profit maximization implies that equilibrium adult wage is given by,

$$w_a = F_1\left(\left(2 + \left(l_{y,k} + l_{o,k}\right)/\mu\right) N, \bar{K}\right)$$

where F_1 represents the derivative of the production function with respect to labor. The substitutability between child and adult labor implies the following relationship between wages,

$$w_k = w_a/\mu$$

The household head makes the child employment decision. If the household is old, the optimal decision is given by,

$$l_{o,k} = \begin{cases} 1 & \text{if} \quad u\left(w_a, \psi\right) \geq u\left(w_a + w_k, 0\right) \\ 0 & \text{if} \quad u\left(w_a, \psi\right) \leq u\left(w_a + w_k, 0\right) \end{cases}$$

[9] Implicit in the notation is the fact that firms discriminate between adults and children, but not between young and old adults and young and old children. This is mainly assumed for simplicity.

[10] Even though the age structure in this economy may be unrealistic, the objective is to keep a constant proportion of young and old children and adults in the economy.

[11] We assume that a child is less productive than a grown up and, therefore, $\mu > 1$.

and if the household is young and there is no child labor legislation, the optimal decision is given by,

$$l_{y,k} = \begin{cases} 1 & \text{if} \quad u\left(w_a, \psi + \delta\right) \geq u\left(w_a + w_k, 0\right) \\ 0 & \text{if} \quad u\left(w_a, \psi + \delta\right) \leq u\left(w_a + w_k, 0\right) \end{cases}$$

Notice that if young families decide to send their children to work, then old families will also decide to do so.

3.3 Equilibria in the model

This model can generate three different equilibria, each of them characterized by which are the economically active children. We assume the parameters of the model are such that all three equilibria exist[12], which are characterized in the following subsections.

3.3.1 The "all children work" equilibrium

In this equilibrium, all children in the economy work. Adult wage is given by $w_a = F_1\left(\left(1 + 1/\mu\right) 2N, \bar{K}\right)$ and child wage is given by $w_k = F_1\left(\left(1 + 1/\mu\right) 2N, \bar{K}\right)/\mu$. The necessary and sufficient condition for the existence of this equilibrium is,

$$u\left(F_1\left(\left(1 + 1/\mu\right) 2N, \bar{K}\right), \psi + \delta\right) \leq u\left(F_1\left(\left(1 + 1/\mu\right) 2N, \bar{K}\right)\left(1 + 1/\mu\right), 0\right)$$

This condition holds, for example, if the equilibrium wage for the adult is below the subsistence level but the combined wages of the adult and the children are over this level (that is, $w_a < \bar{C}$ and $w_k + w_a \geq \bar{C}$). Therefore, every adult forces his child to work, no matter his age, in order to guarantee the subsistence of the family.

3.3.2 The "no children work" equilibrium

In this equilibrium, none of the children in the economy work. Adult wage is given by $w_a = F_1\left(2N, \bar{K}\right)$ and child wage is given by $w_k = F_1\left(2N, \bar{K}\right)/\mu$. The necessary and sufficient condition for the existence of this equilibrium is,

$$u\left(F_1\left(2N, \bar{K}\right), \psi\right) \geq u\left(F_1\left(2N, \bar{K}\right), 0\right)$$

In order for this condition to hold, it is necessary that equilibrium adult wages are above the subsistence level (that is, $w_a > \bar{C}$).

3.3.3 The "only old children work" equilibrium

In this equilibrium, old families send their old children to work and young families prefer not to send their young children to work. Adult wage is given by $w_a = F_1\left(\left(2 + 1/\mu\right) N, \bar{K}\right)$ and child wage is given by $w_k = F_1\left(\left(2 + 1/\mu\right) N, \bar{K}\right)/\mu$. The necessary and sufficient condition for the existence of this equilibrium

[12] This is not necessarily true for every parameter value.

is,

$$u\left(F_1\left((2+1/\mu)\,N,\bar{K}\right),\psi+\delta\right)\geq u\left(F_1\left((2+1/\mu)\,N,\bar{K}\right)(1+1/\mu)\,,0\right)\geq u\left(F_1\left((2+1/\mu)\,N,\bar{K}\right),\psi\right)$$

In order for this condition to hold, it is necessary that equilibrium adult wages are above the subsistence level (that is, $w_a > \bar{C}$).

3.4 The effect of child labor legislation

As mentioned earlier, we assume that all three equilibria exist as shown in figure 1. For low wages, all the households of the economy will decide to send their children to work. At intermediate wages, old parents will send their old children to work but young parents will decide not to. Finally, when wages are high enough, all families are sufficiently wealthy to avoid sending their children to work.

[FIGURE 1 SHOULD PLACED HERE]

3.4.1 Pre-legislation equilibrium

In 1880, the U.S. labor market was characterized by high levels of child labor participation[13]. Based on this observation, we assume that the pre-legislation situation was an "all children work" equilibrium. Therefore, the pre-legislation equilibrium wages are given by,

$$F_1\left(2\,(1+1/\mu)\,N,\bar{K}\right)=w_a^{pre}=w_k^{pre}/\mu$$

The situation is depicted in figure 2, which represents the equilibrium for both young and old families.

[FIGURE 2 SHOULD BE PLACED HERE]

3.4.2 Post-legislation equilibrium

We now introduce child labor legislation to our model. Since the bulk of state-wide child labor legislation issued in the U.S. at the end of the nineteenth century was a ban on child labor for children of less than 14 years of age, we set the cutoff age between young and old children at 14 years old.

The effect of the child labor legislation depends on whether the legislation is properly enforced or not. In order to explore more interesting results, suppose that the legislation is properly enforced. In this case, the effect of the law depends on the fundamentals of the economy. As a consequence of the prohibition, young children are forced out of the labor market and thus, the pre-legislation "all children work" equilibrium is eliminated. The elimination of young child labor supply causes an increase in wages, which determines the general equilibrium effect of the legislation according tot the following cases.

[13] In the 1880 U.S. census, 47% of boys ages 10 to 13 and 63% of boys ages 14 to 15 were reported working for wages. The corresponding figures for girls are 36% and 39%, respectively.

Case 0: Ineffective legislation In this case, legislation has no effect on child labor participation and the post-legislation situation is identical to the pre-legislation situation. This is shown in figure 3. This outcome is only possible if the legislation is not enforced.

[FIGURE 3 SHOULD BE PLACED HERE]

Case 1: Distortive legislation In this case, the prohibition of young child labor produces a mild increase in equilibrium wages, which is not sufficient to induce changes in households' decisions. Old households still decide to send their old children to work and, in absence of legislation, young households would do so too. The child labor legislation is not Pareto optimal and therefore, not benign[14].

This is shown in figure 4. The legislation is effective in reducing young child labor and ineffective in reducing old child labor.

[FIGURE 4 SHOULD BE PLACED HERE]

Case 2: Small benign legislation In this case, the elimination of young child labor produces a greater increase in wages. The raise in family's income is large enough to induce young families to remove their children from the labor market, but not enough to convince old families to remove their children from the labor market.

The legislation causes a switch between two equilibria. In this case, the pre- and post-legislation equilibrium are both Pareto optimal situations. This is represented in figure 5. As a consequence of the child labor laws, young child labor is reduced and old child labor remains high. Notice how this case is observationally equivalent to the previous one.

[FIGURE 5 SHOULD BE PLACED HERE]

Case 3: Large benign legislation In this case, the removal of young child labor produces a big increase in wages, causing a significant increase in household income. This induces all families to remove their children from the labor force, regardless of their age. As in the previous case, the legislation causes a switch between equilibria and the post-legislation equilibrium is also Pareto optimal.

Figure 6 depicts the situation. The legislation is effective in reducing child labor levels across all ages, even though the legislation is only explicitly targeted to young children. Moreover, notice hat computing differences in treatment effects between treated and untreated children would severely underestimate the treatment effect on young child labor[15].

[FIGURE 6 SHOULD BE PLACED HERE]

3.4.3 Conclusions

The following table summarizes how young and old child labor participation can help us characterize whether child labor legislation was effective and/or benign.

[14] This would also be the outcome if the "all children work" equilibrium were the only equilibrium in the economy.

[15] In our simple theoretical illustration, the labor market participation for both children goes from 100% to 0% but the difference in the treatment effects is zero.

[TABLE 1 SHOULD BE PLACED HERE]

The legislation is effective in reducing young (old) child labor if the treatment effect on young (old) children is negative. Treatment effects can be directly estimated by plugging in our estimators in equation 2.1.

The legislation is benign if its effect is not restricting the household's behavior but rather changing the pre-legislation equilibrium to a different one, where families with young children voluntarily choose to comply with the legislation.

From our previous analysis, case 1 is the only one where the legislation is not benign. Unfortunately, cases 1 and 2 are observationally equivalent and hence, we will only be able to determine that the legislation is benign in cases 0 and 3. In case 0, the legislation has no effect whatsoever, which makes it benign in a non-interesting way. In case 3, the legislation causes a reduction in old child labor, distinguishing it from the remaining cases.

4 Econometric methodology

In this section, we describe the econometric model and the data used for our inference.

4.1 Econometric model

Denote by w the binary variable of interest that takes value of one if the child is employed and zero otherwise. We assume that w is determined by the following binary response model,

$$w = \begin{cases} 1 & \text{if} \quad \alpha_1 d2 + \alpha_2 dB + \alpha_3 d2dB + \beta x + \varepsilon \geq 0 \\ 0 & \text{if} \quad \alpha_1 d2 + \alpha_2 dB + \alpha_3 d2dB + \beta x + \varepsilon < 0 \end{cases}$$

where $d2$ is the binary variable that takes value of one if the observation occurred in 1900 (period 2) and zero if it occurred in 1880 (period 1), dB is the binary variable that takes the value of one if the observation corresponds to a state that issued child labor legislation in 1990 (B states) and zero otherwise (A states), $d2dB$ is their interaction, x are remaining observable controls and ε denotes an unobserved random term. We assume ε is independent and normally distributed, i.e. we adopt a probit specification[16]. If we denote the parameters of the model by $\pi = [\alpha_1, \alpha_2, \alpha_3, \beta]$ and we denote the observable covariates vector by $X = [d2, dB, d2dB, x]$, the probability of employment evaluated at X is given by,

$$P(w = 1 | d2, dB, d2dB, x) = F(X\pi)$$

The parameters of the model can be consistently and asymptotically efficiently estimated by maximum likelihood estimation[17]. We denote the estimated parameters $\hat{\pi} = \left[\hat{\alpha}_1, \hat{\alpha}_2, \hat{\alpha}_3, \hat{\beta}\right]'$. In this case, the estimate of the probability of employment evaluated at X is given by,

$$\hat{P}(w = 1 | d2, dB, d2dB, x) = F(X\hat{\pi})$$

[16] The logit model produced similar results.

[17] For an excellent reference on maximum likelihood estimation and all other topics in this subsection, see Amemiya [1].

Under the usual regularity conditions, $\sqrt{n}\left(\hat{\pi}-\pi\right)$ is an asymptotically normally distributed vector with mean zero and variance covariance matrix given by the Outer Product matrix (or, equivalently, Hessian matrix), which we denote by $V\left(\pi\right)$, and whose consistent estimator is denoted $V\left(\hat{\pi}\right)$.

In the results section, we will be interested in testing whether the probability of children employment is zero or not. Using the Delta method, we deduce that,

$$\sqrt{n}\left(F\left(X\hat{\pi}\right)-F\left(X\pi\right)\right)\xrightarrow{d}N\left(0,f\left(X\pi\right)X'V\left(\pi\right)Xf\left(X\pi\right)\right)$$

where f denotes the derivative of F. This result can be used to show that, under the null hypothesis that the probability of employment at X is zero ($H_0: F\left(X\pi\right)=0$), then,

$$\frac{n\left(F\left(X\hat{\pi}\right)\right)^2}{f\left(X\hat{\pi}\right)X'V\left(\hat{\pi}\right)Xf\left(X\hat{\pi}\right)}\xrightarrow{d}\chi_1$$

where χ_1 denotes the chi-squared distribution with one degree of freedom.

The treatment effect of the legislation corresponds to the change in the probability of employment caused exclusively by the child labor legislation, keeping the remaining covariates at a specific level of interest. Under our assumptions, the treatment effect can be identified by computing the difference in the probability from a situation with no child labor legislation ($d2dB=0$) to a situation with child labor legislation ($d2dB=1$), keeping the remaining covariates constant at a specific level of interest. If we denote $X_0=\left[d\bar{2},d\bar{B},0,\bar{x}\right]$ and $X_1=\left[d\bar{2},d\bar{B},1,\bar{x}\right]$, then the treatment effect evaluated at $\left(d\bar{2},d\bar{B},\bar{x}\right)$ is given by,

$$TE\left(d\bar{2},d\bar{B},\bar{x}\right)=F\left(X_1\pi\right)-F\left(X_0\pi\right)$$

and it can be consistently estimated by,

$$T\hat{E}\left(d\bar{2},d\bar{B},\bar{x}\right)=F\left(X_1\hat{\pi}\right)-F\left(X_0\hat{\pi}\right)$$

In the results section, we will be interested in testing whether the treatment effect is zero or not. Using the Delta method, under the null hypothesis that the treatment effect at $\left[d\bar{2},d\bar{B},\bar{x}\right]$ is zero ($H_0: TE\left(d\bar{2},d\bar{B},\bar{x}\right)=0$), then,

$$\frac{n\left(T\hat{E}\left(d\bar{2},d\bar{B},\bar{x}\right)\right)^2}{\left[\left(f\left(X_1\hat{\pi}\right)X_1-f\left(X_0\hat{\pi}\right)X_0\right)V\left(\hat{\pi}\right)\left(X_1'f\left(X_1\hat{\pi}\right)-X_0'f\left(X_0\hat{\pi}\right)\right)\right]}\xrightarrow{d}\chi_1$$

4.2 Details of the empirical methodology

The data were constructed from a random sample of individual level records from the 1880 and 1900 U.S. federal censuses[18] which are part of the Integrated Public Use Microdata Series or IPUMS[19]. The 1880

[18] Moehling [11] also uses information from the 1910 U.S. census. In the 1910 census, 81% of the children ages 10 to 15 have missing employment information. Since employment information is necessary to construct our dependent variable, we decided not to use this census year. For the 1880 and 1900 censuses, the percent of missing employment information is always below 18%.

[19] The IPUMS data and its description are publicly available at http://www.ipums.umn.edu.

dataset is a 1-in-100 sample containing data on over 107,000 households and 502,000 individuals and the 1900 dataset is a 1-in-760 sample containing data on over 89,000 households and 366,000 individuals.

Following Moehling [11], we restrict attention to children living in non-agricultural households with at least one parent[20]. We also restrict our analysis to white children, since white and non-white kids faced different labor market opportunities. To simplify the construction of variables, we restrict attention to households that contained only one family and to children who were sons or daughters of the household head[21].

In order to implement our inference, we need to adopt a working definition of a child. We define children to be individuals of ages 13 and 14, where 13-year-olds play the role of young children and 14-year-olds play the role of old children[22]. Since the labor market for boys and girls were considered relatively different, we run separate estimations for each of these groups.

We now discuss the main variables in the study. The dependent variable of the study is a binary variable that indicates whether the child has a gainful occupation or not (possibly restricted to occupation in certain sector). Ideally, we would like to observe if an individual held any type of gainful occupation, whether regular and intermittent but, unfortunately, the census data only reports each individual's regular or usual form of employment. As a consequence, we will be limited to study the effect of child labor legislation on children that work *on a regular basis*.

Following Moehling [11], we run two separate estimations. In the first one, the dependent variable indicates if the individual works regularly in any sector[23]. In the second one, the dependent variable indicates if the individual works regularly in the manufacturing sector[24]. Observations with missing occupational information are ignored[25].

The typical state-wide child labor legislation imposed a variety of restrictions: minimum age limits for employment in the manufacturing sector, maximum work hour limits, minimum school enrollment and minimum grade completion requirements. Following Moehling [11], we focus on the minimum age for employment in the manufacturing sector since this is the one that imposed greater constraints on the employment of children. Specifically, we define child labor legislation to be the prohibition of children of less than 14 years of age to be employed in the manufacturing sector. Until 1880, almost none of the U.S. states had passed child labor legislation and, according to Sanderson [16], these laws had little publicity and were poorly enforced. By 1900, already eleven states had issued child labor legislation.

We now proceed to explain the construction of the explanatory variables. The information regarding which states passed child labor legislation between 1880 and 1900 can be found in Ogburn [13], which is reproduced in Moehling [11]. We are also guided by Moehling [11] in the choice of our control variables.

[20] Children in agricultural households worked mainly in agriculture, which was not targeted by the child labor movement at the end of the century.

[21] We eliminate few observations of children between 12 and 15 years of age who were parents.

[22] We have also conducted the analysis defining children to be individuals of ages 12 to 15, where 12 to 13 are young children and 14 and 15 are the old children. This alternative definition is produces similar results, and therefore we consider that our conclusions are robust to how children are defined.

[23] A child will not be considered to have a regular gainful occupation if, according to the 1950-occupation classification, he is at school, keeps the house, helps his parents, is unemployed or without occupation, is invalid or disabled with no occupation reported or has any other non-occupation.

[24] A child will be considered to work in this sector if, according to the 1950-occupational classification, he is employed in a craftsmen or operatives category.

[25] There is no missing occupational information in the 1880 census and less than 18% in the 1900 census.

To control for the household's wealth we include the household head's age and squared age, his Duncan socioeconomic index and his occupational score. We also include variables indicating whether the head reported having no occupation, whether he had an occupation that required no skills, and whether he had a professional or technical occupation[26]. In addition to that, binary variables indicating whether the head could read and/or write are included as well. We also control for the months that the household head has been unemployed in the previous year. We include binary variables that indicate whether the mother and/or the father were absent, whether the child and/or the parents were foreign born, the number of older and younger sisters and brothers, and the presence in the household of children of less than 5 years of age. To capture the human capital stock of the child, we include binary variables that indicate whether the child could read and/or write. To capture the size of the labor market we introduce binary variables that indicate whether the household lived in an area with high population level (25,000 or more habitants), medium population level (between 2,500 and 24,999 habitants) or low population level (less than 2,500 habitants, omitted). We also introduce variables that indicate the metropolitan status of the household, that is, whether the household was located outside a metropolitan area (Metro1), in a central city within a metropolitan area (Metro2) or outside a central city within a metropolitan area (Metro3, omitted).

Summary statistics for all the variables used in the regressions are provided in tables 2 and 3.

[TABLES 2 AND 3 SHOULD BE PLACED HERE]

5 Results

This section reports the results of the estimation.

5.1 Regression estimates

Table 4 provides the estimates of the parameters of the likelihood of having an occupation in any sector, i.e. general employment. We indicate statistical significance of the coefficients with the usual star notation[27]. Under the assumptions of the model, the sign of the coefficient associated to the variable $d2dB$ is the sign of the treatment effect of the child labor legislation on the child labor. In all the samples, the child labor legislation reduced the probability of having an occupation in any sector.

[TABLE 4 SHOULD BE PLACED HERE]

Table 5 presents the estimates of the parameters for the likelihood of having an occupation in the manufacturing sector. Results indicate that child labor legislation reduced the probability of having an occupation in the manufacturing sector.

[TABLE 5 SHOULD BE PLACED HERE]

[26] Excluded categories include occupations that require skill, clerical occupation, sales, managers, proprietors and officials.

[27] One star means significant at 10% level, two stars mean significant at 5% level and three stars mean significant at 1% level.

5.2 Effectiveness analysis

Table 6 provides estimates of the probability of child employment in any sector with and without child labor legislation. By computing the difference between these two, we also compute an estimate of the treatment effect of the child labor legislation on child labor. The remaining control variables are evaluated at five different values of interest: (a) the U.S. average on both periods, (b) the pre-treatment (1880) average on non-treated states (A states), (c) the pre-treatment (1880) average on treated states (B states), (d) the post-treatment (1900) average on non-treated states (A states) and, finally, (e) the post-treatment (1900) average on treated states (B states).

[TABLE 6 SHOULD BE PLACED HERE]

Child labor legislation generated a significant decrease in the probability of employment for young boys and a (barely) insignificant decrease in probability of employment for young girls. Also, the legislation generated an insignificant decrease in the probability of employment for older boys and significant decrease in the probability of employment of older girls.

Table 7 describes the effectiveness of the child labor legislation in reducing child labor in the manufacturing sector. The legislation produced insignificant decreases in probability of employment for all groups of children.

[TABLE 7 SHOULD BE PLACED HERE]

5.3 Benignity analysis

Child labor legislation decreased general employment levels of young and old boys, but the decrease is statistically significant only for young boys. In this case, we do not have sufficient evidence to decide if the legislation had a benign effect on general employment for boys. This type of outcome could be caused by a benign legislation (case 2) or by a distortive legislation (case 1). Girls present the opposite pattern. The legislation reduced general employment levels of young and old girls, but the reduction is statistically significant only for old girls. According to our analysis, this is evidence that the reduction of employment of girl labor caused by the imposition of child labor legislation was benign (case 3).

Since the child labor legislation was found to be ineffective in reducing manufacturing employment for all groups of children, we deduce that, in terms of manufacturing employment, it represented a trivially benign public policy (case 0).

6 Conclusions

Between 1880 and 1930, the employment rate of children ages 10 to 15 decreased by over 75% in the U.S. economy. During this period, several U.S. states dictated state-wide child labor legislation that imposed minimum age restrictions for employment in the manufacturing sector. This paper studies whether this child labor legislation contributed to the decline in child labor market participation.

In addition to evaluating whether the legislation was effective or not, we analyze the labor market mechanism by which this takes place. This analysis may allow us to establish if the legislation constituted a benign policy or not, that is, whether the legislation imposed constraints to the behavior of the children (not benign) or whether it generated a change in labor market equilibrium (benign).

The effectiveness of the child labor legislation in reducing child labor had already been addressed in the literature, mainly by Moehling [10] and Moehling [11]. In her work, Moehling estimates a non-linear model (probit or logit) to analyze the children's employment decision and applies differencing estimation methods to characterize the effect of the legislation. We show that differencing estimation methods are inadequate to study the effectiveness of child labor legislation. First, differencing estimators do not identify the treatment effect of interest in non-linear models, such as the one used to analyze labor market participation. Second, when the economy presents multiple equilibria, differencing estimators may severely underestimate the effect of the legislation.

In order to analyze the consequences of child labor legislation, we develop a model along the lines of Basu and Van [3], which takes into account the possible multiplicity of equilibria. This model allows us to derive observable consequences to identify whether the legislation was effective and/or benign.

We conduct separate estimates for young children (13-year-olds), who were legally prohibited to work in the manufacturing sector, and old children (14-year-olds), who were free to work. Our estimates indicate that the legislation was effective in reducing general employment for young boys, for old girls and, mildly, for young girls. Based on this information, we can deduce that the legislation was benign for general employment of girls. Unfortunately, our results do not allow us to decide if the legislation was benign for general employment of boys. When we conduct the estimation for labor participation in the manufacturing sector, we find that child labor legislation was ineffective in reducing child labor for both girls and boys and, hence, trivially benign.

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	Equilibrium level of...		Legislation is...			Diff. in T.E. between young & old equals T.E. on young?
	Old child participation	Young child participation	Effective on young?	Effective on old?	Benign?	
Case 0	constant	constant	No	No	Yes	Yes
Case 1	constant	decreases	Yes	No	No	Yes
Case 2	constant	decrease	Yes	No	Yes	Yes
Case 3	decreases	decreases	Yes	Yes	Yes	No

Table 1: Possible cases

	Boys			Girls		
Variable	Mean	Std. dev.	Num. of obs	Mean	Std. dev.	Num. of obs
Works in any sector	0.142	0.349	5737	0.054	0.225	5726
Works in manufacturing	0.028	0.166	5737	0.009	0.097	5726
$d2dB$	0.225	0.418	5737	0.258	0.438	5726
dB	0.476	0.499	5737	0.493	0.5	5726
$d2$	0.466	0.499	5737	0.518	0.5	5726
Metro Area 1	0.323	0.468	5737	0.33	0.47	5726
Metro Area 2	0.096	0.295	5737	0.1	0.3	5726
U.S. born	0.919	0.272	5737	0.928	0.258	5726
Absent father	0.129	0.335	5737	0.128	0.334	5726
Absent mother	0.034	0.181	5737	0.033	0.178	5726
No. children under 5	0.605	0.826	5737	0.611	0.826	5726
School	1.837	0.369	5737	1.855	0.352	5726
Read	0.958	0.201	5737	0.973	0.162	5726
Write	0.944	0.229	5737	0.962	0.191	5726
No. older brother	0.731	0.945	5737	0.738	0.954	5726
No. younger brother	1.027	1.106	5737	1.038	1.123	5726
No. older sister	0.698	0.906	5737	0.67	0.899	5726
No. younger sister	1.013	1.1	5737	1.008	1.117	5726
Head's age	44.761	7.726	5737	44.584	7.813	5726
Head's age^2	2063.227	731.151	5737	2048.785	739.002	5726
Head reads	0.922	0.269	5737	0.926	0.262	5726
Head writes	0.905	0.293	5737	0.909	0.287	5726
Head S.E.I.	24.253	22.363	5737	24.776	22.759	5726
Head's Occup. Score	23.552	12.486	5737	23.875	12.744	5726
Head's Unemp. Months	0.911	2.205	5084	0.844	2.144	5093
Parents born in U.S.	0.505	0.5	5737	0.507	0.5	5726
Medium population	0.218	0.413	5737	0.229	0.42	5726
Big population	0.38	0.485	5737	0.393	0.488	5726
Head has no occupation	0.113	0.317	5695	0.11	0.313	5689
Head is unskilled	0.229	0.42	5695	0.235	0.424	5689
Head is professional	0.035	0.184	5695	0.041	0.199	5689

Table 2: Summary statistics for young children

Variable	Boys Mean	Boys Std. dev.	Boys Num. of obs.	Girls Mean	Girls Std. dev.	Girls Num. of obs.
Works in any sector	0.438	0.496	5333	0.18	0.384	5135
Works in manufacturing	0.1	0.299	5333	0.038	0.19	5135
d2dB	0.236	0.424	5333	0.268	0.443	5135
dB	0.492	0.5	5333	0.513	0.5	5135
d2	0.47	0.499	5333	0.524	0.499	5135
Metro Area 1	0.352	0.478	5333	0.337	0.473	5135
Metro Area 2	0.097	0.295	5333	0.097	0.296	5135
U.S. born	0.895	0.307	5333	0.909	0.288	5135
Absent father	0.159	0.366	5333	0.142	0.349	5135
Absent mother	0.036	0.187	5333	0.037	0.189	5135
No. children under 5	0.462	0.748	5333	0.5	0.767	5135
School	1.554	0.497	5333	1.635	0.481	5135
Read	0.962	0.19	5333	0.975	0.155	5135
Write	0.949	0.219	5333	0.967	0.179	5135
No. older brother	0.680	0.875	5333	0.672	0.88	5135
No. younger brother	1.089	1.181	5333	1.096	1.176	5135
No. older sister	0.609	0.824	5333	0.59	0.825	5135
No. younger sister	1.061	1.147	5333	1.107	1.2	5135
Head's age	46.609	7.796	5333	46.47	7.63	5135
Head's age^2	2233.147	763.71	5333	2217.694	745.364	5135
Head reads	0.913	0.282	5333	0.927	0.26	5135
Head writes	0.892	0.311	5333	0.91	0.286	5135
Head S.E.I.	23.045	22.333	5333	25.41	23.429	5135
Head's Occup. Score	22.532	13.088	5333	23.647	13.424	5135
Head's Unemp. Months	0.87	2.168	4528	0.855	2.102	4456
Parents born in U.S.	0.485	0.5	5333	0.504	0.5	5135
Medium population	0.224	0.417	5333	0.224	0.417	5135
Big population	0.406	0.491	5333	0.396	0.489	5135
Head has no occupation	0.15	0.357	5286	0.129	0.336	5090
Head is unskilled	0.224	0.417	5286	0.208	0.406	5090
Head is professional	0.034	0.181	5286	0.044	0.205	5090

Table 3: Summary statistics for old children

	Young children		Old children	
Variable	Boys	Girls	Boys	Girls
$d2dB$	-0.542***	-0.292	-0.0897	-0.540***
$d2$	-0.342***	-0.235	-0.313***	0.342**
dB	-0.121	0.0175	-0.0886	0.530***
Metro area 1	0.192	0.490**	0.256	0.156
Metro area 2	-0.108	0.204	-0.0651	0.472***
U.S. born	-0.270*	-0.427***	-0.386***	-0.253*
Absent father	0.552***	0.549**	0.164	0.537**
Absent mother	0.240	-0.217	-0.0652	-0.222
No. children under 5	-0.209***	-0.208**	-0.0894	-0.0836
School	-1.990***	-1.660***	-2.073***	-1.908***
Reads	1.321***	0.0550	0.278	0.419
Writes	-1.003***	0.425	-0.0472	-0.421
No. older brothers	0.0513	-0.0322	0.0118	-0.0516
No. younger brothers	0.0903**	0.0878*	0.142***	0.0451
No. older sisters	-0.147***	0.0930	-0.0118	0.0879
No. younger sisters	0.116***	0.175***	0.0553	0.129***
Head's age	0.0757	-0.0636	-0.0143	-0.0206
Head's age^2	-0.000798	0.000658	0.000194	0.000273
Head reads	-0.310	-0.236	0.00439	-0.632
Head reads	-0.0114	0.0624	-0.376	0.453
Head writes	-0.00827*	-0.0187***	-0.008**	-0.0178***
Head's S.E.I	-0.00356	0.0127	0.0107	0.0169
Head's unemp. months	0.0260	0.0166	0.0469***	0.0486***
Parents born in U.S.	-0.0385	-0.193	0.0303	0.0407
Medium population	-0.142	-0.0370	-0.0270	0.0488
Big population	-0.369	-0.120	-0.163	0.457**
Head has no occupation	-0.611	dropped	-0.366	0.407
Head is unskilled	0.225**	0.209*	0.0366	0.169*
Head is professional	0.151	0.378	-0.360	-0.237
Constant	1.314	2.649**	3.473***	1.3465
Number of observations	2348	2388	2344	2375

Table 4: Probit estimates of the likelihood of having an occupation in any sector

	Young children		Old children	
Variable	Boys	Girls	Boys	Girls
d2dB	-0.360	-0.687*	-0.184	-1.265***
d2	-0.0206	0.818***	0.175	1.044***
dB	-0.451**	0.379	-0.117	0.595**
Metro area 1	0.231	0.166	-0.169	0.918*
Metro area 2	0.0547	-0.376	-0.506***	0.446
U.S. born	-0.313	-0.534**	-0.213*	-0.114
Absent father	0.704**	0.554	0.223	-0.498
Absent mother	0.224	-0.136	0.253	-0.425
No. children under 5	-0.183	0.111	0.0178	-0.0139
School	-1.411***	-1.72***	-1.165***	-1.606***
Reads	0.418	0.557	-0.384	1.181
Writes	-0.0771	-0.102	0.739	-0.974*
No. older brothers	0.0280	-0.206*	0.105**	-0.218**
No. younger brothers	0.0588	-0.0956	0.0672	0.0426
No. older sisters	-0.124	0.0583	-0.0829	-0.0731
No. younger sisters	0.169**	-0.0500	0.0191	-0.0361
Head's age	-0.127**	-0.0463	-0.0458	0.0821
Head's age^2	0.00136**	0.000742	0.000539	-0.000694
Head reads	-0.330	0.594	0.0379	-1.119
Head writes	0.153	-0.679	-0.331	1.423
Head's S.E.I.	-0.0515***	-0.0195	-0.0187***	0.00651
Head's occup. score	0.0969***	0.0317	0.0449***	-0.0236
Head's unemp. months	0.0607**	0.0559*	0.00568	0.0479
Parents U.S. born	-0.371**	-0.363	-0.450***	-0.385*
Medium population	-0.691***	0.0132	-0.270**	0.0970
Big population	-0.395	0.332	-0.0460	-0.190
Head has no occupation	0.907	dropped	1.051**	0.708
Head is unskilled	0.606***	0.0975	0.297***	0.170
Head is professional	dropped	dropped	-0.0989	0.156
Constant	2.085	0.00608	0.662	-2.955
Number of observations	2267	2278	2344	2375

Table 5: Probit estimates of the likelihood of having an occupation in manufacturing sector

	Young children					
	Boys			Girls		
	With C.L.L.	No C.L.L.	T.E.	With C.L.L.	No C.L.L.	T.E.
1880-1900 US	5.29%***	14.11%***	-8.82%***	0.26%*	0.62%***	-0.36%
1880, A states	11.06%**	24.78%***	-13.71%***	0.23%	0.55%***	-0.32%**
1880, B states	6.94%***	17.41%***	-10.46%***	0.61%*	1.35%***	-0.73%
1900, A states	3.76%**	10.80%***	-7.03%***	0.09%	0.24%**	-0.15%
1900, B states	1.85%***	6.13%***	-4.28%**	0.29%***	0.69%**	-0.36%
	Old children					
	Boys			Girls		
	With C.L.L.	No C.L.L.	T.E.	With C.L.L.	No C.L.L.	T.E.
1880-1900 US	20.55%***	23.20%***	-2.64%	1.18%**	4.24%***	-3.06%***
1880, A states	30.60%***	33.81%***	-3.21%	0.32%	1.38%***	-1.08%***
1880, B states	24.46%***	27.36%***	-2.90%	1.82%**	6.03%***	-4.21%***
1900, A states	16.15%***	18.45%***	-2.29%	0.58%*	2.36%***	-1.78%***
1900, B states	11.90%***	13.78%***	-1.88%	4.04%***	11.40%***	-7.36%**

Table 6: Likelihood of employment in any sector and treatment effects

	Young children					
	Boys			Girls		
	With C.L.L.	No C.L.L.	T.E.	With C.L.L.	No C.L.L.	T.E.
1880-1900 US	0.13%	0.41%**	-0.27%	0.00%	0.01%	-0.01%
1880, A states	0.38%	1.06%**	-0.67%	0.00%	0.00%	-0.00%
1880, B states	0.07%	0.23%	-0.16%	0.00%	0.01%	-0.01%
1900, A states	0.20%	0.60%**	-0.39%	0.00%	0.01%	-0.01%
1900, B states	0.03%	0.13%	-0.09%	0.01%	0.16%	-0.14%
	Old children					
	Boys			Girls		
	With C.L.L.	No C.L.L.	T.E.	With C.L.L.	No C.L.L.	T.E.
1880-1900 US	2.27%**	3.47%***	-1.19%	0.00%	0.29%	-0.29%
1880, A states	2.69%*	4.06%***	-1.36%	0.00%	0.01%	-0.01%
1880, B states	1.91%**	2.95%***	-1.03%	0.00%	0.21%	-0.21%
1900, A states	2.71%**	4.08%***	-1.37%	0.00%	0.31%	-0.31%
1900, B states	1.82%***	2.82%***	-0.99%	0.11%	3.68%	-3.57%

Table 7: Likelihood of employment in manufacturing sector and treatment effects

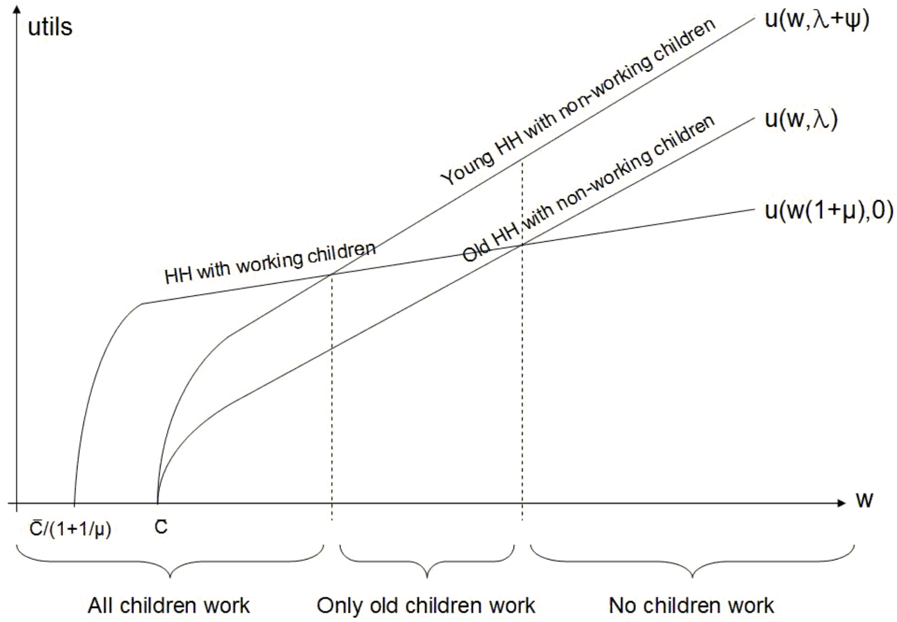

Figure 1: Multiple equilibria

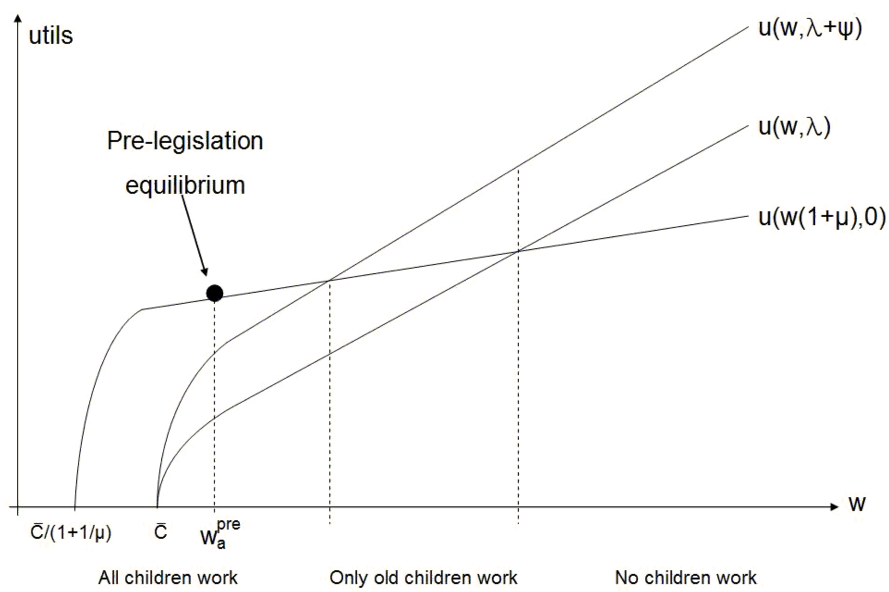

Figure 2: Pre-equilibrium situation

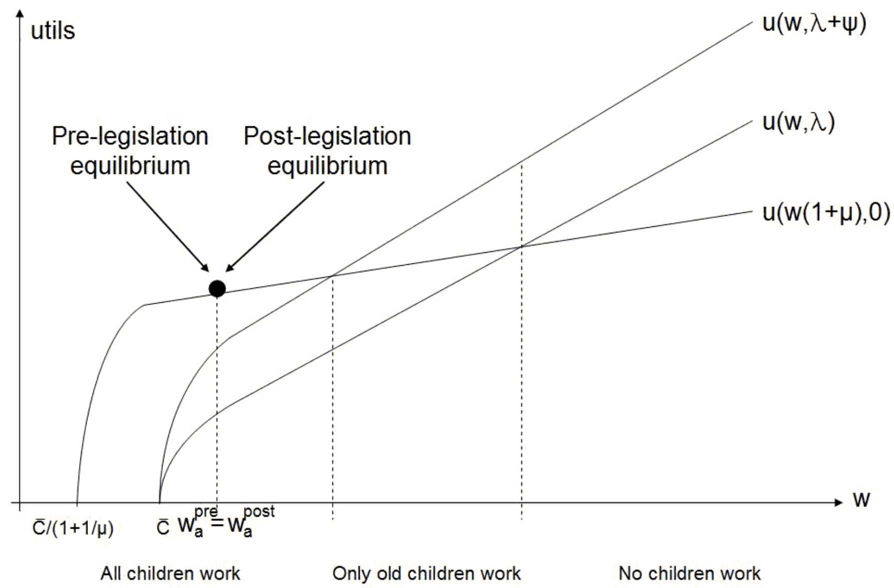

Figure 3: Case 0: no effect

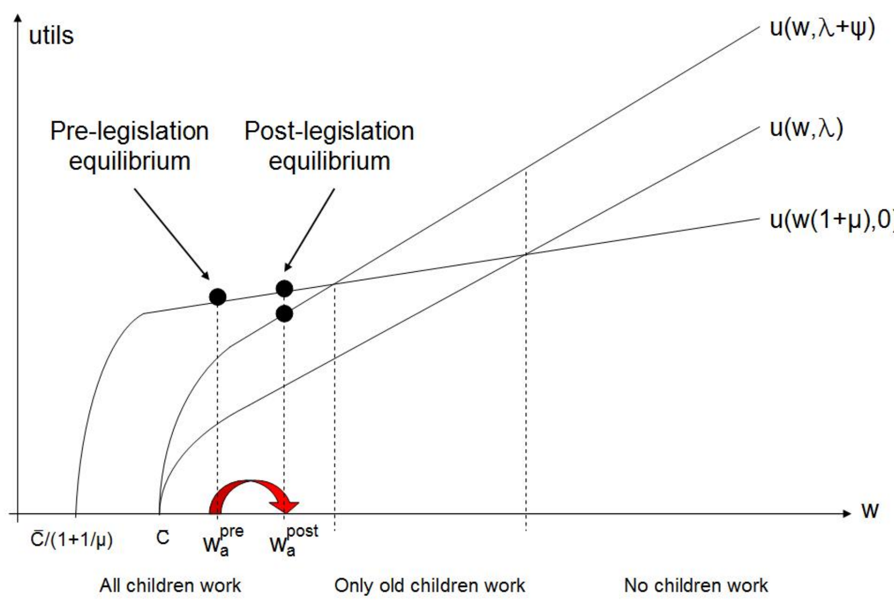

Figure 4: Case 1: small distortive effect

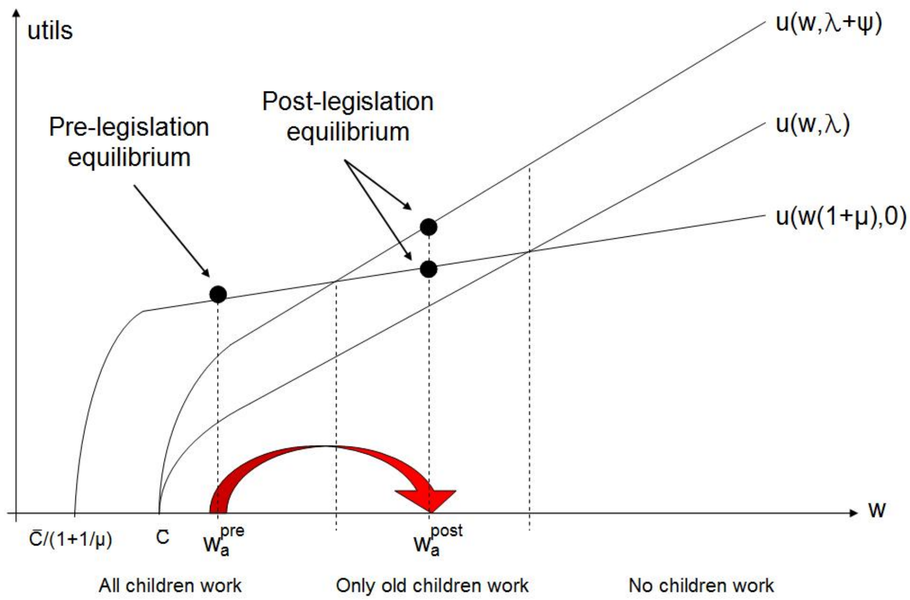

Figure 5: Case 2: small benign effect

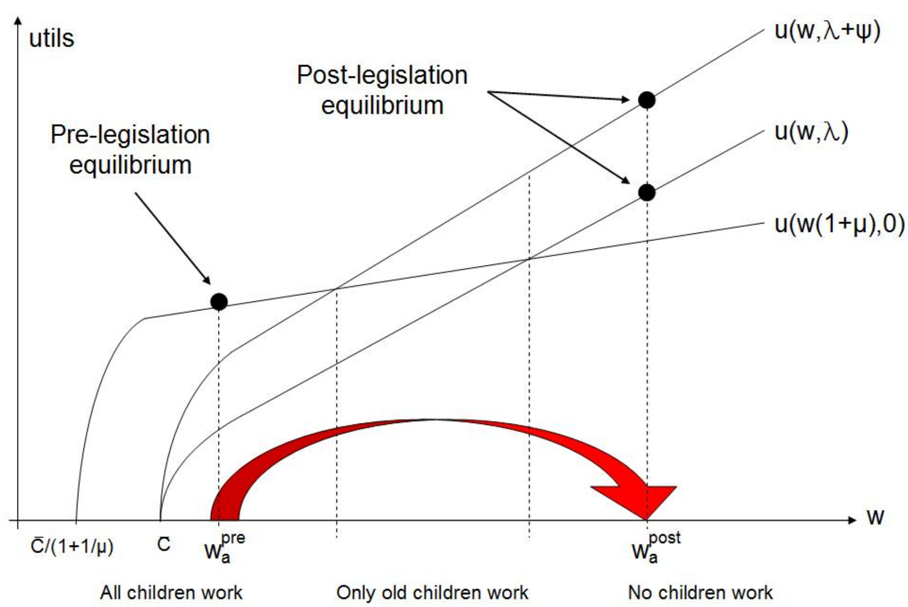

Figure 6: Case 3: large benign effect