The Macroeconomics of Child Labor Regulation

Matthias Doepke
Fabrizio Zilibotti

CCPR-032-03

December 2003

The Macroeconomics of Child Labor Regulation*

Matthias Doepke
UCLA

Fabrizio Zilibotti
IIES, IFS and CEPR

December 2003

Abstract

We construct a dynamic general equilibrium model with endogenous policy choice to analyze the adoption of child labor laws. The key mechanism in our model is that parents' decisions on family size interact with their preferences for child labor regulation. If policies are endogenous, multiple steady states with different child labor policies can exist. Consistent with empirical evidence, the model predicts a positive correlation between child labor, fertility, and inequality. In addition, the theory implies that the political support for regulation should increase if a rising skill premium induces parents to choose smaller families. The model replicates features of the history of the U.K. in the nineteenth century, when regulations were introduced after a period of rising wage inequality, and coincided with rapidly declining fertility rates and an expansion of education.

*An earlier version of this paper was presented under the title "Voting with Your Children: A Positive Analysis of Child Labor Laws." We thank Richard Blundell, Moshe Hazan, Narayana Kocherlakota, Dirk Krueger, Robert Lucas, Torsten Persson, Victor Rios-Rull, Jean-Laurent Rosenthal, Ken Sokoloff, Nancy Stokey, Kjetil Storesletten, and seminar participants at the Minnesota Workshop in Macroeconomic Theory, the SED Annual Meetings in New York, the Max-Planck Institute for Demographic Research, NBER, Minerva Conference "From Stagnation to Growth" and departmental seminars at CERGE-EI, IIES, LSE, Louvain, MIT, Northwestern, Stanford, UCL, UC Davis, UCLA, and Wisconsin for helpful comments. We also thank Christina Loennblad for editorial assistance. Doepke acknowledges financial support by the National Science Foundation (grant SES-0217051). Doepke: Department of Economics, UCLA, 405 Hilgard Ave, Los Angeles, CA 90095. E-mail address: doepke@econ.ucla.edu. Zilibotti: IIES, SE 10691 Stockholm, Sweden. E-mail: fabrizio.zilibotti@iies.su.se.

1 Introduction

In the current political debate, child labor is commonly regarded as an evil to be eradicated. Before the nineteenth century, however, the perception of child labor was quite different: not only did most children work, but child labor was also considered to be beneficial for children. Much more feared than child labor was its opposite, idleness of children, which was thought to lead to disorder, crime, and lack of preparation for a productive working life.[1] Opposition to child labor and, ultimately, child labor laws arose only after the rise of the factory system, which changed traditional employment patterns for children. Child labor regulations (CLR) were first introduced in Britain in the nineteenth century, and have by now been put into place in all industrialized countries. At the same time, child labor continues to be a widespread phenomenon in many developing countries, where CLR are often either lacking or weakly enforced.

What explains shifting attitudes towards child labor and the adoption of CLR in some countries, but not others? This paper argues that a society's views on child labor depend on economic incentives. In particular, self-interested agents may have different opinions on this issue depending on the complementarity of their skill endowment with child labor, and the extent to which their family income relies on child labor. Under some conditions, the support for child labor can be unanimous in the society, and self-reinforcing over time. However, technological change can break this unanimity. In particular, either an increase in the skill premium or a reduction in the complementarity between adult and child labor can shift the preferences of unskilled workers over CLR and induce them to support a ban on child labor. Once CLR are introduced, their support increases over time and restrictions are never lifted.

Our emphasis on the preferences of unskilled workers is motivated by the observation that, in Britain as well as the United States, the trade union movement played a key role in lobbying for the introduction of CLR.[2] According to Nardinelli (1990) (e.g., p.141), the unions' actions were driven mainly by a concern about children competing with unskilled adults in the labor market, and therefore exerting downward pressure on wages. This view is in line with the main thesis of the paper.

We formalize our ideas with the aid of a dynamic general equilibrium model. The model economy is populated by overlapping generations of altruistic agents who

[1]Similar arguments were still to be heard in the twentieth century. Opponents of a child labor bill discussed by the state legislature of Georgia in 1900 argued that the "danger to the child was not in work, but in idleness which led to vice and crime." (Davidson 1939, p. 77). The bill was defeated.

[2]In Britain, the first regulation of the employment of children was introduced in 1833, but it was limited to the textile industry. A series of Factory Acts extended the restrictions first to the mines, in 1842, and then to other non-textile industries in the 1860s and 1870s. While humanitarian organizations were a major driving force behind the first regulations, the unions' role was particularly important in the second half of the nineteenth century. CLR came later in the U.S., with state regulation being introduced mainly between 1880 and 1910, and federal statutes starting to appear in 1910-20.

choose their family size (fertility) and the education of their children, facing a Beckerian quantity-quality tradeoff. The fertility choice has irreversible consequences for an agent's attitude towards child labor. Parents with few children have little to gain from child labor and are, ceteris paribus, more inclined to support the introduction of restrictions. Thus, the political preferences of a given worker may differ before and after deciding on the number of children: before choosing family size, parents have a margin of adjustment to policy changes, but this is lost once fertility decisions are taken.

The other key determinant of agents' political preferences is their skill level. We make the realistic assumption that child labor competes with unskilled adult labor in the labor market. Hence, CLR have a general equilibrium effect on wages and skill premia that makes unskilled workers more supportive of CLR than skilled workers. This effect is similar to the one described by Basu and Van (1998).

The steady state equilibrium of a laissez-faire economy (i.e., absent CLR) is unique. Suppose, however, that unskilled workers can influence the child labor legislation (through their political organizations and unions), and that the political choice is endogenous. In this case, multiple steady states may arise. In one steady state, child labor is unrestricted, and unskilled workers choose large families and make their children work. Poor families depend heavily on child labor income and all agents, including unskilled workers, oppose the introduction of restrictions. In another steady-state, CLR are in place, and unskilled workers have small families and support CLR. This multiplicity hinges on the irreversible nature of fertility decisions.

The existence of multiple steady states can explain why some developing countries persistently get locked-in into equilibria where a large proportion of children works and political support for the introduction of CLR is low, while other countries at similar stages of development have strict regulations and a low incidence of child labor.

We then consider the effect of technological change, and show that skill-biased technological change can lead to the disappearance of the equilibrium without CLR. According to our theory, the political support for CLR rises over time if technological change increases the return to education or eliminates specialized tasks for children (see Kirby 1999). In an economy where all children of unskilled parents initially work, a progressive increase in the return to schooling will eventually induce some of the newly formed families to have fewer children and send them to school. The proportion of small families will keep increasing and, eventually, a majority of the unskilled workers will support CLR. This prediction of the model is consistent with the observation that CLR were first introduced in Britain (as well as in other Western countries) in the nineteenth century after a period of increasing wage inequality. Moreover, the introduction of CLR was accompanied by a period of substantial fertility decline and an expansion of education, which is again consistent with the theory.

Along the transition, the theory predicts that the change in workers' preferences for

CLR occurs gradually. Moreover, the working class does not back CLR unanimously at first, since families with many children continue to depend on child labor. Consistent with these predictions, Cunningham (1996) observes that during the introduction of the first restrictions in Lancashire "child labor found its strongest and most persistent advocates within the working class, much to the embarrassment of trade union leaders." Similarly, when restrictions on child labor were proposed in the mill villages in the Southern U.S., many workers, particularly those with large families, were opposed precisely because their own children were working: "For an adult male operative whose entire family worked in the mill, factory legislation would reduce family income. Such operatives tended to oppose child labor laws" (Nardinelli 1990 p. 142).

A natural question is whether the labor movement had the political strength to impose its desired political choice over CLR. A thorough investigation of the role of political institutions is beyond the scope of our analysis. We note, however, that in spite of the limited voting rights of the poor in the nineteenth century, unions were able to achieve improvements in labor legislation in favor of their members (such as shorter working hours, safety regulations etc., see Marimon and Zilibotti 2000) through other actions such as strikes or public campaigns. Therefore, we find it reasonable to focus on the preferences of the working class. An alternative, complementary argument is that CLR may have also served the interests of other groups who were part of the political elite. We formalize this idea by introducing, in an extension, capital as a third productive factor, which is owned by a specific set of agents (the capitalists). We show that CLR may in fact benefit capitalists as well as unskilled workers. CLR affect capitalists' income via two channels. First, CLR reduce the supply of unskilled labor, by removing children from the labor market and, possibly, by reducing population growth. This harms capitalists. Second, CLR induce parents to educate their children, thereby increasing the average skill of the work force. If the technology is sufficient skill-intensive, this benefits capitalists. The net effect is in general ambiguous. However, skill-biased technological change unambiguously increases the importance of the second channel. Therefore, the theory predicts that the same shock that changed the attitudes of unskilled workers towards CLR may have changed the preferences of capitalists in the same direction, inducing them to either weaken their opposition or even support CLR.

In the following section, we discuss the related theoretical and empirical literature on child labor and its regulation. Section 3 describes the model economy. In Section 4 we analyze steady states for fixed policies and provide conditions for existence and uniqueness. Political economy is introduced in Section 5. We introduce the concept of a steady state political equilibrium (SSPE), and show that there can be multiple SSPE. Section 6 demonstrates how exogenous changes in the skill premium can trigger the introduction of child labor laws, and Section 7 considers how capital owners are affected by this transition. Section 8 concludes.

2 Overview of Related Literature

Our contribution relates to different streams of the literature. A number of recent papers have developed arguments why ruling out child labor might be improve welfare.[3] In Basu and Van (1998), CLR can be beneficial because parents dislike child labor, but have to send their children to work if their income falls below the subsistence level. Ruling out child labor can increase the unskilled wage sufficiently to push family incomes above the subsistence level even when children do not work. In essence, the Basu-Van model has multiple equilibria in the labor market, and CLR can be used to select the "good" equilibrium. A similar effect is at work in our model: unskilled workers who send their children to school prefer to rule out child labor in order to increase their own wage. Contrary to Basu and Van, however, our model does not generate multiple equilibria in the absence of regulation. Other reasons why child labor may be inefficient are presented by Baland and Robinson (2000), Dessy and Pallage (2001), and Ranjan (2001), who explore the role of coordination failures and imperfections in financial markets.

The decline of child labor in the process of development has also been analyzed by Berdugo and Hazan (2002). In their model, technical progress increases the return to education and induces altruistic parents to switch from quantity to quality in their choice of fertility and child-rearing (as in Galor and Weil 2000). Child labor declines in parallel to the rise of education. Since education, in turn, increases technical progress, CLR may expedite the transition and temporarily foster growth. While Berdugo and Hazan develop a representative-agent economy with exogenous policies, our paper concentrates on distributional conflicts associated with the introduction of CLR. Our approach is similar, in this respect, to that of Krueger and Tjornhom (2000), who use a quantitative model to assess the welfare effect of child labor laws on different groups of the population in the presence of human capital externalities. While certain groups of workers can gain from a ban on child labor, compulsory education is generally the preferable policy in their model. Krueger and Tjornhom abstract from fertility choice and endogenous policies, however.

Galor and Moav (2001) use a model with financial market imperfections to show that an increase in the return to human capital may have induced capitalists to support education subsidies for the poor. Similarly, it could be argued that the introduction of CLR was a vehicle to spread education, and, therefore may have actually served the interest of capitalists. Thus, our analysis is close and complementary to Galor and Moav (2001). We choose however to emphasize the preference of the working class since historically unions rather than firm-owners were the main active campaigners of CLR. Of course, the success of the unions' action may have been due to the diminished opposition of firm-owners to CLR, once they realized that the short-run loss

[3] A comprehensive overview of the economic literature on child labor can be found in the recent surveys by Basu (1999) and Brown, Deardorff, and Stern (2001).

could be offset by an increase in human capital accumulation.

Our paper also relates, both in substance and method, to recent work by Greenwood, Seshadri, and Yorukoglu (2004) who develop a dynamic general equilibrium model where technological change generates a long transition in female labor supply. In their model, improvements in the household technology reduce the cost for women to participate in the market economy. In contrast, in our model, an increase in the return to education (and, possibly, CLR) reduces fertility and induces families to withdraw their children from the labor force and send them to school.

An important question is whether CLR were ever binding or legally enforced. A number of empirical studies have measured the effects of legal restrictions on labor supply and the education of children. Peacock (1984) documents that the British Factory Acts of 1833, 1844 and 1847 were actively enforced by inspectors and judges, resulting in a large number of firms being prosecuted and convicted from 1834 onwards. In line with this observation, Galbi (1997) finds that the number of children employed in English cotton mills fell significantly after the introduction of the restrictions in the 1830s. Despite the effects on children's employment, Nardinelli (1980) concludes that the early Factory Acts had only limited impact on aggregate child labor, since the reduction in child labor outside the textile industry was small. Moving to the U.S., Acemoglu and Angrist (2000) use state-by-state variation in child labor laws to estimate the size of human capital externalities. Using data from 1920 to 1960, their results suggest that CLR were binding in most of this period. Margo and Finegan (1996) find that the combination of compulsory schooling laws with child labor regulation is binding in the sense that it significantly raises school attendance, while compulsory schooling laws alone have insignificant effects. Similarly, Angrist and Krueger (1991) find that compulsory schooling laws had a significant effect on schooling in the twentieth century. However, Moehling (1999) studies the effect of state-by-state differences in minimum age limits from 1880 to 1910, and finds that CLR contributed little to the decline in child labor. We will discuss this finding from the perspective of our model in Section 6.

A key part of our theory is that parents face a tradeoff between the number of children and the quality of each child. The notion of a quantity-quality tradeoff, going back to Becker (1960) and Becker and Lewis (1973), was originally developed to account for fertility behavior in developed countries, where there is strong evidence for such a tradeoff. In both cross section and time series data, family size and education levels tend to be negatively related. In developing countries the picture is more mixed, but many studies still find evidence of a quantity-quality tradeoff. Rosenzweig and Evenson (1977) examine a data set from rural India and find fertility to be positively associated with child labor and negatively associated with schooling attainment. Similarly, Rosenzweig and Wolpin (1980) report that an exogenous increase in fertility reduces child quality as measured by a schooling index, and Singh and Schuh (1986) find that child labor has a positive effect on fertility in rural Brazilian data. Ray (2000) studies national household surveys from Peru and Pakistan, and documents that the number of children in a family significantly raises labor supply of children in Peru, whereas the estimate for Pakistan is insignificant. In both Peru and Pakistan schooling is negatively related to the number of children. Hossain (1990) finds that in rural counties in Bangladesh high child labor wages are associated with larger family sizes and lower levels of schooling. Finally, in a recent study on the effects across states of the Indian liberalization reform of 1991, Chamarbagwala (2003) finds that an increase in the return to education had significant effects on child labor.

Cross-country analysis is also consistent with the main predictions of the theory. Ideally, one would like to have direct measures of CLR, but regulations are difficult to measure and compare across countries. Our theory, however, predicts that the incidence child labor should be positively correlated to fertility rates. To examine this prediction, we regressed child labor over fertility rates for a panel of 125 countries from 1960 to 1990, with observations at ten-year intervals, controlling for time dummies, $log(GDP)$, $log(GDP)$ squared, the share of agriculture in employment, and the share of agriculture in employment squared.[4] The coefficient on the fertility rate is positive and highly significant. The point estimate is 1.3, and the White standard error is 0.29 (the R^2 of the regression is 0.89).[5] The estimate implies that a one standard deviation increase in the fertility rate is associated with and increase in the child labor rate of 2.5 percent (the child labor rates varies in the sample between 0 and 59 percent with a standard deviation of 15 percent). If we add a measure of income inequality (Gini coefficient), the point estimate of the effect of inequality on child labor is positive, but statistically insignificant. If, in addition, we include country fixed-effects, the coefficient on fertility becomes smaller (point estimate of 0.41, with a standard error of 0.20), but remains statistically significant.

3 The Model

The model economy is populated by overlapping generations of agents differing in age and skill. There are two skill levels, high and low ($h \in \{S, U\}$), and two age

[4]Child labor is the percentage of children aged 10-14 who are economically active. The total fertility rate is defined as the sum of age-specific fertility rates, i.e., the number of births divided by the number of women of a given age. The fertility rate and the share of agriculture in employment are from the World Bank Development Indicators, Ginis are from the Deininger-Squire data set, GDP per capita is from the Penn World Tables, and child labor (share of children 10-14 economically active) is from the ILO. We control for the share of agriculture because it is well known that child labor is more widespread in the agricultural sector. We ignore endogeneity problems; the regression is simply meant to document correlation between the variables of interest.

[5]Similar result holds if one runs four separate cross-country regressions. The coefficient on fertility is always positive and highly significant, except in 1960 when it is positive but not significant. Including measures of democracy does not change the results.

groups, young and old. Agents age and die stochastically. Each household consists of one parent and her children, where the number of children depends on the parent's earlier fertility decisions. Children age (i.e., become adult) in each period with probability λ. Whenever a child ages, her parent dies (hence, old agents die with probability λ). As soon as they become adult, agents decide on their number of children. For simplicity, there are only two family sizes, large (grande) and small (petite) ($n \in \{G, P\}$).

All adults work and supply one unit of (skilled or unskilled) labor. Children may either work or go to school. Working children provide $l < 1$ units of unskilled labor in each period in which they work. Children in school supply no labor, and there is a schooling cost, p, per child. When they become adult, children who worked in the preceding period become skilled with probability π_0, whereas educated children become skilled with probability $\pi_1 > \pi_0$. For simplicity, we assume that only the educational choice ($e \in \{0, 1\}$) in the period before aging determines the probability for an agent of becoming skilled (either π_0 or π_1).

In the model economy, all decisions are carried out by adult agents. Young adults choose once-and-for-all how many children they want, as well as the education of their children in the current period. Old adults are locked-in into the family size that they chose when becoming adult and, consequently, only choose the current education of their children $e \in \{0, 1\}$. For an adult who has already chosen her number of children, the individual state consists of the skill level and the number of children. V_{nh} denotes the utility of an old agent with n children and skill h. Preferences are defined over consumption c, discounted future utility in case of survival, and the average discounted expected utility of the children in the case of death. The utility of an agent with n children and skill h is then given by

$$V_{nh}(\Omega) = \max_{e \in \{0,1\}} \left\{ u(c) + \lambda \beta z \left(\pi_e \max_{n \in \{G,P\}} V_{nS}(\Omega') + (1 - \pi_e) \max_{n \in \{G,P\}} V_{nU}(\Omega') \right) \right\} + (1 - \lambda) \beta V_{nh}(\Omega') \tag{1}$$

subject to:

$$c + pne \leq w_h(\Omega) + (1 - e) \, nlw_U(\Omega) \, .$$

Here, $u(\cdot)$ is an increasing and concave function, Ω is the aggregate state of the economy (to be defined in detail below), Ω' the state in the following period, w_h the wage for skill level h, and e denotes the education decision, where $e = 1$ is schooling and $e = 0$ is child labor. Consumption is restricted to be nonnegative. The probability of survival is $1 - \lambda$, and future utility is discounted by the factor β. With probability λ, an adult passes away and applies discount factor βz to the children's utility. Here, z is allowed to differ from one, so that parents can value their children's utility more or less than they would value their own future utility. For utility to be well-defined, we assume that $\beta z < 1$. With probability π_e, depending on the educational choice, the offspring will be skilled.

Note that after their skill has been realized in the next period, aging children will have the possibility of choosing their optimal family size, hence the term $\max_{n\in\{G,P\}} V_{nh}(\Omega')$. The budget constraint has consumption and, if $e = 1$, educational cost on the expenditure side and the wage income of the adult plus, if $e = 0$, the wage income of the n children on the revenue side. Note that children do not consume (this assumption is easily relaxed). Once family size has been chosen by a young adult, the only remaining decision is whether to educate the children or send them to work. The decision problem is also simplified by the fact that the number of children does not enter the utility parents derive from their children, since they care about their average utility. Parents will therefore have a large number of children only if they expect to send them to work, because in that case more children result in a higher income.

The main differences between our setup and the standard altruistic family model of Becker and Barro (1988) are that in our model, altruism does not depend on the number of children, and only two choices each for education and fertility are possible. We introduce these simplifications partly for ease of exposition, and partly to facilitate the computation of political equilibria. Despite the simplifications, the key implications of our model are similar to richer models with a continuous fertility choice.[6]

We now move to the production side of the economy. The consumption good is produced with a technology using skilled and unskilled labor as inputs. The technology features constant returns to scale and a decreasing marginal product to each factor. Formally, we can write the output per unskilled worker, y, as

$$y = f(x),$$

where $x \equiv X_S/X_U$ is the skill ratio, and f is an increasing and concave function. Labor markets are competitive, and wages are equal to the marginal product of each factor

$$w_S = f'(x), \tag{2}$$
$$w_U = f(x) - f'(x)\,x. \tag{3}$$

The main role of the production setup is to generate an endogenous skill premium. Wages depend on the supply of skilled and unskilled labor. If child labor is restricted, the supply of unskilled labor falls, and therefore the unskilled wage rises. This wage effect is one of the key motives that determines agents' preferences over CLR (the other motive being potential child labor income, which, in turn, depends on the num-

[6]Doepke (2001) considers the choice of education versus child labor in an otherwise standard Barro-Becker model with skilled and unskilled workers. As in our model, unskilled workers are more likely to choose child labor, and fertility is higher conditional on choosing child labor. The main difference is that in Doepke (2001) the fertility differential is endogenous, while it is exogenously fixed in our setup.

ber of children) [7].

We still need to determine the supply of workers at each skill level. It simplifies the exposition to restrict attention to economies where all children who do not work go to school. This is necessarily a feature of the equilibrium if the cost of education is sufficiently small. We will denote by x_{nh} the total number of adults of each type after family size has been determined by the young adults, and define

$$\Omega = \{x_{PU}, x_{GU}, x_{PS}, x_{GS}\}$$

as the state vector.[8] The number of working children is equal to

$$L = l\left(\left(1-e_{GU}\right)x_{GU} + \left(1-e_{GS}\right)x_{GS}\right)G + l\left(\left(1-e_{PU}\right)x_{PU} + \left(1-e_{PS}\right)x_{PS}\right)P, \tag{4}$$

where e_{nh} denotes the educational choice of parents of type n, h. The supply of skilled and unskilled labor, respectively, is given by

$$\begin{aligned} X_S &= x_{PS} + x_{GS}, \\ X_U &= x_{PU} + x_{GU} + L. \end{aligned}$$

The state vector Ω follows a Markov process such that

$$\Omega' = \left(\left(1-\lambda\right)\cdot I + \lambda \cdot \Gamma\left(\eta_U, \eta_S\right)\right)\cdot \Omega, \tag{5}$$

where I is the identity matrix, η_U, η_S denote the proportion of young unskilled and skilled adults, respectively, choosing a small family size and providing their children with education, and

$$\Gamma\left(\eta_U, \eta_S\right) \equiv$$
$$\begin{bmatrix} \eta_U\left(1-\pi_e\right)P & \eta_U\left(1-\pi_e\right)G & \eta_U\left(1-\pi_e\right)P & \eta_U\left(1-\pi_e\right)G \\ \left(1-\eta_U\right)\left(1-\pi_e\right)P & \left(1-\eta_U\right)\left(1-\pi_e\right)G & \left(1-\eta_U\right)\left(1-\pi_e\right)P & \left(1-\eta_U\right)\left(1-\pi_e\right)G \\ \eta_S\pi_e P & \eta_S\pi_e G & \eta_S\pi_e P & \eta_S\pi_e G \\ \left(1-\eta_S\right)\pi_e P & \left(1-\eta_S\right)\pi_e G & \left(1-\eta_S\right)\pi_e P & \left(1-\eta_S\right)\pi_e G \end{bmatrix},$$

[7]The unskilled workers would never support child labor laws if child labor and unskilled labor were complements instead of substitutes. Interestingly, almost all early child labor laws in Europe and the U.S. explicitly excluded agriculture, where it is often argued that adult and child labor are indeed complementary.

[8]Note that young adults choose their family size at the beginning of the period, before anything else happens. After their choice, they become old adults. The state vector summarizes the number of workers of each type after this decision has been taken. Thus, formally, this decision is subsumed into the law of motion.

is a transition matrix, conditional on the choice of family size of the young adults.[9]

We restrict attention to economies such that the skilled wage is larger than the unskilled wage. Furthermore, we impose the stronger requirement that skilled adults always receive higher consumption than unskilled adults, even if the former choose a small family and educate their children, whereas the latter choose a large family of working children. To this aim, recall that wages are given by marginal products and depend on the ratio of skilled to unskilled labor supply. The highest possible ratio of skilled to unskilled labor supply is given by $\underline{x} \equiv \pi_1 / (1 - \pi_1)$, which yields the lowest possible wage premium. We then formalize the desired restriction by the following assumption.

Assumption 1

$$f'(\underline{x}) - pP > [f(\underline{x}) - f'(\underline{x})\underline{x}](1 + Gl)$$

We are now ready to define an equilibrium for our economy. In the definition, we assume that the child labor policy is exogenous, i.e, the amount of unskilled labor l that children can supply is fixed. It is easy to extend the definition to the case of an exogenous, but time-varying policy, by adding a time subscript to l and switching to a sequential definition of an equilibrium. Later on, we will also consider equilibria with an endogenous policy choice.

Definition 1 (Recursive Competitive Equilibrium) *An equilibrium consists of functions (of the state vector Ω) V_{nh} , e_{nh}, w_h, and η_h, where $n \in \{G, P\}$ and $h \in \{U, S\}$, and a law of motion m for the state vector, such that:*

- *Utilities V_{nh} satisfy the Bellman equation* (1)*, and education decisions e_{nh} attain the maximum in* (1)*.*
- *Decisions of young adults are optimal, i.e., for $h \in \{U, S\}$:*

$$\begin{aligned} &\text{If } \eta_h(\Omega) = 0 : V_{Gh}(\Omega) \geq V_{Ph}(\Omega), \\ &\text{if } \eta_h(\Omega) = 1 : V_{Gh}(\Omega) \leq V_{Ph}(\Omega), \\ &\text{if } \eta_h(\Omega) \in (0, 1) : V_{Gh}(\Omega) = V_{Ph}(\Omega), \end{aligned}$$

[9] Consider, for instance, the measure of adult unskilled workers with small families, $x_{PU,t+1}$. $(1 - \lambda)\, x_{PU,t}$ is the measure of surviving old unskilled adults with small families. The rest consists of young adults: $\lambda \eta_U (1 - \pi_1)\, Px_{PU,t}$ children of unskilled parents with small families who had given their offspring an education, $\lambda \eta_U (1 - \pi_0)\, Gx_{GU,t}$ children of unskilled parents with large families who had given their offspring no education, $\lambda \eta_U (1 - \pi_1)\, Px_{PS,t}$ children of skilled parents with small families who had given their offspring an education, and, finally, $\lambda \eta_U (1 - \pi_0)\, Gx_{GS,t}$ children of skilled parents with large families who had given their offspring no education. A similar reasoning applies to the remaining variables.

- *Wages w_h are given by* (2) *and* (3).
- *For $\Omega' = m(\Omega)$, the law of motion, m, satisfies* (5).

4 Steady States with Fixed Policies

We begin the analysis of the model by examining steady states with exogenous policies. Formally, we assume child labor to be unrestricted. However, the analysis also comprises steady states with CLR, since ruling out child labor amounts to setting the parameter governing child labor supply to zero: $l = 0$.

We define a steady state as a situation where the fraction of each type of adult in the population is constant, and a constant fraction η_U of unskilled parents decide to have small families. Define $N_t = x_{PU,t} + x_{GU,t} + x_{PS,t} + x_{GS,t}$. Further, let $\xi_j \equiv x_j/N$, $\Xi = \{\xi_{PU}, \xi_{GU}, \xi_{PS}, \xi_{GS}\}$ and $g_t = N_{t+1}/N_t - 1$.

In steady state, the law of motion (5) specializes to

$$(1+g) \cdot \Xi = ((1-\lambda) \cdot I + \lambda \cdot \Gamma(\eta_U, \eta_S)) \cdot \Xi, \tag{6}$$

$$1 \cdot \Xi = 1. \tag{7}$$

Note that, given preferences as defined in (1), in steady-state all agents with small families educate their children, and all agents with large families choose child labor. (6)-(7) define a system of five linear equations in five unknowns, $\xi_{PU}, \xi_{GU}, \xi_{PS}, \xi_{GS}$ and g.

Definition 2 (Steady State Equilibrium) *A steady state equilibrium (SSE) consists of fractions $\eta_U \in [0,1]$ and $\eta_S \in [0,1]$ of unskilled and skilled parents, respectively, deciding to have small families, utilities V_{PS}, V_{GS}, V_{PU}, V_{GU} of each type of family, an education decision for each type, a child labor supply L, wages w_S and w_U, a vector of constant fractions of each family type, $\Xi = \{\xi_{PS}, \xi_{GS}, \xi_{PU}, \xi_{GU}\}$, and a population growth rate g such that:*

- *Wages w_S and w_U are given by (2) and (3).*
- *Child labor supply L is given by (4).*
- *The vector of fractions of family types, Ξ, and the population growth rate g are solutions to the laws of motion (6)-(7).*
- *The utilities satisfy (1), and education decisions are optimal.*

- *Decisions of young adults are optimal, i.e., for $h \in \{U, S\}$:*

$$\begin{aligned} &\textit{If } \eta_h = 0 : V_{Gh} \geq V_{Ph}, \\ &\textit{if } \eta_h = 1 : V_{Gh} \leq V_{Ph}, \\ &\textit{if } \eta_h \in (0,1) : V_{Gh} = V_{Ph}. \end{aligned}$$

In Appendix A.2, we establish formally the following intuitive results:

1. Whenever skilled adults strictly prefer to have large families, unskilled adults also strictly prefer to have large families (Lemma 1);
2. The average population growth rate falls in the fraction of agents deciding to have small families (Lemma 2);
3. The fraction of skilled adults in the population strictly increases in both η_U and η_S, i.e., more education implies a larger skill-to-unskill ratio (Lemma 3).

The intuition for Lemma 1 is that since skilled adults have a higher income, their utility cost of providing education to their children is smaller. Therefore, skilled parents are generally more inclined towards educating their children than unskilled parents. Lemma 2 and 3 are immediate.

Lemma 1 allows potential steady states to be indexed by the sum $\tilde{\eta} \equiv \eta_S + \eta_U$, where $\tilde{\eta} \in [0, 2]$. Furthermore, Lemma 3 implies the steady state equilibrium skill premium is decreasing in $\tilde{\eta}$. [10] Five candidate types of steady states can be distinguished:

1. All agents educate their children, $\tilde{\eta} = 2$.
2. All skilled workers and a positive proportion of the unskilled workers educate their children, $\tilde{\eta} \in (1, 2)$.
3. All skilled workers and no unskilled workers educate their children, $\tilde{\eta} = 1$.
4. A positive proportion of the skilled workers and no unskilled workers educate their children, $\tilde{\eta} \in (0, 1)$.
5. No agents educate their children, $\tilde{\eta} = 0$.

[10] Note that whenever $\tilde{\eta}$ takes on an integer value, i.e., $\tilde{\eta} \in \{0, 1, 2\}$ all agents in (at least) one group strictly prefer one of the two educational choices. If $\tilde{\eta} \in (0, 1)$, skilled workers are indifferent, whereas if $\tilde{\eta} \in (1, 2)$, unskilled workers are indifferent.

In steady states with either $\tilde{\eta} = 2$ or $\tilde{\eta} = 0$, all agents behave identically. When $\tilde{\eta} = 2$, in spite of the wage premium being at its lower bound, all children receive an education and all families are small. Conversely, when $\tilde{\eta} = 0$, the wage premium is at its upper bound, all children work, and all families are large. In the steady state with $\tilde{\eta} = 1$, at the equilibrium wage, all unskilled parents have large families and make their children work, while skilled workers find it optimal to educate their children. Finally, when $\tilde{\eta} \in (1,2)$ or $\tilde{\eta} \in (0,1)$ either the skilled or the unskilled parents are just indifferent between having large uneducated or small educated families. The formal conditions for each of the steady states to hold as an equilibrium are provided in the appendix.

We now analyze the conditions for the existence and uniqueness of a steady state equilibrium. We prove the existence of a unique steady state by establishing that, for all agents, the difference between the utilities from having small educated or large uneducated families is strictly increasing in the wage premium.

The argument can be illustrated with the aid of Figure 1. In the plot, the downward-sloping schedule SS_1 represents the negative relationship between the wage premium w_S/w_U and $\tilde{\eta}$ that follows from Lemma 3. Intuitively, an increase in the relative supply of skills, parameterized by $\tilde{\eta}$, decreases the skill premium. The piecewise positive schedule EE represents the optimal steady state educational choice of parents as a function of the wage premium.[11] In particular, for a range of low wage premia, all agents prefer not to educate their children ($\tilde{\eta} = 0$). For an intermediate range of wage premia, education is chosen only by skilled agents ($\tilde{\eta} = 1$). For a range of high wage premia, all agents prefer education ($\tilde{\eta} = 2$). Between these regions, there exist threshold wage premia $\underline{w}_S/\underline{w}_U$ and $\bar{w}_S/\bar{w}_U$ at which, respectively, either skilled workers ($\tilde{\eta} \in (0,1)$) or unskilled workers ($\tilde{\eta} \in (1,2)$) are indifferent.

If the difference between the utilities from educating or not educating children is strictly increasing in the wage premium, the thresholds $\underline{w}_S/\underline{w}_U$ and $\bar{w}_S/\bar{w}_U$ are unique, as in Figure 1. In general, however, there could exist multiple thresholds (i.e., the EE curve could be locally decreasing), implies multiple steady states. In particular, while the threshold $\underline{w}_S/\underline{w}_U$ is always unique, there may be multiple thresholds $\bar{w}_S/\bar{w}_U$.[12]

[11] Educational decisions not only depend on the ratio, but also on the level of both the skill and unskilled wage. In the particular case of CRRA utility and no cost of education ($p = 0$), the educational choice only depends on the ratio, however. While the figure is correct for a given technology, comparative statics (e.g., a change in the skill bias of technology that shifts the SS schedule while not affecting the EE schedule) are legitimate only under CRRA utility and $p = 0$.

[12] The reason is the following. On the one hand, as the skill premium rises, education becomes more attractive to unskilled agents, since the utility from potential skilled descendants increases. On the other hand, a higher skill premium also implies that unskilled parents earn a lower wage, and this increases the utility cost of paying the fixed cost of education. If the curvature of utility is high, the latter effect may dominate. In fact, if marginal utility is infinite at zero, unskilled adults have no choice but to have large families whenever the education cost exceeds their income.

The same problem does not arise for skilled workers, since an increase in the wage premium implies an increase in their income and, therefore, a lower utility cost to provide education.

To rule out this possibility and ensure the uniqueness of the steady state, we must introduce an additional assumption that bounds the curvature of utility in the relevant range. Under CRRA preferences, a sufficient, though not necessary, condition is:

Assumption 2

$$(1+Gl)\frac{1-\beta(1-\lambda)}{1-\beta(1-\lambda(1-z(\pi_1-\pi_0)))} > \frac{u'(w_{U,2}-pP)}{u'(w_{U,2}(1+Gl)))}.$$

Proposition 1 *Under Assumption (2) and CRRA preferences, there exists a unique steady state.*

The proof of the proposition is provided in Appendix A.3. Consider, now, the effect of technological change raising the skill premium. For example, assume an increase in the share of skilled labor, denoted by α, under a Cobb-Douglas technology (the same exercise can be performed with a more general CES production function). Suppose that, initially, α is low. Then, the supply schedule would be described by the SS_0 (dashed) schedule, with the equilibrium featuring $\tilde{\eta} = 0$. An increase in α would shift the schedule to the right, while the EE curves remain unaffected. Thus, the steady state equilibrium would feature an increasing $\tilde{\eta}$. For some intermediate level of α, the supply schedule is given by the SS_1 schedule. In this case, $\tilde{\eta} \in (1,2)$, i.e., all skilled and some unskilled workers educate their children. Eventually, for large values of α, the curve shifts to SS_2 and all workers educate their children.

5 Steady States with Endogenous Policies

So far, we have established that the model has a unique steady state when parents can choose freely whether to make their children work. Imposing CLR is equivalent to reducing the parameter l, or setting it to zero when child labor has been completely banned. Therefore, the previous section shows that there is a unique steady state for any child labor policy that is exogenously fixed. [13]

It is easy to construct examples where, for instance, all parents choose large families with working children ($\tilde{\eta} = 0$) if there are no CLR, but the introduction of CLR moves the economy to a steady state equilibrium where all parents choose small families with educated children ($\tilde{\eta} = 2$). Assume that the cost of schooling is infinitesimal ($p \to 0$) and that CLR takes the extreme form of a complete ban, i.e., $l = 0$. Then,

[13] Note that decreasing l moves both the SS and the EE curves to the left in Figure 1. Thus, the wage premium unambiguously falls, whereas the effect on the educational choice is, in principle, ambiguous.

it is immediate that, under CLR, all parents would choose small families and send their children to school (in Figure 1, the EE line would be horizontal at $\tilde{\eta} = 2$). In the absence of CLR, an equilibrium with $\tilde{\eta} = 0$ holds if condition (18) is satisfied. If preferences are logarithmic, for instance, this can be expressed as

$$\ln\left(1 + Gl\right) \geq \beta\lambda z \frac{\pi_1 - \pi_0}{1 - \beta\left(1 - \lambda\right)} \ln\left(\frac{w_{S0}}{w_{U0}}\right), \tag{8}$$

where the wage premium depends on G, π_0 and π_1, but not on the discount factor $\beta\lambda z$. Thus, in economies with sufficiently low $\beta\lambda z$, the inequality (8) holds and the steady state features widespread child labor if there are no CLR.

While CLR was treated as exogenous in this example, the main objective of this section is to establish the possibility of multiple steady states with different policies when the choice of policy is *endogenous*. In order to carry out this analysis, we must specify a political mechanism in the model. We assume that CLR can be irreversibly introduced when a majority of adult agents support them. Clearly, this "referendum" decision is a stand-in for more complicated decision processes whereby different groups in society can exert political pressure to introduce restricting laws. An interpretation of our reduced-form political mechanism is that unions can impose their will on the issue of CLR. Unions represent the interests of all workers, and decide according to the will of the majority of their members.[14] In reality, the situation is more complex, and the effectiveness of unions' action is mediated by a variety of political institutions. While we leave to future research an analysis of these important aspects, we regard it as useful to focus on the interests of unskilled workers, as in our model this is the only group that could potentially gain from (and which indeed historically supported) CLR. In short, our analysis pins down under which conditions the "working class" supports the introduction of CLR. We will also ask the opposite question. Namely, would a majority in an economy where CLR have been in effect for a long time prefer that CLR be abandoned?

The main result is that there exist parameter configurations such that, if the economy is in a steady state with no CLR, a majority of the adults (the skilled and some or all of the unskilled) will be opposed to the introduction of CLR. Conversely, if CLR exist, a majority of the adults (some or all of the unskilled) will prefer to keep the restrictions in place. The source of this multiplicity is that old adults are locked-in into the family size that they chose previously, and this determines their policy preferences. As in the example above, absent CLR unskilled workers would choose large families and make their children work, whereas, if CLR were in place, they would choose small families and educate their children. This feedback between political decisions and family size gives rise to multiple steady states. For simplicity, we will state the analytical results

[14] We could alternative assume that skilled and unskilled workers are unequally represented within the union. This would not change the qualitative results.

under the assumption that the child labor policy includes compulsory schooling. [15]

Definition 3 (Steady State Political Equilibrium) *A steady state political equilibrium (SSPE) consists of a child labor policy (child labor is either ruled out or not), $\tilde{\eta} \in [0,2]$ denoting the distribution of educational choices, utilities V_{PS}, V_{GS}, V_{PU}, V_{GU} of each type of family, a child labor supply L, constant fractions ξ_{PS}, ξ_{GS}, ξ_{PU}, and ξ_{GU} of each type of family, and a population growth rate g that:*

- *Given the policy, all conditions in Definition 2 are satisfied.*
- *A majority of adults obtain higher utility under the current child labor policy than if the opposite policy were permanently introduced.*

From the perspective of old unskilled agents, CLR imply both gains (higher wages) and losses (no child labor income). The tradeoff determines whether they support CLR. The key factor leading to multiple SSPE is the lock-in into family size decisions. The loss of child labor income is larger for families with many children. CLR induce smaller families who support CLR, while the absence of CLR induces larger families, who oppose CLR.

Assume that unskilled agents are pivotal (if skilled agents were pivotal, there would be no equilibrium with CLR). Consider, first, an SSPE where child labor is unrestricted. In this steady state, unskilled families are large, and their children work. If CLR were introduced, there would be an immediate increase in the unskilled wage since children are withdrawn from the labor force. For the SSPE to be sustained, the gain from this general equilibrium effect must be more than offset by the loss of child labor income. The fact that families are large and earn a large fraction of their income from child labor makes it more likely that unskilled workers prefer the status quo. Conversely, in a candidate SSPE where child labor is unrestricted, families are initially smaller. If CLR were lifted, unskilled families would have little to gain from making their children work. Once again, agents would prefer the status quo (CLR in this case).

Building on this intuition, Proposition 2, proven in Appendix A.3, formally establishes that there are parameters such that multiple SSPE exist.

Proposition 2 *The model parameters can be chosen such that:*

- *The old unskilled are the majority.*

[15] If the CLR does not include a compulsory schooling provision, the result establishing multiplicity of steady states still goes through, but requires additional, if natural, assumptions on the production function.

- *In the absence of CLR, the steady state features $\tilde{\eta} < 2$.*
- *Both CLR and no CLR are SSPE.*

We now illustrate the theoretical results obtained so far by analyzing steady states in a parameterized version of our economy. Table 1 displays the parameter values used. Preferences are CRRA with risk-aversion parameter σ. The production function is of the constant-elasticity-of-substitution form

$$Y = [\alpha X_S^\kappa + (1-\alpha) X_U^\kappa]^{\frac{1}{\kappa}} .$$

The fertility values for small and large families are $P = 1$ and $G = 3$. A family of two would therefore have two children if they prefer education, or six children if they opt for child labor. This fertility differential approximates the fertility differential between mothers in the lowest and highest income quintiles in countries with widespread child labor, such as Brazil or Mexico (see Kremer and Chen 2002). The choice for λ implies that adults on average live for $6\frac{2}{3}$ periods. Assuming that a model period corresponds to six years, people survive 40 years on average after becoming adults. The probabilities $\pi_0 = 0.05$ and $\pi_1 = 0.4$ of becoming skilled are chosen so that the fractions of skilled agents in a pre-industrial (i.e., where no children receive formal education) and post-industrial (i.e., where all children receive formal education) societies are, respectively, 5 percent and 40 percent. The choices of λ, π_0, and π_1 jointly imply that the old unskilled always constitute the majority of the population. β is chosen so that it implies a rate of time preference that would generate an annual interest rate of 4 percent per year (if assets could be traded), which is the standard basis for calibrating β in the RBC literature. The choice $l = 0.1$ for the supply of child labor implies that a large family with working children derives about a quarter of family income from children, which is in line with evidence from Britain in the period of early industrialization (Horrell and Humphries 1995) and recent data from developing countries. The elasticity parameter $\sigma = 0.5$ sets the elasticity of substitution half way between the Cobb-Douglas and the linear production technology. The weight α of skilled labor in the production function is left unspecified for now. We will use α to parameterize the skill premium and compute outcomes for a variety of α.

We start by determining which steady states and SSPE exist for different values of α. Recall from Section 4 that as long as Assumption 2 is satisfied, there is a unique steady state in the economy with an exogenous policy. Figure 2 displays the steady state $\tilde{\eta}$ as a function of α. For low α, the skill premium is low. Consequently, education is not very attractive, and there is a range of α where all parents prefer child labor ($\tilde{\eta} = 0$). As the skill premium rises, we reach a threshold for α at which a fraction of skilled adults educates their children ($\tilde{\eta} \in (0,1)$), and ultimately all skilled parents choose education ($\tilde{\eta} = 1$). For even higher α, there is a wide region in which unskilled parents are indifferent between education and child labor ($\tilde{\eta} \in (1,2)$). Throughout this region, higher α are offset by a higher supply of skilled labor, which keeps the unskilled parents indifferent. Ultimately, all parents educate their children ($\tilde{\eta} = 2$).

Figure 3 considers the model with endogenous policy choice, and shows which SSPE exist as a function of α. For low values of α, the only SSPE is no CLR. In other words, the return to education is so low that even a population of adults all of whom have small families would prefer to abandon CLR. For an intermediate range of α, there are multiple SSPE: both CLR and no CLR are steady states supported by a majority of the population. In the range of multiplicity, in the absence of CLR at least a fraction of unskilled agents would choose child labor and large families. However, if CLR are already in place, unskilled parents are locked into having small families, and therefore prefer to keep CLR. As the wage premium increases, we enter a region where CLR is the only SSPE. In this region, even unskilled parents with large families prefer to introduce CLR. The immediate income loss after the introduction of CLR is made up by higher unskilled wages in the present (because other parents' children can no longer work) and in the future (which they care about because they care for their children).

To show that the multiplicity result depends on endogenous fertility choice, we also computed outcomes without fertility differentials by setting $P = G = 1$, i.e., families of working and educated children are of the same size. We still find that, for low α's, no CLR is an SSPE, and for high α's CLR is an SSPE. However, there is no overlap, i.e., in no region both policies can be supported in steady state, since the policies no longer lock agents into different fertility choices. In fact, there is a region where neither policy is an SSPE. The reason for the non-existence of SSPE for some α is the endogenous skill premium. If CLR are in place, the supply of skilled labor is high, and the skill premium is low. The low skill premium makes child labor attractive relative to education, so that a majority is in favor of abandoning CLR. If there are no restrictions, however, the supply of skilled labor is low and the skill premium is high. This makes education more attractive, and increases the gain from removing other parents' children from the labor market, and thus, a majority is in favor of introducing CLR. The endogenous skill premium therefore works against multiplicity of steady states. In the model with endogenous fertility, this effect is overcome since parents choose a different family size in each political regime, which induces them to favor the status quo.

6 Transitions: the Introduction of CLR

So far, we have shown that the interaction of fertility choice and political preferences can lead to a lock-in effect, resulting in multiple SSPE, either with child labor and high fertility or no child labor and low fertility. This feature of the model can explain why there is a great deal of variation in the incidence of child labor around the world, even when controlling for income per capita. However, we also need to explain why many countries have adopted child labor bans over the last two centuries, starting from a situation where child labor was common all over the world. In our model, a transition from no CLR to CLR is possible if technological change increases the skill premium, and therefore the return to education. If the increase in the return to education is large, even unskilled adults prefer to have small families and educate their children, which ultimately creates a majority in favor of the introduction of CLR.

This explanation of the introduction of CLR is consistent with the evidence on the evolution of the skill premium in the U.K. before the introduction of CLR. Figure 4 shows that the ratio of skilled to unskilled wages increased sharply at the beginning of the 19th century in the U.K. [16] The skill premium reached a peak in 1850, declined subsequently, and by 1910 it had returned to its 1820 level. To show how an increase of the skill premium can trigger the introduction of CLR in our model, we computed a transition path for an economy that starts out in the steady state without CLR, and then experiences a phase of skill-biased technological change (which can be parameterized as an increase in the technology parameter α). We chose the specific transition path such that in the steady state without CLR, the wage premium in the model matches the observed value of 2.5 in the U.K. around 1820 (see Figure 4). This is achieved by setting the initial α to 0.33 (apart from α, the model is parameterized as in Section 5, see Table 1). The endpoint of the transition was chosen such that in the steady state with CLR, the skill premium matches 2.5 as well, as in the data around 1910. This implies a final value for α of 0.65. Notice that in the new steady state with CLR there is a higher supply of skilled labor, so that α has to be higher than at the beginning of the transition to generate the same skill premium. In the computed transition path, α is at 0.33 until period 2, and then increases linearly until the maximum of 0.65 is reached in period 9 (see Figure 5).

Generally, the problem of computing transitions paths with an endogenous policy choice is complicated. Agents' decisions depend on the entire path of expected future policies. Future policies therefore partly determine the evolution of the state vector of the economy which, in turn, affects the preferences over these same policies. This interdependence can lead to multiple equilibria (not just multiplicity of steady states), or the nonexistence of equilibria. In principle, these problems could arise in our framework, but it turns out that unique results are obtained for the calibrated version of our model. To limit the number of time paths of future policies, we assume that once CLR are introduced, they cannot be revoked. [17] Future policies can

[16] The skill-premium data, from Williamson 1985, is computed as the ratio of the wages in twelve skilled and six unskilled professions, weighted by employment shares. This data source is criticized by Feinstein (1988), who presents alternative estimates indicating a smaller hump in skill premia. Even a flatter profile of the skill premium, however, would indicate a significant increase in the demand for skills, given the simultaneous increase in their supply associated with rising education in the labor force.

[17] We conjecture that in our specific application the results would not change if we allowed CLR to be

therefore be indexed by the period when CLR are introduced.

The conditions for the introduction of CLR to occur in a given period T can therefore be checked as follows. We assume that the economy starts in the steady state corresponding to the initial value of α. First, we compute private decisions and the evolution of the state vector under the assumption that CLR are indeed introduced at time T. In period T, we check whether a majority prefers the introduction of CLR to the alternative. The relevant alternative here is not to introduce CLR at T, but to expect their introduction at $T+1$ (the skill premium and therefore the incentive to introduce CLR increases over time, therefore if T is the equilibrium switching time, the switch would certainly occur at $T+1$.). We also must check that CLR are not introduced before T. Once more, because the incentive to introduce CLR increases over time, it is sufficient to check that given the path for the state variable resulting from expecting the switch at T, there is still a majority opposed to introducing CLR at time $T-1$. In summary, for T to be an equilibrium switching time, conditional on agents expecting CLR to be introduced at time T, a majority must prefer no CLR at time $T-1$, and a majority must prefer CLR at time T . Since the evolution of the state vector depends on the expected policies, there could be, in principle, multiple or none such switching times, but in our example there is a unique switching time.

In the computed transition path, a majority continues to oppose the introduction of CLR in the first periods of the increasing wage premium. Beginning in period 5, however, all young unskilled adults start to choose education and small families, in response to the increasing skill premium and the expected future introduction of CLR. Old unskilled families are stuck with many children and therefore continue to choose child labor. In period 7, unskilled families with small families form the majority of the population and support a permanent introduction of CLR.

Figure 6 shows the evolution of the skill premium during the transition. Initially, the skill premium increases due to an increasing α. Once CLR are introduced and children are withdrawn from the labor market the skill premium drops, however, since the increase in α is offset by the smaller supply of unskilled labor. After α stops increasing, the skill premium declines further, as the number of skilled workers gradually increases. The introduction of CLR also leads to a sharp decline in population growth (Figure 8), because all unskilled parents then have small families. Notice, however, that the decline in population growth starts even before CLR are introduced, because young unskilled families start to have small families already in period 5. The switch in the decisions of young unskilled parents also triggers an immediate decline in the supply of child labor, as shown by Figure 7. Thus, child labor declines even before CLR are introduced. However, the future introduction of CLR is still responsible for part of the decline in child labor: If the introduction of CLR in pe-

revokable in later periods, because we focus on an episode where the skill premium is increasing over time, which together with the lock-in effect of endogenous fertility choice tends to increase support for CLR over time.

riod 7 was not expected, a smaller number of families would have chosen education in period 5.

Figures 9 and 10 show how the skill premium and the fraction of working children would have evolved without the endogenous introduction of CLR. There is still a peak in the evolution of the skill premium and a decline in child labor, but child labor falls much less, and inequality remains much higher than with the introduction of CLR. Thus, in the model, neither technological change nor CLR are solely responsible for the decline in child labor; rather, both explanations are complementary.

The simulations reproduce key features of the data. First, both the simulation and the data exhibit a hump-shape profile in the skill premium (see Figure 4). Second the model predicts that fertility rates start declining before the introduction of CLR. This timing is also featured by the data in the history of the introduction of CLR in Britain. The first child labor restrictions (the "Factory Acts") were put into place in 1833 and 1842, and were extended to other non-textile industries in the 1860s and 1870s.[18] However, the most effective constraint on child labor was the introduction of compulsory schooling in 1880. Compulsion was effectively enforced: in the 1880s, close to 100,000 cases of truancy were prosecuted every year (see Cunningham 1996), which made truancy the second-most popular offense in terms of cases brought before the courts (drunkenness being the first). The total fertility rate (see Figure 11) peaked around 1820, then started declining before the introduction of the Factory Acts. Then, a second more pronounced decline in fertility is observed after 1880 and continued throughout the first quarter of the twentieth century. Figures 12 and 13 show the corresponding decline in child labor rates (the fraction of 10 to 14 year-olds who were economically active) and increase in schooling rates (the fraction of children aged 5-14 at school). Therefore, the data are consistent with the prediction of the model that fertility starts falling before CLR are introduced, and CLR cause an acceleration in the fertility decline.[19]

A similar pattern is observed in other European countries such as France, Germany and Italy. In these countries, like in Britain, CLR was introduced in the third quar-

[18]The initial Factory Acts, however, only applied to some industries (textiles and mining), and Nardinelli (1980) argues that while the laws effectively restricted the employment of young children in these industries, the effect on overall child labor was short lived. The Factory Acts were extended to other non-textile industries in the 1860s and 1870s. The introduction of compulsory schooling in 1880 put an additional constraint on child labor. Compulsion was effectively enforced: in the 1880s, close to 100,000 cases of truancy were prosecuted every year (see Cunningham 1996), which made truancy the second-most popular offense in terms of cases brought before the courts (drunkenness being the first).

[19]However, the transition is sharper and more rapid in the simulation than in the data. This discrepancy may be due to the fact that in the simulation CLR are introduced and perfectly enforced instantaneously, whereas, in the data, this happens progressively. Also, our model does not allow for combinations of schooling with part-time work, while this practice was relatively widespread at the time.

ter of the nineteenth century.[20] Moreover, the introduction of CLR is more closely related to changes in the fertility behavior than to structural characteristics of these economies. In Germany and Italy, CLR were introduced soon after the beginning of the demographic transition, and were followed by large further reductions in fertility (in France, however, the demographic transition had started substantially earlier). At the time of the introduction of CLR, England was an industrialized country, with the share of agriculture approaching ten percent, while in Italy, for instance, well over half of employment was still accounted for by agriculture. The differences in living standards were also large.[21]

In the U.S., birth rates and total fertility rates were falling from the beginning of the nineteenth century. However, the overall numbers mask substantial variation across states and regions. Since until about 1910 all child labor restrictions were state laws, this variation can be related to political developments. Most states introduced laws mandating a minimum age for employment in the period from 1880 to 1920. In 1880, only seven states had such laws; by 1910, 43 states did. The first states to introduce child labor restrictions were also the first to experience substantial fertility decline. Consider the comparison of the eight states which introduced a minimum age of employment of 14 before 1900 and the 14 states which introduced this limit only after 1910.[22] In the middle of the nineteenth century, birth rates were slightly higher in the group of early adopters (in 1860, the birth rate was 30 in the early group and 29 in the late group). However, after 1870 fertility decline progressed faster in the states which adopted child labor laws early. By 1890, the average birth rate had fallen to 25 in the early group, but was still at 30 in the late group. This birth-rate differential persisted throughout the first part of the twentieth century; in 1928, the difference was still 19 to 24.

---

[20] Both Germany and Italy introduced pervasive regulation after unification. Prussia had a child labor law in 1839, which was extended to the whole German Empire after 1871. It was not until 1878, however, that the minimum age in factories was raised to 12, and enforcement became active (see According to Nardinelli (1990)). In Italy, the first child labor law was passed in Lombardy in 1843, before unification. Education became compulsory in 1859, but initially there was little enforcement of this law. A national child labor law was passed in 1873.

In France, a law passed in 1841 mandated a minimum age of eight for employment and specified a maximum workday of eight hours for children aged eight to twelve. In addition, working children under the age of twelve were also required to attend school. The law applied only to firms with at least 20 workers however, and no effective provisions for enforcement were made (Weissbach 1989). In 1874, a law was passed that applied to all firms, set the minimum age to twelve, with minimum schooling conditions for workers under the age of 15. In 1892 the minimum age for employment was raised to 13.

[21] According to Maddison (1995), in 1890 GDP per capita in Italy was only 40 percent as high as in the U.K., and lower than GDP per capita in the U.K. in 1820. Relative to the U.K., in 1890 France and Germany were at 57 and 62 percent, respectively.

[22] The states in the first group are Illinois, Indiana, Massachusetts, Michigan, Minnesota, Missouri, New York, and Wisconsin. The group of late adopters is made up of Alabama, Delaware, Florida, Georgia, Mississippi, New Hampshire, New Mexico, North Carolina, South Carolina, Texas, Utah, Vermont, Virginia, and West Virginia. Birth rate figures are from the U.S. Census.

Our results also suggest a reason why some econometric studies which find that child labor laws only have a relatively small effect on the supply of child labor may be misleading. Moehling (1999) and others use state-by-state variation in the introduction of CLR in the U.S. to estimate the effects of regulations, employing a "difference-in-difference" estimator. In our model, child labor typically declines even before CLR are actually introduced, since young families start to have small families of educated children in response to a higher return on education. The relative decline in child labor in the periods before and after the introduction of restrictions depends on average family size, the number of young families, and the enforcement of CLR. Depending on these variables, it is possible that the measured impact of the legislation is small (i.e., the difference in the decline of child labor before and after the introduction of CLR, either within or across states). The true effect of CLR would be larger than this empirical measure, since it is not generally true that the child labor rate would have continued to decrease without a law. In our example, if no CLR are introduced, child labor rates remain at 60 to 80 percent throughout. The restrictions therefore account for the major part of the ultimate decline in child labor. A difference-in-difference estimator would have compared the decline in child labor before and after the introduction of the law, which would suggest, misleadingly, a much smaller effect of the legislation. To a large extent, CLR work indirectly by reducing family size and changing families' education decisions, as opposed to directly removing children from the labor market who would otherwise have worked.

7 Would Capitalists Support CLR?

A possible objection to the analysis of the previous section is that in the nineteenth century unskilled workers may not have had the political power to impose CLR against the resistance of more wealthy and politically powerful groups. As discussed earlier, we believe that the unions' political activism may have played an important role, in spite of the lack of universal suffrage. In this section we explore the possibility that other groups may have benefited from the introduction of CLR. In particular, our analysis has not yet considered the preferences of firm-owners (capitalists). As pointed out by Galor and Moav (2001), if capital is complementary to skilled labor, it may be in the capitalists' interest to support, and even finance, policies that foster human capital accumulation. We now show that this possibility arises naturally in an extension of our model.

Consider the following generalization of the production technology:

$$Y = K^{\theta} \left[\alpha X_S^{\kappa} + (1-\alpha) X_U^{\kappa}\right]^{\frac{1-\theta}{\kappa}} .$$

This technology implies that, if markets are competitive, the owners of capital appropriate a constant share θ of the total output. We assume, for simplicity, that there is a constant stock of capital, which is owned by a separate class of agents. This feature is for simplicity; regardless of the amount of capital, the total income of capitalists depends on the composite labor input $\left[\alpha X_S^\kappa + (1-\alpha) X_U^\kappa\right]$. Therefore, the preferences of capitalists would be similar if capital could be accumulated and responded to changes in its productivity.

We consider the following experiment. We analyze the same transition discussed above towards an expected date at which CLR are introduced. We then calculate the share of output accruing to the capitalists conditional on the alternative assumptions that CLR are either passed or rejected. This comparison would determine the capitalists' choice if they had the power to veto CLR.

As Figure 14 shows, conditional on CLR (dashed line) there is an initial drop (in period 7) in the capitalists' income after the introduction of CLR. This is due to children of large families being forced out of the labor force. However, this is followed by a recovery triggered by increasing education and a larger proportion of skilled workers in the population. In contrast, under no CLR (solid line) there is no initial drop in output, and the skill ratio does not grow. Despite the increase in education under CLR, from period 11 onwards there is a clear output divergence in favor of the economy without CLR. This is due to the fact that fertility is higher in the long-run under no CLR. Although output per worker is higher in the economy with CLR, total output is smaller. Since capitalists appropriate a constant share of total output, their interests are harmed by the introduction of CLR in this example.

The outcome would be different if the increase in the skill bias of the technology were sufficiently large to push even the economy without CLR to a steady state where all families educate their children. In this case, long-run population growth does not depend on the policy, and the income of the capitalists depends only on the relative supply of the two skills. To illustrate this case, Figure 15 shows the capitalists' income under the two policies if α increases to 0.85 instead of 0.65, resulting in a steady state where all families are small. A similar effect could be reached by a policy that subsidizes education. As before, the introduction of CLR initially harms the capitalists (dashed line) due to the declining supply of unskilled labor. From the first period after the reform onwards, however, the capitalists gain from CLR due to the higher supply of skilled labor. In the steady state, the two policies yield the same income for the capitalists. Clearly, the capitalists would prefer CLR in this example, unless they are very impatient.

The analysis of this section could be further extended by distinguishing different types of capitalists who operate different technologies. From a historical perspective, the most important distinction is the one between land owners and factory owners, which were both politically influential in the period of the introduction of CLR in Britain (as evidenced by the debates on the Corn Laws and the Poor Laws). If we assume that land is complementary to child labor, whereas skill-biased technological change leads to complementarity between industrial capital and skilled labor, a conflict of interest between landowners and factory owners arises. The support for CLR would therefore also depend on the relative political power of these two groups. It is still the case, however, that skill-biased technological change would increase the likelihood of the introduction of CLR.

In summary, this section demonstrates that the same type of technological change that leads unskilled workers to support CLR may also shift capitalists' preferences in favor of CLR. Historically, we observe little evidence that capitalists actively supported the introduction of CLR, which is why we put most emphasis on the preferences of the working class. Nevertheless, even if capitalists did not literally gain from restrictions, skill-biased technical change could make capitalists less adamant in their opposition. Changing preferences of the working class and the capitalists are therefore complementary explanations for the introduction of CLR.

8 Conclusions

The aim of this paper was to shed light on the political economy of child labor laws. The key novelty of our model is an interaction between demographic variables (the number of children per family as chosen by the parents) and political preferences. While it may seems obvious that whether or not a worker has working children will influence preferences over child labor laws, our model shows that this fact leads to surprising implications. Since the decision to have children is irreversible and children are long-lived, fertility decisions can lock agents into specific political preferences. Multiple steady states can then arise, because CLR induce individual behavior which, in turn, increases the support for maintaining the restrictions. This "lock-in" effect can explain why we observe large variations in the incidence of child labor and child labor laws across countries of similar income levels.

In order to account for the initial introduction of child labor laws, we extend the model to allow for a change in the economy which shifts political preferences in favor of CLR. Here, our preferred explanation is technological progress which raises the return to skilled labor, thereby providing incentives for parents to choose small families and educate their children even while child labor continues to be legal. Once the skill premium is sufficiently high, political pressure for the introduction of CLR will endogenously rise. In our model, technological change and child labor legislation are complementary explanations for the disappearance of child labor. While the initial decline in child labor is caused by technological change raising the return to education, this change later on triggers the introduction of legislation which ultimately eliminates child labor completely. We concentrate on skill-biased technological change as the original cause of fertility decline because this explanation is consistent with evidence on trends in wage inequality in major industrializing countries in the nineteenth century[23]. However, other factors can trigger a similar transition, e.g., a fall in the relative productivity of child labor, or exogenous factors affecting fertility rates.

Our theory can provide some guidance in the debate on the introduction of child labor laws in developing countries. The model predicts that even in countries where the majority currently opposes the introduction of CLR, the constituency in favor of these laws may increase over time once the restrictions are in place. This statement needs qualifications, though. First, if the cost of schooling is too high, poor parents may decide not to send their children to school anyway. Second, if children are still productive (in household or marginal activities), the policy may fail to reduce fertility and induce the switch from quantity to quality. All agents, including children, might in this case be worse off after CLR have been introduced. Therefore, CLR should be accompanied by policies reducing the cost or increasing the accessibility of schools.

[23]See Williamson (1985) on Britain, Williamson and Lindert (1980) on the U.S., and Brenner, Kaelble, and Thomas (1991) on Belgium, Germany, and Sweden.

A Mathematical Appendix

A.1 Characterization of Steady States Described in Section 4

A.1.1 All Workers Educate Their Children, $\tilde{\eta} = 2$

In this steady state, $x_{GU} = x_{GS} = 0$ and $e_{PU} = e_{PS} = 1$. Hence, $L = 0$. The necessary and sufficient condition for this steady state to be an equilibrium is that, given wages, the unskilled adults find it optimal to educate their children. By Lemma 1, this implies, a fortiori, that the skilled adults also choose to educate their children.

The steady state utility of unskilled adults in the steady state where all children receive education is given by:

$$V_{PU,2} = u\left(w_{U,2} - pP\right) + \lambda\beta z\left(\pi_1 V_{PS,2} + (1-\pi_1)\, V_{PU,2}\right) + (1-\lambda)\,\beta V_{PU,2},$$

where $V_{nh,\tilde{\eta}}$ denotes the steady state utility of an agent of family size n and skill h conditional on $\tilde{\eta}$. A similar notation is used for wages. This equation can be solved and expressed as:

$$V_{PU,2} = \frac{u(w_{U,2} - pP) - \Pi^{1,1}_{U\to S}[u\left(w_{U,2} - pP\right) - u\left(w_{S,2} - pP\right)]}{1 - \beta(1 - \lambda(1 - z))}, \tag{9}$$

where $\Pi^{e_U,e_S}_{h\to h'}$ denotes the average discounted probability for an agent who is currently of skill level h to have descendants of skill level h'. The superscripts denote whether the skilled and unskilled parents educate their children. The average discounted probability entering equation (9) is given by:

$$\Pi^{1,1}_{U\to S} = \frac{\beta z \lambda \pi_1}{1 - \beta(1-\lambda)}.$$

For the candidate steady state to be sustained, deviations must be unprofitable, i.e., no agent can increase her utility by choosing a large family and making her children work. Consider an unskilled adult who deviates and chooses a large family and child labor. If this deviation is profitable for the parent, it would also be profitable for a potential unskilled child. We therefore check a continued deviation of an entire dynasty, i.e., we assume that the parent and all future unskilled descendants choose a large family and child labor. The resulting utility is:

$$V_{GU,2} = \frac{u(w_{U,2}(1+Gl)) - \Pi^{0,1}_{U\to S}[u(w_{U,2}(1+Gl)) - u\left(w_{S,2} - pP\right)]}{1 - \beta(1 - \lambda(1 - z))},$$

where

$$\Pi_{U\to S}^{0,1} = \frac{\lambda\beta z\pi_0}{(1-\beta(1-\lambda(1-z(\pi_1-\pi_0))))}.$$

Comparing $V_{PU,2}$ and $V_{GU,2}$, we find that the deviation is not profitable as long as

$$u(w_{U,2}(1+Gl)) - u(w_{U,2}-pP) \le \Pi_{U\to S}^{0,1}\left[u(w_{U,2}(1+Gl)) - u(w_{S,2}-pP)\right] - \Pi_{U\to S}^{1,1}\left[u(w_{U,2}-pP) - u(w_{S,2}-pP)\right]. \quad (10)$$

Note that, since we consider individual deviations, we have held wages constant at the steady state level. Inequality (10) is a necessary and sufficient condition for a steady state equilibrium where all agents educate their children ($\tilde{\eta} = 2$) to be sustained.

A.1.2 All Skilled and Some Unskilled Workers Educate Their Children, $\tilde{\eta} \in (1,2)$

A necessary and sufficient condition for this equilibrium is that, for some $\tilde{\eta} \in (1,2)$, the skilled and unskilled wages, $w_{S,\tilde{\eta}}$ and $w_{U,\tilde{\eta}}$, are such that $V_{GU,\tilde{\eta}} = V_{PU,\tilde{\eta}}$, i.e.,

$$u\left(w_{U,\tilde{\eta}}(1+Gl)\right) - u(w_{U,\tilde{\eta}}-pP) = \Pi_{U\to S}^{0,1}\left[u\left(w_{U,\tilde{\eta}}(1+Gl)\right) - u\left(w_{S,\tilde{\eta}}-pP\right)\right] - \Pi_{U\to S}^{1,1}\left[u\left(w_{U,\tilde{\eta}}-pP\right) - u\left(w_{S,\tilde{\eta}}-pP\right)\right]. \quad (11)$$

Recall that, by Lemma 1, $V_{GU,\tilde{\eta}} = V_{PU,\tilde{\eta}}$ implies that $V_{GS,\tilde{\eta}} < V_{PS,\tilde{\eta}}$. Hence, skilled adults strictly prefer small families with educated children.

A.1.3 All Skilled and No Unskilled Workers Educate Their Children, $\tilde{\eta} = 1$

In this steady state, $x_{PU} = 0$, $x_{GS} = 0$, $e_{GU} = 0$, and $e_{PS} = 1$. Hence, $L = lGx_{GU}$. Two conditions need to be checked. First, skilled workers must prefer to educate their children. Second, unskilled workers should prefer not to educate their children. For one of the two groups, at least, the preference will be strict. Proceeding as before, we find:

$$V_{GU,1} = \frac{u(w_{U,1}(1+Gl)) - \Pi_{U\to S}^{0,1}\left(u(w_{U,1}(1+Gl)) - u(w_{S,1}-pP)\right)}{1-\beta(1-\lambda(1-z))}, \quad (12)$$

$$V_{PS,1} = \frac{u(w_{S,1}-pP) - \Pi_{S\to U}^{0,1}\left(u(w_{S,1}-pP) - u(w_{U,1}(1+Gl))\right)}{1-\beta(1-\lambda(1-z))}, \quad (13)$$

where

$$\Pi_{S\to U}^{0,1} = \frac{\lambda\beta z(1-\pi_1)}{(1-\beta(1-\lambda(1-z(\pi_1-\pi_0))))}.$$

Next, consider individual deviations. Consider, respectively, an unskilled parent who decides to educate her children and a skilled parent who decides not to educate her children. The deviating parent's utility is:

$$V_{PU,1} = \frac{u\left(w_{U,1} - pP\right) - \Pi^{1,1}_{U\to S}\left(u\left(w_{U,1} - pP\right) - u\left(w_{S,1} - pP\right)\right)}{1 - \beta\left(1 - \lambda\left(1 - z\right)\right)},$$

$$V_{GS,1} = \frac{u\left(w_{S,1} + w_{U,1}Gl\right) - \Pi^{0,0}_{S\to U}\left(u\left(w_{S,1} + w_{U,1}Gl\right) - u\left(w_{U,1}\left(1 + Gl\right)\right)\right)}{1 - \beta\left(1 - \lambda\left(1 - z\right)\right)},$$

where

$$\Pi^{0,0}_{S\to U} = \frac{\lambda\beta z\left(1 - \pi_0\right)}{\left(1 - \beta\left(1 - \lambda\right)\right)} > \Pi^{0,1}_{S\to U}.$$

The two deviations do not increase utility as long as, respectively,

$$\begin{aligned} u(w_{U,1}(1 + Gl)) - u(w_{U,1} - pP) \geq \Pi^{0,1}_{U\to S}\left[u(w_{U,1}(1 + Gl)) - u\left(w_{S,1} - pP\right)\right] \\ - \Pi^{1,1}_{U\to S}\left[u\left(w_{U,1} - pP\right) - u(w_{S,1} - pP)\right], \end{aligned} \quad (14)$$

$$\begin{aligned} u\left(w_{S,1} + w_{U,1}Gl\right) - u(w_{S,1} - pP) \leq \Pi^{0,0}_{S\to U}[u\left(w_{S,1} + w_{U,1}Gl\right) - u\left(w_{U,1}\left(1 + Gl\right)\right)] \\ - \Pi^{0,1}_{S\to U}[u\left(w_{S,1} - pP\right) - u\left(w_{U,1}\left(1 + Gl\right)\right)]. \end{aligned} \quad (15)$$

For our candidate steady state equilibrium to be sustained, both (14) and (15) must hold simultaneously. To see that the range of parameters satisfying the two conditions is not empty, consider a knife-edge economy such that (14) holds with equality, i.e., given the wage premium consistent with $\eta_S = 1$ (skilled workers educate their children) and $\eta_U = 0$, unskilled workers are indifferent between large and small families. Then, by Lemma 1, $V_{GS,1} < V_{PS,1}$. By continuity, the same inequality holds in a neighborhood of this knife-edge economy where unskilled workers strictly prefer large families. Therefore, the set of economies for which a steady state equilibrium with $\eta_U = 0$ and $\eta_S = 1$ exists is not empty.

A.1.4 Some Skilled and No Unskilled Workers Educate Their Children, $\tilde{\eta} \in (0, 1)$

A necessary and sufficient condition for this equilibrium is that, for some $\tilde{\eta} \in (0, 1)$, the skilled and unskilled wages, $w_{S,\tilde{\eta}}$ and $w_{U,\tilde{\eta}}$, are such that $V_{GS,\tilde{\eta}} = V_{PS,\tilde{\eta}}$, i.e.,

$$\begin{aligned} u\left(w_{S,\tilde{\eta}} + w_{U,\tilde{\eta}}Gl\right) - u(w_{S,\tilde{\eta}} - pP) = \Pi^{0,0}_{S\to U}[u\left(w_{S,\tilde{\eta}} + w_{U,\tilde{\eta}}Gl\right) - u\left(w_{U,\tilde{\eta}}\left(1 + Gl\right)\right)] \\ - \Pi^{0,1}_{S\to U}[u\left(w_{S,\tilde{\eta}} - pP\right) - u\left(w_{U,\tilde{\eta}}\left(1 + Gl\right)\right)]. \end{aligned} \quad (16)$$

Recall that, by Lemma 1, $V_{GS,\tilde{\eta}} = V_{PS,\tilde{\eta}}$ implies that $V_{GU,\tilde{\eta}} > V_{PU,\tilde{\eta}}$. Hence, unskilled adults strictly prefer large families with working children.

A.1.5 No Workers Educate Their Children, $\tilde{\eta} = 0$

In this steady state, no children receive education and all families are large. The necessary and sufficient condition for this steady state to be an equilibrium is that, given wages, the skilled adults find it optimal not to educate their children. By Lemma 1, this implies, a fortiori, that the unskilled adults also choose not to educate their children. The steady state utility of skilled adults in this steady state is given by:

$$V_{GS,0} = \frac{u(w_{S,0} + w_{U,0}Gl) - \Pi^{0,0}_{S\to U}[u\left(w_{S,0}(1+Gl)\right) - u\left(w_{S,0} + w_{U,0}Gl\right)]}{1-\beta(1-\lambda(1-z))}. \tag{17}$$

The utility from a deviation (educating children) is given by:

$$V_{PS,0} = \frac{u(w_{S,0} - pP) - \Pi^{0,1}_{S\to U}[u(w_{S,0} - pP) - u\left(w_{U,0}\left(1+Gl\right)\right)]}{1-\beta(1-\lambda(1-z))},$$

The deviation is not profitable as long as:

$$u\left(w_{S,1} + w_{U,1}Gl\right) - u(w_{S,1} - pP) \geq \Pi^{0,0}_{S\to U}[u\left(w_{S,1} + w_{U,1}Gl\right) - u\left(w_{U,1}\left(1+Gl\right)\right)]. \tag{18}$$

A.2 Statement and Proofs of Lemmas

Lemma 1 *In steady state, $V_{GS} - V_{PS} < V_{GU} - V_{PU}$. Hence:*

1. *$V_{GS} \geq V_{PS}$ ($\eta_S > 0$) implies that $V_{GU} > V_{PU}$ ($\eta_U = 0$), and*
2. *$V_{GU} \leq V_{PU}$ ($\eta_U > 0$) implies that $V_{GU} < V_{PU}$ ($\eta_S = 1$).*

Proof of Lemma 1: Proving that $V_{GS}(\Omega) - V_{PS}(\Omega) < V_{GU}(\Omega) - V_{PU}(\Omega)$ is identical to prove that:

$$(1-\beta(1-\lambda)) \cdot (V_{GS}(\Omega) - V_{GU}(\Omega)) < (1-\beta(1-\lambda)) \cdot (V_{PS}(\Omega) - V_{PU}(\Omega)).$$

From (1), plus being in a steady state ($\Omega = \Omega'$), it follows that:

$$(1-\beta(1-\lambda)) \cdot (V_{GS}(\Omega) - V_{GU}(\Omega)) = u\left(w_S + w_U lG\right) - u\left(w_U + w_U lG\right) <$$

$$u\left(w_S - pP\right) - u\left(w_U - pP\right) = \left(1 - \beta\left(1 - \lambda\right)\right) \cdot \left(V_{PS}\left(\Omega\right) - V_{PU}\left(\Omega\right)\right)$$

The last inequality follows from the concavity of the utility function. Q.E.D.

Lemma 2 *The steady state population growth rate g has the following properties.*

1. *If $\eta_S = 1$, then*

$$1 + g/\lambda = \frac{P}{2}\left(\psi\left(\eta_U\right) + \sqrt{\psi\left(\eta_U\right)^2 - 4\frac{G}{P}\left(1 - \eta_U\right)\left(\pi_1 - \pi_0\right)}\right) \equiv \gamma\left(\eta_U\right),$$

where $\psi\left(\eta_U\right) \equiv 1 + \left(1 - \eta_U\right)\left(\frac{G}{P}\left(1 - \pi_0\right) - \left(1 - \pi_1\right)\right) \geq 1$, and $\gamma\left(1\right) = P$. The population growth rate g is a strictly decreasing function of the fraction η_U of unskilled adults with small families.

2. *If $\eta_S < 1$, then*

$$1 + g/\lambda = \frac{G}{2}\left(\psi_S\left(\eta_S\right) + \sqrt{\psi_S\left(\eta_S\right)^2 - 4\frac{P}{G}\eta_S\left(\pi_1 - \pi_0\right)}\right) \equiv \gamma_S\left(\eta_S\right),$$

where $\psi_S\left(\eta_S\right) \equiv 1 + \eta_S\left(\frac{P}{G}\pi_1 - \pi_0\right)$, $\gamma_S\left(0\right) = G$ and $\gamma_S\left(1\right) = \gamma\left(0\right)$. The population growth rate g is a strictly decreasing function of the fraction η_S of skilled adults with small families.

Proof of Lemma 2: Define $q \equiv G/P > 1$.

Part 1: The law of motion (6), together with the restriction that $\eta_S = 1$ and $x_{GS,t+1} = 0$, defines a system of four equations in four unknowns. The unique solution with non-negative fractions of each type yields a solution for the growth rate of the population such that $1 + g/\lambda \equiv \gamma\left(\eta_U\right)$, where $\gamma\left(\eta_U\right)$ is as defined in the text. It is useful to note that:

$$\psi\left(\eta_U\right) \geq \left(1 + \left(1 - \eta_U\right)q\left(\left(1 - \pi_0\right) - \left(1 - \pi_1\right)\right)\right) \equiv \tilde{\psi}\left(\eta_U\right),$$

with strict inequality for any $\eta_U < 1$ (whereas $\psi\left(1\right) = \tilde{\psi}\left(1\right) = 1$), and that:

$$\psi'\left(\eta_U\right) < \tilde{\psi}'\left(\eta_U\right) < 0.$$

Next, define:

$$\tilde{\gamma}\left(\eta_U\right) \equiv \frac{P}{2}\left(\tilde{\psi}\left(\eta_U\right) + \sqrt{\tilde{\psi}\left(\eta_U\right)^2 - 4q\left(1 - \eta_U\right)\left(\pi_1 - \pi_0\right)}\right) \leq \gamma\left(\eta_U\right),$$

and observe that, using the definition of $\tilde{\psi}(\eta_U)$:

$$\tilde{\gamma}(\eta_U) = \frac{P}{2}\left((1+(1-\eta_U)\,q\,(\pi_1-\pi_0)) + \sqrt{(1-(1-\eta_U)\,q\,(\pi_1-\pi_0))^2}\right) = P \leq \gamma(\eta_U).$$

Thus, $\lambda(P-1)$ is a lower bound to the growth rate of the population. Note also that $\tilde{\psi}(\eta_U)^2 - 4q(1-\eta_U)(\pi_1-\pi_0) = (1-(1-\eta_U)\,q\,(\pi_1-\pi_0))^2 > 0$, hence, $\psi(\eta_U)^2 - 4q(1-\eta_U)(\pi_1-\pi_0) > 0$, i.e., $\gamma(\eta_U) \in R^+$. Furthermore,

$$\gamma'(\eta_U) < \tilde{\gamma}'(\eta_U) = 0,$$

proving that g is uniformly decreasing in η_U.

Part 2: The law of motion (6), together with the restriction that $\eta = 0$ and $x_{PU,t+1} = 0$ defines a system of four equations in four unknowns. The unique solution with non-negative fractions of each type yields a solution for the growth rate of the population such that $1 + g/\lambda \equiv \gamma_S(\eta_S)$, where $\gamma_S(\eta_S)$ is as defined in the text. First, note that the discriminant in the definition of $\gamma_S(\eta_S)$ is positive, since:

$$\psi_S(\eta)^2 - 4q\eta_S(\pi_1-\pi_0) \geq (1+\eta_S q(\pi_1-\pi_0))^2 - 4\eta_S q(\pi_1-\pi_0) = (1-\eta_S q(\pi_1-\pi_0))^2 \geq 0.$$

Next, observe that:

$$\gamma_S(\eta) \leq \tilde{\gamma}_S(\eta) \equiv \frac{G}{2}\left(\psi_S(\eta) + \sqrt{\psi_S(\eta)^2 - 4\eta_S\left(\frac{P}{G}\pi_1 - \pi_0\right)}\right),$$

and, moreover, $\gamma_S'(\eta_S) < \tilde{\gamma}_S'(\eta_S)$. Finally, note that:

$$\begin{aligned}
\tilde{\gamma}_S(\eta) &\equiv \frac{G}{2}\left(\psi_S(\eta) + \sqrt{\psi_S(\eta)^2 - 4\eta_S\left(\frac{P}{G}\pi_1 - \pi_0\right)}\right) = \\
&= \frac{G}{2}\left(1+\eta_S\left(\frac{P}{G}\pi_1-\pi_0\right) + \sqrt{\left(1+\eta_S\left(\frac{P}{G}\pi_1-\pi_0\right)\right)^2 - 4\eta_S\left(\frac{P}{G}\pi_1-\pi_0\right)}\right) \\
&= \frac{G}{2}\left(1+\eta_S\left(\frac{P}{G}\pi_1-\pi_0\right) + \sqrt{\left(1-\eta_S\left(\frac{P}{G}\pi_1-\pi_0\right)\right)^2}\right) = G,
\end{aligned}$$

implying that $\tilde{\gamma}_S'(\eta_S) = 0$. This establishes that $\gamma_S'(\eta_S) < 0$, i.e., g is uniformly decreasing in η_S. Q.E.D.

Lemma 3 *The fraction ξ_{PS} of skilled adults with small families is strictly increasing in η_U.*

The fraction ξ_{GU} of unskilled adults with large families is strictly decreasing in η_S. The ratio of skilled to unskilled labor supply increases with both η_U and η_S. Hence, the equilibrium skilled (unskilled) wage decreases (increases) with both η_U and η_S

Proof of Lemma 3: Once more, the two cases of $\eta_U \in (0,1)$ and $\eta_S \in (0,1)$ are parallel. We therefore concentrate on the case $\eta_U \in (0,1)$ (which implies $\eta_S = 1$. Using the solution for g and the definition of $\gamma(\eta_U)$ defined in the proof of Lemma 2, we can solve for the steady state proportion of each type, as a function of η_U:

$$\begin{aligned}
\xi_{PU}(\eta_U) &= \frac{G\eta_U\left((1-\pi_0) - P(\pi_1-\pi_0)/\gamma(\eta_U)\right)}{\gamma(\eta_U) + (G-P)\eta_U + (G\pi_0 - P\pi_1)(1-\eta_U)}, \\
\xi_{GU}(\eta_U) &= \frac{\gamma(\eta_U) - P(\eta_U + \pi_1(1-\eta_U))}{\gamma(\eta_U) + (G-P)\eta_U + (G\pi_0 - P\pi_1)(1-\eta_U)}, \\
\xi_{PS}(\eta_U) &= \frac{G\pi_0 + GP\eta_U(\pi_1-\pi_0)/\gamma(\eta_U)}{\gamma(\eta_U) + (G-P)\eta_U + (G\pi_0 - P\pi_1)(1-\eta_U)}.
\end{aligned}$$

We now calculate the total derivative of $\xi_{PS}(\eta_U)$:

$$\begin{aligned}
\xi'_{PS}(\eta_U) = {} & 2P^2(\pi_1-\pi_0)\lambda^3 \\
& \left[F(\eta_U)P + (G(1-\pi_0) - P(\pi_1-\pi_0))\sqrt{\psi(\eta_U)^2 - 4q(1-\eta_U)(\pi_1-\pi_0)}\right],
\end{aligned}$$

where:

$$\begin{aligned}
F(\eta_U) = {} & q^2(1-\eta_U)(1-\pi_0)^2 \\
& + q\left(\eta_U(1-\pi_0)^2 + \pi_0(3-\pi_0) - 2\pi_1\right) + (\pi_1-\pi_0)(\eta_U + \pi_1(1-\eta_U)).
\end{aligned}$$

We want to prove that $\xi'_{PS}(\eta_U) \geq 0$ for all $\eta_U \in [0,1]$. To this aim, we define the function:

$$\begin{aligned}
\tilde{\bar{\xi}}(\eta_U) = {} & 2P^3(\pi_1-\pi_0)\lambda^3 \\
& \left[F(\eta_U) + (q(1-\pi_0) - (\pi_1-\pi_0))\sqrt{\tilde{\psi}(\eta_U)^2 - 4q(1-\eta_U)(\pi_1-\pi_0)}\right] \\
= {} & 2P^3(\pi_1-\pi_0)\lambda^3(1-\pi_1) \\
& \Big[(1-\eta_U)\left(q^2(1-\pi_0) - (\pi_1-\pi_0)\right) + \\
& q\left(2\left(\pi_0(1-\eta_U) + \eta_U\right) + (1-\pi_1)(1-\eta_U)\right)\Big],
\end{aligned}$$

where we have that $\bar{\xi}(\eta_U) \geq \tilde{\xi}(\eta_U)$. It is immediate to verify that $\tilde{\xi}(\eta_U) \geq 0$, with strict inequality holding whenever $\pi_0 < \pi_1 < 1$. Hence, $\xi'_{PS}(\eta_U) \geq 0$. In fact, $\xi'_{PS}(\eta_U) > 0$ whenever $\pi_0 < \pi_1 < 1$. A parallel argument applies to the case

$\eta_S \in (0,1)$. It therefore follows that ratio of skilled to unskilled labor supply increases with with both η_U and η_S. Q.E.D.

A.3 Proofs of Propositions

Proof of Proposition 1: We begin by defining the utility differential for unskilled and skilled adults between having large and small families in steady state:

$$\Delta_U(\tilde{\eta}) = V_{GU,\tilde{\eta}} - V_{PU,\tilde{\eta}},$$
$$\Delta_S(\tilde{\eta}) = V_{GS,\tilde{\eta}} - V_{PS,\tilde{\eta}}.$$

According to conditions (10), (11), (14), (15), (16) , and (18), a steady state of type $\tilde{\eta} = 2$ exists if $\Delta_U(2) \leq 0$, type $\tilde{\eta} \in (1,2)$ exists if $\Delta_U(\tilde{\eta}) = 0$ for some $\tilde{\eta} \in (1,2)$, type $\tilde{\eta} = 1$ exists if $\Delta_U(\tilde{\eta}) \geq 0$ and $\Delta_S(\tilde{\eta}) \leq 0$, type $\tilde{\eta} \in (0,1)$ exists if $\Delta_S(\tilde{\eta}) = 0$ for some $\tilde{\eta} \in (0,1)$, and, finally, type $\tilde{\eta} = 0$ exists if $\Delta_S(0) \geq 0$. A unique steady state therefore exists if $\Delta_U(\tilde{\eta})$ and $\Delta_S(\tilde{\eta})$ are strictly monotonically increasing in $\tilde{\eta}$. Given that Lemma 3 establishes that the wage premium is strictly decreasing in $\tilde{\eta}$, for the skilled adults this monotonicity is immediate. The situation is more complicated for the unskilled adults, since there are two opposing effects: as the skill premium rises, education becomes more attractive, but also less affordable. Writing steady state utilities for unskilled adults as a function of $\tilde{\eta}$ we get:

$$V_{GU,\tilde{\eta}} = \frac{u\left(w_{U,\tilde{\eta}}(1+Gl)\right) - \Pi^{0,1}_{U\to S}\left(u\left(w_{U,\tilde{\eta}}(1+Gl)\right) - u\left(w_{S,\tilde{\eta}} - pP\right)\right)}{1-\beta(1-\lambda(1-z))},$$
$$V_{PU,\tilde{\eta}} = \frac{u(w_{U,\tilde{\eta}} - pP) - \Pi^{1,1}_{U\to S}[u\left(w_{U,\tilde{\eta}} - pP\right) - u\left(w_{S,\tilde{\eta}} - pP\right)]}{1-\beta(1-\lambda(1-z))}.$$

Here we assume that skilled adults educate their children, which is the relevant case. We now have

$$\Delta'_U(\tilde{\eta}) = \frac{1}{1-\beta(1-\lambda(1-z))}\Big[u'\left(w_{U,\tilde{\eta}}(1+Gl)\right)\left(1-\Pi^{0,1}_{U\to S}\right)(1+Gl)\,w'_{U,\tilde{\eta}}$$
$$- u'\left(w_{U,\tilde{\eta}} - pP\right)\left(1-\Pi^{1,1}_{U\to S}\right)w'_{U,\tilde{\eta}} - u'\left(w_{S,\tilde{\eta}} - pP\right)\left(\Pi^{1,1}_{U\to S} - \Pi^{0,1}_{U\to S}\right)w'_{S,\tilde{\eta}}\Big],$$

where $w'_{U,\tilde{\eta}} > 0$, $w'_{S,\tilde{\eta}} < 0$, and $\Pi^{1,1}_{U\to S} - \Pi^{0,1}_{U\to S} > 0$. It therefore suffices to show that:

$$u'\left(w_{U,\tilde{\eta}}(1+Gl)\right)\left(1-\Pi^{0,1}_{U\to S}\right)(1+Gl) > u'\left(w_{U,\tilde{\eta}} - pP\right)\left(1-\Pi^{1,1}_{U\to S}\right)$$

or:

$$(1+Gl)\frac{1-\Pi^{0,1}_{U\to S}}{1-\Pi^{1,1}_{U\to S}} > \frac{u'(w_{U,\tilde{\eta}}-pP)}{u'\left(w_{U,\tilde{\eta}}(1+Gl)\right)}.$$

Under CRRA, the right-hand side is increasing in the wage and, therefore, Assumption 2 is a sufficient condition for a unique steady state to exist. Q.E.D.

Proof of Proposition 2: To begin, set $\beta = 0$ (to be relaxed later), choose an arbitrary $G > 0$, and choose λ, π_0, and $\pi_1 > \pi_0$ such that the old unskilled are always in majority (i.e., $(1-\lambda)(1-\pi_1) > 0.5$), which satisfies the first condition in the proposition. Since given $\beta = 0$ the future is not valued, there is no incentive for education. Therefore without CLR, for any positive values of the remaining parameters p and P the steady state with $\tilde{\eta} = 0$ prevails (all families are large), satisfying the second part of the proposition. Conversely, when CLR are in place (combined with a compulsory education policy) the steady state is $\tilde{\eta} = 2$, as all families are small to economize on the educational cost.

We still need to show that we can choose p and P such that both CLR and no CLR are SSPE, and that the assumption $\beta = 0$ can be relaxed. First, assume that the steady state without CLR prevails. We want to find conditions such that the (old unskilled) majority would oppose CLR if a referendum occurred. In the steady state without CLR, the ratio of skilled to unskilled labor supply is:

$$x_0 = \frac{\pi_0}{1-\pi_0+Gl},$$

and the corresponding unskilled wage is $w_{U,0} = f(x_0) - f'(x_0)x_0$. If CLR are introduced, all children are withdrawn from the labor market. The new skill ratio is:

$$\tilde{x}_0 = \frac{\pi_0}{1-\pi_0},$$

and the corresponding wage $\tilde{w}_{U,0} = f(\tilde{x}_0) - f'(\tilde{x}_0)\tilde{x}_0$ satisfies $w_{U,0} < \tilde{w}_{U,0}$. However, the unskilled workers also lose child labor income and have to pay the schooling cost. The old unskilled majority oppose CLR if their consumption is lower under CLR, i.e., if:

$$w_{U,0}(1+Gl) > \tilde{w}_{U,0} - pG$$

is satisfied. Clearly, the education cost p can always be chosen sufficiently high such that the majority of unskilled agents opposes the introduction of CLR.

Now consider the case where currently the steady state with CLR prevails. We want to find conditions under which the (old unskilled) majority would prefer to keep CLR in place. In the steady state with CLR, the ratio of skilled to unskilled labor supply is:

$$x_2 = \frac{\pi_1}{1-\pi_1},$$

and the corresponding unskilled wage is $w_{U,2} = f(x_2) - f'(x_2)x_2$. If CLR are abandoned, all children will enter the labor market, and young families will choose the large family size G. The ensuing skill ratio is:

$$\tilde{x}_2 = \frac{\pi_1}{1 - \pi_1 + (1-\lambda)Pl + \lambda Gl},$$

and the corresponding wage $\tilde{w}_{U,2} = f(\tilde{x}_2) - f'(\tilde{x}_2)\tilde{x}_2$ satisfies $\tilde{w}_{U,2} < w_{U,2}$. The old unskilled will prefer to maintain CLR if their consumption falls if CLR are abandoned, i.e.:

$$w_{U,2} - pP > \tilde{w}_{U,2}(1 + Pl).$$

This condition can be satisfied by choosing P sufficiently small. Notice that $\tilde{w}_{U,2}$ does not converge to $w_{U,2}$ as P goes to zero, because the young adults choose the large family size G. By choosing P, we can therefore ensure that the majority prefers to keep CLR in place. We have therefore found a set of parameters for which multiple SSPE exist. Finally, since utility is continuous in β, the same result can be obtained for positive β, sufficiently close to zero, and the same remaining parameters. Q.E.D.

References

Acemoglu, Daron and Joshua D. Angrist. 2000. "How Large are Human Capital Externalities? Evidence from Compulsory Schooling Laws." *NBER Macroeconomics Annual 2000*, pp. 9–59.

Angrist, Joshua D. and Alan B. Krueger. 1991. "Does Compulsory School Attendance Affect Schooling and Earnings?" *The Quarterly Journal of Economics* 106 (4): 979–1014.

Baland, Jean-Marie and James Robinson. 2000. "Is Child Labor Inefficient?" *Journal of Political Economy* 108 (4): 663–679.

Basu, Kaushik. 1999. "Child Labor: Cause, Consequence, and Cure, with Remarks on International Labor Standards." *Journal of Economic Literature* 37 (3): 1083–1117.

Basu, Kaushik and Pham Hoang Van. 1998. "The Economics of Child Labor." *American Economic Review* 88 (3): 412–427.

Becker, Gary S. 1960. "An Economic Analysis of Fertility." *Demographic and Economic Change in Developed Countries*. Princeton: Princeton University Press.

Becker, Gary S. and Robert J. Barro. 1988. "A Reformulation of the Economic Theory of Fertility." *Quarterly Journal of Economics* 103 (1): 1–25.

Becker, Gary S. and H. Gregg Lewis. 1973. "On the Interaction between the Quantity and Quality of Children." *Journal of Political Economy* 81:S279–288.

Berdugo, Binyamin and Moshe Hazan. 2002. "Child Labor, Fertility and Economic Growth." *Economic Journal* 112 (482): 810–28.

Brenner, Y. Simon, Harmut Kaelble, and Mark Thomas, eds. 1991. *Income Distribution in Historical Perspective*. Cambridge: Cambridge University Press.

Brown, Drusilla, Alan V. Deardorff, and Robert M. Stern. 2001. "Child Labor: Theory, Evidence and Policy." Unpublished Manuscript, University of Michigan.

Chamarbagwala, Rubiana. 2003. "The Role of Capital-Skill Complementarities in Child Labor and Schooling in India." Unpublished Manuscript, University of Maryland.

Cunningham, Hugh. 1996. "Combating Child Labor: The British Experience." In *Child Labor in Historical Perspective: Case Studies from Europe, Japan, and Colombia*, 41–55. UNICEF.

Davidson, Elizabeth H. 1939. *Child Labor Legislation in the Southern Textile States*. Chapel Hill: The University of North Carolina Press.

Dessy, Sylvain and Stephane Pallage. 2001. "Child Labor and Coordination Failures." *Journal of Development Economics* 65 (2): 469–476.

Doepke, Matthias. 2001. "Accounting for Fertility Decline During the Transition to Growth." UCLA Department of Economics Working Paper No. 804.

Feinstein, Charles. 1988. "The Rise and Fall of the Williamson Curve." *Journal of Economic History* 48 (3): 699–729.

Galbi, Douglas A. 1997. "Child Labor and the Division of Labor in the Early English Cotton Mills." *Journal of Population Economics* 10:357–375.

Galor, Oded and Omer Moav. 2001. "Das Human Kapital." CEPR Discussion Paper No. 2701.

Galor, Oded and David N. Weil. 2000. "Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond." *American Economic Review* 90 (4): 806–28.

Greenwood, Jeremy, Ananth Seshadri, and Mehmet Yorukoglu. 2004. "Engines of Liberation." Forthcoming, Review of Economic Studies.

Horrell, Sara and Jane Humphries. 1995. "The Exploitation of Little Children: Child Labor and the Family Economy in the Industrial Revolution." *Explorations in Economic History* 32:485–516.

Hossain, Shaikh I. 1990. "Interrelations between Child Education, Health, and Family Size: Evidence from a Developing Country." *Economic Development and Cultural Change* 38 (4): 763–81.

Kirby, Peter. 1999. "The Historic Viability of Child Labor and the Mines Act of 1842." Chapter 4 of *A Thing of the Past? Child Labour in Britain in the Nineteenth and Twentieth Centuries*, edited by Michael Lavalette. Liverpool: Liverpool University Press.

Kremer, Michael and Daniel L. Chen. 2002. "Income Distribution Dynamics with Endogenous Fertility." *Journal of Economic Growth* 7 (3): 227–58.

Krueger, Dirk and Jessica Tjornhom. 2000. "Economic Inequality and the Emergence of Child Labor Laws." Unpublished Manuscript, Stanford University.

Maddison, Angus. 1995. *Monitoring the World Economy, 1820-1992*. Paris: OECD.

Margo, Robert A. and T. Aldrich Finegan. 1996. "Compulsory Schooling Legislation and School Attendance in Turn-of-the-Century America: A "Natural Experiment" Approach." *Economics Letters* 53:103–10.

Marimon, Ramon and Fabrizio Zilibotti. 2000. "Employment and Distributional Effects of Restricting Working Time." *European Economic Review* 44:1291–326.

Moehling, Caroline M. 1999. "State Child Labor Laws and the Decline of Child Labor." *Explorations in Economic History* 36:72–106.

Nardinelli, Clark. 1980. "Child Labor and the Factory Acts." *Journal of Economic History* 40 (4): 739–755.

———. 1990. *Child Labor and the Industrial Revolution*. Bloomington: Indiana University Press.

Peacock, A.E. 1984. "The Successful Prosecution of the Factory Acts, 1833-55." *The Economic History Review* 37:197–210.

Ranjan, Priya. 2001. "Credit Constraints and the Phenomenon of Child Labor." *Journal of Development Economics* 64:81–102.

Ray, Ranjan. 2000. "Child Labor, Child Schooling, and Their Interaction with Adult Labor: Empirical Evidence from Peru and Pakistan." *The World Bank Economic Review* 14 (2): 347–67.

Rosenzweig, Mark R. and Robert Evenson. 1977. "Fertility, Schooling, and the Economic Contribution of Children in Rural India: An Econometric Analysis." *Econometrica* 45 (5): 1065–1079.

Rosenzweig, Mark R. and Kenneth I. Wolpin. 1980. "Testing the Quantity-Quality Fertility Model: The Use of Twins as a Natural Experiment." *Econometrica* 48 (1): 227–40.

Singh, Ram D. and G. E. Schuh. 1986. "The Economic Contribution of Farm Children and the Household Fertility Decisions: Evidence from a Developing Country, Brazil." *Indian Journal of Agricultural Economics* 41 (1): 29–41.

Weissbach, Lee Shai. 1989. *Child Labor Reform in Nineteenth-Century France*. Baton Rouge: Louisiana State University Press.

Williamson, Jeffrey G. 1985. *Did British Capitalism Breed Inequality?* Boston: Allen and Unwin.

Williamson, Jeffrey G. and Peter H. Lindert. 1980. *American Inequality: A Macroeconomic History*. New York: Academic Press.

Parameter	Value
β	0.8
z	1
σ	0.5
λ	0.15
P	1
G	3
π_0	0.05
π_1	0.4
p	0.013
l	0.1
κ	0.5

Table 1: Parameter Values

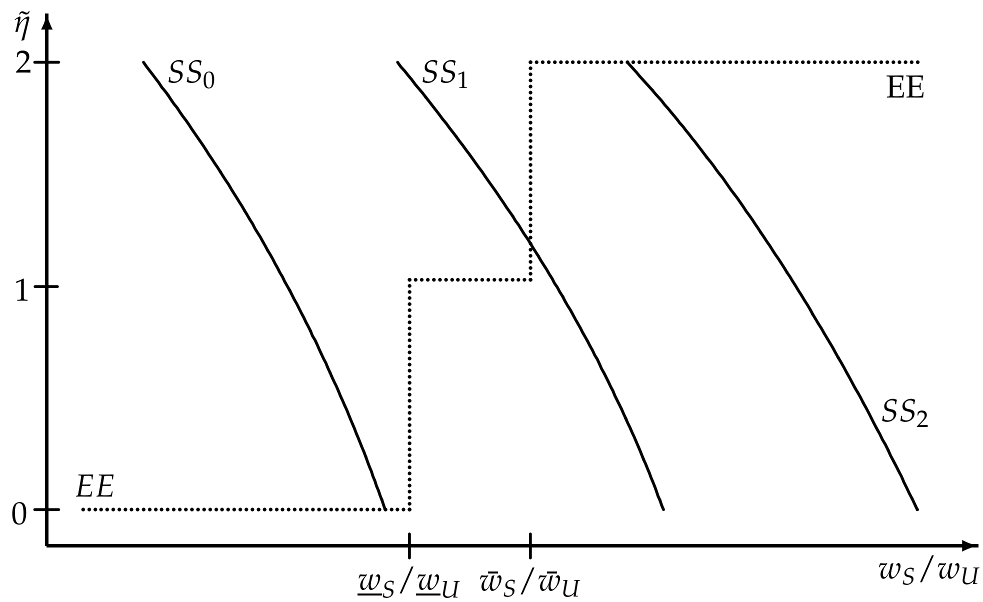
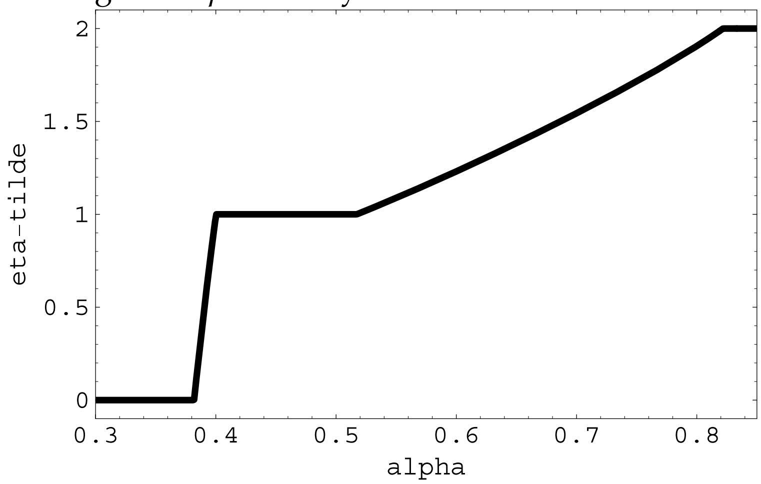


Figure 1: Steady States

Figure 2: $\tilde{\eta}$ in Steady State as a Function of α



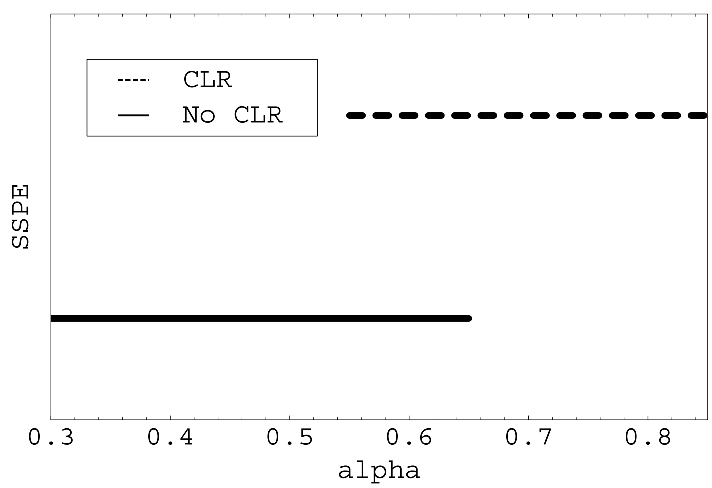


Figure 3: SSPE as a Function of α

Figure 4: Skill Premium in U.K.

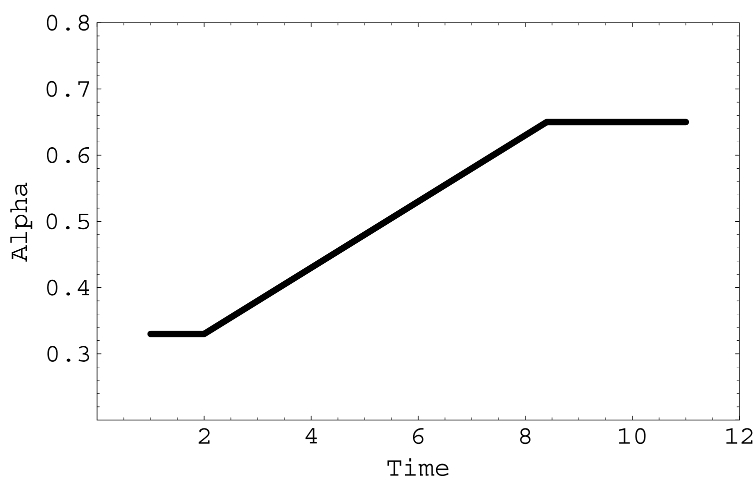
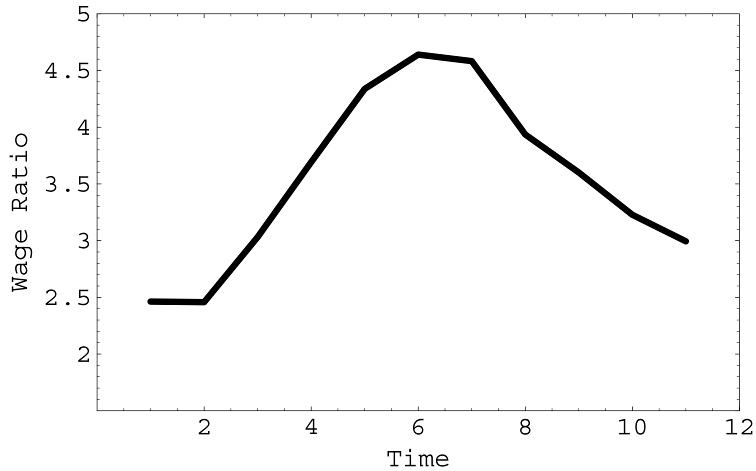


Figure 5: Parameter α over Time

Figure 6: Wage Premium over Time, Endogenous Policy



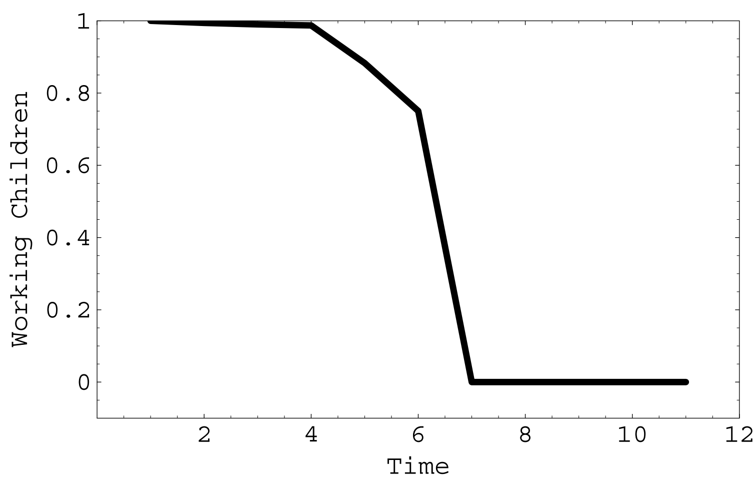
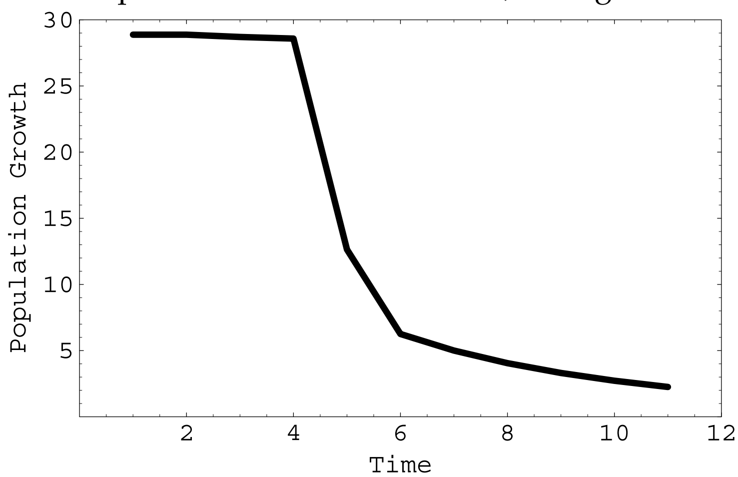


Figure 7: Fraction of Children Working, Endogenous Policy

Figure 8: Population Growth over Time, Endogenous Policy



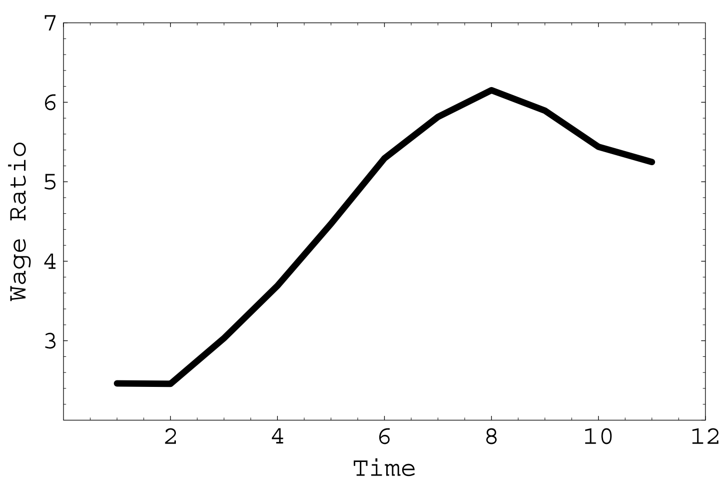
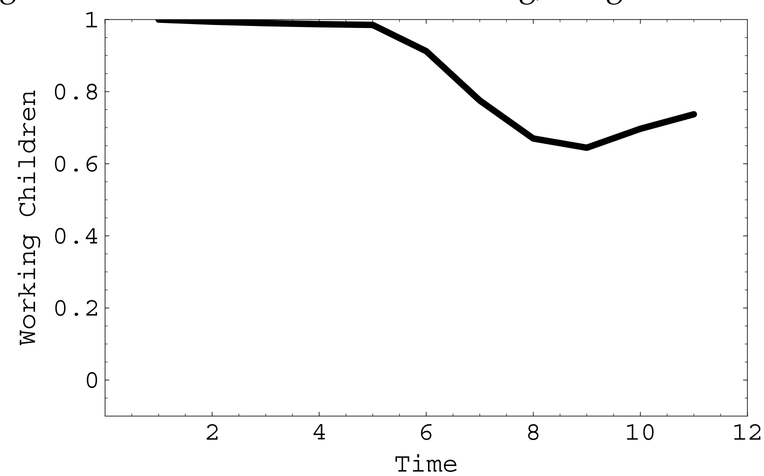


Figure 9: Wage Premium over Time, Exogenous Policy

Figure 10: Fraction of Children Working, Exogenous Policy



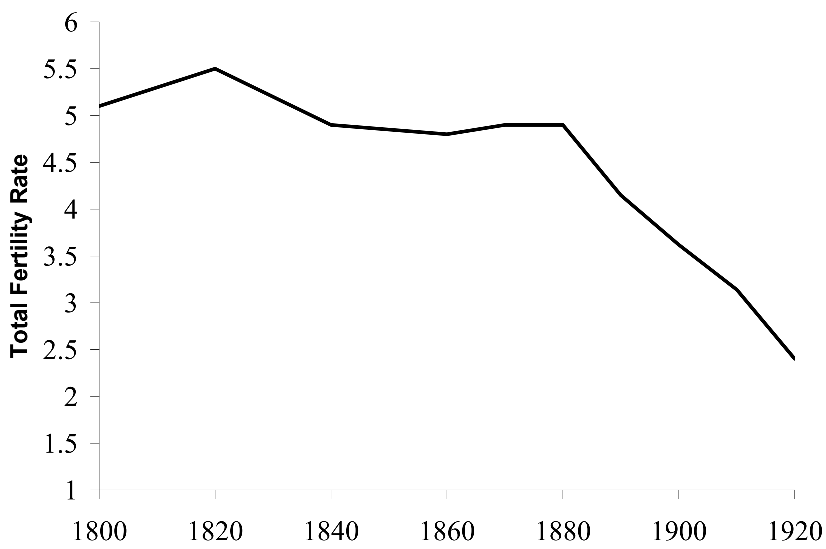
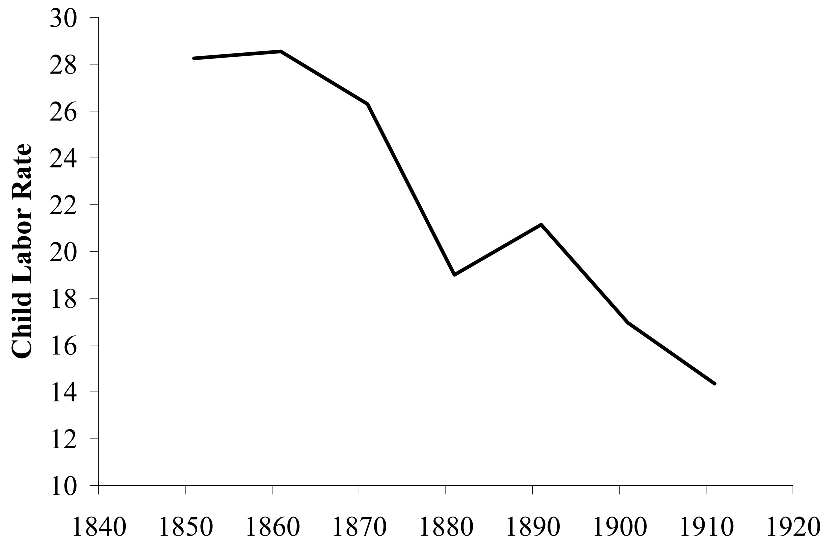


Figure 11: Total Fertility Rate in U.K.

Figure 12: Child Labor Rates in U.K.



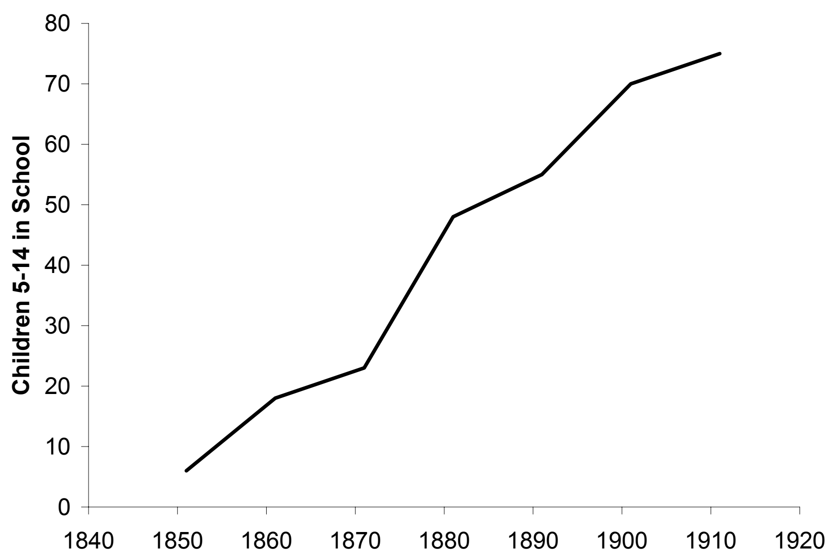
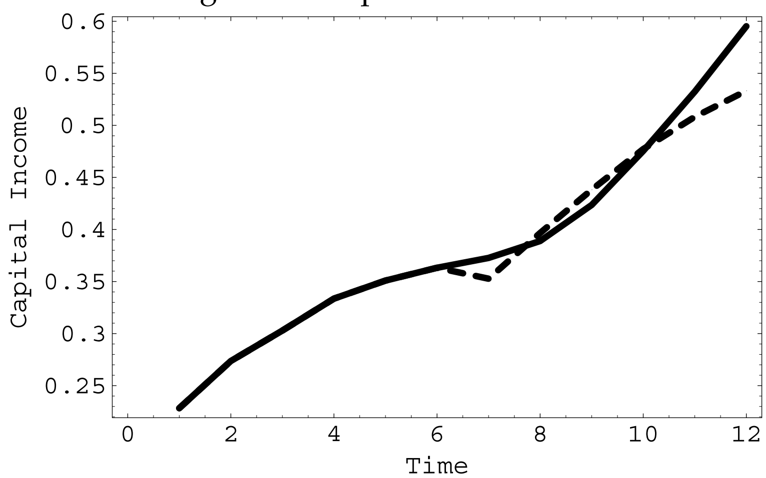


Figure 13: Schooling in U.K.

Figure 14: Capitalists' Income



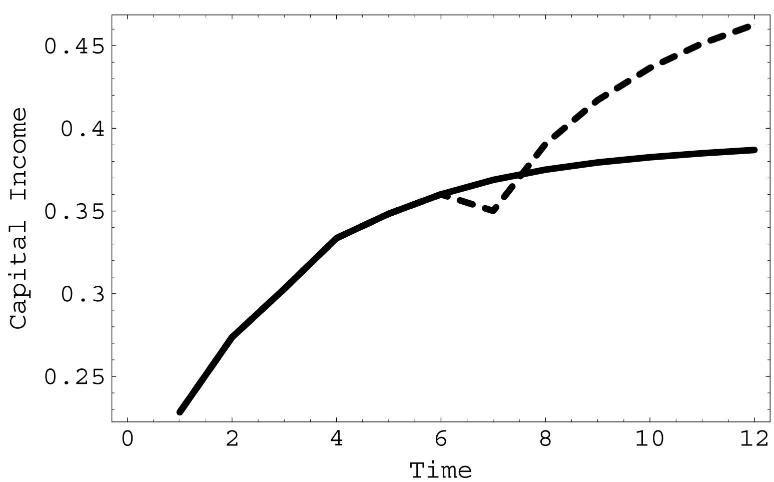


Figure 15: Capitalists' Income with Larger Increase in Skill Bias