Origins and Consequences of Child Labor Restrictions: A Macroeconomic Perspective*

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Abstract

We investigate the positive and normative consequences of child-labor restrictions for economic aggregates and welfare. We argue that even though the *laissez-faire* outcome may be inefficient, there are usually better policies to cure these inefficiencies than the imposition of a child-labor ban. Given this finding, we investigate the potential political-economic reasons behind the emergence and persistence of child-labor legislation. Our investigation is based on a structural dynamic general equilibrium model that provides a coherent and uniform framework for our analysis.

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1 Introduction

Laws restricting child labor are among the most widespread labor regulations today. Most countries in the world have imposed at least some form of child-labor restriction, with outright bans under a certain age limit being the norm. For example, according to the International Labour Organization (ILO) to date 141 countries have signed ILO Convention 138, which mandates countries to specify a minimum age of employment for children, under normal circumstances not less than 15 years. Consequently, in the signing countries (which exclude the United States) child labor is illegal. Even in many countries that have not signed the convention regulations that effectively outlaw child labor are in place.

Given the almost universal presence of legal bans, one might expect that child labor should have been mostly eliminated by now, leaving child labor as a topic best studied by economic historians. In actual fact, however, child labor is alive and well. In most empirical studies a child is defined as a person below the age of 15, and a child is said to do child labor if it is economically active, in the sense that the child "does work on a regular basis for which he or she is remunerated or that results in output destined for the market" (Basu 1999, p. 1085). Following this definition (which does not include work performed by children in the non-market sector), according to the ILO in 2000 there were about 190 million working children. These children account for about 16 percent of their cohort.

Not only is child labor a common feature of developing economies today, but it was the rule rather than the exception in Europe until the second half of the nineteenth century. Data from England suggest that as late as 1861 more than one third of all boys from 10-14 were child laborers, which exceeds the incidence of child labor in any region of the world today.[1]

In this paper, we address the impact of child labor on a nation's economy. Since excellent surveys of the literature on child labor exist elsewhere (see especially Basu 1999 and Brown, Deardorff, and Stern 2003), we focus on a specific set of

[1] As Basu (1999) points out, there are, however, single countries that feature higher rates of child labor today than Britain had in the last century. See his article for an excellent summary over the empirical facts concerning the incidence of child labor, both in today's world and in historical perspective.

questions, and we use a standard macroeconomic modeling framework to attempt to answer them. We frame our analysis within a simple extension of the standard neoclassical growth model. Our model allows for human capital investment, and we distinguish the labor inputs by children, skilled adults, and unskilled adults.

First, we take a positive stand and ask what are the consequences of introducing child-labor legislation on the equilibrium allocation of consumption, physical and human capital, as well as education and welfare. In addition to investigating the effects of a direct child-labor ban we also deduce the consequences of a mandatory education law. Since our benchmark model is a representative-agent economy and the welfare theorems hold, we come to the standard conclusion that exogenous legal restrictions such as child-labor laws or mandatory schooling lower welfare. This raises the question of why child-labor laws are so popular in the real world. To make progress on this question, in Section 3 we introduce model elements that may lead to inefficient equilibria, thus possibly providing a justification for government intervention. In particular, we focus on externalities in production, capital market imperfections (such as borrowing constraints and missing insurance markets against idiosyncratic parental income risk) and conflicting private and social time preference rates. With these modifications a more meaningful normative analysis of child-labor legislation can be conducted. A main result from Section 3 is that even if there is a rationale for government intervention because the *laissez-faire* equilibrium is not efficient, there generally exist more efficient policy interventions than a child-labor ban to cure the problem.

In Section 4, we change direction and analyze the issue of child-labor legislation from a political-economy perspective. We ask whether there might be a politically influential group that stands to gain from introducing child-labor restrictions, even if there is no evident normative justification for such restrictions. We find that if households are heterogeneous by skill, political support for child-labor restrictions may indeed arise. In particular, adult workers who compete with children in the labor market may attempt to raise their wages by banning children from the labor market. We discuss conditions under which this motive is sufficient to explain the passing of a ban, and the extent to which the political-economy approach can account for various real-world features of child-labor legislation. Section 5 offers brief concluding remarks.

2 A Benchmark Model

In this section we construct an analytically tractable benchmark model to analyze the effects of child-labor legislation on economic aggregates and welfare. Given our macroeconomic perspective, the analytical framework is the standard neoclassical growth model, extended by introducing human capital investment and a distinction of the labor inputs by children, skilled adults, and unskilled adults.

2.1 Households

We envision a family where each member lives for two periods, being a child in the first period and an adult in the second period. All decisions of the family are made by the adult members of the family. We abstract from population growth and fertility issues for now, thus every adult has one child. Parents are altruistic towards their children, and discount the children's utility at discount rate β.

Let c_t denote consumption of the family at date c_t, and a_{t+1} denote the bequests parents at date t leave to their children. In the benchmark model we do not place any restrictions on the sign of bequests; that is, parents can borrow against the labor income of their children (to pay for their education, among other things). In addition to deciding upon bequests and family consumption parents decide whether to have their children obtain education. A child that goes to school has to pay a resource cost ϕ and forgoes wages from working as a child laborer w_t^c. The benefits of obtaining education are higher wages as an adult. We denote by w_t^u the wage of an adult that did not go to school and is labeled unskilled. Adults that went to school and accumulated human capital earn a wage w_t^s and are labeled as skilled.

In the benchmark model, in order to abstract from interesting, but analytically difficult distributional aspects of child labor and its regulation we make the assumption that each household (there is a measure one of identical households) is composed of a continuum of members of mass 1 who share consumption and bequests perfectly among them. Some of the households members may be skilled, others unskilled, some children may be sent to school, others not. Let p_{t+1} denote the fraction of children of the family that are sent to school in period t and p_0 denotes the fraction of the initial cohort of adults that are skilled. Also, a_0 denotes the initial wealth of a dynasty and the real interest rate at time t is given by r_t.

The household choice problem then reads as:

$$\max_{\{c_t, a_{t+1}, p_{t+1}\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t u(c_t), \tag{1}$$

where the maximization is subject to:

$$\begin{aligned} c_t + a_{t+1} + \phi p_{t+1} &= p_t w_t^s + (1-p_t) w_t^u + (1+r_t) a_t + (1-p_{t+1}) w_t^c, \\ c_t &\geq 0, p_{t+1} \in [0,1], \end{aligned}$$

and a no-Ponzi-scheme condition on bequests. We assume that the period utility function u is strictly increasing, strictly concave, at least twice differentiable, and satisfies the Inada conditions.

2.2 Firms

There is a representative firm in our economy that behaves competitively and operates a constant returns to scale technology to produce output. The production technology is given by

$$Y_t = F(K_t, N_t^s, N_t^u, N_t^c),$$

where K_t is the amount of capital rented by the firm, and (N_t^s, N_t^u, N_t^c) are the numbers of skilled and unskilled adult workers, as well as children hired by the firm. The function F is homogeneous of degree one in its arguments. Further assumptions about the complementarity or substitutability of the factors of production will be made as they become necessary. Physical capital depreciates at rate δ in the production process.

Given wages and rental rates on capital, the firm chooses production inputs to maximize period-by-period profits:

$$\max_{\{K_t, N_t^s, N_t^u, N_t^c\}} F(K_t, N_t^s, N_t^u, N_t^c) - (r_t + \delta)K_t - w_t^s N_t^s - w_t^u N_t^u - w_t^c N_t^c. \qquad (2)$$

2.3 Markets, Equilibrium, and Efficiency

There are three spot markets that open in every period: the goods market, the rental market for capital, and the labor market (in fact, there are separate markets for skilled, unskilled, and child labor). We are now ready to define a competitive equilibrium in the absence of child-labor legislation.

Definition 1 *Given initial conditions $\{a_0, p_0\}$ a competitive equilibrium consists of allocations for the representative household, $\{c_t, a_{t+1}, p_{t+1}\}_{t=0}^{\infty}$, allocations for the representative firm, $\{K_t, N_t^s, N_t^u, N_t^c\}_{t=0}^{\infty}$, and prices $\{r_t, w_t^s, w_t^u, w_t^c\}_{t=0}^{\infty}$ such that:*

1. *Given prices $\{r_t, w_t^s, w_t^u, w_t^c\}_{t=0}^{\infty}$ the household allocation solves the household maximization problem (1).*

2. *Given prices $\{r_t, w_t^s, w_t^u, w_t^c\}$, the firm allocation solves the firm's problem (2) for every period t.*

3. *All markets clear:*

   (a) The goods market:

$$F(K_t, N_t^s, N_t^u, N_t^c) = c_t + K_{t+1} - (1-\delta)K_t + \phi p_{t+1}.$$

   (b) The capital market:

$$K_t = a_t.$$

(c) *The labor markets:*

$$\begin{aligned} N_t^s &= p_t, \\ N_t^u &= 1 - p_t, \\ N_t^c &= 1 - p_{t+1}. \end{aligned}$$

Below, we will frequently refer to this unconstrained equilibrium as the *laissez-faire* equilibrium, to distinguish it from outcomes under restrictive child-labor policies.

It is straightforward to define a Pareto-efficient allocation:

Definition 2 *Given $\{K_0, p_0\}$, an allocation $\{c_t, K_{t+1}, p_{t+1}\}_{t=0}^{\infty}$ is feasible if it satisfies*

$$F(K_t, p_t, 1 - p_t, 1 - p_{t+1}) = c_t + K_{t+1} - (1 - \delta)K_t + \phi p_{t+1}$$

and $c_t \geq 0$, $p_{t+1} \in [0, 1]$, $K_{t+1} \geq 0$.

Definition 3 *An allocation is Pareto efficient if it is feasible and there is no other feasible allocation that gives strictly higher lifetime utility to the representative household.*

Without proof, we state versions of the first and second welfare theorems for our environment.

Proposition 1 *Let $\{c_t, K_{t+1}, p_{t+1}\}_{t=0}^{\infty}$ be (part of) a competitive equilibrium allocation. Then $\{c_t, K_{t+1}, p_{t+1}\}_{t=0}^{\infty}$ is Pareto efficient.*

Proposition 2 *Suppose that an allocation $\{c_t, K_{t+1}, p_{t+1}\}_{t=0}^{\infty}$ solves the social planner problem*[2]

$$\max_{\{c_t, K_{t+1}, p_{t+1}\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t u(c_t)$$

s.t.

$$F(K_t, p_t, 1 - p_t, 1 - p_{t+1}) = c_t + K_{t+1} - (1 - \delta)K_t + \phi p_{t+1}.$$

[2]It is straightforward to show that an allocation is Pareto efficient if and only if it solves the social planner problem is our model. Also, since there is a representative family in our model, an efficient allocation can be supported by a competitive equilibrium *without* transfers.

Then we can find prices $\{r_t, w_t^s, w_t^u, w_t^c\}_{t=0}^{\infty}$ *such that the allocation together with these prices form a competitive equilibrium.*

These theorems imply that in our representative-agent benchmark economy any form of child-labor legislation cannot have beneficial welfare consequences. In the remainder of this section we will analyze the positive implications of introducing child-labor legislation.

2.4 Characterization of the Laissez-Faire Equilibrium

The first-order conditions characterizing optimal (and thus equilibrium) allocations are (assuming interior allocations for consumption and capital)[3]:

$$\begin{aligned}
\lambda_t &= \beta^t u'(c_t), \\
\lambda_{t+1} &= \beta^{t+1} u'(c_{t+1}), \\
\lambda_t &= \lambda_{t+1}\left[1-\delta+F_K(t+1)\right], \\
\lambda_t\left[\phi+F_{N^c}(t)\right] &= \lambda_{t+1}\left[F_{N^s}(t+1)-F_{N^u}(t+1)\right]+\lambda_t\xi_t-\lambda_t\nu_t.
\end{aligned}$$

Here $F_K(t+1)$ denotes the partial derivative of the production function with respect to K, evaluated at inputs in period $t+1$. The terms $F_{N^c}(t)$, $F_{N^s}(t+1)$, $F_{N^u}(t+1)$ are interpreted analogously. The Lagrange multipliers ξ_t and ν_t (which are scaled by λ_t) are associated with the constraints $p_{t+1} \geq 0$ and $p_{t+1} \leq 1$ and satisfy complementary slackness conditions:

$$\begin{aligned}
\xi_t p_{t+1} &= 0, \\
\nu_t(1-p_{t+1}) &= 0.
\end{aligned}$$

Combining the conditions gives:

$$u'(c_t) = \beta u'(c_{t+1})\left[1-\delta+F_K(t+1)\right], \tag{3}$$

$$u'(c_t)\left[\phi+F_{N^c}(t)\right] = \beta u'(c_{t+1})\left[F_{N^s}(t+1)-F_{N^u}(t+1)\right]+u'(c_t)\left[\xi_t-\nu_t\right] \tag{4}$$

[3]For consumption this is guaranteed by the Inada condition. Below we will make additional assumptions to guarantee interiority with respect to capital K_{t+1} as well.

and thus:

$$\phi + F_{N^c}(t) = \frac{F_{N^s}(t+1) - F_{N^u}(t+1)}{[1-\delta+F_K(t+1)]} + \xi_t - \nu_t. \tag{5}$$

This condition states that at an interior solution for p_{t+1} the opportunity cost of educating the marginal child today (composed of the direct resource cost ϕ and forgone child-labor income, the child's wage in the decentralization) has to equal the discounted benefits of education, equal to the increase in production due to one more skilled worker (the skill wage premium in the decentralization).[4]

The Euler equations (3) and the optimal allocation condition on children's time use (5), together with the resource constraints and the initial conditions (K_0, p_0) as well as the transversality condition for capital pin down the optimal (and thus equilibrium) allocation $\{c_t, K_{t+1}, p_{t+1}\}_{t=0}^{\infty}$. Equilibrium interest rates and wages are given by the marginal products of capital and the various labor inputs.

In the remainder of this section we assume that the following separability condition on the production function holds:

Condition 1

$$F(K, N^s, N^u, N^c) = f(K, L),$$

where

$$L = g(N^s, N^u, N^c)$$

and f is homogeneous of degree one in $\{K, L\}$. Furthermore, f has positive but strictly decreasing marginal products and satisfies the Inada conditions. The function g is homogeneous of degree 1 in its arguments (which assures that F is homogeneous of degree 1 in its arguments).

This assumption immediately implies that $F_K = f_K$ is homogeneous of degree 0, so that the marginal product of capital f_K only depends on the capital-labor ratio

[4] In the market economy, these conditions therefore read as

$$\begin{aligned} u'(c_t) &= \beta u'(c_{t+1})(1+r_{t+1}), \\ \phi + w_t^c &= \frac{w_{t+1}^s - w_{t+1}^u}{1+r_{t+1}} + \xi_t - \nu_t. \end{aligned}$$

$k = \frac{K}{L}$. In addition, we have:

$$L_t = g(N_t^s, N_t^u, N_t^c) = g(p_t, 1 - p_t, 1 - p_{t+1}).$$

Equations (3) and (5) then become:

$$\begin{aligned} u'(c_t) &= \beta u'(c_{t+1})(1 - \delta + f_K(k_{t+1})), && (6) \\ \phi + f_L(k_t) g_{N^c}(t) &= \frac{f_L(k_{t+1}) \left[g_{N^s}(t+1) - g_{N^u}(t+1) \right]}{(1 - \delta + f_K(k_{t+1}))} + \xi_t - \nu_t. && (7) \end{aligned}$$

Let $\beta = \frac{1}{1+\rho}$, where ρ is the time discount rate. The equations characterizing a steady state $(c^\star, k^\star, p^\star)$ are given by:[5]

$$\begin{aligned} \delta + \rho &= f_K(k^\star), \\ 1 + \rho &= \frac{f_L(k^\star) \left[g_{N^s}(\star) - g_{N^u}(\star) \right] + (1+\rho)(\xi^\star - \nu^\star)}{\phi + f_L(k^\star) g_{N^c}(\star)}, \\ c^\star &= F(K^\star, L^\star) - \delta K^\star - \phi p^\star. && (8) \end{aligned}$$

2.5 Introducing Child Labor Legislation

Into our simple neoclassical growth model with child labor and human capital accumulation we now introduce child-labor legislation. We consider two different policies aimed at curbing child labor and use the term child-labor legislation to refer to both policies.

The first policy is a ban on child labor. Parents are not allowed to have their children do market work, but they still have a decision to make as to what fraction of children to send to school. The second policy is a mandatory education law that requires all children to attend school. Under this policy, given that going to school by assumption requires the full time of a child, parents have no decision to make with respect to a child's time allocation.

[5] Note that $L^\star = g(p^\star, 1 - p^\star, 1 - p^\star)$ and $K^\star = k^\star L^\star$.

2.5.1 A Ban on Child Labor

Since the *laissez-faire* equilibrium with none of the restrictions in place is Pareto efficient, we know that the equilibrium allocation under a child-labor ban is (weakly) worse from a welfare point of view. Such a policy imposes additional restrictions on the choice sets of households without correcting any type of market failure, which by assumption is absent in the benchmark model. The purpose of our analysis in this section is merely to determine the effect of such a policy on equilibrium allocations.

Under a child-labor ban the household decision problem is to maximize (23) subject to:

$$\begin{aligned} c_t + a_{t+1} + \phi p_{t+1} &= p_t w_t^s + (1 - p_t) w_t^u + (1 + r_t) a_t, \\ c_t &\geq 0, p_{t+1} \in [0, 1], \end{aligned}$$

which results in household Euler equations:

$$\begin{aligned} u'(c_t) &= \beta u'(c_{t+1})(1 + r_{t+1}), \\ \phi &= \frac{w_{t+1}^s - w_{t+1}^u}{1 + r_{t+1}} + \xi_t - \nu_t. \end{aligned}$$

Replacing prices with marginal products, the conditions can be written as:

$$\begin{aligned} u'(c_t) &= \beta u'(c_{t+1})(1 - \delta + f_K(k_{t+1})), \\ \phi &= \frac{f_L(k_{t+1}) \left[g_{N^s}(t+1, N^c = 0) - g_{N^u}(t+1, N^c = 0) \right]}{(1 - \delta + f_K(k_{t+1}))} + \xi_t - \nu_t. \end{aligned}$$

The equations characterizing the steady state of the model under a child-labor ban are:

$$\begin{aligned} \delta + \rho &= f_K(k^\star), \\ 1 + \rho &= \frac{f_L(k^\star) \left[g_{N^s}(\star, N^c = 0) - g_{N^u}(\star, N^c = 0) \right] + (1 + \rho)(\xi^\star - \nu^\star)}{\phi}, \\ c^\star &= F(K^\star, p_s^\star, 1 - p_s^\star, 0) - \delta K^\star - \phi p_s^\star. \end{aligned} \tag{9}$$

2.5.2 A Mandatory Education Law

For the same reason as with a child-labor ban, in the current model a mandatory-education law cannot be welfare improving relative to the *laissez-faire* equilibrium. Now the fraction of children obtaining education is not a choice variable, as the government enforces $p_t = 1$ for all t. The optimality condition for capital remains in place:

$$u'(c_t) = \beta u'(c_{t+1})(1 - \delta + f_K(k_{t+1})),$$

and the steady-state equations read as:

$$\begin{aligned} \delta + \rho &= f_K(k^\star), \\ p^\star &= 1, \\ c^\star &= F(K^\star, 1, 1, 0) - \delta K^\star - \phi. \end{aligned} \tag{10}$$

2.6 The Long-Run Consequences of Child Labor Legislation

We now deduce the long-run (that is, steady state) allocational consequences of child-labor legislation. The first result characterizes the effect on child-labor legislation on the capital-labor ratio (and consequently the interest rate):

Proposition 3 *The long-run capital-labor ratio $k^\star$ is not affected by the introduction of legal restrictions on child labor; neither is the long-run interest rate nor the long-run price of an efficiency unit of labor.*

This result is, of course, owed to Condition 1, which rules out features such as capital-skill complementarity. To make further progress we now make parametric assumptions on the function g which aggregates labor inputs into effective units of labor.

Condition 2 *Suppose that*

$$g(N^s, N^u, N^c) = \max_{s \in [0,1]} (sN^s)^\theta \left(\kappa^s(1-s)N^s + \kappa^c N^c + N^u\right)^{1-\theta},$$

where θ is the share parameter on skilled labor.[6] *Skilled workers can be used as unskilled workers, in which case they are κ^s times as efficient as unskilled workers (whose efficiency we normalize to 1). Children can do unskilled work, and they are κ^c as efficient as unskilled adults.*

This formulation has the advantage that labor supply L is positive even when there are no unskilled workers and no child laborers (as is the case in the steady state with mandatory education). The firm's optimal allocation of its skilled workers is to allocate a fraction

$$s = \min\left\{1, \theta\left[1 + \frac{\kappa^c N^c + N^u}{\kappa^s N^s}\right]\right\}$$

to skilled work and use the remaining $1 - s$ as unskilled workers. We see that if skilled agents are not very efficient in doing unskilled work (relative to unskilled workers and children) or if there are few skilled workers relative to unskilled or children workers, then it is optimal to make all skilled workers do skilled work. Otherwise it is optimal to use some skilled workers for unskilled work.

We now want to investigate how the long-run allocation of workers among skilled and unskilled (and thus the economy-wide stock of human capital) is affected by child-labor legislation. Once we have characterized the steady-state fraction $p^\star$ of skilled adults, total effective labor supply $L^\star$, the aggregate capital stock $K^\star$, as well as aggregate consumption $c^\star$ will follow.

Evidently, under mandatory education we have $p^\star = 1$. However, if κ^s is sufficiently large, even under *laissez faire* or a child-labor ban every child will receive education, and steady-state equilibria under all regimes will coincide. To distinguish the policy regimes, we thus want to establish conditions under which the *laissez-faire* steady state and the child-labor ban steady state feature $p^\star < 1$. The benchmark for comparisons is the steady state under mandatory education where every worker is skilled, the share of skilled workers doing unskilled work is $s = \theta$, and ratio of wages between skilled and unskilled workers equals κ^s (the relative productivity of the skilled workers doing unskilled work).

[6]We can allow $\theta = 0$ in which case skilled and unskilled workers are perfect substitutes. But in this case steady-state equilibria with interior education allocations exist only as knife-edge case. Thus unless otherwise noted we assume $\theta > 0$.

2.6.1 Education Allocation in the Laissez Faire Steady State

In the *laissez-faire* equilibrium the Euler allocation for education reads as:

$$1+\rho=\frac{f_L(k^\star)\left[g_{N^s}(\star)-g_{N^u}(\star)\right]+(1+\rho)(\xi^\star-\nu^\star)}{\phi+f_L(k^\star)g_{N^c}(\star)}. \tag{11}$$

Define $\bar{p}^\star$ as the threshold share of educated workers below which all skilled workers are allocated to skilled jobs; it is given by:

$$\bar{p}^\star_{LF}=\frac{1}{1+\frac{(1-\theta)\kappa^s}{\theta(1+\kappa^c)}}\in(0,1).$$

In the appendix we prove the following result:

Proposition 4 *Assume that $\kappa^s\leq 1$.*[7] *Then there exists a unique steady-state share of skilled workers under laissez faire $0<p^\star_{LF}<\bar{p}^\star_{LF}<1$. All skilled workers do skilled (as opposed to unskilled) work, that is, $s=1$.*

As a straightforward corollary we obtain that the education and skill level of the work force is strictly higher with a mandatory education law than in the *laissez-faire* steady state.

Proposition 5 *Under laissez faire, relative wages of skilled and unskilled workers are given by:*

$$\frac{w^s_{LF}}{w^u_{LF}}=\kappa^s\frac{\bar{p}^\star_{LF}}{p^\star_{LF}}\frac{1-p^\star_{LF}}{1-\bar{p}^\star_{LF}}>\kappa^s, \tag{12}$$

whereas with mandatory education

$$\frac{w^s_{ME}}{w^u_{ME}}=\kappa^s.$$

Thus, steady-state wage inequality is strictly higher in the laissez-faire steady state.

[7] This is a sufficient but by no means necessary condition.

2.6.2 Education Allocation with Child Labor Ban

As in the previous discussion we can now deduce the optimal education allocation if a child-labor ban is in place. The key Euler equation reads as

$$1+\rho = \frac{f_L(k^\star)\left[g_{N^s}(\star, N^c=0) - g_{N^u}(\star, N^c=0)\right] + (1+\rho)(\xi^\star - \nu^\star)}{\phi}. \tag{13}$$

The threshold $\bar{p}_B^\star$ below which all skilled workers are allocated to skilled jobs is now given by:

$$\bar{p}_B^\star = \frac{1}{1+\frac{(1-\theta)\kappa^s}{\theta}} < \bar{p}_{LF}^\star.$$

This leads to the following proposition:

Proposition 6 *Assume that $\kappa^s \leq 1$. Then there exists a unique steady state share of skilled workers under a child-labor ban $0 < p_B^\star < \bar{p}_B^\star < 1$. All skilled workers do skilled (as opposed to unskilled) work, that is, $s = 1$. Relative wages of skilled and unskilled are given by:*

$$\frac{w^s}{w^u} = \kappa^s \frac{\bar{p}_B^\star}{p_B^\star} \frac{1-p_B^\star}{1-\bar{p}_B^\star} > \kappa^s. \tag{14}$$

So far we have established that the capital labor-ratio is unaffected by child-labor legislation. Mandatory education implements higher human capital and lower wage inequality in society than either *laissez faire* or a child-labor ban, since $p_B^\star, p_{LF}^\star < 1$.

Finally, comparing the *laissez-faire* steady state with that under a child-labor ban we find that a ban on child labor may be counterproductive in that it may lower the fraction of children obtaining education, that is, $p_B^\star < p_{LF}^\star$. This may seem counterintuitive at first inspection of (11) and (13). A child-labor ban reduces the opportunity cost of sending a child to school, since it is legally precluded from working in the market sector. This cost shows up in the denominator of (11) as $f_L(k^\star)g_{N^c}(\star)$, which, ceteris paribus, reduces $p^\star$, relative to (13). But there is also an effect of the child-labor ban on relative wages of skilled versus unskilled adult workers. A child-labor ban reduces the supply of unskilled labor from children and therefore makes unskilled labor scarce relative to skilled labor. Thus, the relative wage of the skilled is lower than without a child-labor ban, which reduces incentives to acquire education. These two effects go in opposite directions, and one can construct examples such that either effect quantitatively dominates.

2.7 Transition Path

So far we have restricted our analysis to a steady state comparison. Since the first welfare theorem holds, the welfare implications of introducing child-labor legislation are unambiguously negative; a transition analysis is not required to establish this result. Thinking from a social planner's perspective also makes clear that welfare under a mandatory-education law must be weakly lower than under a child-labor ban, since the mandatory-education allocation is feasible under a child-labor ban, whereas the opposite is not true (the planner can choose $p^\star < 1$ under a child-labor ban). Thus mandatory education imposes additional restrictions on the social planner, which weakly lowers welfare.

The full dynamics of allocations are hard to characterize analytically since the model has two state variables, K and p. In the case of a child-labor ban total current output Y is a sufficient state variable, since it is not affected by the current education choice. From the initial condition (K_0, p_0) (which could be the *laissez-faire* steady state) the dynamics of physical and human capital can then be characterized by the Bellman equation:

$$V(Y) = \max_{K',p'} \left\{ u(Y - K' - \phi p') + \beta V(F(K', g(p', 1 - p', 0))) \right\}.$$

While it is hard to obtain clear-cut qualitative results from this recursive formulation (one can show that under mild conditions the evolution of consumption is monotonic over time), solving this problem numerically is straightforward and suggests that the evolution of human and physical capital is (weakly) monotonic as well.

2.8 Distributional Consequences of Child Labor Laws

So far, despite the fact that every representative household has unskilled and skilled members, the change in relative wages due to the introduction of child-labor legislation has no distributional consequences since consumption is perfectly insured within the family.

Now assume that the economy starts out at the *laissez-faire* steady state and all individuals have the same initial capital. But now relax the assumption of perfect consumption insurance and assume instead that there is no insurance at all among members of the initial cohort of households (but full insurance thereafter). Thus, now there are two types of households, unskilled and skilled, and therefore distributional consequences from introduction of child-labor legislation will arise.

Skilled and unskilled households face the same choice set of consumption and physical and human capital accumulation, apart from the fact that unskilled individuals earn lower wages in the current period. Thus the relative welfare consequences of a policy on both groups are fully determined by the impact of the policy on wages in the initial period.[8]

Under both a child-labor ban and mandatory education the supply of child labor is zero, either as required by law or on account of the assumption that children that go to school cannot work. Thus, given that the skill composition $p^\star \in (0, \bar{p}^\star_{LF})$ and the capital-labor-ratio $k^\star$ is predetermined, the impact on first period wages of both groups is given by:

$$\begin{aligned}
\Delta w_s &= f_L(k^\star)\left[g_{N^s}(p^\star, 1-p^\star, 0) - g_{N^s}(p^\star, 1-p^\star, 1-p^\star)\right] \\
&= f_L(k^\star)\theta\left[\frac{1-p^\star}{p^\star}\right]^{1-\theta}(1-(1+\kappa^c)^{1-\theta}) < 0, \\
\Delta w_u &= f_L(k^\star)\left[g_{N^u}(p^\star, 1-p^\star, 0) - g_{N^u}(p^\star, 1-p^\star, 1-p^\star)\right] \\
&= f_L(k^\star)\theta\left[\frac{1-p^\star}{p^\star}\right]^{-\theta}(1-(1+\kappa^c)^{-\theta}) > 0.
\end{aligned}$$

Not surprisingly, skilled workers lose from the introduction of child labor while unskilled workers gain. The reason is that child labor is a perfect substitute for unskilled labor but only an imperfect substitute for skilled labor in production.

[8]One can show that as long as the period utility function is homothetic and and education allocations are interior, aggregate allocations in this variant of the model coincide with that in the previous section.

Furthermore, the size of the wage gains and losses (and thus the welfare gains and losses) depend on the initial skill distribution of society as determined by $p^\star$.

These results indicate that while the laissez-fare equilibrium is Pareto efficient, there are groups that can potentially gain from the introduction of child-labor legislation. Our analysis so far identifies unskilled adults as the prime group for which this may be true. Even for this group, however, there are opposing effects (such as the loss of child labor income) that could lead them to oppose child-labor legislation despite the increase in their wage. We will explore this point further in Section 4 below, where we examine the political economy of child-labor restrictions.

2.9 Extensions

We have made several restrictive modeling assumptions in order to obtain sharp analytical results. We now briefly discuss (rather than formally analyze) two of what we consider to be the most important extensions.

2.9.1 Home Production

We have assumed that children that go to school cannot work at all and that a ban on child labor is perfectly enforced, so that children are prevented from doing any work. An important extension would be to explicitly model home production.[9] In that case children could be permitted to work after school at home, and one may assume that a child-labor ban is enforceable in the formal market sector, but not in the informal home production sector. While a formal analysis of such a model is beyond the scope of this paper, one may conjecture that the impact of child-labor legislation on equilibrium allocations is quantitatively smaller in such a model, because households are given an additional margin of adjustment (how much to let children work at home) to deal with such legislation.

[9] For a general treatment of home production in macroeconomics, see Greenwood, Rogerson, and Wright (1995) and Parente, Rogerson, and Wright (2000).

2.9.2 Model Elements that Generate Multiple Equilibria

There is a substantial literature, pioneered by Basu and Van (1998) and skillfully summarized in Section 6 of Basu (1999) suggesting that child-labor legislation may move the economy from a socially undesirable to a socially desirable equilibrium. Of course such an argument requires a model that features multiple equilibria, or at least multiple steady states. At the heart of many of these models is a backward bending family labor supply curve: as wages for (adult) labor are falling parents may find it optimal to increasingly send children to work. An equilibrium with high child labor and low wages results. If the government imposes a ban on child labor, an equilibrium with high wages and no child labor (and thus increased education and human capital accumulation) ensues. In such circumstances a ban on child labor can be the first-best policy, if indeed the high-wage equilibrium allocation constitutes the socially optimal allocation and the ban is costless to enforce.

A potential caveat is that most of the work that stresses the importance of multiple equilibria employs static models. While it may be feasible to construct dynamic models with similar features, in our modeling framework the steady-state equilibrium is unique. In particular, the time discount rate of households unique determines interest rates, and thus the capital-labor ratio. Since equilibrium wages only depend on this ratio, multiple (long-run) equilibria in the labor market can be ruled out. An unanticipated child-labor ban may still implement a high-wage equilibrium temporarily, but this would also lower the return to capital. The capital-labor ratio would then begin to fall, until the original lower wage is restored. To obtain multiple equilibria in dynamic models one either has to break the link between time preference rates and interest rates, or the link from capital-labor ratios to wages. This may be feasible in some skillfully constructed dynamic model, but in a wide class of models commonly used in macroeconomics it is not.

3 Potential Rationales for Government Intervention

We now turn to a discussion of models (or better, model elements) that may provide a normative justification for the presence of child-labor legislation. Of course this requires a model where the welfare theorems fail.

3.1 Human Capital Externalities

Positive externalities in production (or consumption) from a high average level of education are commonly cited as justifications for policies trying to enhance human-capital accumulation in general and child-labor laws in particular. John Stuart Mill in 1848 already pointed out the potential negative consequences for society as a whole (in addition to the consequences for individual families) when children fail to attain proper education.[10] A formal analysis of child-labor legislation in the presence of externalities is contained in Grootaert and Kanbur (1995), and the quantitative implications of child-labor policies for allocations and welfare in such a model are deduced by Krueger and Donahue (2005). The following discussion builds on their work.

Introducing a production externality into the previous model is straightforward. Assume that the labor aggregator in the production function is now given by:

$$g(N^s, N^u, N^c, \bar{N}^s) = \left(\bar{N}^s\right)^{\xi} (sN^s)^{\theta} \left(\kappa^s(1-s)N^s + \kappa^c N^c + N^u\right)^{1-\theta}$$

with $\xi > 0$. Here $\bar{N}^s$ is the number of skilled workers in society, whereas N^s is the number of skilled workers a given firm hires. Of course, one could also envision physical capital externalities or externalities from unskilled labor or child labor (with a negative sign, presumably), but the main message of this section would remain the same.[11]

[10]See Basu's (1999) quotation of the original statement made by Mill, p. 1095.

[11]Models with externalities can have multiple equilibria and multiple steady states if the externality is sufficiently strong. In our theoretical analysis we implicitly assume that ξ is sufficiently small for this not to occur.

Now solutions to the social planner problem and competitive equilibrium allocations no longer coincide. The Euler equation for capital reads as before, in both the social planner problem as well as in the competitive equilibrium (with and without child-labor legislation):

$$u'(c_t) = \beta u'(c_{t+1}) \left[1 - \delta + f_K(k_{t+1})\right].$$

Now, however, the Euler equation for the education decision (assuming interiority) for the social planner problem reads as

$$u'(c_t) \left[\phi + f_L(k_t) g_{N^c}(t)\right] = \beta u'(c_{t+1}) f_L(k_{t+1}) \left[g_{N^s}(t+1) + g_{\bar{N}^s}(t+1) - g_{N^u}(t+1)\right], \tag{15}$$

while it it is given by

$$u'(c_t) \left[\phi + f_L(k_t) g_{N^c}(t)\right] = \beta u'(c_{t+1}) f_L(k_{t+1}) \left[g_{N^s}(t+1) - g_{N^u}(t+1)\right] \tag{16}$$

in the *laissez-faire* competitive equilibrium. With a ban on child labor we obtain the decentralized optimality condition (again assuming interiority):

$$u'(c_t)\phi = \beta u'(c_{t+1}) f_L(k_{t+1}) \left[g_{N^s}(t+1) - g_{N^u}(t+1)\right], \tag{17}$$

while mandatory education forces the education allocation to be $p_{t+1} = 1$.

Unless $\xi = 0$, the *laissez-faire* competitive equilibrium allocation is no longer Pareto efficient, as a simple comparison between (15) and (16) reveals. In general, the competitive equilibrium features too little education relative to the social optimum. As is well known, efficiency could be restored by paying education or wage subsidies to skilled workers (in the amount of $f_L(k_{t+1}) g_{\bar{N}^s}(t+1)$) financed by lump-sum taxes. Child-labor legislation may move the competitive equilibrium education allocation towards the social optimum, but it is not obvious a priori that such a second-best policy is in fact welfare improving.

To obtain sharper analytical results it is again fruitful to investigate steady states. The steady state capital-labor ratio in the social optimum and in equilibrium (under all policies) satisfies

$$\rho + \delta = f_K(k^\star),$$

and the socially optimal education allocation $p^\star_{SO}$ as well as the equilibrium education allocations $p^\star_{LF}$, $p^\star_B$ satisfy, respectively (again assuming interiority):

$$\begin{aligned}
1+\rho &= \frac{g_{N^s}(p^\star_{SO}) + g_{\bar{N}^s}(p^\star_{SO}) - g_{N^u}(p^\star_{SO})}{\phi/f_L(k^\star) + g_{N^c}(p^\star_{SO})}, \\
1+\rho &= \frac{g_{N^s}(p^\star_{LF}) - g_{N^u}(p^\star_{LF})}{\phi/f_L(k^\star) + g_{N^c}(p^\star_{LF})}, \\
1+\rho &= \frac{[g_{N^s}(p^\star_B, N^c=0) - g_{N^u}(p^\star_B, N^c=0)]}{\phi/f_L(k^\star)}.
\end{aligned}$$

Tedious algebra similar to the one used in proving Propositions 4 to 6 delivers the following results:

Proposition 7

1. *If ξ (or κ^s) is sufficiently large, then $p^\star_{SO} = 1$. In this case a mandatory education law implements the socially optimal level of education in the long run. The long-run education levels in the laissez-faire and child-labor ban equilibria are inefficiently low, because, as before:*

$$\begin{aligned}
0 < \quad p^\star_B < \bar{p}^\star_B \quad < 1, \\
0 < \quad p^\star_{LF} < \bar{p}^\star_{LF} \quad < 1.
\end{aligned}$$

2. *As long as $\xi > 0$, we have $p^\star_{SO} > p^\star_{LF}$, and thus the long-run education level in the social optimum is always strictly higher than in the laissez-faire steady state.*

3. *There exist parameter values such that:*

$$p^\star_B = p^\star_{SO} > p^\star_{LF},$$

but this is true only for a measure zero of the parameter space. That is, a child-labor ban may accidentally implement the long run socially optimal level of education.

4. *As before, the ranking*

$$p^\star_{SO} > p^\star_{LF} > p^\star_B$$

occurs for a positive measure of the parameter space.

The results of this section can therefore be summarized as follows. With production externalities the *laissez-faire* equilibrium is not socially optimal. If the externality is sufficiently large, a mandatory education law implements the first-best allocation in which everybody gets educated. A child-labor law may accidentally implement the first-best allocation (but only if the first-best allocation calls for some agents remaining unskilled).[12] Appropriately chosen policies that correct the externality directly (such as an education subsidy or a wage subsidy for the skilled) can always implement the first best allocation.[13]

3.2 Borrowing Constraints

In the previous model parents could borrow to pay the cost of education ϕ for their children. As demonstrated nicely in a two-period model by Baland and Robinson (2000), if households face borrowing constraints of the form

$$a_{t+1} \geq 0$$

and if these constraints are binding, education and human capital accumulation may be inefficiently low and child labor inefficiently high.[14] Parents desiring to borrow (but unable to do so) in order to finance current consumption or the cost of schooling may call upon their children to provide additional income for the family in excess of what is socially optimal.

We can make this point formally in our model by contemplating the following ex-

[12]There are three effects that have to cancel each other out exactly. First, with a child-labor ban the opportunity cost of going to school is lowered, since the foregone production of children is not taken into account by households. Second, the reduction of unskilled labor relative to skilled labor changes the relative marginal product of skilled and unskilled. Both these effects were present before. A third effect comes from the externality: higher education leads to higher societal human capital and thus shifts the production function upwards, an effect that is not internalized in the competitive equilibrium with a child-labor ban (or without a child-labor ban, for that matter).

[13]Along similar lines, Dessy and Pallage (2005) point out that even when education is desirable, banning child labor can be counterproductive, as it robs poor families of the resources needed to acquire at least some education for their children.

[14]In addition to the large literature in macroeconomics that routinely imposes borrowing constraints on households, in the context of studies of child labor this assumption has been used, among others, by Ranjan (2001), Dessy and Pallage (2001), and Krueger and Donahue (2005).

tension. Impose borrowing constraints on a household of measure zero, so that equilibrium prices and aggregate quantities remain unchanged.[15] In an equilibrium with an interior education and child labor allocation we have

$$1 + r_{t+1} = \frac{w^s_{t+1} - w^u_{t+1}}{\phi + w^c_t}, \tag{18}$$

which states that the gross return on physical and human capital are equalized. Now suppose that the borrowing constraint of our atomless household at date t binds.[16] Then that household's optimality conditions read as[17]

$$u'(c_t) \quad > \quad \beta u'(c_{t+1})(1 + r_{t+1}), \tag{19}$$

$$u'(c_t)(\phi + w^c_t) \quad = \quad \beta u'(c_{t+1})\left(w^s_{t+1} - w^u_{t+1}\right) + u'(c_t)\xi_t, \tag{20}$$

where ξ_t is the Lagrange multiplier on the constraint $p_{t+1} \geq 0$; the constraint $p_{t+1} \leq 1$ can be ignored for what follows. Consolidating equations (19) and (20) and using (18) implies that $\xi_t > 0$, and thus $p_{t+1} = 0$. Previously, in the absence of the borrowing constraint, the household had sent $p_{t+1} > 0$ children to school like everybody else in the economy (and what the social planner would have mandated as well), but with a binding borrowing constraint it is optimal to increase market work for the household's children to alleviate the constraint.[18]

While the previous argument demonstrates that in the presence of binding borrowing constraints the *laissez-faire* equilibrium is inefficient, it is less clear that child-labor legislation leads to a Pareto improvement. In fact, absent general equilibrium price effects our atomless household is evidently worse of if prevented from sending her children to work by either a child-labor ban or a mandatory-

[15]Of course this is our thinly veiled attempt to ignore the general equilibrium price effects from the imposition of borrowing constraints.

[16]Of course this is a choice of the household. This choice may be optimal, e.g. at time $t = 1$ if the household comes into the period with no assets because it had initial condition $a_0 = 0$. Rather than providing restrictions on exogenous parameters that make this choice optimal, for simplicity we assume it here and deduce the consequences of this assumption.

[17]We focus on the case where we do not have a false corner: the Lagrange multiplier on the borrowing constraint is assumed to be strictly positive.

[18]It is straightforward to obtain a more continuous, but qualitatively similar response of child labor to binding borrowing constraints by either introducing home production for children with decreasing marginal products or a human capital accumulation equation with decreasing marginal returns, as in, for example, Baland and Robinson (2000).

education law.[19] Again, direct policies to alleviate the effects of these borrowing constraints appear to be preferable.[20]

3.3 Imperfect Altruism

If the social planner (or the government) values children more in its social welfare function than parents do, child labor allocations chosen by parents for their children may be inefficient from the perspective of society.[21]

In our modeling framework this point can be made in a simple fashion. Again we restrict ourselves to steady states. Suppose the social planner maximizes the social welfare function

$$\sum_{t=0}^{\infty} \left(\frac{1}{1+\rho^{SP}} \right)^t u(c_t),$$

where $\rho^{SP} < \rho$ is the social time discount factor. From the steady state capital accumulation equations we have:

$$\begin{aligned} \delta + \rho^{SP} &= f_K(k^\star_{SP}), \\ \delta + \rho &= f_K(k^\star), \end{aligned}$$

and thus $k^\star_{SP} > k^\star$ and $f_L(k^\star_{SP}) > f_L(k^\star)$. Intuitively, since the social planner values future generations more than private households she mandates more capital accumulation.

Analogous to Section 2.6, under weak conditions we can show that in the steady state of the social optimum and the *laissez-faire* equilibrium education decisions

[19]The introduction of child-labor legislation for *everybody* evidently will have general equilibrium price effects, and a Pareto ranking of the *laissez-faire* equilibrium and the equilibrium under the child labor policy is not straightforward in the model with borrowing constraints.

[20]One has to be cautious here since such obvious policies as income or wealth transfers to the poor may create other distortions due to the need to generate tax revenues, and due to adverse incentive effects in models with private information or moral hazard.

[21]For this argument it is not necessary that parents do not love their children at all; all that is needed is that they love them less than what is implied by the social welfare function. A related rationale for child-labor legislation, especially mandatory schooling laws, arises if parents suffer from a commitment problem for sending their children to school. See Dessy and Knowles (2001) for an analysis.

are interior and satisfy, respectively:

$$\frac{1+\rho^{SP}}{f_L(k^\star_{SP})} = \frac{\left[g_{N^s}(p^{SP}) - g_{N^u}(p^{SP})\right]}{\phi/f_L(k^\star_{SP}) + g_{N^c}(p^{SP})}, \tag{21}$$

$$\frac{1+\rho}{f_L(k^\star)} = \frac{\left[g_{N^s}(p^\star) - g_{N^u}(p^\star)\right]}{\phi/f_L(k^\star) + g_{N^c}(p^\star)}. \tag{22}$$

The right-hand sides (the societal and market return to education) is strictly decreasing in p^{SP} and $p^\star$ (in their relevant range) respectively, and for any $p = p^{SP} = p^\star$ the right-hand side of (21) is larger than the right-hand side of (22). Since the left-hand side of (21) is smaller than the left-hand side of (22), we find that $p^{SP} > p^\star$, that is, the social planner chooses strictly more education and less child labor than implied by the *laissez-faire* equilibrium. Using the results from Section 2.6 then implies that a ban on child labor may accidentally implement the efficient long-run education and child labor allocation. This, however, is an unlikely event, as it occurs only on measure zero of the parameter space. Since $p^{SP} < 1$, it remains true that (under the assumptions maintained in Section 2.6) mandatory education leads to overaccumulation of human capital in the long run. As before, more direct policies than child-labor legislation are available to implement the socially optimal allocation as a competitive equilibrium.[22]

3.4 Imperfect Insurance Markets

Another model element that may render the competitive equilibrium Pareto inefficient is uninsurable idiosyncratic risk, for example with respect to the health or earnings capacity of parents. In this case child labor, in the absence of formal insurance markets, may act as a source of informal insurance within the family, at least if the child's earnings opportunities are not perfectly correlated with those of the parent that faces the original risk.

Equilibria in models with uninsurable idiosyncratic risk are not Pareto efficient in general, since the social planner can diversify idiosyncratic risk whereas households cannot. But in these models child labor has a *positive* role for intra-family

[22] A direct policy that leads to an equilibrium which is first best now requires a subsidy both to human and physical capital accumulation, again financed by lump-sum taxes.

risk sharing (see also Grootaert and Kanbur 1995).[23] Thus policies designed to curb child labor, such as a child-labor ban or a mandatory education law may be welfare reducing unless other model elements providing a rationale for such legislation are present. If the government aims at reducing child labor without the potentially adverse effects on intra-family risk sharing, it should deal with the source of child labor directly and provide government-sponsored insurance against idiosyncratic income risk of parents.[24]

4 Political Economy of Child Labor Legislation

We have argued in the preceding sections that from a social welfare perspective, child-labor restrictions are often suboptimal, even when there exist frictions that render the market equilibrium inefficient. Nevertheless, in the real world most countries have adopted child labor regulations, and political support for these restrictions is strong. In this section, we address these observations from a political-economy perspective. In particular, we focus on possible reasons why socially suboptimal policies may persist in the political process.

4.1 General Issues

We will restrict the set of available policies to *laissez faire* and a child-labor ban. To determine which of these options is politically viable, we have to specify a political mechanism (such as majority voting). Before going into the details, however, it is instructive to discuss political support for child-labor restrictions at a more general level. For child labor to be chosen in any political mechanism, there has to be a constituency in favor of the ban (the mechanism then merely determines whether the constituency has sufficient power to enforce its preferred policy choice). The first question then becomes which group in our theoretical framework stands to gain (at least potentially) from child-labor restrictions.

[23] Krueger and Donohue's (2005) quantitative model includes parental labor income risk and demonstrates the importance of child labor as an intra-family insurance mechanism.

[24] Of course this simple policy prescription is only valid if the well-known moral hazard problems in providing public income insurance are negligible.

Return for now to our baseline model without externalities or market imperfections. For a homogeneous population, we have already determined that nobody stands to gain from restricting child labor, as in this case the social welfare function is identical to each person's utility function. A heterogeneous population is thus a necessary condition for political support for child-labor restrictions. In particular, consider the case of a population that is heterogeneous in terms of factor endowments, as in our discussion of separate skilled and unskilled groups in Section 2.8 above. Child-labor restrictions affect these groups through two different channels. First, there is a direct impact on the choices of each household. For households that otherwise would have engaged in child labor, a ban implies a loss of family income and possibly additional schooling costs. For rational households, a smaller choice set is never a good thing, so the direct effect cannot lead any type of household to support a child-labor ban.

The situation is different with the second channel. Restricting child labor affects the overall supply of unskilled labor, and thus factor prices. In particular, households whose factors of production are complementary to child labor stand to lose from a restriction in child labor, as the returns to their factor will decline. Given our choice of production function, capital is complementary to aggregate labor supply. Thus *ceteris paribus* restricting child labor will lower the return to capital, so that "capitalists" (i.e., a hypothetical household who supplies only capital but no labor) should be opposed to any restrictions. In contrast, those who supply factors substitutable with child labor stand to gain. In our model, this group consists of workers who compete with children in the labor market. If child labor is restricted, their wages will increase.

Thus, we identify the drive to limit competition as a potential motive of those who support child-labor restrictions. In this sense, it may appear that the political economy of child-labor restrictions is similar to that of other types of legislation such as immigration laws (which limit labor-market competition provided by foreigners) or union privileges (which allow unions to limit competition provided by outsiders). However, in these other examples the motives of those supporting the policy are less ambiguous, because the potential competitors do not enter their own utility function. A key difference between child-labor restrictions and other forms of labor legislation is that in the case of child labor, the competition may be coming (at least partially) from within the own family. Thus, whether a given group favors child-labor restrictions will depend both on the complementarity of their skill and factor endowments with child labor, and on the extent to which their own family income is dependent on child labor.

4.2 A Simplified Model

Analyzing these trade-offs in our general setup is fairly complicated. To form political preferences, voters have to evaluate the consequences of the different economic equilibria corresponding to each policy. In a dynamic setting, the consequences of today's political and economic decisions for future political outcomes also have to be taken into account. These complications make it difficult to analyze the political economy of child-labor laws without relying on numerical results. Nevertheless, the basic trade-offs can be highlighted by using a simplified version of our model and restricting attention to a simple political framework with a one-time vote on child-labor laws. More specifically, in the initial period there is a referendum on the introduction of a permanent child-labor ban. If the ban is adopted, it is put in place permanently; if the referendum is rejected, there will be no further votes in the future. The measure is adopted if a majority of voters (the current adults) favors it. We simplify the economic model by making the following assumptions: the production function is Cobb-Douglas in skilled and unskilled labor (which includes child labor), and physical capital does not enter production; there is a market imperfection that prevents borrowing and lending across generations; the utility function is linear; and there is no direct cost of education ($\phi = 0$; of course the opportunity cost due to lost child-labor income is still present). This simple environment will be sufficient to demonstrate the main trade-offs; we will discuss the implications of more realistic settings (dynamic voting etc.) later on. The decision problem of the dynasty is then to maximize utility

$$\max_{\{c_t, a_{t+1}, p_{t+1}\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t c_t, \tag{23}$$

where the maximization is subject to:

$$\begin{aligned} c_t &= p_t w_t^s + (1 - p_t) w_t^u + (1 - p_{t+1}) w_t^c, \\ c_t &\geq 0, p_{t+1} \in [0, 1]. \end{aligned}$$

The production function is:

$$F(N_t^s, N_t^u, N_t^c) = (N_t^s)^\theta (N_t^u + \kappa^c N_t^c))^{1-\theta},$$

where κ^c is the productivity of a child relative to an unskilled adult. The only choice for the household is the fraction p_{t+1} of children to be educated.

4.2.1 The Laissez-faire Steady State

We assume that the economy is initially (i.e., at the time of the referendum) in the *laissez-faire* steady state where child labor is legal. Under *laissez faire*, the household's first-order condition is:

$$\beta^t w_t^c = \beta^{t+1} \left[w_{t+1}^s - w_{t+1}^u \right].$$

In equilibrium, this first-order condition has to hold with equality because both skilled and unskilled labor are essential for production, implying $0 < p_t < 1$. Plugging in the wages as a function of labor supplies in each periods, the optimality condition can be written as:

$$\kappa^c(1-\theta) \left(\frac{N_t^s}{N_t^u + \kappa^c N_t^c} \right)^\theta = \beta \left[\theta \left(\frac{N_{t+1}^u + \kappa^c N_{t+1}^c}{N_{t+1}^s} \right)^{1-\theta} - (1-\theta) \left(\frac{N_{t+1}^s}{N_{t+1}^u + \kappa^c N_{t+1}^c} \right)^\theta \right].$$

In the *laissez-faire* steady state, this equation can be expressed as a function of the fraction $p^\star_{LF}$ of people of each generation that are skilled:

$$\kappa^c(1-\theta)\left(\frac{p^\star_{LF}}{(1+\kappa^c)(1-p^\star_{LF})}\right)^\theta = \beta\left[\theta\left(\frac{(1+\kappa^c)(1-p^\star_{LF})}{p^\star_{LF}}\right)^{1-\theta} - (1-\theta)\left(\frac{p^\star_{LF}}{(1+\kappa^c)(1-p^\star_{LF})}\right)^\theta\right].$$

The left-hand side is strictly increasing in $p^\star_{LF}$, whereas the right-hand side is strictly decreasing and moving from $+\infty$ to $-\infty$ as $p^\star_{LF}$ varies from 0 to 1, implying that there is a unique steady-state $p^\star_{LF}$ solving this equation, given by

$$p^\star_{LF} = \frac{(1+\kappa^c)\beta\theta}{(\beta+\kappa^c)(1-\theta)+(1+\kappa^c)\beta\theta}.$$

The corresponding wages are:

$$\begin{aligned} w^{s\star}_{LF} &= \left(\frac{\beta+\kappa^c}{\beta}\right)^{1-\theta}\theta^\theta(1-\theta)^{1-\theta}, \\ w^{u\star}_{LF} &= \left(\frac{\beta}{\beta+\kappa^c}\right)^{\theta}\theta^\theta(1-\theta)^{1-\theta}, \\ w^{c\star}_{LF} &= \kappa^c w^{u\star}_{LF}. \end{aligned}$$

4.2.2 The Child-Labor Ban Steady State

In the referendum, the electorate considers a proposal to ban child labor permanently, with no possibility of a future reversal to the *laissez-faire* policy. The referendum takes place before households have to choose the fraction p of their children to be educated. If the resolution is passed, transition to the new steady state is immediate. We will now characterize this steady state, and then use this characterization later on to infer voter's preferences regarding the policy proposal.

In terms of the optimality conditions, adopting a child-labor law is equivalent to setting the parameter κ^c to zero. In this case, the economy will immediately move to a new steady state, characterized by a new optimal fraction of skilled people $p_B^\star$:

$$0 = \beta \left[\theta \left(\frac{1 - p_B^\star}{p_B^\star} \right)^{1-\theta} - (1-\theta) \left(\frac{p_B^\star}{1 - p_B^\star} \right)^{\theta} \right],$$

which yields

$$p_B^\star = \theta.$$

The wages in the steady state are:

$$w_B^{s\star} = w_B^{u\star} = \theta^\theta (1-\theta)^{1-\theta}. \tag{24}$$

Notice that since introducing a child-labor ban reduces the opportunity cost of education to zero, in this steady state $p_B^\star$ is such that the skilled and the unskilled wage are identical. Notice also that there are no transitional dynamics in that convergence to the steady state is immediate (unless in the initial period the education decision is fixed irreversibly before the vote is passed, in which case the steady state is reached in two periods). That is different when there is no child-labor law, because the opportunity cost of education (given by the children's wage) can vary along the transition path.

4.2.3 The Political Equilibrium

We now define a majority-voting equilibrium for a one-time referendum over a child-labor ban more formally.

Definition 4 (Political Equilibrium for One-Time Referendum) *A political equilibrium is a policy (either "laissez-faire" or "child-labor ban") together with a set of individual and aggregate economic variables such that:*

1. *Conditional on the policy being put permanently into place, the economic variables form an equilibrium as defined above, with the laissez-faire steady state as the initial condition.*
2. *For at least 50 percent of the population, utility under the chosen policy is no lower than under the alternative policy.*

Existence of such a political equilibrium is immediate, since we already showed the existence of the economic equilibria corresponding to each policy. Thus each voter's utility under each policy is well defined, so that one of the policies must gather at least 50 percent support.

So far, we have not specified whether the population is initially homogeneous (i.e., families consisting of fraction $p^{\star}_{LF}$ and $1-p^{\star}_{LF}$ of skilled and unskilled workers, with full insurance within the family), or heterogeneous in terms of skill as in Section 2.8 above (the steady state analysis is valid for either case). However, we already know that in a homogeneous population there would be no support for a child-labor ban because it lowers social welfare, which in this case is identical to personal utility.[25] We therefore proceed by considering different types of heterogeneity in the initial population (while continuing to assume that the fractions of skilled and unskilled people are given by the *laissez-faire* steady state).

4.3 Political Preferences of Skilled and Unskilled Workers

Let us consider a situation where skilled and unskilled people are each on their own, rather than forming part of a family that provides insurance. To infer the political preferences of these two groups, we have to compute their lifetime utilities under each policy. In our simplified model environment, this is a straightforward exercise. In the period when the ban is passed, households are affected through changing wages in response to the lower supply of unskilled labor. In addition, the families that were planning to send their children to work suffer a loss of child-labor income. Starting from the following period, the economy will be in the new steady state corresponding to a child-labor ban, so that the utility gap to the status quo can be easily inferred.

We will start out by considering the impact on skilled and unskilled workers' utility in the initial period. To simplify notation, without loss of generality we compute utilities under the assumption that in the *laissez-faire* steady state all of the skilled and none of the unskilled parents educate their children (i.e., only

[25]The First Welfare Theorem still applies despite the absence of a capital market because of the linear utility function.

children of unskilled parents work).[26] Given this assumption, if the *laissez-faire* policy remains in place, the period utilities of skilled and unskilled agents are:

$$
\begin{aligned}
u^s_{0,LF} =& w^{s\star}_{LF} = \left(\frac{\beta+\kappa^c}{\beta}\right)^{1-\theta}\theta^\theta(1-\theta)^{1-\theta}, \\
u^u_{0,LF} =& (1+\kappa^c)w^{u\star}_{LF} = (1+\kappa^c)\left(\frac{\beta}{\beta+\kappa^c}\right)^{\theta}\theta^\theta(1-\theta)^{1-\theta}.
\end{aligned}
$$

In contrast, if the child-labor ban is put into place the utilities in the impact period are:

$$
\begin{aligned}
u^s_{0,B} =& \theta\left(\frac{1-p^\star_{LF}}{p^\star_{LF}}\right)^{1-\theta} = \left(\frac{\beta+\kappa^c}{(1+\kappa^c)\beta}\right)^{1-\theta}\theta^\theta(1-\theta)^{1-\theta}, \\
u^u_{0,B} =& (1-\theta)\left(\frac{p^\star_{LF}}{1-p^\star_{LF}}\right)^{\theta} = \left(\frac{(1+\kappa^c)\beta}{\beta+\kappa^c}\right)^{\theta}\theta^\theta(1-\theta)^{1-\theta}.
\end{aligned}
$$

Notice that the impact-period wages are not identical to the steady-state wages $w^{s\star}_B$ and $w^{u\star}_B$, because the relative supply of skilled and unskilled labor adjust only in the following period (the fraction of skilled is still $p^\star_{LF}$ rather than $p^\star_B$). For the skilled, the ratio of initial utilities under the ban versus *laissez faire* is:

$$
\frac{u^s_{0,B}}{u^s_{0,LF}} = \frac{1}{(1+\kappa^c)^{1-\theta}} < 1.
$$

Thus, despite not engaging in child labor, the skilled suffer from a child-labor ban through lower wages. For the unskilled, the ratio of initial utilities under the ban and *laissez faire* is:

$$
\frac{u^u_{0,B}}{u^u_{0,LF}} = \frac{(1+\kappa^c)^\theta}{1+\kappa^c} = \frac{1}{(1+\kappa^c)^{1-\theta}} < 1. \tag{25}
$$

Thus, even for the unskilled rejecting the child-labor ban yields higher initial utility. The unskilled gain in the form of higher wages, but they also lose child-labor income. Due to diminishing returns ($\theta < 1$), the unskilled wage changes less than

[26] This does not violate optimization because of linear utility: everyone, regardless of income, is indifferent between educating and not educating their children. For expositional purposes, it is useful to focus on the status quo where the children of the unskilled work, also because this is the relevant case in the data (i.e., child labor rates generally decrease in parental income).

proportionally with the supply of unskilled labor. Given that the relative decline in each family's labor supply is equal to the relative decline of aggregate labor supply, this implies that the wage gain cannot make up for the income loss.

So far, we have found that at least initially, both skilled and unskilled workers would suffer from the introduction of a child-labor ban. However, this finding is not sufficient to determine political preferences, because the long-run impact of the ban also needs to be taken into account. If the ban is passed, in the subsequent period the economy reaches a new steady state where the skilled and unskilled wages are equal and given by (24). Using these future wages, we can compute the full lifetime impact of the introduction of the ban. For skilled workers, the ratio of lifetime utilities under the ban and *laissez faire* is:

$$
\begin{aligned}
\Delta U^s =& \frac{w_0^s + \frac{\beta}{1-\beta} w_B^{s\star}}{\frac{1}{1-\beta} w_{LF}^{s\star}} \\
=& \frac{\left(\frac{\beta+\kappa^c}{(1+\kappa^c)\beta}\right)^{1-\theta} \theta^\theta (1-\theta)^{1-\theta} + \frac{\beta}{1-\beta} \theta^\theta (1-\theta)^{1-\theta}}{\frac{1}{1-\beta} \left(\frac{\beta+\kappa^c}{\beta}\right)^{1-\theta} \theta^\theta (1-\theta)^{1-\theta}} \\
=& \frac{(1-\beta)\left(\frac{\beta+\kappa^c}{(1+\kappa^c)\beta}\right)^{1-\theta} + \beta}{\left(\frac{\beta+\kappa^c}{\beta}\right)^{1-\theta}} < 1.
\end{aligned}
$$

Thus, the skilled are unambiguously opposed to the introduction of a child-labor ban. Due to lower skilled wages, both the short- and the long-run effect are negative. The same ratio for unskilled workers is given by:

$$
\begin{aligned}
\Delta U^u =& \frac{\left(\frac{(1+\kappa^c)\beta}{\beta+\kappa^c}\right)^{\theta} \theta^\theta (1-\theta)^{1-\theta} + \frac{\beta}{1-\beta} \theta^\theta (1-\theta)^{1-\theta}}{\frac{1}{1-\beta}(1+\kappa^c) \left(\frac{\beta}{\beta+\kappa^c}\right)^{\theta} \theta^\theta (1-\theta)^{1-\theta}} \\
=& \frac{(1-\beta)(1+\kappa^c)^\theta \beta^\theta + \beta(\beta+\kappa^c)^\theta}{(1+\kappa^c)\beta^\theta} \\
=& \frac{(1-\beta)(1+\kappa^c)^\theta + \beta(1+\kappa^c/\beta)^\theta}{1+\kappa^c}.
\end{aligned}
$$

This ratio can be smaller or larger than one, depending on parameters. In particular, the unskilled will gain from an introduction of a child-labor ban if the parameter θ is sufficiently close to one. Intuitively, a large θ implies that the unskilled wage is highly elastic with respect to unskilled labor supply. We saw earlier that in the short run, even with a large θ the wage increase for unskilled workers does not make up for the lost child-labor income. In the long run, however, the unskilled wage increases even more than in the impact period, due to a higher relative supply of skilled workers. If this effect is sufficiently large, unskilled workers stand to gain from the introduction of a ban in terms of lifetime utility. In this case the unskilled would vote in favor of the ban, and if the unskilled also form the majority of the population, the child-labor ban is a political equilibrium.

Up to this point, we have identified unskilled workers as the potential constituency behind the introduction of a child-labor ban. If the unskilled wage is sufficiently elastic with respect to the supply of child labor, these workers stand to gain from the introduction of a ban and thus would politically support it. In Section 3, we discussed a number of potential justifications for child-labor restrictions from a social perspective, and found that in most cases another, more targeted policy is more appropriate than a child-labor ban for addressing a social inefficiency. It is worth pointing out that from a political-economy perspective, there is no such alternative, even-more-appealing policy. As far as the unskilled workers are concerned, competition from children in the labor market is the heart of the problem, thus banning child labor is exactly what they want to do.

In summary, the results suggests that the political-economy approach has some merits in terms of explaining the widespread presence of child-labor restrictions in countries around the world. Nevertheless, the analysis carried out so far has a number of shortcomings which might call the results into question. First of all, we found that if unskilled workers support restrictions at all, their gains would be realized only in the long term. One might question whether uncertain future gains (which might be further mitigated by general-equilibrium effects through capital accumulation that our simple model abstracts from) are sufficient to create strong political support for restrictions in the face of short-term losses. Second, we so far have focused on a political setup with a one-time referendum. One might question whether a child-labor ban would hold up if, as in reality, repeated voting on the same issue were possible. We will now address some of these issues in a number of modifications of our basic framework.

4.4 Dependency on Child Labor and Political Support for a Ban

Up to this point, political support for child-labor legislation emerges as a possible but somewhat unlikely scenario. Only the unskilled (those competing with children in the labor market) can be in favor in principle, and even they gain only in the long run and only if the unskilled wage is sufficiently elastic. Stronger political support for a child-labor ban can arise if there is additional heterogeneity within the group of the unskilled. In particular, the natural constituency for a child-labor ban consists of unskilled workers whose families do not rely on child labor themselves.

Consider a variant of our basic model where becoming skilled not only requires education, but also a high level of ability. Each workers has a child which is either of high or low ability, where the fraction of high-ability children is $\bar{p}$. Since low-ability children cannot become skilled, they work for sure. If the fraction of high-ability children is low, $\bar{p} < p^{\star}_{LF}$, the parents of high-ability children strictly prefer to educate their children. The fraction of skilled in the population is then given by $\bar{p}$, regardless of whether a child-labor ban is in place. Let us now consider the incentives of an unskilled parent with a high-ability child regarding a child-labor ban, provided that currently the economy is in the *laissez-faire* steady state. Given that the fraction of adult skilled workers is fixed at $\bar{p}$, the skilled and unskilled wages under *laissez faire* and the ban in any period are:

$$
\begin{aligned}
w_{LF}^{s\star} =& \theta \left(\frac{(1+\kappa^c)(1-\bar{p})}{\bar{p}} \right)^{1-\theta}, \\
w_{LF}^{u\star} =& (1-\theta) \left(\frac{\bar{p}}{(1+\kappa^c)(1-\bar{p})} \right)^{\theta}, \\
w_{B}^{s\star} =& \theta \left(\frac{1-\bar{p}}{\bar{p}} \right)^{1-\theta}, \\
w_{B}^{u\star} =& (1-\theta) \left(\frac{\bar{p}}{1-\bar{p}} \right)^{\theta}.
\end{aligned}
$$

Under the assumption that the realization of ability is independent over time, in the long run each dynasty is skilled with probability $\bar{p}$ and unskilled with probability $1-\bar{p}$. The expected period utility in steady state under each policy therefore is:

$$
\begin{aligned}
u_{LF}^{\star} =& \bar{p} w_{LF}^{s\star} + (1-\bar{p})(1+\kappa^c) w_{LF}^{u\star} = (1+\kappa^c)^{1-\theta} \, \bar{p}^{\theta} \, (1-\bar{p})^{1-\theta}, \\
u_{B}^{\star} =& \bar{p} w_{B}^{s\star} + (1-\bar{p}) w_{B}^{u\star} = \bar{p}^{\theta} \, (1-\bar{p})^{1-\theta}.
\end{aligned}
$$

Thus, in the long-run *laissez faire* yields higher utility, due to higher expected output when children are allowed to work. In the short run, however, unskilled workers with high-ability children gain unambiguously from introducing a child-labor ban. Their ratio of initial utilities under ban and *laissez faire* is:

$$
\frac{u_{0,B}^{u}}{u_{0,LF}^{u}} = \frac{w_{B}^{u\star}}{w_{LF}^{u\star}} = (1+\kappa^c)^{\theta} > 1.
$$

If the weight on current utility is sufficiently large (i.e., the discount factor β is small), unskilled workers with high-ability children will support the introduction of the ban.[27]

To put it more generally, unskilled workers usually have an incentive to prevent other people's children from working, but this does not necessarily translate into

[27] However, these workers will generally not form a majority, so that the child-labor ban is not a political equilibrium in the sense of Definition 4. To explain the adoption of a ban in this framework one would need to use a political setup where motivated special-interest groups can successfully lobby for the passing of legislation even when they are not in the majority.

strong political support for a ban as long as the workers' own children are working as well. In an environment where almost all children are at work (which was true for most countries until after the Industrial Revolution), we would not expect to see much support for a ban. In contrast, once sufficiently many families abandon child labor in favor of an alternative such as education, political pressure for introducing a child-labor ban is likely to rise. This feature accords well with the observation that in Western countries, the introduction of comprehensive child-labor restrictions closely followed a rapidly expansion of schooling levels in the population. Moreover, the theory predicts that the battle over the introduction of a ban is fought to large extent between different groups of unskilled workers, those with working children and those without. Consistent with this prediction, Doepke and Zilibotti (2005) and Krueger and Donahue (2005) document that in the cases of the U.S. and Britain, political pressure in favor of restrictions came to a large extent from labor unions. The restrictions were opposed by capitalists and the business interest, but also by poor families whose livelihood depended on child-labor income.

4.5 Repeated Voting and Policy Persistence

Our political-economy framework is so far restricted to a one-time referendum in which voters can once-and-for-all put a child-labor ban into place. In real-world political systems, however, votes on the same issue can be carried out at different times, and previous decisions can be reversed. While a fully dynamic political-economic analysis is beyond the scope of this paper, a few of the issues that arise in this context can be addressed in our framework.

Let us first consider the question whether a child-labor ban, once passed into law, would be likely to persist in the future if another possibility for a referendum opened up. Let us thus assume that the model parameters are such that in the *laissez-faire* steady state the unskilled form a majority of the electorate and favor the introduction of a ban. Consequently, the ban is passed and the economy switches to the child-labor-ban steady state. If now the issue was opened to a (previously unexpected) second referendum, would the unskilled still vote in favor of the ban? Compared to the initial referendum, the situation is now reversed. The long-run (steady state) utility comparison does not change. Thus, if the unskilled previously were able to increase their steady-state utility by introducing a ban, abandoning the ban later on would entail a loss in long-term utility by the same amount. Hence, the long-term incentives still favor the child-labor ban. The short-run incentives also reverse: In terms of initial utility, the unskilled would gain if they return to *laissez faire* through increased family income. The size of this gain, however, is now larger that the initial utility loss that the unskilled suffered when the ban was first introduced. The reason is that in the child-labor ban steady state, unskilled wages are higher than in the original *laissez-faire* steady state, which makes child labor more attractive. The ratio of initial utilities under the ban and under *laissez faire* is still given by (25), but with the higher level of unskilled wages and utilities this ratio now translates into a larger absolute utility loss.

In summary, after the child-labor ban is passed initially, the strength of political support for the ban is likely to diminish over time.[28] The main long-run consequence of a child-labor ban is an increase of the unskilled relative to the skilled wage. It is exactly this higher unskilled wage which increases the attraction of child labor, and lowers the appeal of the ban. Whether this effect is large enough to lead to a reversal of the initial policy decision depends on model parameters. At a minimum, however, the finding suggests that it might be difficult to sustain political support for a child-labor ban in the long term. The empirical evidence, however, does not seem to support this conclusion. There are very few examples of reversals in child-labor legislation. In most countries and periods, child-labor legislation has persisted and, if anything, become more stringent over time.

The disparity between model and data raises the question whether additional features not present in our simple model may be able to account for the persistence of child-labor policies. One such feature is proposed by Doepke and Zilibotti (2005) who analyze child-labor legislation in a model with endogenous fertility choice. Fertility, education, and child-labor decisions interact; in particular, parents who plan to educate their children choose a small family size, while

[28]For a full analysis transitional dynamics also need to be considered, but this does not alter the direction of the change.

parents who plan to send their children to work have many children in order to maximize child-labor income. Fertility decisions are made at the beginning of adulthood. The irreversible nature of these fertility decisions leads to persistence in political preferences over child-labor legislation. Consider, for example, the incentives of an unskilled family when a child-labor ban is in place. Given the ban, the family will optimally plan to educate their children, and thus choose a small number of children. If now the possibility of abandoning the ban arises, this family has little to gain, since with a small number of children potential child labor income is small. In contrast, if child labor had initially been legal, the family would have chosen to have more children, and thus would have become more dependent on child labor. The end result is that the political preferences of the family are likely to favor the status quo. This type of status-quo bias often arises in a political-economy environment when voters make irreversible decisions that are optimal given the current policy regime, but suboptimal under some alternative policy. In the case of child labor, the lock-in effect is likely to be particularly strong, as the impact of fertility and education decisions on a family's economic incentives are large and long lived.[29]

4.6 Discussion

The upshot of the preceding discussion is that the political-economy approach can make a substantial contribution to our understanding of child-labor restrictions. When we discussed social inefficiencies of the *laissez-faire* equilibrium in Section 3, we found that while a child-labor ban can be welfare-improving in certain circumstances, usually other policies exist that do even better. In contrast, in our political-economy analysis a child-labor ban is exactly what is desired by those who stand to gain from it. The main conclusion from the analysis is that political pressure for the introduction of child-labor legislation should stem mostly from voters who compete with children in the labor market, while not relying on child-labor income themselves. This conclusion is consistent with the major

[29] There is a large theoretical and empirical literature on the interaction of child labor, fertility, and education; see Berdugo and Hazan (2002) and Doepke (2004) for macroeconomic analyses of the long-run growth implications of the child-labor-fertility tradeoff.

role played by labor unions in campaigning for child-labor restrictions in many countries, as well as the rise of child-labor restrictions just when education levels started to rise, implying that at least some families became less dependent on child labor income.

Throughout our analysis, we assumed that children and unskilled adults compete in the labor market. It is straightforward to show that with an alternative production setup where child labor is complementary to adult labor, there won't be any support for a child-labor ban. Moreover, if children perform different tasks, only some of which are in competition with adult labor, we would expect political pressure for a ban on only those activities where children and adults compete. Consistent with this prediction, in many countries child-labor restrictions refer explicitly to employment of children in industry and services, while excepting agriculture from the ban. The political economy view can rationalize this pattern by assuming, realistically for many countries, that agriculture is a family-based activity where adults and children engage in different and complementary tasks, whereas there is more direct competition between adults and children for formal employment in industry and services. In contrast, if child labor were ruled out to improve social efficiency in the face of human-capital externalities or incomplete financial markets, there would be no obvious justification for a sector-specific ban.

We abstracted from a number of additional factors that could plausibly also play an important role in the political economy of child-labor legislation. Humanitarian concern for the working conditions of children clearly played a role in a number of campaigns for child-labor legislation, although union pressure was probably more important on the whole (see the discussion in Doepke and Zilibotti 2005). We also did not consider the interests of groups other than skilled or unskilled workers, such capitalists or landowners. A topic that has received a lot of attention lately is international pressure for child-labor restrictions. To some extent, this happens through international organizations such as the ILO. Recently, however, there has been an increasing number of campaigns directed at consumers in developed countries, with the aim of boycotting products manufactured in developing countries using child labor. The origins and effects of such phenomena are beyond the scope of our analysis.[30]

5 Conclusions

While child-labor laws enjoy strong support among politicians around the world their popularity among economists is limited. In this paper we have, within the context of various extensions of the neoclassical growth model, identified conditions under which such legislation is not, and conditions under which such legislation may be desirable. Since we came to the conclusion that child-labor legislation tends to be at most a poor substitute for more direct policies addressing underlying economic inefficiencies we then delved into the realm of political economics to explain the persistence of child-labor legislation. Indeed, we found that if children and adults compete in the labor market, adult workers have an incentive to lobby for the abolition of child labor. This incentive will be especially powerful for workers who face labor-market competition from children, but do not rely on child labor income in their own family. The political-economy approach can account for a number of features of real-world child-labor legislation, such as the widespread introduction of restrictions right after an expansion of education lessened dependency on child labor income, and the fact that restrictions usually extend only to formal employment, but not to child labor in the context of traditional family-based agriculture.

An alternative explanation for why child-labor laws abound is that it is politically advantageous for politicians to impose them, and it is inconsequential for the economy if these laws are not enforced effectively. We have ignored the issue of law enforcement altogether here, always implicitly assuming that enforcement of child-labor legislation is perfect. In addition to developing the political-economy approach to child-labor legislation further, we view the enforcement issue as a fruitful field for future research.

[30]For a discussion of some of the international aspects of child-labor legislation, see Basu (1999), Edmonds and Pavcnik (2005b), Edmonds and Pavcnik (2005a) and Pallage and Zimmermann (2005).

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A Optimal Education Allocation in the Laissez Faire Steady State

For a given $k^\star$ define

$$\Gamma(p^\star) = \frac{g_{N^s}(p^\star) - g_{N^u}(p^\star)}{\phi / f_L(k^\star) + g_{N^c}(p^\star)}.$$

We now show that under the assumption $\kappa^s \leq 1$ we have that $\Gamma(p^\star)$ tends to ∞ as $p^\star \to 0$, that $\Gamma(p^\star \geq \bar{p}^\star) \leq 0$ and constant and that $\Gamma(p^\star)$ is continuous. Here $\bar{p}^\star$ is the threshold share of educated workers below which all skilled workers are allocated to skilled jobs; it is explicitly given by

$$\bar{p}^\star = \frac{1}{1 + \frac{(1-\theta)\kappa^s}{\theta(1+\kappa^c)}} \in (0, 1).$$

In general:

$$\begin{aligned}
g_{N^s} &= \theta \left[\frac{(\kappa^s(1-s)p^\star + (\kappa^c + 1)(1-p^\star))}{sp^\star} \right]^{1-\theta} \left[s + p^\star \frac{\partial s}{\partial N^s} \right] \\
&\quad + (1-\theta) \left[\frac{(\kappa^s(1-s)p^\star + (\kappa^c + 1)(1-p^\star))}{sp^\star} \right]^{-\theta} \kappa^s \left[(1-s) - p^\star \frac{\partial s}{\partial N^s} \right] \\
g_{N^u} &= \theta \left[\frac{(\kappa^s(1-s)p^\star + (\kappa^c + 1)(1-p^\star))}{sp^\star} \right]^{1-\theta} \left[p^\star \frac{\partial s}{\partial N^u} \right] \\
&\quad + (1-\theta) \left[\frac{(\kappa^s(1-s)p^\star + (\kappa^c + 1)(1-p^\star))}{sp^\star} \right]^{-\theta} \left[1 - \kappa^s p^\star \frac{\partial s}{\partial N^u} \right] \\
g_{N^c} &= \theta \left[\frac{(\kappa^s(1-s)p^\star + (\kappa^c + 1)(1-p^\star))}{sp^\star} \right]^{1-\theta} \left[p^\star \frac{\partial s}{\partial N^c} \right] \\
&\quad + (1-\theta) \left[\frac{(\kappa^s(1-s)p^\star + (\kappa^c + 1)(1-p^\star))}{sp^\star} \right]^{-\theta} \left[\kappa^c - \kappa^s p^\star \frac{\partial s}{\partial N^c} \right],
\end{aligned}$$

where s is given in the main text. Thus

$$\begin{aligned}
\frac{\partial s}{\partial N^s} &= \begin{cases} 0 & \text{if } p^\star < \bar{p}^\star \\ -\frac{\theta(1-p^\star)(1+\kappa^c)}{\kappa^s (p^\star)^2} & \text{else} \end{cases} \\
\frac{\partial s}{\partial N^u} &= \begin{cases} 0 & \text{if } p^\star < \bar{p}^\star \\ \frac{\theta}{\kappa^s p^\star} & \text{else} \end{cases} \\
\frac{\partial s}{\partial N^c} &= \begin{cases} 0 & \text{if } p^\star < \bar{p}^\star \\ \frac{\theta \kappa^c}{\kappa^s p^\star} & \text{else} \end{cases}
\end{aligned}$$

For $p^\star < \bar{p}^\star$ we have $s = 1$ and thus

$$\begin{aligned}
g_{N^s} &= \theta \left[\frac{(\kappa^c + 1)(1 - p^\star)}{p^\star} \right]^{1-\theta} \\
g_{N^u} &= (1-\theta) \left[\frac{(\kappa^c + 1)(1 - p^\star)}{p^\star} \right]^{-\theta} \\
g_{N^c} &= (1-\theta)\kappa^c \left[\frac{(\kappa^c + 1)(1 - p^\star)}{p^\star} \right]^{-\theta}
\end{aligned}$$

whereas for $p^\star \geq \bar{p}^\star$ we know that

$$\begin{aligned}
g_{N^s} &= \kappa^s g_{N^u} \\
g_{N^c} &= \kappa^c g_{N^u}
\end{aligned}$$

since some skilled workers work as unskilled and their marginal product as unskilled is κ^s times that of unskilled. In this range $s = \theta \left[1 + \frac{(\kappa^c+1)(1-p^\star)}{\kappa^s p^\star} \right]$ and thus

$$\begin{aligned}
g_{N^u} &= \theta \left[\frac{(\kappa^s(1-s)p^\star + (\kappa^c+1)(1-p^\star))}{s p^\star} \right]^{1-\theta} \left[\frac{\theta}{\kappa^s} \right] \\
&\quad + (1-\theta) \left[\frac{(\kappa^s(1-s)p^\star + (\kappa^c+1)(1-p^\star))}{s p^\star} \right]^{-\theta} [1-\theta] \\
&= \left[\frac{1-\theta}{\theta} \kappa^s \right]^{-\theta} [1-\theta] .
\end{aligned}$$

Consequently, under the assumption that $\kappa^s \leq 1$ we find that $\Gamma(p^\star)$ is constant in $p^\star$ and nonpositive for $p^\star \geq \bar{p}^\star$, whereas for $p^\star < \bar{p}^\star$ we find that $\Gamma(p^\star)$ is strictly decreasing in $p^\star$ since g_{N^s} is strictly decreasing in $p^\star$ and g_{N^u}, g_{N^c} are strictly increasing in $p^\star$. Furthermore it is straightforward to see from the expressions for g_{N^s}, g_{N^u}, g_{N^c} that

$$\lim_{p^\star \to 0} \Gamma(p^\star) = \infty$$

and that $\Gamma(p^\star)$ is continuous in $(0, 1]$.

B Optimal Education Allocation with a Child-Labor Ban

In general we now have

$$\begin{aligned} s &= \min\left\{1, \theta\left[1 + \frac{1-p^\star}{\kappa^s p^\star}\right]\right\} \\ \bar{p}^\star &= \frac{1}{1 + \frac{(1-\theta)\kappa^s}{\theta}} \in (0,1) \end{aligned}$$

$$\begin{aligned} g_{N^s} &= \theta\left[\frac{(\kappa^s(1-s)p^\star + (1-p^\star))}{sp^\star}\right]^{1-\theta}\left[s + p^\star\frac{\partial s}{\partial N^s}\right] \\ &\quad +(1-\theta)\left[\frac{(\kappa^s(1-s)p^\star + (1-p^\star))}{sp^\star}\right]^{-\theta}\kappa^s\left[(1-s) - p^\star\frac{\partial s}{\partial N^s}\right] \\ g_{N^u} &= \theta\left[\frac{(\kappa^s(1-s)p^\star + (1-p^\star))}{sp^\star}\right]^{1-\theta}\left[p^\star\frac{\partial s}{\partial N^u}\right] \\ &\quad +(1-\theta)\left[\frac{(\kappa^s(1-s)p^\star + (1-p^\star))}{sp^\star}\right]^{-\theta}\left[1 - \kappa^s p^\star\frac{\partial s}{\partial N^u}\right] \end{aligned}$$

$$\begin{aligned} \frac{\partial s}{\partial N^s} &= \begin{cases} 0 & \text{if } p^\star < \bar{p}^\star \\ -\frac{\theta(1-p^\star)}{\kappa^s (p^\star)^2} & \text{else} \end{cases} \\ \frac{\partial s}{\partial N^u} &= \begin{cases} 0 & \text{if } p^\star < \bar{p}^\star \\ \frac{\theta}{\kappa^s p^\star} & \text{else} \end{cases} \end{aligned}$$

For $p^\star < \bar{p}^\star$ we have $s = 1$ and thus

$$
\begin{aligned}
g_{N^s} &= \theta \left[\frac{1-p^\star}{p^\star}\right]^{1-\theta} \\
g_{N^u} &= (1-\theta) \left[\frac{1-p^\star}{p^\star}\right]^{-\theta}
\end{aligned}
$$

whereas for $p^\star \geq \bar{p}^\star$ we have that

$$
\begin{aligned}
g_{N^s} &= \kappa^s g_{N^u} \\
g_{N^u} &= \left[\frac{1-\theta}{\theta}\kappa^s\right]^{-\theta} [1-\theta]
\end{aligned}
$$

and thus we obtain the same qualitative statements as for the *laissez-faire* steady state.