Who Gains from Child Labor? A Politico-Economic Investigation*

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June 2002

Abstract

This paper develops a positive theory of the adoption of child labor restrictions (CLR). The key mechanism in our model is an interaction between parental decisions on family size and their preferences for CLR. While parents with few children have little to gain from child labor and are therefore likely to favor CLR, parents with many working children would be expected to oppose CLR. Fertility decisions, in turn, are affected by existing and expected child-labor policies. If policies are determined by majority voting, the interaction between fertility decisions and political preferences can lead to multiple steady states with different child-labor policies. A switch from no regulation to CLR is possible if a rising skill premium induces parents to choose smaller families, which over time creates a majority in favor of CLR. Consistent with this explanation, the introduction of CLR in the U.K. followed a period of rising wage inequality, and coincided with rapidly declining fertility and rising education levels.

*Preliminary and incomplete. We thank Kjetil Storesletten, Torsten Persson, and seminar participants at Université catholique de Louvain, UCLA, and the SED Annual Meeting in New York for helpful comments. Doepke: Department of Economics, UCLA, Box 951444, Los Angeles, CA 90095. E-mail address: doepke@econ.ucla.edu. Zilibotti: IIES, Stockholm University, University of Southhampton and CEPR. E-mail: Fabrizio.Zilibotti@iies.su.se.

1 Introduction

Child labor has been a widespread practice across different periods and cultures in human history. It was during the British industrial revolution and the development of the modern factory system that child labor started to be regarded with social concern. At the end of the 18th Century, children in British cotton mills could work 13-15 hours a day. The reaction against such extreme working conditions manifested itself in early attempts, already at the beginning of the 19th Century, to impose restrictions to ameliorate the conditions of working children. It was only in 1878, however, when under the pressure of the labor movement Britain passed a comprehensive legislation banning the employment of children below 10, and imposing various regulations on the employment conditions of older children.

Child labor continues to be widespread in most developing countries, where child labor legislations are either absent or not enforced. The persistence of this phenomenon, and the perception that it deprives children in poor countries of a chance of exiting poverty through acquiring education, has triggered a lively political debate as to whether CLR should also be introduced in developing countries. A common argument of opponents, popular among mainstream economists, is that CLR can harm the groups that they are supposed to help, by removing child labor income and thereby lowering the living standards of poor households.

This paper studies the issue of child labor regulation from a rational choice perspective. We construct a dynamic model where parents maximize utility with perfect foresight about the effects of individual and collective decisions, and are altruistic towards their children. The extent of such altruism responds, as we will see, to economic incentives. We also account for the conflicting interests that different groups in societies have with respect to CLR, and focus on the political economy of child labor standards. Different from previous economic literature, the model is not only intended as a mathematical illustration of a mechanism, but can be given a quantitative assessment through calibration.

The first building block of our theory is that preferences for CLR are closely related to the choice of family size. Parents with few children have little to gain from child labor, and are therefore likely to favor the introduction of restrictions. Parents with many working children, on the other hand, tend to be harmed by CLR. Furthermore, attitudes to CLR are different before and after the decision on family size is made. Once parents choose their family size, they are locked-in into specific preferences over child labor policies. The second building block is that preferences for child labor legislation depend on the wealth of the agents, in particular on their human wealth. As noted by Basu and Van (1998), children typically compete in the labor market with unskilled workers, but increase the return to capital (that we ignore in the analysis) and skilled labor. Finally, our theory recognizes the existence of a feedback mechanism: the distribution of family size and factor endowments in the population are endogenous, and their dynamics are affected by the existence of CLR.

To analyze this feedback mechanism more formally, we construct an overlapping-generations model with endogenous fertility and education choice. In the model economy, all agents are born identical, but turn, ex post, heterogenous in productivity. In particular, some become high productivity (skilled) workers, and some become low productivity workers (unskilled). When young, each agent can either work or go to school. Education, which is chosen by altruistic parents, increases the probability for a young worker to become a skilled adult worker. Parents face a quantity-quality tradeoff in their decisions on children. Parents who plan to make their children work will tend to have more children in order to increase family income from child labor. Conversely, parents who send their children to school will tend to choose a smaller family size to economize on the cost of schooling.

We first characterize the steady-state equilibrium in a laissez-faire economy, i.e., absent CLR. We establish the existence of a unique steady-state distribution over skill types and family sizes. In the region of the parameter space that we regard as the most interesting, skilled workers educate their children and choose a small family size, whereas a positive proportion, and possibly all, of the unskilled workers choose to have large families and to make their children work. Intuitively, since skilled workers earn higher wages and have a lower marginal utility of consumption, they place less value on the additional resources that they can extract from their children's work. This makes them more prone to manifest their altruism to their offspring by sending them to school. The economy with no CLR has low social mobility and high inequality. The children of skilled parents go to school and become, in majority, skilled adults, whereas part (or all) of the children of unskilled parents do not go to school and become unskilled adults. This implies a high correlation of earnings within dynasties (low social mobility). Second, low education translates into a large share of unskilled workers in the population, and a high skill premium (high cross-sectional inequality).

Next, we consider economies with perfectly enforced CLR. Given our assumed preferences, no parents will choose large families. Also, unless education is prohibitively expensive, all parents will choose to give their children an education. Thus, the steady-state with CLR will be less unequal and characterized by higher social mobility.

Finally, we move to the most important part of our analysis and consider transitions. In particular, we study a society in a steady-state with no CLR and analyze which groups would support the introduction of CLR, given that all agents rationally anticipate that CLR would generate a transition towards the more equal and mobile society described above. We focus on the adults' preferences, although the adults' preference entail some degree of altruism. It is straightforward to establish that skilled workers would never support CLR, since, due to the effect on the skill premium, they unambiguously gain from the work of other families' children. Thus, a first prediction of the theory is that societies that are politically dominated by elites of capitalists or rich workers will not introduce CLR. Conversely, assume that unskilled workers are politically decisive, either because they are the majority in a democracy, or because they can exert political pressure through, for example, trade unions. Will they want to trigger the transition towards a society with no child labor? The answer is, in this case, ambiguous. On the one hand, all unskilled workers benefit from CLR due to the "Basu-Van" effect of CLR on the equilibrium wage. But, on the other hand, in the initial state, a positive proportion of the unskilled workers has large families and sends their own children to work, and children's earnings make up a significant share of their family income. Thus, CLR causes a loss to these families. While unskilled workers with small families unambiguously support CLR, those with large families may or may not support CLR, depending on which effect dominates. It is therefore possible that poor households with large families make a common cause with the rich workers and want to have the "right" to send their children to work.

An interesting extreme case is an initial steady-state equilibrium where all unskilled workers have large families with working children, and no adult worker in the population support the introduction of CLR. In such an economy, it would seem as if external pressure via trade sanctions etc. to introduce CLR would be completely unwarranted. Yet, if such pressure were to lead the implementation of to CLR and a transition in the fertility patterns of the unskilled workers, one would observe growing political support for the restriction, particularly among poorer households. Eventually, the economy would converge to a new steady-state characterized by lower fertility and where unskilled workers support the continuation of CLR.

The situation described above can be characterized more formally in terms of multiple steady-state political equilibria. Consider first an economy with no CLR. Unskilled workers have an incentive to choose large families and let their children work. Hence, all adults, including unskilled workers, will oppose introduction of CLR. Thus, the initial absence of CLR induces individual behavior that prevents the future rise of a constituency for CLR. Conversely, consider an otherwise identical economy in which CLR are already in place. Since no child labor is possible, parents will choose a small family size. Thus, unskilled workers support CLR. The link between CLR and fertility decisions gives rise to a self-reinforcing mechanism generating, under some parameters, multiple steady states. In particular, one steady state features high inequality, low schooling and no CLR, whereas another features low inequality, high schooling and CLR.

Thus, the model can explain why countries get locked into equilibria where a large proportion of children works, and there is no political support for the introduction of CLR. But, historically, we observed a change of attitude towards child labor during the industrial revolution, and a growing pressure of the union movement for CLR. What can explain this change? According to our theory, the political support for CLR can rise over time if the return to education increases. Consider an economy where all children of unskilled parents work. A progressive increase in the return to schooling will eventually induce some of the newly formed families to have few children and send them to school. The proportion of poor small families will keep increasing as the wage premium continues to trend upwards and, eventually, a majority of the unskilled workers will support CLR. If CLR is eventually introduced, the trend of increasing wage inequality will be, at least temporarily, reversed and, one may observe a decline in inequality due to the relative supply effect (more children will go to school, increasing the number of skilled workers, and child labor is withdrawn from the labor force). This prediction of the model is consistent with the observation that

CLR were first introduced in Britain in the 19th century after a period of increasing wage inequality. Moreover, the introduction of CLR was accompanied by a period of substantial fertility decline, which is again consistent with the predictions of the model.

Concerning the current debate whether CLR should be introduced in developing countries even when the local political support is weak, our model predicts that such reforms may be opposed in the short run, but create their own constituency over time. This statement needs a qualification, though. If the cost of schooling is too high, parents may decide not to send children to school anyway. If children are still productive (either in some household or illegal activities), the policy may fail to reduce fertility and induce the switch from quantity to quality. In some cases, the policy may make all agents worse off. The model suggests that the introduction of CLR would be more likely to succeed if accompanied by policies that lower the cost or accessibility of schools.

The paper is organized as follows. In the following section, we review the related literature. Section 3 describes the model economy. In Section 4 we analyze steady states for fixed policies, and provide conditions under which steady states for fixed policies exist and are unique. Voting is introduced in Section 5. We introduce the concept of a steady-state political equilibrium (SSPE), and show that there can be multiple SSPE even when there is a unique steady state without voting. Section 6 illustrates our results for steady states and SSPE with a computed example. Section 7 provides computational experiments to demonstrate how exogenous changes to the skill premium can lead to the introduction of CLR, and Section 8 concludes.

2 Related Literature

This section discusses some of the related theoretical and empirical literature on child labor. A more comprehensive overview can be found in the recent surveys by Basu (1999) and Brown, Deardorff, and Stern (2001). In the theoretical child-labor literature, a number of papers develop arguments why ruling out child labor might be welfare-improving, or be preferred by a majority of the population. In Basu and Van (1998) CLR can be beneficial because parents dislike child labor, but have to send their children to work if their income falls below the subsistence level. Ruling out child labor can increase the unskilled wage sufficiently to push family incomes above the subsistence level even when children do not work, leaving everyone better off. Basically, the Basu-Van model has multiple equilibria in the labor market, and CLR can be used to select the "good" equilibrium. A similar effect is at work in our model: Unskilled workers who send their children to school prefer to rule out child labor in order to increase their own wage. Contrary to Basu and Van, however, the wage effect is not large enough to render CLR universally welfare-improving.

Another example of a coordination failure leading to inefficient child labor is given by Dessy and Pallage (2001). Parents do not invest in the education of their children since the demand for skilled labor is low, and firms do not invest in skill-intensive technologies since the supply of skilled labor is low. Again, ruling out child labor can be welfare improving. In a model with altruistic parents, Baland and Robinson (2000) show that banning child labor can be welfare improving when capital markets are imperfect, or bequests are zero. The reason is that in the presence of these imperfections the parents invest less than the socially optimal amount in the education of their children. In a similar vein, Ranjan (2001) develops a model in which credit constraints lead to inefficient child labor, and analyzes the welfare and distributional consequences of different policies targeted at child labor.

The papers discussed so far have in common that they rely on the representative-agent framework; CLR are either preferred by all agents, or by none of them. In contrast, our paper concentrates on the conflicts of interest that arise between different groups in the population on the issue of child labor. Our approach is similar to Krueger and Tjornhom (2000), who use a quantitative model to assess the welfare effect of child labor laws on different groups of the population in the presence of human capital externalities. While certain groups of workers can gain from a ban of child labor, compulsory education is generally the preferable policy in their model. Krueger and Tjornhom abstract from fertility choice and endogenous policies. A different rationale for restrictions is developed by Dessy and Knowles (2001). In their model, parents have time-inconsistent "quasi-geometric" preferences, which leaves them unable to commit to the ex-ante optimal education level for their children. CLR can help the parents overcome their commitment problem. Dessy and Knowles also allow voting over compulsory education laws, and find that such laws will be introduced once the income of the median voter reaches a threshold level. Endogenous fertility in relation to child labor is considered in Dessy (2000). Child-labor restrictions lead to lower fertility and can prevent the economy from staying in a poverty trap. Doepke (2001) introduces CLR in a model which features an industrial revolution from stagnation to growth, and finds that CLR have large effects on the income distribution and account for much of the fertility decline experienced by industrializing countries.

In the empirical literature, a number of papers measure the effects of legal restrictions on labor supply and education of children in order to assess whether the restrictions were actually binding. Acemoglu and Angrist (2000) use state-by-state variation in child-labor laws to estimate the size of human capital externalities. Using data from 1920 to 1960, their results suggest that CLR were binding during most of this period. Papers that concentrate on data from the end of the 19th century, on the other hand, sometimes fail to find binding effects. For example, Moehling (1999) exploits state-by-state differences in CLR (more specifically, minimum age limits) to assess whether CLR constrained the occupational choice of children. The data is from 1880 until 1910, and the finding is that CLR contributed little to the decline in child labor (the occupation rate of children age 10 to 15 fell by 75% from 1880 to 1930, or from 32 to 6 and 12 to 2 percent for boys and girls, respectively). Nardinelli (1980, 1990) makes a similar argument with respect to the effect of the first Factory Acts on child labor in 19th-century Britain. Galbi (1997) finds that the share of children employed in English cotton mills fell significantly before the introduction of restrictions in the 1830s. In contrast, Margo and Finegan (1996) find that the combination of compulsory schooling laws with child-labor regulation is binding in the sense that it significantly raises school attendance, while compulsory schooling laws alone have insignificant effects. Similarly, Angrist and Krueger (1991) find that compulsory schooling significantly affected schooling in the 20th century. We will discuss below how the predictions of our model relate to this empirical evidence.

Our arguments in this paper build on the assumption that parents face a tradeoff between their number (quantity) of children and each child's quality. The notion of a quantity-quality tradeoff, going back to Becker (1960) and Becker and Lewis (1973), was originally developed to account for fertility behavior in developed countries. For developed countries, there is strong evidence for the quantity-quality tradeoff.

In both cross-section and time-series data, family size and education levels tend to be negatively related. Hanushek (1992) provides evidence for the U.S. which links to family size to scholastic achievement measures (reading comprehension and vocabulary tests). He finds that annual achievement growth falls by two percent when a second child is added, and one-half percent when a sixth child is added. For developing countries, the picture is more mixed, but still many studies find evidence of a quantity-quality tradeoff. Rosenzweig and Evenson (1977) examine a data set from rural India and find that fertility is positively associated with child labor and negatively with schooling attainment. Rosenzweig and Wolpin (1980) find that an exogenous increase in fertility lowers child quality as measured by a schooling index. Singh and Schuh (1986) find that child labor has a positive effect on fertility in rural Brazilian data. Ray (2000) looks at national household surveys from Peru and Pakistan, and finds that the number of children in a family significantly raises labor supply of children in Peru, whereas the estimate for Pakistan is insignificant. In both Peru and Pakistan schooling is negatively related to number of children. Hossain (1990) reports that in rural counties in Bangladesh high child-labor wages are associated with larger family sizes and lower schooling levels.

3 The Model

The model economy is populated by overlapping generations of agents who differ by age and skill. There are two skill levels, high and low ($h \in \{S, U\}$), and two age groups, young and old. Agents age and die stochastically. Each household consists of one parent and her children, where the number of children depends on the parent's earlier fertility decisions. Children age (i.e., become adult) in each period with probability λ. Whenever a child ages, her parent dies (hence, old agents die with probability λ). As soon as they become adult, agents decide on their number of children. For simplicity, there are only two family sizes, large (grand) and small (petite) ($n \in \{G, P\}$).

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

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

$$
\begin{aligned}
V_{nh}(\Omega) = \max_{e \in \{0,1\}} & \left\{ u(c) + \lambda \beta z \left(\pi_e \max_{n \in \{G,P\}} V_{nS}(\Omega') + (1 - \pi_e) \max_{n \in \{G,P\}} V_{nU}(\Omega') \right) \right\} \\
& + (1 - \lambda) \beta V_{nh}(\Omega') \qquad (1) \\
& \text{s.t.} \\
c + pne \leq w_h(\Omega) & + (1 - e) nlw_U(\Omega)
\end{aligned}
$$

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

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

The main differences between our setup and the standard altruistic family model of Becker and Barro (1988) are that in our model, altruism does not depend of the number of children, and only two choices each for education and fertility are possible. We introduce these simplifications partially for ease of exposition, and partially to facilitate computation of equilibria with dynamic voting, which is difficult in more complicated models. Despite the simplifications, the key implications of our model are similar to richer models with continuous fertility choice.[1]

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

$$y = f(x),$$

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

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

The main role of the production setup is to generate an endogenous skill premium. Wages depend on the supply of skilled and unskilled labor. If child labor is restricted,

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

the supply of unskilled labor falls, and therefore the unskilled wage rises. This wage effect is one of the key motives that determines agents preferences over CLR (the other motive being potential child labor income, which in turn depends on the number of children).

We now move to determine the supply of workers of each skill level. It simplifies the exposition to restrict attention, in the benchmark case, to economies where all children who do not work go to school. This is necessarily a feature of the equilibrium if the cost of education is sufficiently small. We will later consider the effect of relaxing this restriction. We will denote by x_{nh} the total number of adults of each type after family size has been determined by the young adults, and define:

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

as the state vector.[2]

The number of working children is equal to:

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

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

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

The state vector Ω follows a Markov process such that:

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

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

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

with education, and:

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

is a transition matrix, conditional on the choice of family size of the young adults.[3]

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

Assumption 1

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

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

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

a sequential definition of an equilibrium. Later on, we will also consider equilibria with endogenous policy choice.

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

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

$$\begin{aligned} \textit{If } \eta_U(\Omega) &= 0 : V_{GU}(\Omega) \geq V_{PU}(\Omega), \\ \textit{if } \eta_U(\Omega) &= 1 : V_{GU}(\Omega) \leq V_{PU}(\Omega), \\ \textit{if } \eta_U(\Omega) &\in (0,1) : V_{GU}(\Omega) = V_{PU}(\Omega), \end{aligned}$$

  and:

$$\begin{aligned} \textit{If } \eta_S(\Omega) &= 0 : V_{GS}(\Omega) \geq V_{PS}(\Omega), \\ \textit{if } \eta_S(\Omega) &= 1 : V_{GS}(\Omega) \leq V_{PS}(\Omega), \\ \textit{if } \eta_S(\Omega) &\in (0,1) : V_{GS}(\Omega) = V_{PS}(\Omega). \end{aligned}$$

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

4 Steady States with Fixed Policies

We begin the analysis of the model by examining steady states with fixed policies and without voting. Formally, we assume that child labor is unrestricted. However, the analysis also comprises steady states with CLR, since ruling out child labor amounts to setting the parameter ruling child-labor supply to zero: $l = 0$.

In the model, each adult has to decide on family size, and whether to educate her children or send them to work. The situation is simplified since every adult who chooses to send children to work will choose a large family, because having children is costless, and having more children increases income from child labor. Conversely, parents who decide to educate their children will always choose a small family, since education is costly and, given that parents care only about the average utility of their children, there is no benefit from having additional children.

Another immediate implication of the model is that if unskilled parents are willing to choose small families and educate their children, the skilled parents will do so as well. The reason is that the gain from educating children (the added utility for the children) is the same for the two types of parents, whereas the cost of education (direct cost plus lost child-labor income) is higher for unskilled parents in utility terms, since the unskilled wage is lower.

4.1 Properties of Steady States

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

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

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

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

The education decisions are known in advance, since in steady state all agents with small families educate their children, and all agents with large families choose child labor. Note that therefore (6)-(7) defines a system of five linear equations in five unknowns, $\xi_{PU}, \xi_{GU}, \xi_{PS}, \xi_{GS}$ and g.

We are now ready to define a steady-state equilibrium formally.

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

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

$$\begin{aligned} \text{If } \eta_U &= 0 : V_{GU} \geq V_{PU}, \\ \text{if } \eta_U &= 1 : V_{GU} \leq V_{PU}, \\ \text{if } \eta_U &\in (0,1) : V_{GU} = V_{PU}, \end{aligned}$$

and

$$\begin{aligned} \text{If } \eta_S &= 0 : V_{GS} \geq V_{PS}, \\ \text{if } \eta_S &= 1 : V_{GS} \leq V_{PS}, \\ \text{if } \eta_S &\in (0,1) : V_{GS} = V_{PS}, \end{aligned}$$

We are now ready to establish a number of lemmas which are useful for characterizing steady states.

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

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

This lemma establishes that, if skilled young adults do not strictly prefer small families and educated children, unskilled young adults will strictly prefer large families with working children. The intuition for the result is that because skilled adults have a higher income, their utility cost of providing education to their children is smaller. Therefore skilled parents are generally more inclined towards educated children than unskilled parents.

The next lemma establishes the intuitive result that population growth falls in the fraction of agents deciding to have small families.

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

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

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

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

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

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

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

The growth rate of the population depends on the fractions of the population deciding to have small versus large families, and since η_U (η_S) is the fraction of unskilled (skilled) adults having small families, the growth rate of population g decreases in η_U (η_S).

Next, we establish that the fraction of skilled adults in the population strictly increases in η_U and η_S. Again, this is an intuitive result, since a higher η_U (η_S) means that more unskilled (skilled) parents decide to educate their children, which raises the probability of being skilled as an adult.

Lemma 3 *The fraction ξ_{PS} of skilled adults in the steady state is strictly increasing in η_U. The fraction ξ_{GU} of unskilled adults in the steady state is strictly decreasing in η_S. The ratio of skilled to unskilled labor supply increases with both η_U and η_S. Hence, the equilibrium skilled (unskilled) wage decreases (increases) with both η_U and η_S.*

4.2 Types of Steady States

Five potential types of steady states can be distinguished:

1. All agents educate their children, $\eta_S = \eta_U = 1$.
2. All skilled workers and a positive proportion of the unskilled workers educate their children, $\eta_S = 1$ and $\eta_U \in (0,1)$.
3. All skilled workers and no unskilled worker educate their children, $\eta_S = 1$ and $\eta_U = 0$.
4. A positive proportion of the skilled workers and no unskilled worker educate their children, $\eta_S \in (0,1)$ and $\eta_U = 0$.
5. No agent educates her children, $\eta_S = \eta_U = 0$.

Since, by Lemma 1, $\eta_U > 0$ implies $\eta_S = 1$ and $\eta_S < 1$ implies $\eta_U = 0$, potential steady-states can be indexed by the sum $\tilde{\eta} \equiv \eta_S + \eta_U$, where $\tilde{\eta} \in [0,2]$.[4] From Lemma 3, it follows immediately that the steady-state equilibrium skill premium is decreasing in $\tilde{\eta}$. Which, if any, of these potential steady states prevails hinges on the question which of them is consistent with maximizing behavior. In Subsection 4.3 we will show that, given parameters, there exists a unique steady-state equilibrium.

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

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

In this steady state, all children receive education and all families are small. Formally, this steady-state features $x_{GU} = x_{GS} = 0$ and $e_{PU} = e_{PS} = 1$. Hence, there is no child labor, i.e., $L = 0$. [5] The necessary and sufficient condition for this steady-state to be an equilibrium is that, given wages, the unskilled adults find it optimal to educate their children. By Lemma 1, this implies, a fortiori, that the skilled adults also choose to educate their children.

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

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

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

$$V_{PU,2} = \frac{u(w_{U,2} - pP) - \Pi^{1,1}_{U\to S}[u\left(w_{U,2} - pP\right) - u\left(w_{S,2} - pP\right)]}{1 - \beta(1 - \lambda(1 - z))} \tag{8}$$

where $\Pi^{e_U,e_S}_{h\to h'}$ denotes average discounted probability for an agent who is currently of skill level h to have descendants of skill level h'. This term reflects that agents are altruistic and only know the probability distribution over the skill level of their offspring. The superscripts denote whether the skilled and unskilled parents educate their children or not. The average discounted probability that enters equation (8) is defined as:

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

For the candidate steady state equilibrium to be sustained, deviations must be unprofitable, i.e., no agent (or dynasty) can increase her utility by choosing a large family and make her children work. Consider an unskilled adult who deviates and chooses a large family where children work. If this deviation is profitable for the parent, it would also be profitable for a potential unskilled child. We therefore check a con-

[5] Equilibrium expression are particularly simple in this case. It is immediate to establish that $g = \lambda(P-1)$ (see Lemma 2) and $x_{PU}/x_{PS} = \left(1-\pi_1\right)/\pi_1$.

tinued deviation of an entire dynasty, i.e., we assume that the parent and all future unskilled descendants choose a large family and child labor. The resulting utility is:

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

where:

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

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

$$(1-\Pi^{0,1}_{U\to S})u(w_{U,1}(1+Gl)) - (1-\Pi^{1,1}_{U\to S})u(w_{U,2}-pP) \leq \\ (\Pi^{1,1}_{U\to S} - \Pi^{0,1}_{U\to S})u\left(w_{S,2}-pP\right). \quad (9)$$

Note that, since we consider individual deviations, we have held wages constant at the steady state level. Inequality (9) is a necessary and sufficient condition for a steady-state equilibrium where all agents educate their children ($\tilde{\eta} = 2$) to be sustained.

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

In this equilibrium, unskilled workers are indifferent between having large uneducated or small educated families. A necessary and sufficient condition for this equilibrium is that, for some $\tilde{\eta} \in (1,2)$, the skilled and unskilled wages, $w_{S,\tilde{\eta}}$ and $w_{U,\tilde{\eta}}$, are such that $V_{GU,\tilde{\eta}} = V_{PU,\tilde{\eta}}$, i.e.,

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

The consumption gain from a large family of working children offsets exactly the altruistic expected welfare gain from having more frequently skilled descendants. Recall that, by Lemma 1, $V_{GU,\tilde{\eta}} = V_{PU,\tilde{\eta}}$ implies that $V_{GS,\tilde{\eta}} < V_{PS,\tilde{\eta}}$. Hence, skilled adults strictly prefer small families with educated children.

4.2.3 All Skilled and No Unskilled Worker Educate Their Children, $\tilde{\eta} = 1$.

In this steady state, all unskilled agents have large families and make their children work, while skilled workers educate their children. Formally, $x_{PU} = 0$, $x_{GS} = 0$, $e_{GU} = 0$, and $e_{PS} = 1$. Hence, $L = lGx_{GU}$. In this case, two conditions need to be checked. First, skilled workers have to prefer to educate their children. Second, unskilled workers should prefer not to educate their children. For one of the two groups, at least, the preference will be strict.

Proceeding as before, we find:

$$V_{GU,1} = \frac{u\left(w_{U,1}\left(1+Gl\right)\right) - \Pi^{0,1}_{U\to S}\left(u\left(w_{U,1}\left(1+Gl\right)\right) - u\left(w_{S,1}-pP\right)\right)}{1-\beta\left(1-\lambda\left(1-z\right)\right)} \quad (10)$$

$$V_{PS,1} = \frac{u\left(w_{S,1}-pP\right) - \Pi^{0,1}_{S\to U}\left(u\left(w_{S,1}-pP\right) - u\left(w_{U,1}\left(1+Gl\right)\right)\right)}{1-\beta\left(1-\lambda\left(1-z\right)\right)} \quad (11)$$

where:

$$\Pi^{0,1}_{S\to U} = \frac{\lambda\beta z(1-\pi_1)}{\left(1-\beta\left(1-\lambda\left(1-z\left(\pi_1-\pi_0\right)\right)\right)\right)}$$

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

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

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

where:

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

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

$$\left(1-\Pi^{0,1}_{U\to S}\right)u\left(w_{U,1}\left(1+Gl\right)\right) - \left(1-\Pi^{1,1}_{U\to S}\right)u\left(w_{U,1}-pP\right) \geq \left(\Pi^{1,1}_{U\to S}-\Pi^{0,1}_{U\to S}\right)u\left(w_{S,1}-pP\right) \quad (12)$$

$$\left(1-\Pi^{0,1}_{S\to U}\right)u\left(w_{S,1}-pP\right)-\left(1-\Pi^{0,0}_{S\to U}\right)u\left(w_{S,1}+w_{U,1}Gl\right)\geq \left(\Pi^{0,0}_{S\to U}-\Pi^{0,1}_{S\to U}\right)u\left(w_{U,1}\left(1+Gl\right)\right) \quad (13)$$

Note that condition (12) is identical to condition (9), except that the inequality is reversed, and the equilibrium wages are different.

In order for our candidate steady-state equilibrium to be sustained, both (12) and (13) must hold simultaneously for some parameters. To see that the range of parameters satisfying the two conditions is not empty, consider a knife-edge economy such that (12) holds with equality, i.e., given the wage premium consistent with $\eta_S = 1$ (skilled workers educate their children) and $\eta_U = 0$, unskilled workers are indifferent between large or small families. Then, by Lemma 1, $V_{GS,1} < V_{PS,1}$. By continuity, the same inequality holds in a neighborhood of this knife-edge economy where unskilled workers strictly prefer large families. Therefore, the set of economies for which a steady-state equilibrium with $\eta_U = 0$ and $\eta_S = 1$ exists is not empty.

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

In this equilibrium, skilled workers are indifferent between having large uneducated or small educated families. A necessary and sufficient condition for this equilibrium is that, for some $\tilde{\eta} \in (0,1)$, the skilled and unskilled wages, $w_{S,\tilde{\eta}}$ and $w_{U,\tilde{\eta}}$, are such that $V_{GS,\tilde{\eta}} = V_{PS,\tilde{\eta}}$, i.e.,

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

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

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

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

The steady-state utility of skilled adults in this steady state is given by:

$$V_{GS,0} = \frac{u(w_{S,0}(1+Gl)) - \Pi^{0,0}_{S\to U}[u\left(w_{S,0}(1+Gl)\right) - u\left(w_{U,0}(1+Gl)\right)]}{1-\beta(1-\lambda(1-z))} \tag{14}$$

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

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

The deviation is not profitable as long as:

$$(1-\Pi^{0,1}_{S\to U})u(w_{S,0} - pP) - (1-\Pi^{0,0}_{S\to U})u(w_{S,0}\left(1+Gl\right)) \leq \\ (\Pi^{0,0}_{S\to U} - \Pi^{0,1}_{S\to U})u\left(w_{U,0}\left(1+Gl\right)\right). \tag{15}$$

4.3 Existence and Uniqueness of Steady States

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

To see the intuition behind this argument, consider Figure 1. In the plot, the downward-sloping schedule SS_1 represents the negative relationship between the wage premium w_S/w_U and $\tilde{\eta}$ that follows from Lemma 3. Intuitively, an increase in the relative supply of skills, parameterized by $\tilde{\eta}$, decreases the skill premium. The piecewise positive schedule EE represent the optimal steady-state educational choice of parents as a function of the wage premium.[6] In particular, for a range of low wage premia, no

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

education is strictly preferred by all agents ($\tilde{\eta} = 0$). For an intermediate range of wage premia, no education is strictly preferred by unskilled agents, whereas education is chosen by skilled agents ($\tilde{\eta} = 1$). For a range of high wage premia, all agents prefer education ($\tilde{\eta} = 2$). Between these regions, there exist threshold wage premia $\underline{w}_S/\underline{w}_U$ and $\bar{w}_S/\bar{w}_U$ at which, respectively, either skilled workers ($\tilde{\eta} \in (0, 1)$) or unskilled workers ($\tilde{\eta} \in (1, 2)$) are indifferent. If the difference between the utilities from educating or not educating children is strictly increasing in the wage premium, the thresholds $\underline{w}_S/\underline{w}_U$ and $\bar{w}_S/\bar{w}_U$ are unique, as in Figure 1. The steady-state equilibrium is in that case unique and corresponds to one of the five types of steady-states discussed earlier. If the difference between the utilities from educating or not educating children were non-monotonic, however, there could exist multiple thresholds (i.e., the EE curve could be locally downward sloping), and the steady-state equilibrium could fail to be unique.

The threshold $\underline{w}_S/\underline{w}_U$ is necessarily unique. Namely, the difference between the utilities from having small educated or large uneducated families is strictly increasing in the wage premium for skilled parents (see proof of Proposition 1). The same monotonicity does not necessarily hold for unskilled parents, however, for the following reason. On the one hand, as the skill premium rises, education becomes more attractive to unskilled agents, since the utility from potential skilled descendants increases. On the other hand, a higher skill premium also implies that the unskilled parents earn a lower wage, and this increases the utility cost of paying the fixed cost of education.[7] If the curvature of utility is high, the latter effect may dominate. In fact, if marginal utility at zero is infinite, unskilled adults have no choice but to have large families whenever the education cost exceeds their income. To obtain a unique steady state, we must therefore introduce an additional assumption that bounds the curvature of utility in the relevant range. Under CRRA preferences, a sufficient, though not necessary, condition is:

Assumption 2

$$(1 + Gl)\frac{1 - \Pi^{0,1}_{U \to S}}{1 - \Pi^{1,1}_{U \to S}} > \frac{u'(w_{U,2} - pP)}{u'\left(w_{U,2}(1 + Gl)\right)}$$

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

We can now establish the following result.

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

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

5 Steady States with Endogenous Policies

So far, we have established that the model has a unique steady state when parents can choose freely whether or not to make their children work. Imposing CLR is equivalent to lowering the parameter l, or setting it to zero when child labor is completely banned. Therefore, the previous section shows that there is a unique steady state for any child-labor policy that is fixed exogenously (maintaining Assumption 2 throughout). [8]

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

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

that, under CLR, all parents would choose small families and send their children to school (in Figure 1, the *EE* line would be horizontal at $\tilde{\eta} = 2$). In the absence of CLR, an equilibrium with $\tilde{\eta} = 0$ holds if condition (15) is satisfied. If preferences are logarithmic, this can be expressed as:

$$\ln(1 + Gl) \geq \beta\lambda z \frac{\pi_1 - \pi_0}{1 - \beta(1 - \lambda)} \ln\left(\frac{w_{S0}}{w_{U0}}\right), \tag{16}$$

where the wage premium depends on G, π_0 and π_1, but not on the discount factor $\beta\lambda z$. Thus, in economies with sufficiently low $\beta\lambda z$, the inequality (16) holds and the steady state features widespread child labor if there is no CLR.

While in this example CLR was treated as exogenous, the main objective of this section is to establish the possibility of multiple steady states with different policies when the choice of policy is *endogenous*. In order to carry out this analysis, we have to specify a political mechanism in the model. We assume that CLR can be irreversibly introduced by a majority of adult agents. Clearly, this "referendum" decision is a stand-in for more complicated decision processes whereby different groups in society can exert political pressure to introduce restricting laws. What we are mainly interested in is to analyze conditions such that the "working class" (unskilled workers) supports the introduction of CLR, as it is historically observed. We will also ask the opposite question. Namely, would a majority in an economy where CLR have been in place for long time vote for CLR to be abandoned?

The main result is that there exists parameter configurations such that, if the economy is in a steady state with no CLR, a majority of the adults (the skilled and some or all of the unskilled) will vote against the introduction of CLR. Conversely, if CLR exist, a majority of the adults (some or all of the unskilled) will vote to keep the restrictions in place. The source of this multiplicity is that old adults are locked-in into the family size that they chose when they become adult, which influences their policy preferences. As in the example above, absent CLR agents would choose large families and make their children work, whereas, if CLR are in place, they choose small families and educate their children. This feedback between political decisions and family size gives rise to multiple steady states. For simplicity, we will state analytical results under the assumption that the CLR policy includes compulsory schooling.

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

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

Consider, first, a candidate SSPE in which child labor is unrestricted. For this SSPE to be sustained, a majority of adults has to prefer to keep child labor unrestricted, as opposed to switching to CLR forever. To make the problem interesting, we assume that the old unskilled are in the majority (skilled agents always prefer no CLR) and that at least some of them have large families in the unrestricted steady-state. We need to compare the utility of old unskilled agents in the steady-state with no CLR to the utility they get if CLR are introduced. To compute the latter, we must take into account transitional dynamics, since the wage premium would be changing over time after the approval of CLR. In particular, as soon as CLR are introduced, all young adults have to educate their children and therefore choose small families. The old unskilled are stuck with large families, but they have to educate their children as well. The impact effect of CLR is a decline in the wage premium, since the stock of children of unskilled families is suddenly withdrawn from the labor force, which increases the ratio of skilled to unskilled labor supply. Thereafter, the skill ratio in the adult population continues to increase gradually, since, in the new environment, all parents educate their children. Thus, the wage premium falls monotonically to the new steady-state level, corresponding to the skill ratio in the labor force $\pi_1/(1-\pi_1)$.

Consider, next, a candidate SSPE with CLR. Given CLR, everyone is forced to educate their children. Therefore all parents choose small families and educate their children. For this situation to be an SSPE, the old unskilled majority has to prefer to keep rather than eliminating the existing CLR. The steady-state utility for unskilled workers associated with the status quo (CLR) must be compared with the utility that prevails if CLR are abandoned and the economy converges to a new steady-state. As before, we assume that without CLR some unskilled workers, at least, choose large families (otherwise CLR would be irrelevant). If the unskilled workers prefer large families and child labor at the steady-state without CLR, a fortiori, they do so at the wages prevailing in the steady-state with CLR, since the skill premium is lower, making education even less attractive. Therefore, once CLR are lifted, young unskilled (and, possibly, also skilled) parents will start choosing large families and make their children work, causing the skill premium to rise over time.

From the perspective of old unskilled agents, who form the majority, CLR implies both gains and losses. The former are associated with larger unskilled wages. The latter are associated with the opportunity cost of child labor income. The trade-off between these two effects determines whether or not they support CLR. The key factor for multiple SSPE to emerge is the lock-in into family size decisions. For the parents of large families the opportunity cost of child labor, as well as the cost of education, is higher than for parents of small families. Thus, ceteris paribus, families that were formed under no CLR are less supportive of introducing a ban on child labor, since they have more children. Conversely, families formed under CLR are more supportive of retaining ban on child labor, since they have fewer children.

Building on this intuition, Proposition 2 establishes formally that there are parameters such that multiple SSPE an exists.

Proposition 2 *There exists a set of parameters such that:*

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

6 A Computed Example

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

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

The fertility values for small and large families are $P = 1$ and $G = 3$. A family of two would therefore have two children if they prefer education, or six children if they decide for child labor. This fertility differential approximates the fertility differential between mothers in the lowest and highest income quintiles in countries with widespread child labor, such as Brazil or Mexico (see Kremer and Chen (2000)). The probability of death $\lambda = 0.15$ and the probabilities $\pi_0 = 0.05$ and $\pi_1 = 0.4$ of becoming skilled are chosen such that the old unskilled are always the majority of the population, and therefore politically decisive.[9] The choice for λ implies that adults live on average for $6\frac{2}{3}$ periods. If we assume that people survive 40 years on average after becoming adults, a model period corresponds to six years. The rate of time preference implied by our choice of β would generate an annual interest rate of 4% per year (if assets could be traded), which is the standard basis for calibrating β in the RBC literature. The choice $l = 0.1$ for the supply of child labor implies that a large family with working children derives about a quarter of family income from children, which is in line with evidence from Britain in early industrialization (Horrell and Humphries 1995) and recent data from developing countries. The elasticity parameter $\sigma = 0.5$ puts the elasticity of substitution in the middle between Cobb-Douglas and linear production. The weight α of skilled labor in the production function is left unspecified for now. We will use α as a measure of the skill premium, and compute outcomes for a variety of α.

We start by determining which steady states and SSPE exist for different values of α. Recall from Section 4 that as long as Assumption 2 is satisfied, there is a unique steady state in the economy without voting. Figure 2 displays the steady-state $\tilde{\eta}$ as a function of α. For low α, the skill premium is low. Consequently, education is not very attractive, and there is a range in which all parents prefer child labor ($\tilde{\eta} = 0$). As the skill premium rises, we reach a threshold for α at which a fraction of skilled

[9] If the skilled adults have political control, the problem is not interesting, since skilled agents always oppose CLR. Even in a more complicated political mechanism where different groups can exert political pressure the unskilled adults would be important, since they are the only group whose preferences over CLR are, in principle, ambiguous.

adults educates their children ($\tilde{\eta} \in (0,1)$), and ultimately all skilled parents choose education ($\tilde{\eta} = 1$). For even higher α, there is a wide region in which unskilled parents are indifferent between education and child labor ($\tilde{\eta} \in (1,2)$). Throughout this region, higher α are offset by a higher supply of skilled labor, which keeps the unskilled parents indifferent. Ultimately, all parents educate their children ($\tilde{\eta} = 2$).

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

To demonstrate that the multiplicity result depends on endogenous fertility choice, we also computed outcomes without fertility differentials by setting $P = G = 1$, i.e., families of working and educated children have the same size. Figure 4 shows that the steady-state $\tilde{\eta}$ shifts to the left. For a given technology, more parents choose to educate their children. This was to be expected, since by lowering the maximum family size we lowered the income that can be derived from child labor, rendering education relatively more attractive. Figure 5 shows SSPE as a function of α. We still find that for low α no CLR is an SSPE, and for high α CLR obtains. However, there does not exist an overlap region where both policies can be supported in steady state, since the policies no longer lock agents into different fertility choices. In fact, there is a region where neither policy is an SSPE. The reason for the non-existence of SSPE for some α is the endogenous skill premium. If CLR are in place, the supply of skilled labor is high, and the skill premium is low. The low skill premium makes child labor attractive relative to education, so that a majority is in favor of abandoning CLR. If there are no restrictions, however, the supply of skilled labor is low and the skill premium is high. This makes education more attractive, and increases the gain from removing other parents' children from the labor market, so a majority is in favor of introducing CLR.

7 The Transition to CLR

So far, we have shown that the interaction of fertility choice and political preferences in our model can lead to a lock-in effect, which results in multiplicity of SSPE, either with child labor and high fertility or no child labor and low fertility. This feature of the model can explain why there is a lot of variation in the incidence of child labor around the world, even when controlling for income per capita. However, we also need to explain why by today many countries adopted child-labor bans, even though 200 years ago child labor was common all over the world. In our model, a transition from no CLR to CLR is possible if exogenous factors make education (and therefore smaller families) sufficiently attractive for a majority of unskilled agents to prefer the introduction of CLR. To demonstrate this possibility, we computed transitions paths for our model which are triggered by an exogenous increase in the skill premium (brought about, say, by the introduction of new industrial technologies). A rising skill premium can be parameterized by an increase in the parameter α in the production function.

Generally, the problem of computing transitions paths with endogenous policy choice is complicated. The decisions of agents in any period depend on the entire path of expected future policies. Future policies therefore partly determine the evolution of the state vector of the economy, which in turn affects the preferences over these same policies. This interdependence can lead to multiple equilibria (not just multiplicity of steady states), or nonexistence of equilibria. In principle, these problems could arise in our framework, but it turns out that for the calibrated version of our model unique results can be obtained. To limit the number of time paths of future policies, we assume that once CLR are introduced, they cannot be revoked. Future policies therefore can be indexed by the period in which CLR are introduced. We conjecture that in our specific application our results would still apply if we allowed CLR to be revoked in later periods, because we consider only the case of an increasing skill premium, which together with the lock-in effect of endogenous fertility choice would tend to increase support for CLR over time.

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

For our computations, we assume that α is initially equal to 0.45, starts to increase in the third period by 0.05 per period, until in period 6 the parameter α reaches 0.65 and stays there. Given the initial α, the economy starts out in the steady state with $\tilde{\eta} = 1$, i.e., all skilled and no unskilled parents educate their children. In the first periods of the increasing wage premium, a majority continues to oppose the introduction of CLR. Starting in period 3, however, all young unskilled adults start to choose education and small families, in response to the increasing skill premium and the expected future introducing of CLR. Old unskilled families are stuck with many children, and therefore continue to choose child labor. In period 5, unskilled families with small families form the majority of the population, and vote for the permanent introduction of CLR.

Figure 6 shows the evolution of the skill premium during the transition. Initially, the skill premium increases due to the rising α. Once CLR are introduced and children are withdrawn from the labor market, however, the skill premium drops, since the increase in α is offset by the smaller supply of unskilled labor. After α stops increasing, the skill premium declines further, as the number of skilled workers increases gradually. The introduction of CLR also leads to sharp decline in population growth (Figure 7), because now all unskilled parents have small families. Notice, however, that the decline in population growth starts even before CLR are introduced, because young unskilled families start to have small families already in period 3. The switch in decisions of young unskilled parents also triggers an immediate decline in the supply of child labor, as Figure 8 shows. Thus, child labor declines even before CLR are introduced. However, the future introduction of CLR is still responsible for part of the decline in child labor: If the introduction of CLR in period 5 was not expected, a much smaller number of families would have chosen education in period 3, and therefore the decline in child labor would have been smaller as well.

This account of the transition to CLR leads to a number of predictions which are consistent with the historical development in the U.S. and the United Kingdom. First, the policy switch would be expected to occur after a phase of increasing wage premia. This prediction is confirmed by evidence which suggests that both the U.K. and the U.S. reached the peak of the Kuznets curve at about the same time as the major reforms in the areas of child-labor laws and compulsory schooling took place. A second prediction is that the introduction of CLR would coincide with a phase of rapid fertility decline, as more and more families decide to have small families, and a phase of rapidly expanding education. Again, these predictions are confirmed by the timing of the demographic transition in both countries. A third prediction is that CLR would be expected to stay in place or even become more severe over time once they are first introduced, since the presence of CLR helps build a constituency which supports CLR in the future. Consistent with this prediction, with very few exceptions in both countries CLR have been getting more restrictive over time.

The same theory which explains policy transitions also predicts that countries which are similar initially might adopt different policies and therefore ultimately diverge. Picture two countries which both experience a temporary increase in the skill premium, but the increase is slightly larger in country A than country B. For example, country B may be using a technology which is more intensive in unskilled labor. It is then possible that in country A the majority votes in favor of CLR and thereby leads the economy on a future path with low fertility and inequality, while support for CLR just fails to reach 50 in country B, so that large families and high inequality would continue to dominate.

Finally, the results suggest a reason why some econometric studies find that CLR have only a relatively small effect on the supply of child labor. Moehling (1999) and others use state-by-state variation in the introduction of CLR in the U.S. to estimate the effects of CLR, employing "difference-in-difference" estimators. Our results show that child labor may decline even before CLR are actually introduced, since young families start to have small families of educated children in anticipation of future CLR. The relative decline of child labor in the periods before and after the introduction of CLR depends on average family size, the number of young families, and the enforcement of CLR. Depending on these variables, it is possible that the measured impact of CLR would be small (i.e., the difference in the decline of child labor before and after the introduction of CLR, either within a state or across states). The true effect of CLR would be larger than this empirical measure, since the underlying decline in average family size is triggered by the expected introduction of CLR as well. In our example, if no CLR are introduced, child labor rates remain at 60 to 80 percent throughout. In other words, CLR work to a large extent indirectly by reducing family size and changing families' education decisions, as opposed to directly by removing children from the labor market who would have worked otherwise.

8 Conclusions

The aim of this paper is to shed light on the political economy of child-labor restrictions. The key novelty of the model presented is an interaction between demographic variables (the number of children per family as chosen by the parents) and political preferences. The results described above show that the model can generate multiple steady states, because CLR induce individual behavior which in turn increases support for maintaining CLR. This "lock-in" effect can explain why we observe large variations in the incidence of child-labor and child-labor laws across countries, even after controlling for income levels. A typical example of this would be the contrast between American countries like Mexico and Brazil and Asian countries such as South Korea. In Mexico and Brazil (which have been democracies for some time) there is comparatively little child-labor regulation, enforcement of the existing laws is lax, and the incidence of child labor is high. In South Korea, there is more regulation, laws are actually enforced, and child-labor rates have been very low for many years. Consistent with the predictions of the model, fertility differentials within the population are much higher in Mexico or Brazil than in South Korea (see Alam and Casterline 1984 and Mboup and Saha 1998).

In order to account for the initial introduction of CLR, the model has to be extended to allow for an exogenous change which shifts preferences in favor of CLR. Our prime suspect for this shift is a change in technology which raises the return to skilled labor, and thereby provides incentives for parents to choose small families and educate their children even while child labor continues to be legal. Once the skill premium is sufficiently high, political pressure for the introduction of CLR would be expected to rise. The theory predicts that unskilled workers with few children will profit from the introduction of CLR, since they compete with children in the labor market, but have little to gain from sending their own children to work. It is consistent with this account of the transition that in the U.S. organized labor was the driving force behind the introduction of CLR. In addition, the theory predicts that the introduction of CLR should follow a period of rising wage inequality and coincide with a period of falling fertility and rising education levels.

Beyond the specific case of child labor, we see this project as contributing to an emerging theoretical literature which puts the spotlight on policy reforms in the course of development. During the same time when child-labor laws first came into effect towards the end of the 19th century, a number of industrializing countries also extended voting rights, introduced free, public, and compulsory education, and started social insurance programs. Two recent papers which address some of these changes are Acemoglu and Robinson (2001), where a rich elite introduces reforms to reduce a threat of revolution, and Galor and Moav (2000), where social institutions are put into place in order to reap human capital externalities. The research outlined in this paper provides another perspective which links policy reforms to changes in technology, but also to the major demographic changes which were taking place at the same time.

A Mathematical Appendix

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

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

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

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

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

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

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

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

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

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

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

Next, define:

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

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

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

Thus, $\lambda(P-1)$ is a lower bound to the growth rate of the population.

Note also that $\tilde{\psi}(\eta_U)^2 - 4q(1-\eta_U)(\pi_1-\pi_0) = (1-(1-\eta_U)q(\pi_1-\pi_0))^2 > 0$, hence, $\psi(\eta_U)^2 - 4q(1-\eta_U)(\pi_1-\pi_0) > 0$, i.e., $\gamma(\eta_U) \in R^+$.

Furthermore,

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

proving that g is uniformly decreasing in η_U.

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

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

Next, observe that:

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

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

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

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

Proof for Lemma 3: Again, the two cases of $\eta_U \in (0,1)$ and $\eta_S \in (0,1)$ are parallel.

We therefore concentrate on the case $\eta_U \in (0,1)$. Using the solution for g and the definition of $\gamma(\eta_U)$ defined in the proof of Lemma 2 we can solve for the steady-state proportion of each type, as a function of η_U:

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

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

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

where:

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

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

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

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

Proof for Proposition 1:

We need to show that the steady-state utility differential between having large and small families is monotonically increasing in *eta*. Lemma 3 establishes that the wage premium is strictly decreasing in *eta*, we therefore want to show that the utility differential is strictly decreasing in the wage premium. This result is immediate for the skilled adults. We therefore concentrate on the differential for the unskilled adults. Writing steady-state utilities as a function of $\tilde{\eta}$ we get:

$$\begin{aligned} V_{GU}(\tilde{\eta}) &= \frac{u\left(\left(f\left(x\left(\tilde{\eta}\right)\right)-f'\left(x\left(\tilde{\eta}\right)\right)x\left(\tilde{\eta}\right)\right)(1+Gl)\right)}{1-\beta\left(1-\lambda\left(1-z\right)\right)} \\ &\quad -\frac{\Pi^{0,1}_{U\to S}\left(u\left(\left(f\left(x\left(\tilde{\eta}\right)\right)-f'\left(x\left(\tilde{\eta}\right)\right)x\left(\tilde{\eta}\right)\right)(1+Gl)\right)-u\left(f'\left(x\left(\tilde{\eta}\right)\right)-pP\right)\right)}{1-\beta\left(1-\lambda\left(1-z\right)\right)} \\ V_{PU}(\tilde{\eta}) &= \frac{u(f\left(x\left(\tilde{\eta}\right)\right)-f'\left(x\left(\tilde{\eta}\right)\right)x\left(\tilde{\eta}\right)-pP)}{1-\beta(1-\lambda(1-z))} \\ &\quad -\frac{\Pi^{1,1}_{U\to S}[u\left(f\left(x\left(\tilde{\eta}\right)\right)-f'\left(x\left(\tilde{\eta}\right)\right)x\left(\tilde{\eta}\right)-pP\right)-u\left(f'\left(x\left(\tilde{\eta}\right)\right)-pP\right)]}{1-\beta(1-\lambda(1-z))}. \end{aligned}$$

Let:

$$\Delta\left(\tilde{\eta}\right)=V_{GU}\left(\tilde{\eta}\right)-V_{PU}\left(\tilde{\eta}\right).$$

We have:

$$\begin{aligned} \Delta'\left(\tilde{\eta}\right) &= -u'\left(w_U(\tilde{\eta})\left(1+Gl\right)\right)\left(1-\Pi^{0,1}_{U\to S}\right)\left(1+Gl\right)x\left(\tilde{\eta}\right)f''\left(x\left(\tilde{\eta}\right)\right)x'\left(\tilde{\eta}\right) \\ &\quad +u'\left(w_U(\tilde{\eta})-pP\right)\left(1-\Pi^{1,1}_{U\to S}\right)x\left(\tilde{\eta}\right)f''\left(x\left(\tilde{\eta}\right)\right)x'\left(\tilde{\eta}\right) \\ &\quad +\left(\Pi^{0,1}_{U\to S}-\Pi^{1,1}_{U\to S}\right)u'\left(w_S(\tilde{\eta})-pP\right)f''\left(x\left(\tilde{\eta}\right)\right)x'\left(\tilde{\eta}\right) \end{aligned}$$

where:

$$\begin{aligned} x'\left(\tilde{\eta}\right) &> 0, \\ f''\left(x\left(\tilde{\eta}\right)\right) &< 0, \\ \left(\Pi^{0,1}_{U\to S}-\Pi^{1,1}_{U\to S}\right) &< 0 \end{aligned}$$

Therefore it suffices to show that:

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

or:

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

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

Proof for Proposition 2: To begin, set $\beta = 0$ and choose arbitrary positive values for the other parameters, under the condition that the old unskilled are always the majority (i.e., $(1-\lambda)(1-\pi_1) > 0.5$). Since the future is not valued, there is no incentive for education. Therefore without CLR, the steady state with $\tilde{\eta} = 0$ prevails, and all families are large. Conversely, when CLR are in place (which are combined with a compulsory education policy) the steady state is $\tilde{\eta} = 2$, as all families are small to economize on the education cost.

Consider this economy under the assumption that the steady state without CLR prevails. We want to find conditions under which the (old unskilled) majority would vote against CLR if a referendum occurs. The gain from introducing CLR consists of a rising wage premium, since the supply of child labor falls. The loss consists of reduced income from child labor and the education cost pG for the children. The relative size of these effects depends on the production function, the fertility-parameter G, the education cost p, and on π_0 (which determines the relative number of skilled and unskilled agents in this steady state), but not on P. For given remaining parameters, the education cost p can always be chosen such that the majority of unskilled agents opposes the introduction of CLR.

Conversely, consider the same economy under the assumption that the steady state with CLR prevails. We want to find conditions under which the majority would prefer to keep CLR in place. The gain from abandoning CLR consists of increased income opportunities through child labor, and forgoing the education cost pP. the loss from abandoning CLR consists of lower unskilled wages through the increased supply of unskilled wages. The gain from abandoning CLR goes to zero as P goes to zero. The loss, in contrast, does not go to zero, since fraction λ of young parents will choose the large family size G, resulting in a downward effect on the unskilled wage which is independent of P. By choosing P sufficiently small, we can therefore ensure that the majority votes to keep CLR in place. We have therefore found a set of parameters for which multiple SSPE exist. Finally, since utility is continuous in β, the same result can be obtained for positive β, sufficiently close to zero, and the same remaining parameters. Q.E.D.

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Parameter	Value
β	0.8
z	1
σ	0.5
λ	0.15
P	1
G	3
π_0	0.05
π_1	0.4
p	0.015
l	0.1
κ	0.5

Table 1: Parameter Values

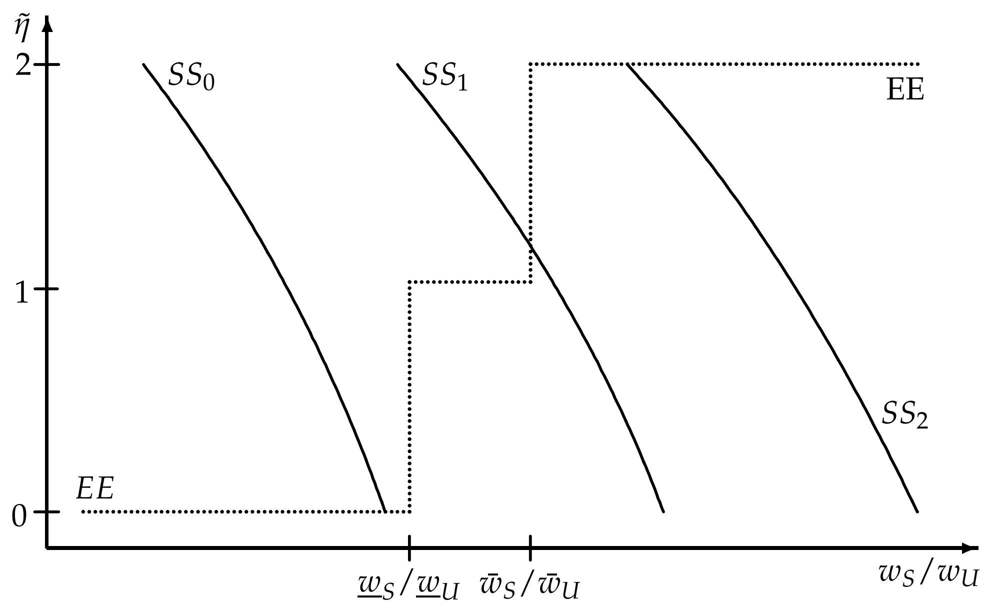

Figure 1: Steady States

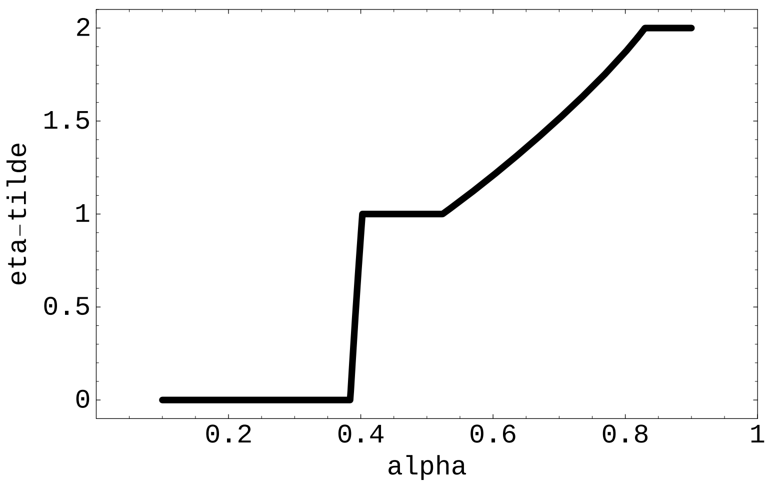

Figure 2: Steady-State $\tilde{\eta}$ (Unskilled Parents with Small Families) as a Function of α

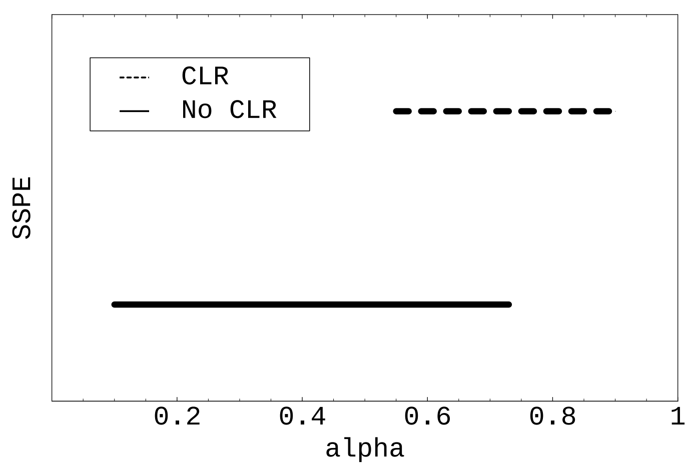

Figure 3: SSPE as a Function of α

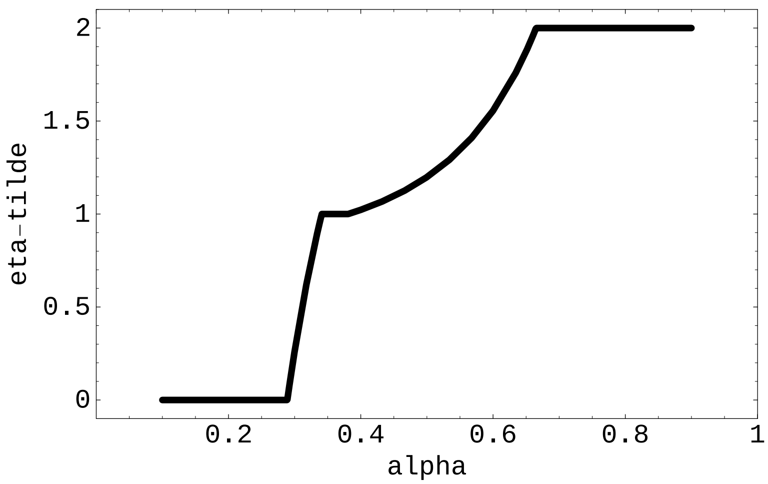

Figure 4: $\tilde{\eta}$ as a Function of α without Fertility Differential

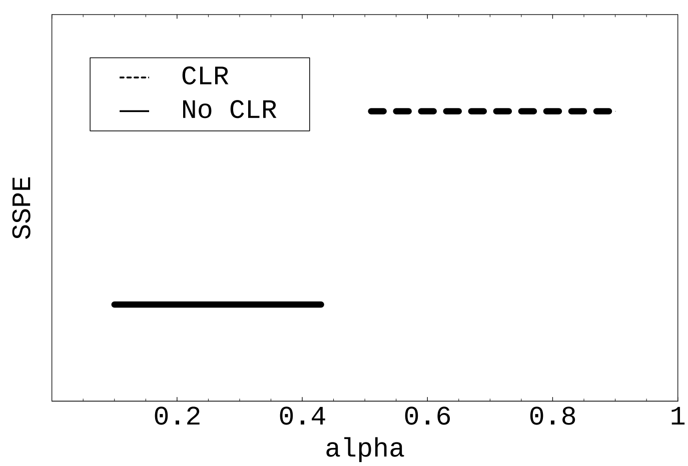

Figure 5: SSPE as a Function of α without Fertility Differential

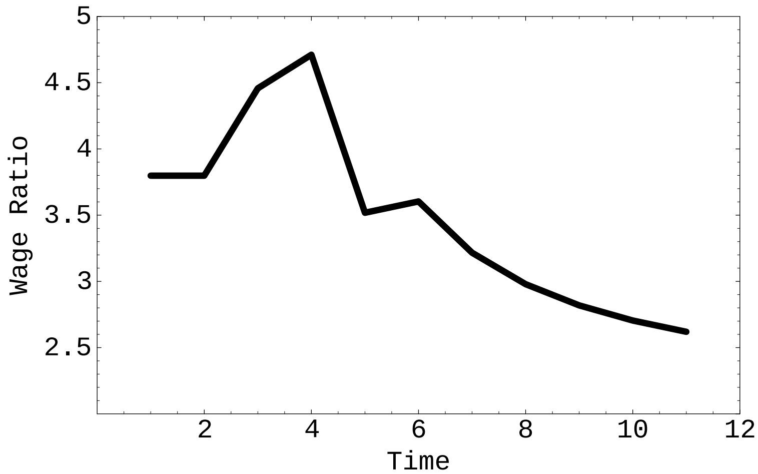

Figure 6: Wage Premium over Time, Endogenous Policy

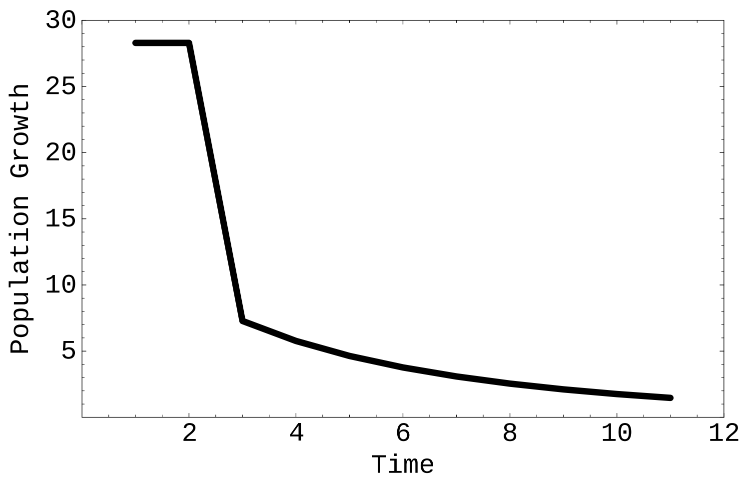

Figure 7: Population Growth over Time, Endogenous Policy

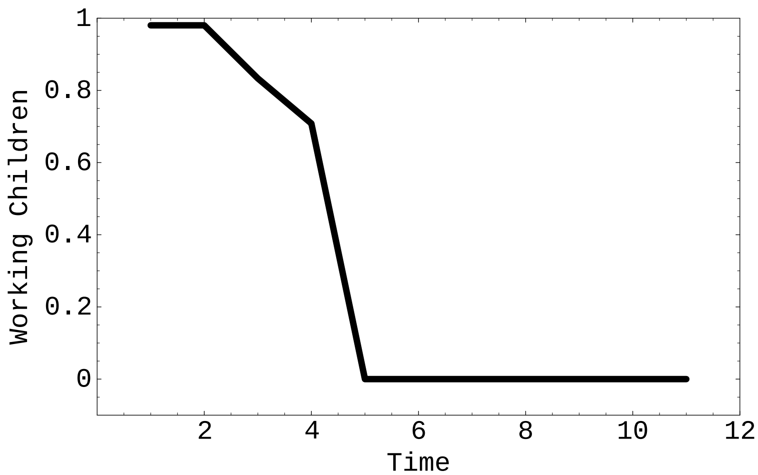

Figure 8: Fraction of Children Working, Endogenous Policy