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FILIAL OBLIGATIONS AND CHILD LABOR

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Abstract

This paper introduces the effect of social norms of filial obligations on household decision-making with respect to child labor. These norms of mutual care are sustainable as an equilibrium in the intergenerational game, even when parents are not altruistic, thus solving the widely discussed contracting problem *á la* Becker that is supposed to explain under-investment in schooling by poor households. The existence of such social norm in equilibrium, however, does not induce *per se* the elimination of child labor. Technological parameters and relative returns to schooling also play a fundamental role. The model yields results that are consistent with cross-country data, in the sense that poorer countries would have a higher incidence of child labor and time-intensive care of retired parents, whereas richer countries would have negligible child labor and would indulge in money-intensive care of the old.

JEL Classifications: D10, J22, O12, O17, O33

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FILIAL OBLIGATIONS AND CHILD LABOR

To breed an animal with the right to make promises -is not this the paradoxical problem nature has set itself with regard to man?
F. Nietzsche, *The Genealogy of Morals*

1. Introduction

Both the theoretical and empirical literature on child labor has grown in recent years. The interest in the topic has increased both in the academic and the policy circles. It is now well known that even when child labor takes place in normal, non-hazardous work conditions, it has lasting effects on the economy. It affects human capital formation and thus the aggregate level of human capital and productivity, which constrains the growth possibilities of the economy in the long run. From a microeconomic perspective, it affects future earnings of children --by reducing the levels of schooling-- and may introduce "poverty traps" at the household level. According to estimates a vast majority of working children live in less developed economies. Child labor seems to be strongly linked to poverty.

The participation rate of children in the labor market shows its lowest level in Europe, 0.10%. Conversely, countries like Ethiopia, Brazil, and India show participation rates of children in the labor market at 43%, 18%, and 17%, respectively. Even countries that are now considered as well-developed experienced this phenomenon during the early stage of industrialization. As an example, Great Britain showed an increase in child labor during the industrial revolution, reaching its peak around 1870 only to steadily fall afterwards.[1] Other studies have analyzed

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[1] On this issue, see Basu (1999a). Galbi (1997) shows different dates for the peak of child labor incidence but in a consistent way in terms of pattern

the high incidence of child labor in the United States during the last century (Goldin, 1979).

There have been several theoretical explanations of the existence of child labor and low investment in human capital in poor households. Among these, a now classical explanation of the observed low investment in schooling by poor parents is that by Becker (1993). This explanation suggests the existence of contracting problems between parents and their children. Recent work has explored such hypothesis and concluded that it is indeed the possibility of opportunistic behavior by children, who may want to fully internalize the benefits of schooling when they grow up, which may explain the incidence of child labor, even if parents are altruistic (Baland and Robinson, 1999). Baland and Robinson (1999) also show that bequests and access to the credit market may induce a level of child labor that is "optimal" from a welfare perspective, by equalizing the foregone income that education of children implies to the returns to schooling. Bequests and borrowing can be used to smooth consumption optimally. Two-sided altruism cannot solve the inefficiency of child labor, even when bequests exist, if there exist borrowing constraints for children.

Static models assume the existence of altruism on the side of the parents. Dynamic settings that analyze the contracting issues between parents and children also assume altruism, for otherwise children or parents will never invest in each others' well being (Baland and Robinson, 1999). It is emphasized that formal contracts cannot be signed between parents and children, and any promise by the children to compensate their parents in the future for higher education is a non-credible commitment in those finite-time models. This paper shows that there are implicit contracts that can be sustained over time, as social norms of filial obligations

between parents and children, and that these norms can be sustained as an equilibrium in the intergenerational interaction. The solution of such contracting problems, it shall be shown, does not eliminate the existence of child labor. Technological conditions that determine relative returns to human capital investment with respect to child labor wages, as well as the interest rate and the quality of schooling, also play a fundamental role. That is the first contribution of this paper to the literature.

The informal contracts between parents and children shall be termed *social conventions* or *norms* throughout the paper. Though the jury is still out in terms of the empirical validity of the hypothesis of altruism within the family (see, for example, Altonji, et. al. 1997; Parsons and Goldin, 1989; Cox and Rank, 1992), this model shall consider parents to only care about their own consumption. This assumption of non-altruistic has a methodological *raison d'ètre*, namely the interest in showing the sustainability of the social norm and the conditions for the elimination of child labor even for the extreme case of non-altruistic parents. Allowing parents to be altruistic would only strengthen our main findings.

The perspective investigated here, that of the effect of social norms on child labor, has not been previously discussed in the literature.[2] For that, an overlapping-generations structure is used, following a setting similar to that discussed previously in Kreps (1985), Dasgupta (1993), and Kahhat (1999).

The second part of this paper investigates alternative forms of parental care provided by their adult children. That is, when the technology to look after retired parents is generalized to allow children to substitute monetary transfers with their

[2] For a discussion on the interaction between social norms and economic decisions, see Basu (2000).

own time, it shall be shown that for different parameter values (child wage, adult wage, interest rate, and quality of schooling) the economy shows interesting outcomes. In certain cases, no child labor and money-intensive care would be observed; others would be characterized by high incidence of child labor and time-intensive care. Those scenarios are consistent with an empirical regularity: rich countries –where the relative returns to skilled labor are higher- show a negligible incidence of child labor and the care of parents is money-intensive. Poor countries, on the other hand, show time-intensive care and high levels of child labor. Generating that regularity is the second main contribution of this model.

The intuition throughout the paper comes from the fact that parents face an intertemporal trade-off under the social norm: child labor implies more consumption today, whereas more schooling implies more consumption during retirement if the children are going to transfer a proportion of their higher wages to their predecessors. In the case of the care technology that includes the children's time, full schooling increases the offspring's opportunity cost of providing time-intensive care, which in turn explains the coexistence of no-child labor (full schooling) and money-intensive care of parents, under specific parameter values. The type of social norm analyzed here is an "equilibrium selection" norm (Basu, 1997; 2000). There is multiplicity of equilibria.

The paper contains six sections. A brief review of the theoretical literature on child labor follows. The third section discusses the importance of contracting problems *á la* Becker between parents and children, as well as the relevance of social norms that affect economic decisions and can informally solve those contracting problems. Section four states the social norms and social perceptions that shall induce the sustainability of the informal contracts, describes the overlapping-

generations setting, and shows the results in the case of a care technology that uses only money as input. That result tells us the basic intuition and the sensitivity of child labor to relative wages, interest rates, and changes in the quality of schooling. In the subsequent section, the care technology is enriched to introduce the possibility of substitution between time and money to look after one's parents.

2. Pertinent Literature

Most of the existing models that analyze child labor are of a static nature.[3] Those models assume the "unitary" model of the household where there is one decision-maker in the family allocating time to different activities, following the unitary model. They assume that parents are altruistic by introducing in their utility function some variables related to the children's welfare (consumption, leisure, or schooling). In the empirical analysis, the substitution between quantity and quality of children, as well as the relevance of the parents' wages and employment status, are key explanatory factors of child labor supply (Rosenzweig and Evenson, 1977). The model presented in this paper shares the feature of the unitary model, but eliminates the altruistic assumption.

Basu and Van (1998) proposed a framework in which the possibility of multiple equilibria is explored. Two assumptions drive their main result: the *luxury* axiom and the *substitution* axiom. The former says that altruistic parents would send their children to school could they afford to do so. The latter axiom establishes that firms can substitute adult labor for child labor in the production process. From those two axioms, Basu and Van show the possibility of multiple equilibria in the labor market. In one equilibrium, adult wages are high and children do not work, whereas

[3] These include, for example, Rozensweig and Evenson (1977) and Basu and Van (1998). For a thorough review of the literature, see Grootaert and Kanbur (1995) and Basu (1999a).

there also exists an equilibrium where adult wages are low and children work. The existence of multiple equilibria opens the door to permanent effects of policy intervention. Swinnerton and Rogers (1998) show that an unequal distribution of wealth is also necessary for Basu and Van's results to hold. The model below departs from that framework, which has been discussed in paper 1

Fully dynamic models have been written recently. A pioneer work is Jacoby and Skoufias (1997), which develops a dynamic model with altruistic parents to analyze the effect of income shocks on schooling attendance and labor force participation in Semi-Arid region of India. When there is no access to formal insurance and credit markets, children are used as a consumption-smoothing device. Negative shocks are correlated with children's low school attendance and higher labor force participation. Here, altruism is assumed by introducing the human capital of the children in the last period as an argument of the utility function of the parents. Also, Baland and Robinson (1999) have built a two-period model to analyze fertility and schooling decisions, as well their welfare implications. In their model, the key assumption is the trade-off between child labor and human capital accumulation. Even if parents are altruistic, child labor arises because of the fact that parents can control the child's income but not the income once she has grown up, exactly as proposed by Becker. There is a commitment problem that opens the possibility of child labor in equilibrium. The latter paper also analyzes those contracting problems between parents and children, in an environment were bequests are allowed. The main result consists of showing that at the corners –bequests and or savings being zero—child labor is inefficient, in the sense that the foregone income it induces does not equal the returns to schooling. If bequests or access to the credit market cannot be used to smooth consumption, parents choose an inefficiently higher level of child

work. The model developed in this paper yields results that can be contrasted with the latter papers, in the sense that the contracting problem is solved informally by the existence of the norm. Also in relation to the importance of the access to credit, Ranjan (1999a, 1999b) explores, in a dynamic setting, the relevance of credit market imperfections and income distribution in explaining children's labor force participation.

One feature is common to all the papers in the literature, to wit the fact that they neglect the role of informal institutional arrangements, like social norms. As discussed below, these norms of behavior that are informally enforced do indeed have an effect on the parents' decisions. Recent work on the analysis of reciprocity within the family, following ideas discussed previously by Dasgupta (1993), has shown the impact of such norms on fertility decisions, human capital investment and growth (Kahhat, 1999). The model proposed here is consistent with that same framework proposed in Dasgupta (1993), where the norms play an equilibrium selection role in an environment with multiple equilibria.

3. Intra-household Contracting, Child labor, and Technology

Whenever parents make the decision of whether to send a child to school or to work or, for that matter, at what age the child should start working, they face different restrictions. These can be related to the financial condition of the family, legal restrictions, social norms, and emotions, among others. In this context, filial obligations, as social norms of mutual care between parents and children, may have an effect on the existence of child labor and its persistence. As explained above, the literature on child labor has overlooked these issues by assuming parents are

altruistic and have some variable related to the child's welfare as an argument of their own utility function.[4]

It is now common to quote Richard Dawkins, who proposed in *The Selfish Gene* that altruism is not inherent to our nature. Evolutionary forces may eliminate those altruistic feelings over time. Empirical research, on the other hand, has found mixed evidence on the altruistic hypothesis within the family using data of *inter-vivos* monetary transfers (Parsons and Goldin, 1989; Cox and Rank, 1992; Altonji, et. al., 1997). Altruism has to be taught, according to this view. One way in which reciprocal care between parents and children can be learned is by observation.

The empirical observation shows that parents do invest in the schooling of their children. On the other hand, schooling of children is mandatory under specific legislation. In principle, compulsory schooling laws and regulations that restrict child labor would not be necessary if parents did not have, under certain conditions, incentives to send their children to work in lieu of sending them to school. T.H. Green stated the following in his lecture on freedom of contract in 1880:

> "It was the parliament elected by a more popular suffrage in 1868 that passed, as we know, the first great education act. This act introduced compulsory schooling.
>
> The principle was established once for all that parents were not to be allowed to do as they willed with their children, if they willed either to set them to work or to let them run wild without elementary education. Freedom of contract in respect of all dealings with the labour of children was so far limited." (Nettleship, 1900).

[4] In a way, that can be interpreted as parents having internalized a specific social norm. Another social influence on the parents' decisions is by stigmatizing those who send their children to work (López-Calva, 2000).

Green is thus implying that sending the children to work could be a rational decision on the side of the parents --which had to be prevented by law. He was also stating that freedom of contract between parents and their offsprings should be restricted. Clearly, contracts between parents and their descendants were not signed and enforced by a court. Informal enforcement, however, can make implicit agreements within the household sustainable. Dessy (1999) analyzes the impact of compulsory education on child labor in a dynamic setting with altruistic parents and concludes that such laws are likely to reduce the incidence of child work.

There is thus a view of the relationship between parents and children that sees it as an intergenerational game of self-interested individuals, with respect to certain economic decisions. The question then arises of whether it is possible, even under such a framework, to explain the observed empirical regularity of mutual care between parents and their children. If those informal contracts, which we call social norms, can solve the problem of potentially opportunistic behavior by descendants, the next step is to investigate whether those norms eliminate the existence of child labor or, in any case, under which conditions this occurs.

Becker (1993) comments on the contracting problem stating that:

> "It is easy to see why children's and parents' earnings may be closer in poorer families... Many poorer parents would be willing to lend their children money to help them obtain further training if the parents could expect to get paid back later when they are old. But children may not carry out their part of the bargain, especially in highly mobile societies where children often live far from their parents." (Becker, 1993, p. 22)

This is what Becker (1993) and Baland and Robinson (1999) investigate: that child labor may arise because of that type of a contracting problem. If parents invest

in the human capital of their children, the latter may have an incentive to cheat and fully internalize the benefit of that schooling, without sharing it with their parents when the latter are old. Those contracts, however, can be shown to be sustainable as informal "social norms." The "Beckerian" perspective neglects this possibility. Dasgupta (1993) gives indeed an intuitive proof of the fact that such informal contracts are sustainable as an equilibrium.

On the other hand, Grootaert and Kanbur (1995) mention evidence that shows that child labor is sensitive to technological development in ways that are not obvious and have not been analyzed carefully in the literature. Under the social norm, the fact that technological change may increase the return to schooling leads to the result that parents would be facing a transfer in the future that is a function of the amount of schooling they gave to their children. *A priori*, the sustainability of the social norm of mutual care shall be then reinforced by technological change. possibility is also investigated further below.

4. The Model : Overlapping Generations and Social Perception of Parents

Consider an overlapping-generations model with agents that live for periods: childhood, adulthood, and old-age (see figure 1). Following the unitary model of the household, the parent shall be the decision-maker during adulthood. During childhood, children receive schooling and food from their parents. When adults they give birth to a child, feed her, decide on the amount of time the child should go to work and to school, and supply their own labor inelastically in the labor market. In the same period, they will also decide on whether to give a transfer to their retired parents, who cannot work during old age. During the third period, they retire and can only consume either from their own savings or from transfers given to them by their then adult offspring.

Once the child has grown up, however, the room for opportunistic behavior *á la* Becker arises. The adult has to decide on whether to transfer money to her retired parents or not. An informal intergenerational contract exists, which can only be enforced through "social punishment." The social perception of the adult's decision shall determine the optimal reaction of her own kid and thus whether she is going to get a transfer when retired. Assume that at the beginning of history, a parent is considered good. Let us call such an individual Adam. From that point on, adults must decide whether to transfer money to their parents or not, which will derive in a 'social perception" of them. This perception is defined as follows:

The Social Perception.

i) If *i*'s parent is "good," *i* is considered good if and only if *i* gives her parent at least a fraction *q* of her income.

ii) If *i*'s parent is not good, then *i* shall be considered "good" regardless of whether she transfers money to her parent or not.

According to the social perceptions just defined, every adult will always be in either of two possible situations: having a "good" (deserving) parent or having one that is not good.

Now, it is possible to state a social norm of filial obligations, which may or may not be followed by the agents.

The Social Norm:

As an adult,

i) If your parent is "good" (deserving), give her at least q proportion of your income;

ii) If your parent is not "good", do as you like.[5]

The decision of the adults of whether to follow the norm or neglect it shall be based upon what they observed during childhood, i.e., the perception they have of their own parents. Moreover, they shall take into account what they expect their own child to do in the future, which is a function of their own decision today. Parents can decide whether to be "good" or not "good."

A child requires a certain amount of consumption and, if not fed at all, she would die. Hence, under a very simple assumption, namely that the amount that is needed to feed the child is lower than then minimum of the child wage and the discounted value of the transfer under the norm, non-altruistic parents will always feed their children. The parents can get higher consumption during the current period if the child works and higher consumption during old age if the child goes to school and transfers money to them. Hence, it is rational for the parents to feed the child. The question investigated below is whether the social norm can be sustained as an equilibrium in the intergenerational game and what effect that has on schooling and child labor decisions.

4.1 Technology and the Problem of the Firms

In order to capture the relevance of technology to the incidence of child labor under the social norm, the model assumes a technology similar to that in Galor and Weil (1996). There are three inputs: physical capital, physical labor, and "mental"

[5] This is exactly the type of norm discussed in Dasgupta (1993). An application to the analysis of fertility, schooling, and growth, with altruistic parents, can be found in Kahhat (1999). Dasgupta (1993) requires the children to punish undeserving parents in order for them to be considered as deserving. The specification here simplifies the possible histories of the game at each point in time.

labor.[6] The assumption is that children posses only physical labor, whereas the adults potentially have both physical labor and "mental" labor, i.e. human capital accumulated through schooling. Technological change affects the return of "mental" labor, without having an effect on the return to physical labor, favoring the relative return of the former. There are *m* firms in the economy.

The technology is specified as follows:

$$Y_t = K_t^{\gamma}[A(t)L_{mt}]^{1-\gamma} + BL_{pt}$$

Where Y is output, L_m and L_p are units of mental and physical labor, respectively, $A(t)$ is a parameter of technological progress that changes over time, B is a constant, and the time period is denoted by t.[7] For the sake of simplicity, it shall be assumed that the economy is open to capital flows and therefore the interest rate is determined at the international level, assumed to be fixed and equal to r. Under this framework, the wages for units of physical labor and units of "mental" labor can be obtained and they will be equal to their marginal products, denoted by w_p and w_m, respectively.

Following the traditional model of overlapping generations, the problem of the firms is solved, every period, as:

$$\max_{L_m, L_p, K} \prod = Y_t - w_p L_{pt} - w_{mt} L_{mt} - rK_t \qquad 0 \le \gamma \le 1$$

[6] Physical labor can be interpreted as pure "force", whereas mental labor is related to acquired skills and, in general, human capital.

[7] Galor and Weil (1996) use the same inputs in a CES production function.

Physical capital, can be expressed in efficiency units of "mental" labor, as $k_t = \frac{K_t}{A(t)L_{mt}}$ Also, using the latter expression, wages and the return to capital are given by:

$$w_p = B \tag{1}$$

$$w_{mt} = (1-\gamma)A(t)k^{\gamma} \tag{2}$$

$$r = \gamma k^{\gamma-1} \tag{3}$$

The environment is competitive, so profits vanish in equilibrium. Given the assumption that the interest rate r is constant and determined by the international market, k will also be fixed, as follows from (3). From (1) and (2), as the economy shows technological improvement --changes in the parameter A that increases productivity, the return to "mental" labor increases, whereas the return to physical labor remains constant. The existence of savings justifies the existence of capital in the model, in the sense that parents' savings are converted into physical capital. This is important because savings are an alternative way of consumption-smoothing for parents.

Under the assumption that children shall transfer money to their parents when they reach adulthood, the technological improvement increases the relative return of investing in a child's schooling with respect to the return of sending the child to work, at a given discount rate.[8] The overlapping generations structure is exploited to analyze the sustainability of the social norm but there is no growth in this economy.

[8] In Galor and Weil (1996) the assumption is that women have only "mental" labor while men have both physical and "mental" labor. Accumulation of physical capital and technological change both affect the returns to mental labor positively, which is used to explain the reduction of the wage gender gap over time.

The effect of different levels of physical capital on the relative returns to human capital shall be investigated in a comparative statics fashion.

4.2 The Problem of the household

Consider an economy with n identical households. Each household has preferences represented by a logarithmic utility from consumption in both periods. Let us assume the utility is also time-separable, so that the problem of the representative agent consists of maximizing

$$\underset{c_t^i, e^{i+1}, s^i}{Max}\, U(c_t^i, c_{t+1}^i) = \ln c_t^i + \beta \ln c_{t+1}^i$$

$$s.t. \quad c_t^i + s^i \leq (w_{mt} h^i + w_p) + w_p(1 - e^{i+1}) \tag{4}$$

$$c_{t+1}^i \leq s_t^i R \tag{5}$$

$$0 \leq e^{i+1} \leq 1$$

$$0 \leq s^i$$

Here, c_t^i gives us the adult consumption for generation i at time t, β denotes the subjective discount factor, and $R = (1+r)$ is the gross interest rate. The restriction (4) states that consumption and savings together cannot exceed the income generated by the household. The sources of such income are the wages earned by the adult himself: w_m per unit of human capital $h_{,}$, plus w_p, the amount earned from the provision of physical labor. The wages earned by the child are also added as w_p per unit of time that the child worked instead of going to school (this amount of time is $1 - e^{i+1} \equiv a^{i+1}$, normalizing total available time of child to one). The assumption here, as explained, is that children posses only physical labor, while adults have "mental" labor in addition to that, given by their level of human capital. The restriction (5)

says that the consumption during old age cannot exceed the savings amount plus accrued interest. The fact that savings are assumed to be non-negative incorporates the borrowing constraints into the model, as in Baland and Robinson (1999) and Ranjan (1999a, b). Relaxing that constraint would be unrealistic, though it could reduce the amount of child labor in equilibrium.

Assume now that the norm exists and the individual has a parent who has been good. That could happen at any point in time. The individual could choose whether to give a positive transfer to her parent or not, considering the social perception of her that the decision would trigger. The second constraint (4) in the problem above becomes $c_t^i + s^i \leq (1-q^i)\{(w_{mt}h^i + w_p) + w_p(1-e^{i+1})$, which tells us that the amount left to the adult after a transfer of a fraction q^i of income to her parent has to be enough to cover their own consumption and savings, s^i. On the other hand, her income in old age would now be:

$$c_{t+1}^i \leq q^{i+1}\{(w_{mt+1}h^{i+1} + w_p) + w_p(1-e^{i+2})\} + s_t^i R$$

which corresponds to the sum of the amount received as a transfer from her offspring, plus the savings during adulthood including interest.

Two more things have to be specified, namely the function that tells us how human capital is accumulated --the production function of human capital-- and the minimum transfer specified by the norm. These two restrictions complete the adult's problem:

$$h^{i+1} = h_0 + e^{i^{\alpha}} \qquad (6)$$

$$q^i \geq \bar{q} \geq 0 \qquad (7)$$

The production of human capital says that there is a given endowment, h_0, to which more human capital can be added through schooling. The specification establishes diminishing marginal returns to schooling, for the parameter $\alpha \in (0,1)$ The latter parameter shall be interpreted as the "quality" of schooling.

The Equilibrium

The above environment leads to a description of an economy with a market for physical labor and a market for mental labor, as well as a market for capital. is a homogeneous good, but this market clears when the other three clear, invoking Walras' law. The full specification of the competitive equilibrium is the following:

Definition: A sequence of allocations: $(K^*, L_{pt}^*, L_{mt}^*, e^*, q^*, s^*)$ for t=0,1 and a sequence of price vectors (w_p^*, w_{mt}^*, R^*) for t=0,1, , constitute a competitive equilibrium in this economy if the following conditions simultaneously hold, at every t:

(i) The vector $(K^*, L_{pt}^*, L_{mt}^*)$ satisfies the optimality conditions for the firm.

(ii) The vector (e^*, q^*, s^*) satisfies the individual optimality conditions.

The markets clear, i.e., (w_p^*, w_{mt}^*, R^*) are such that,

Physical Labor Market: $mL_{pt}^* = (2 - e^*)n$

Mental Labor Market: $mL_{mt}^* = h_t n$

Capital Market: $mK^* - [ns(r)^* + f(r)] = 0$, where f is the external flow of capital (either inflow or outflow).

There is, however, a strategic element to this equilibrium on the side of the agents. As shown below, without a social norm the equilibrium would reflect a standard competitive equilibrium. When the norm is imposed as a social restriction that appears as a constraint in the problem of the agents, equilibria with such social norm being sustained shall emerge, when abiding by such a norm is incentive compatible for all the agents. The strategic decision for adult i, in terms of the norm, is to choose

$$[q^{i*} | \text{parent's type}, E(q^{*i+1})]$$

Which is the optimal amount to be transferred to the parent, given the perception he has of his own parent (parent's type: *good* or *not good*), and the expected optimal response of his daughter.

Equilibrium with no transfers

Suppose an adult chooses not to transfer money to her parent. That would trigger an equilibrium norm where the transfer is zero for the next generations, as specified in the next result. The result is as follows:

Proposition 1: *There exists an equilibrium in which the social norm implies no transfers to the retired parents. In such an equilibrium, parents will have no incentives to invest in the schooling for their child.* ($e^*=0$, $q^*=0$).

Proof: See Appendix

This result is consistent with the discussion in Becker (1993) and Baland and Robinson (1999). If adults expect their children not to transfer money to them when

old, the best response is to send them to work because in that way they can extract full consumption gains in that period. Hence, along this equilibrium path, full child labor occurs.

Given the preferences, individuals will save a constant fraction, $\varphi = \frac{\beta}{1-\beta}$, of their income. Consumption and savings are thus given by:

$$s^i * = \varphi(w_{mt} h_0 + 2w_p)$$
$$c_t^i * = (1-\varphi)(w_{mt} h_0 + 2w_p)$$
$$c_{t+1}^i * = \varphi R(w_{mt} h_0 + 2w_p)$$

Equilibrium norm with transfers

There are equilibria in which the norm implies positive transfers. Moreover, the social norm can generate incentives to invest in schooling even by purely non-altruistic parents, reducing the level of child labor.

Let us define the family income at time t as: W_t when children in all generations receive a positive amount of schooling in equilibrium, $e^i * \ \forall i$. Then,

$$W_t \equiv w_{mt}(h_0 + e^i *^{\alpha}) + w_p[1 + (1 - e^{i+1} *)]$$

Let us also define $\omega_t = \frac{w_{mt}}{w_p}$, the relative return to mental labor with respect to physical labor.[9] Also, define

$$\delta = \left[\qquad \right]^{\frac{}{1-\alpha}}$$

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[9] Thus, $\omega_{t+1} = \frac{w_{mt+1}}{w_p}$

The second proposition can thus be stated:

Proposition 2: *There exists a Nash equilibrium, under the norm, that involves positive transfers,* $q_i = \overline{q} \geq 0$. *This will be the outcome of the interaction under the following condition:*

$$e^{i+1} * w_p + \overline{q} W_t < \frac{\overline{q}}{1 + \alpha} W_{t+1}$$

Moreover, on the equilibrium path parents shall always be good, and the investment in schooling is positive. The resulting optimal level of child labor (a^{i+1} **) will be.*

$$a^{i+1} * = \begin{cases} 1 - \delta \omega_{t+1}^{\frac{1}{1-\alpha}} \ (>0) & \text{if} \quad \delta \omega_{t+1}^{\frac{1}{1-\alpha}} < 1 \\ 0 & \text{if} \quad \delta \omega_{t+1}^{\frac{1}{1-\alpha}} \geq 1 \end{cases}$$

Proof: See Appendix 1

The specification of the environment in terms of technology, as well as our assumption that there is an open market for capital, implies that the demand for mental labor would be perfectly elastic at the competitive wage, and physical labor would be remunerated at its marginal productivity. That allows to state the proposition in terms wages, which shall be determined by exogenous parameters: parameters related to technology, including the productivity shifter in the production function, *A(t)*, the marginal productivity of labor, *B*, and the gross interest rate, *R*.

The condition in Proposition 2 has a clearly intuitive interpretation. It tells us that abiding by the norm with positive transfers is a *Nash* equilibrium if the benefit doing so is at least as high as the cost. The cost of abiding by the norm consists of the sum of the forgone child labor wages the parent incurs by giving the child optimal

schooling, added to the amount they actually transferred to their retired parents. The benefit, on the other hand, is simply the discounted value of the transfer that the adult will get when retired if he followed the norm in the previous period, given that he will be considered deserving, which triggers an optimal response of the child that involves a transfer.

Parents shall always be *good* on the equilibrium path and they shall always invest in schooling for their children. This is so because of the social perceptions actions trigger on others, concretely their children. There are two possible histories of the game at each point in time: either the adult's parent is *good* or *not good*. In the former case, under the conditions given above, parents shall always choose to be *good* and abide by the norm. In the latter case, they shall make a gain by not giving a transfer to their parents and still being considered *good*, but in order to maximize the return from their children's transfer, the optimal amount of schooling shall be positive.[10] In equilibrium, however, no parent would choose to be considered *not good*, for that would go against her own interest.

Comparative Statics

Implications on the incidence of child labor can be inferred by implementing a simple comparative statics exercise.

Proposition 3: *Under the social norm, there will be a reduction in the incidence of child labor when at least one of the following occurs:*

i) *The quality of schooling, α, increases,*

ii) *The relative wage of mental labor, ω, increases;*

[10] The social perception of an adult not giving a transfer to a *not good* retired parent is *good*. Thus, her child's best response is to give her a transfer in order to preserve a good social perception. In this manner, the scenario goes back to an equilibrium with positive transfers.

iii) *The interest rate, R, decreases; and*

iv) *The transfer specified under the norm, as a proportion of household income, q, increases.*

Proof: This can be easily verified by taking partial derivatives of a^{*i} with respect to the relevant parameters.

Thus, even in a world of non-altruistic parents, a social norm of filial obligations allows a reduction/abolition of child labor as the economy develops via innovations of technologies (which increases the mental labor wage) and improvement in the educational system.

The results so far would be valid only for the case of filial obligations that are fulfilled through that simple technology: that in which care is provided through monetary transfers. However, time is a very important input for care, especially in developing countries. Parents are looked-after by their children during old age not by exclusively transferring money, but by allowing them to live in same household and spending time with them. A care technology that allows for such a possibility is thus needed. That is the motivation of the more general setting developed in the following section.[11]

5. Time as an Alternative Input for Care

In this section, we introduce the notion that parents, when old, consume a composite commodity, termed "care". The care that an adult of generation *i* provides

[11] There are economies of scale to be exploited by creating extended households. There are also benefits by using the old parent's time to take care of children in the family. Those situations are not analyzed here. Dasgupta (1993) discusses the fact that in poor environments retired parents move to their children's homes and require time-intensive care.

to their parents of generation (*i-1*) consists of two inputs: monetary transfers (goods): z_{t+1}^i and time: v^i. The care technology is defined as follows:[12]

$$g(z_{t+1}^i, v^i) = z_{t+1}^i v^i$$

There is thus partial substitution between the two inputs. This specification measures consumption of care in monetary terms. Also, it has the property that increases in one of the inputs also increase the marginal utility of the other. [13]

The social norm is specified as before, though the restriction on the transfer requires now a certain amount of care, which can be provided by money (goods) or time (foregone income). Under this setting, consistent with the latter interpretation, the norm is imposed as a proportion of the household full wage[14].

With this new specification of care technology, the analog of the adult's problem in section 2.4 consists of maximizing the same utility function, choosing the vector $(c_t^i, s^i, z_t^i, v_t^i, e^i+1)$, subject to the constraint that states that her consumption, savings, and money transfer to parents cannot exceed total income, part of which is reduced by the time spent providing care to the retired parent, $c_t^i + s^i + z_t^i \leq (w_{mt} h^i + w_p)(1 - v_t^i) + w_p(1 - e^{i+1})$, as well as the constraint that specifies the possibilities of consumption during old age, including income from savings, and consumption of care provided by the descendant, $c_{t+1}^i \leq z_{t+1}^i v_{t+1}^{i+1} + (1+R)s^i$ Also, the minimum amount of care provision specified by the norm is considered as a restriction –valued in terms of consumption of goods, $z_t^i v_t^i \geq \theta(w_{mt} h^i + 2w_p)$. The parent expects that being "good" will trigger a response with positive transfers in the

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[12] The "care" technology uses the same inputs as the fixed-proportions technology proposed in Galor and Weil (1995).

[13] That is, if the daughter increases the time spent with the parent, the marginal utility of every dollar transferred to him also increases.

[14] Household full wage is defined as the sum of adult full wage and child full wage.

next generation, $z_{t+1}^{i+1} v_{t+1}^{i+1} \geq \theta(w_{mt+1} h^{i+1} + 2w_p)$. Finally, human capital is accumulated in same way as before, and there are non-negativity constraints, $0 \leq e^{i+1} \leq 1$, $0 \leq v_{t+1}^{i+1} \leq 1$, and $0 \leq \theta \leq 1$

It is important to recall that the analysis is on the equilibrium path, which is be contrasted with the possible deviations when proving the sustainability of the norm.

5.1 The Equilibrium

The competitive equilibrium is defined as follows.

Definition: An allocation: $(K^*, L_{pt}^*, L^*_{mt}, a^*, z^*, v^*, s^*)$ and a price vector $(w_p{}^*, w_{mt}{}^*, R^*)$ constitute a competitive equilibrium in this economy if the following conditions simultaneously hold, at every t:

(i) The vector $(K^*, L_{pt}^*, L_{mt}^*)$ satisfies the optimality conditions of the firm's problem.

(ii) The vector $(s^*, a^*, z^*, v^*, e^*)$ satisfies the individual optimality conditions, for every adult.

The markets clear, i.e., $(w_p{}^*, w_{mt}{}^*, R^*)$ are such that,

Physical Labor Market: $m L^*_{pt} = (1 + a^*) n$

Mental Labor Market: $m L^*_{mt} = hn$

Capital Market: $mK^* - [ns^*(r) + ef_t(r)] = 0$, where ef is the external flow of capital (either inflow or outflow).

Next, we will define the family income at time t when children in all generations receive a positive amount of schooling in equilibrium, $e^i * \forall i$ as $\widetilde{W}_t$

$$\widetilde{W}_t \equiv [w_{mt}(h_0 + e^{i*\alpha}) + w_p](1 - v^i*) + w_p(1 - e^{i+1}*)$$

Using this definition of potential family income, and the same definition of ω_t as above, the conditions for the social norm of mutual care to be sustained as an equilibrium and its effect on child labor can be expressed as follows.

Proposition 4: *Abiding by the social norm, that is, an adult of generation i giving a transfer of* $\theta(w_{mt}h^i + 2w_p)$ *to her retired parent, is a Nash equilibrium for all generations under the following condition.*

$$(w_{mt}h^{*i} + 2w_p) - (\widetilde{W}_t - z^{i*}) \leq \theta\ (w_{mt+1}h^{i+1*} + 2w_p)$$

Moreover, on the equilibrium path parents shall always be good, and investment in schooling is positive. The resulting optimal level of child labor (a^{i+1*}) *will be:*

$$a^{i+1}* = \begin{cases} 1 - \left\{\dfrac{\theta\omega_{t+1}\alpha}{R}\right\}^{\frac{}{1-\alpha}} (>0) \ \textit{if} \left\{\qquad\right\}^{\frac{}{1-\alpha}} < 1 \\ 0 \qquad\qquad \textit{if} \qquad \left\{\dfrac{\theta\omega_{t+1}\alpha}{R}\right\}^{\frac{}{1-\alpha}} \geq 1 \end{cases}$$

Proof: See Appendix

The interpretation of the condition is consistent with the discussion in Proposition 2. It requires that the benefits the adult gets from following the norm are greater than the cost. The benefit is the discounted value of the transfer that they will receive when retired, whereas the cost is the reduction in the expenditures due to the transfer they provide to their retired parents. The latter includes the monetary value of time and goods, as well as the foregone income for sending the child to school.

The decisions in terms of whether to offer time-intensive care or money-intensive care shall be given by the relative prices, and thus shall be influenced by

technological change. This can be seen by looking at the equilibrium level of time-care provided to old parents, $v_t^{i^*}$, which is

$$v_t^{i}* = \sqrt{\theta\left[1+\frac{1}{\omega_t h_i + 1}\right]}$$

It is clear that the optimal level of time care decreases as the mental to physical wage ratio increases.

The level of human capital also has an effect on the optimal form of parental care. An increase in either the quantity or quality of schooling will add more human capital to the child when he grows up and thus induce the adult to substitute time-intensive care with money-intensive care.

Under the norm, higher returns to mental labor via technological change over time would induce a lower level of child labor and more money-intensive care, which is the case in the developed economies, where care provided by descendants is money-intensive (see Altonji, et. al., 1997). Poor countries, on the other hand, show more child labor (lower level of schooling) and relatively time-intensive care, which is also consistent with the model. Whether an economy is in one situation or the other depends upon specific parameter values: interest rates, relative return to skilled labor with respect to unskilled labor, and the quality of schooling.

5.2 Comparative Statics

The incidence of child labor shall not only depend upon the existence of the norm, but also upon the parameter configuration in the economy. This is summarized in the next Proposition

Proposition 5: *Under the social norm, there will be a reduction in the incidence of child labor when at least one of the following occurs.*

i) *The quality of schooling, α, increases;*

ii) *The relative wage of mental labor, ω, increases;*

iii) *The interest rate, R, decreases; and*

iv) *The monetary value of the transfer specified by the norm, measured by the proportion θ, increases.*

Proof: Simple partial derivatives of a^{*i} with respect to the relevant parameters.

Proposition 5 tells us that generalizing the form of parental care does not alter the implication for the incentives of the parents to send their children to work, even under the norm. This result is very important, for it establishes that the solution to contracting problem between generations through social norms of mutual care, norms that are sustained in equilibrium, does not eliminate the incidence of child labor in itself. In that sense, Becker (1993) and Baland and Robinson (1999) only partially explain the causes of this phenomenon. Technological conditions and relative prices, which may change during the development process, have to also satisfy specific conditions.

6. Concluding Remarks

Unlike static, one-period models of child labor, where altruism requirement for parents to reduce child labor and increase investment in schooling, this model shows that a social norm of filial obligations solves the intergenerational contracting problem in an informal, though sustainable manner. Under the norm, different stages of development, as represented by the relevant parameters of the economy, may explain differences in the observed incidence of child labor and schooling.

Contracting problems that have been discussed by Becker (1993) and emphasized recently in models of child labor (Baland and Robinson, 1999) can thus be solved if the norms of mutual care are informally enforced in equilibrium. These social norms do not have to be internalized in the preferences. Though there are multiple equilibria, an empirically relevant equilibrium is the one that is rationalized in this model. It is an observed regularity that adults do take care of their parents and invest in their children's schooling in different countries and under different conditions. Altruism, often assumed in order to obtain the desired result, required in this model in which there are purely self-interested individuals. The social norm plays an "equilibrium selection" role. The idea has been used, in a different context, by Kreps (1985), and in similar contexts by Dasgupta (1993), and Kahhat (1999).

We have shown that, under the social norm of intergenerational reciprocity, as the economy experiences technological innovation and the return to human capital relative to physical labor increases, child labor is reduced and retired parents are looked-after in a money-intensive fashion. When the care technology allows for time and monetary transfers (goods) as inputs, the model yields results that are consistent

with cross-country empirical evidence: poor countries --countries with lower productivity growth, and lower average quality of schooling-- are predicted to show more child labor and time-intensive care of retired parents.

Two extensions to the model would be worth pursuing. First, adding a law of motion of physical capital to introduce growth and endogenously change the parameters of the economy to describe the evolution of child labor over time, under the norm. Second, introducing heterogeneity among households to investigate the coexistence of different levels of child labor in the same economy for a given set parameters.

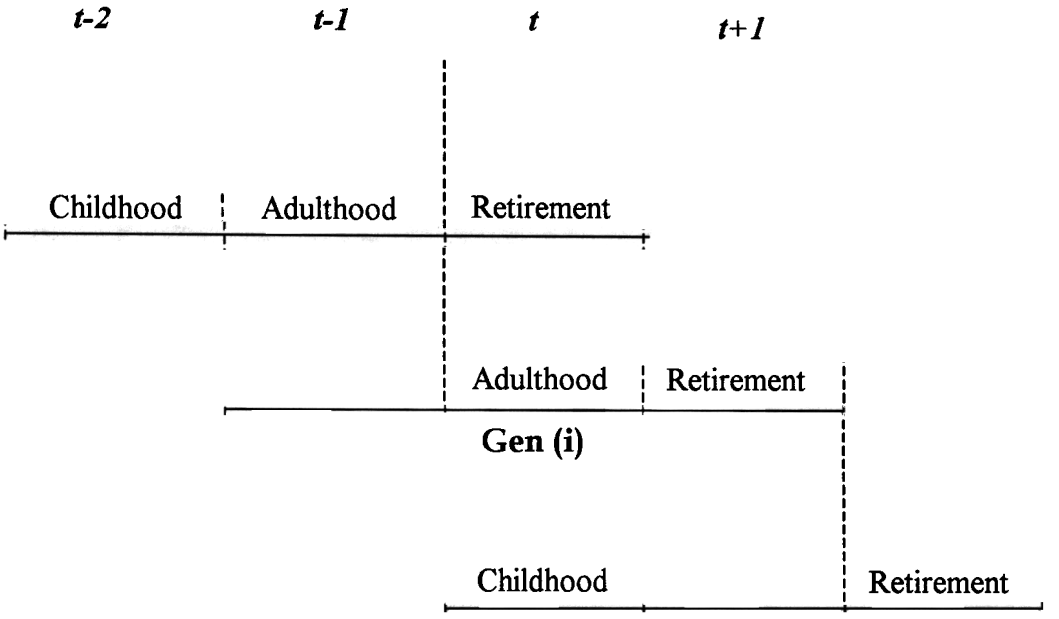

Figure 1
Description of the Overlapping Generations Structure

Appendix

Proof of Results

A1. Proof of Proposition 1

When there is no social norm, the problem of the adult will be:

$$\underset{c_t^i, e^{i+1}, s^i, q^i}{Max} U(c_t^i, c_{t+1}^i) = \ln c_t^i + \beta \ln c_{t+1}^i$$

$$s.t. \quad c_t^i + s^i \le (1-q^i)\left\{(w_{mt}h^i + w_p) + w_p(1-e^{i+1})\right\}$$

$$c_{t+1}^i \le q^{i+1}\left\{(w_{mt+1}h^{i+1} + w_p) + w_p(1-e^{i+2})\right\} + s^i R$$

$$0 \le e^{i+1} \le 1$$

$$0 \le s^i$$

Clearly, without the norm that imposes $q^i > \overline{q}$, the adults will optimally choose not to send any transfers to the retired parent: $q^i = 0$. The utility function is monotonic in consumption, and any positive transfer would reduce adult's consumption. Thus the above problem will simplify to:

$$\underset{c_t^i, e^{i+1}, s^i, q^i}{Max} U(c_t^i, c_{t+1}^i) = \ln c_t^i + \beta \ln c_{t+1}^i$$

$$s.t. \quad c_t^i + s^i \le w_{mt}h^i + w_p + w_p(1-e^{i+1})$$

$$c_{t+1}^i \le s^i R$$

$$0 \le e^{i+1} \le 1$$

$$0 \le s^i$$

Thus, the adults will optimally choose zero schooling for their child. Schooling reduces consumption in period t without adding any benefit in period $t+1$. Given that parents prefer higher consumption in both periods, they would not invest in schooling. ■

A2. Proof of Proposition 2

The goal here is to obtain the parameter restriction under which the parents will have incentives to abide by the norm on the assumption that all other generations do so. This can be done simply by comparing the indirect utility function under the case when the parents abide by the norm (V_1) with the case when they deviate from the norm (V_0). The former can be obtained by solving the following problem:

$$\underset{c_t^i, e^{i+1}, s^i, q^i}{Max} U(c_t^i, c_{t+1}^i) = \ln c_t^i + \beta \ln c_{t+1}^i$$

$$s.t. \quad c_t^i + s^i \le (1-q^i)\left\{w_{mt}h^i + w_p) + w_p(1-e^{i+1})\right\}$$

$$c_{t+1}^i \le q^{i+1}\left\{w_{mt+1}h^{i+1} + w_p) + w_p(1-e^{i+2})\right\} + s^i R$$

$$h^{i+1} = h_0 + e^{\alpha}$$

$$q_i \ge \bar{q}$$

$$0 \le e^{i+1} \le 1$$

$$0 \le s^i$$

First, note that the adult from generation i will choose the level of transfer: q^i to be equal to the minimum amount required by the norm: $q^i = \bar{q}$, since the marginal utility of q^i is strictly negative.

By solving for the first order conditions and combining them, the following results obtain:

$$e^{i+1}{}_* = \left[\frac{(1-\bar{q})(1+r)w_p}{\alpha\, \bar{q} w_{mt+1}}\right]^{\frac{1}{\alpha-1}}$$

$$s^i = \frac{\beta R(1-\bar{q})\left\{w_{mt}h^i{}_* + w_p) + w_p(1-e^{i+1})\right\} - \bar{q}\left\{w_{mt+1}h^{i+1}{}_* + w_p) + w_p(1-e^{i+2})\right\}}{(1+\beta)R}$$

$$c_t^{i*} = \frac{1-\bar{q}}{1+\beta} W_t + \frac{\bar{q}}{(1+\beta)R} W_{t+1}$$

$$c_{t+1}^{i\,*} = \frac{\beta R(1-\bar{q})}{1+\beta} W_t + \frac{\beta \bar{q}}{1+\beta} W_{t+1}$$

Note that this result implies that the introduction of the norm induces parents to invest in a positive amount of schooling $e^{i+1} *> 0$

Next, V_0 can be obtained by solving the parent's problem when he deviates from the norm. The deviation implies two things:

i) The transfer to the current adult's parent would be zero, notwithstanding the fact the father was *good* according to the rule of social perception.

ii) Given that the daughter of the current adult shall consider him *not good* after that action, the transfer next period shall be zero, which makes it optimal for the adult not to invest in schooling of the child. Hence, the problem of the adult that deviates becomes,

$$\underset{c_t^i, s^i}{Max} U(c_t^i, c_{t+1}^i) = \ln c_t^i + \beta \ln c_{t+1}^i$$

$$s.t. \quad c_t^i + s^i \le w_{mt} h^i + 2w_p$$

$$c_{t+1}^i \le s^i R$$

$$0 \le s^i$$

Note that the human capital of the decision-maker (the adult) is $h^i = h_0 + e^{i\,*\alpha}$ since the assumption is that parents of all other generations are abiding by the norm. Thus, from the above two problems we can obtain the two indirect utility functions:

$$V_0 = \ln\left[\frac{w_{mt}(h_0 + e^{i} * \alpha) + 2w_p}{1+\beta}\right] + \beta \ln\left[\frac{\qquad\qquad\qquad\qquad}{1+\beta}\right]$$

$$V_1 = \ln\left[\frac{1-\bar{q}}{1+\beta}W_t + \frac{\bar{q}}{(1+\beta)R}W_{t+1}\right] + \beta \ln\left[\frac{\beta R(1-\bar{q})}{1+\beta}W_t + \frac{\beta\bar{q}}{(1+\beta)}W_{t+1}\right]$$

By comparing V_0 and V_1, the next result obtains,

$V_1 > V_0$ only if

$$e^{i+1} * w_p + \bar{q}W_t < \frac{\bar{q}}{R}W_{t+1}$$

as established in Proposition 3. This is the incentive compatibility condition for the norm to be sustained. This establishes that abiding by the norm is a *Nash* equilibrium.

To show that parents shall be *good* on the equilibrium path, it is necessary to analyze the optimal response of the adults for every possible history of the game.

There are only two possible histories of the game at each period: either the parent of the adult at that point is *good* or *not good*. Since the former case has already been considered in the proof of the Nash equilibrium, it is sufficient to consider only the latter case.

Suppose the parent of the current adult is *not good*. Then the social norm tells the adult that whatever transfer she gives to this *not good* parent (including a zero transfer), the social perception shall make her child consider her as *good*. It is optimal for the adult to then give a zero transfer to the *not good* parent.

The optimal response of her child in the next period, under the condition given above, is to give a transfer to his g*ood* parent (otherwise, he would trigger a zero transfer of his own child). In order to maximize the returns from the transfer, the adult shall choose a positive amount of schooling. Thus, on the equilibrium path,

parents shall always be *good* and schooling shall always be positive under the norm, under the given condition. ■

A3. Proof of Proposition 4

The basic idea of this proof is the same as in the proof of Proposition 2. The goal is to obtain the condition under which the parents have incentives to abide by the norm. Before obtaining the indirect utility function under the norm, it is necessary to first analyze the optimal form of parental care.

Let $v_t^i \in [0,1]$ be the amount of time, z_t^i be the amount of goods spent by the adults of generation i to take care of their old parents, and $z_t^i v_t^i$ be the final composite good produced by adults by combining their time and goods.

The problem of an adult of generation i will then be:

$$\underset{c_t^i, s^i, z_t^i, v_t^i, e^{i+1}}{Max} \ln c_t^i + \beta \ln c_{t+1}^i$$

s.t.

$$c_t^i + s^i + z_t^i \le (w_{mt} h^i + w_p)(1 - v_t^i) + w_p (1 - e^{i+1})$$

$$c_{t+1}^i \le z_{t+1}^i v_{t+1}^{i+1} + Rs^i$$

$$h^{i+1} = h_0 + e^{i+1^{\alpha}}$$

$$z_t^i v_t^i \ge \theta (w_{mt} h^i + 2w_p)$$

$$z_{t+1}^{i+1} v_{t+1}^{i+1} \ge \theta (w_{mt+1} h^{i+1} + 2w_p)$$

$$0 \le e^{i+1} \le 1$$

$$0 \le v_{t+1}^{i+1} \le 1$$

From the two social norm constraints and the budget constraints, it can be concluded that the social norm constraint binds: $z_t^i v_t^i = \theta(w_{mt} h^i + 2w_p)$, $z_{t+1}^{i+1} v_{t+1}^{i+1} \geq \theta(w_{mt+1} h^{i+1} + 2w_p)$

Thus, at the equilibrium, adult i shall minimize the expenditure on her parents: $Z_t^i + (w_{mt} h^i + w_p) v_t^i$ by solving the following problem:

$$\underset{v_t^i \in [0,1]}{Min} \left\{ \frac{\theta (w_{mt} h^i + 2w_p)}{v_t^i} + (w_{mt} h^i + w_p) v_t^i \right\}$$

The interior solution to this problem is: $v_t^i * = \sqrt{\theta \left(1 + \frac{w_p}{w_{mt} h^i + w_p} \right)}$ and $z_t^i = \sqrt{\theta (w_{mt} h^i + 2w_p)(w_{mt} h^i + w_p)}$ Note that, under the norm, there will be no corner solution where $v_t^i * = 0$. Thus all adults provides at least some amount of time care.

By solving for the first order conditions, we obtain the following results:

$$e^{i+1*} = \begin{cases} \frac{1}{\alpha - 1} \\ R \\ \theta \frac{w_{mt+1}}{w_p} \alpha \end{cases}$$

$$s^{i*} = \frac{\beta R \left\{ (w_{mt} h^i * + w_p)(1 - v^i *) + w_p (1 - e^{i+1} *) - z^i * \right\} - q\theta (w_{mt+1} h^{i+1} * + 2w_p)}{(1+\beta) R}$$

$$c_t^{i*} = \frac{\theta (w_{mt+1} h^{i+1} * + 2w_p)}{(1+\beta) R} + \frac{\beta R (\tilde{W}_t - z^i *)}{1+\beta}$$

$$c_{t+1}^{i\ *} = \frac{\beta\theta(w_{mt+1}h^{i+1}{}^{*} + 2w_p)}{1+\beta} + \frac{\beta R(\tilde{W}_t - z^{i}{}^{*})}{1+\beta}$$

Here it is possible to see that, under the social norm, there is a positive level of schooling: $e^{i+1^{*}}$. Finally, the condition such that abiding by the norm is a Nash equilibrium can be obtained. This can be done by directly comparing the indirect utility when individuals abide by the norm (call this $\tilde{V}_1$) and when individuals deviate from the norm (call this $\tilde{V}_0$).

First, V_0 can be obtained by solving the following problem:

$$\underset{c_t^i, s^i}{Max} U(c_t^i, c_{t+1}^i) = \ln c_t^i + \beta \ln c_{t+1}^i$$

$$s.t. \quad c_t^i + s^i \le w_{mt}h^i + 2w_p$$

$$c_{t+1}^i \le s^i R$$

$$0 \le s^i$$

Note that the human capital of the decision-maker (the adult), is again $h^i = h_0 + e^{i^{*\alpha}}$ Thus, from the above two problems of the adult we obtain:

$$\tilde{V}_0 = \ln\left[\frac{w_{mt}(h_0 + e^{i^{*\alpha}}) + 2w_p}{1+\beta} \quad \left[\frac{\beta R\left\{w_{mt}(h_0 + e^{i^{*\alpha}}) + 2w_p\right\}}{1+\beta}\right]\right]$$

$$\tilde{V}_1 = \ln\left[\theta\left\{ \quad {}^{*\alpha}) + 2w_p \quad \frac{\tilde{W}_t - z^{i^*}}{1+\beta} \right. \quad (1+\beta)R \right]$$

$$+\beta\ln\left[\beta\theta\left\{ \quad {}^{*\alpha}) + 2w_p \right\} \quad \overline{+\beta} \quad t \quad \frac{\beta R(\tilde{W}_t - z^{i^*})}{1+\beta}\right]$$

By comparing $\tilde{V}_0$ and $\tilde{V}_1$, we attain the condition specified in Proposition 4, which is the incentive compatibility condition. This establishes that abiding by the norm is a Nash equilibrium under the specified parameter restriction.

The same line of reasoning as in proposition 3 gives the result that on the equilibrium path parents shall always be good and there shall be a positive amount of schooling. ■

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