Exploitation of Child Labor and the Dynamics of Debt Bondage

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Abstract: This paper is concerned with the institution of debt bondage and child labor employment in the context of an agrarian economy with overlapping generations. The model explores the principal-agent interaction between landlords and tenants, and identifies a set of reasons why households put children to work in response to the need to service outstanding debts, only to realize that child labor work is "exploited", and households are made strictly worse off in general equilibrium. Debt bondage in one generation is further shown to leave spillover effects, and contribute to the cycle of debt, bonded child labor and poverty across generations. In this context, the effectiveness of trade sanctions as a policy response to bonded child labor is evaluated. Contrary to expectations, a trade ban can set off a sequence of increasing indebtedness among agrarian households that offset the intended (static) disincentives to employ child labor.

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1 Introduction

Adopted unanimously by the 174 member states of the International Labor Organization (ILO) in June 1999, the "Worst Forms of Child Labor" Convention calls for an immediate end to the engagement of children in slave labor, debt bondage,[1] and other forms of abusive child labor.[2] The 1999 Convention underscores an array of existing multinational commitments to eradicate bonded child labor. Of these, some provided direct intervention through monetary transfers or access to credit for indebted households.[3] Others took a carrot or stick approach, respectively via the granting or withdrawal of international trade privileges. For example, the United States partially suspended General System of Preference (GSP) benefits to Pakistan in October 1996 specifically due to reported child labor and bonded labor problems.[4] Meanwhile, alleged violations of labor rights in countries such as Myanmar, Guatemala, Liberia, Maldives have also led to partial or total suspension of GSP privileges. In 1998, the European Union (EU) began offering additional GSP benefits to countries that apply laws consistent with ILO Conventions, and further allows for the suspension of GSP privileges in countries where any form of slavery is practiced or where slave labor is utilized, as defined by the ILO and Geneva Conventions (Brenton 2000).

Notwithstanding these campaigns and policy interventions aimed at confronting the problem of bonded child labor, formal economic analysis of the problem is as yet lacking. The purpose of this paper is therefore to analyze the institutional arrangements that lead to the emergence and persistence of the phenomenon of bonded child labor, and to explore the static and dynamic consequences of policy interventions. In consonance with existing economic analyses concerning child labor, where poverty is explicitly recognized

[1]The United Nations' 1956 Supplementary Convention on the Abolition of Slavery, the Slave Trade and Institutions and Practices Similar to Slavery. The 1956 Convention defines debt bondage as: "the status or condition arising from a pledge by a debtor of his personal services or of those of a person under his control as security for a debt, if the value of those services as reasonably assessed is not applied towards the liquidation of the debt or the length and nature of those services are not respectively limited and defined."

[2]As of November 2001, 112 countries have ratified Convention 182 since it was adopted in June 1999. In contrast, the ILO adopted the Minimum Age Convention in 1974. Over 70 of a total of 116 ratifications took place after 1995.

[3]For example, in November 2000, a US$3.5 million program was launched by the ILO to achieve the sustainable liberation of an estimated 75,000 men, women and children in Nepal from bonded labor (IPEC 1992).

[4]See Office of the United States Trade Representative (1997) for a list of GSP suspensions, partial suspensions and reviews.

as but one of its root causes (Rosenzweig 1981, Grootaert and Kanbur 1995, Basu and Van 1998), the phenonmenon of bonded child labor also calls into attention the lack of reliable and legal channels through which the poor can secure loans, and safeguard against hunger or unexpected consumption needs. In an environment where money lenders also control local wealth in the form of land and capital, bonded child labor grows out of an institutional arrangement wherein labor and credit contracts are *interlinked*,[5] and outstanding household debts are paid at least in part via labor services provided by children.

In the context of the campaign to eliminate debt bondage as one of the worst forms of child labor, a number of questions naturally arise: Is there a causal link between the prevalence of interlinked credit-labor transactions and the incidence of child labor? Should these child labor - credit transactions be viewed as exploitative, even when participation is voluntary rather than coerced? Without external intervention, can child labor become endemic across generation due solely to the institution of debt bondage? Finally, and in terms of searching for an effective intervention, can international pressure, such as the termination of GSP status, be justified as a viable tool to lower the incidence of bonded child labor?

This paper scrutinizes each of these questions, with particular emphasis on the principal-agent problem confronting landlords-cum-moneylenders and agrarian households that has not been made transparent either in theories concerning child labor, or theories concerning interlinked transactions. To begin with, participation in debt bondage is shown to tip the balance between the household's (i) dis-utility of sending the child to work and (ii) income benefits derived from child labor in favor of the latter. Thus, households' response to the need to service outstanding debts take the form of an increase in the supply of contracted child labor. This enables landlords to rationally anticipate a decline in the residual demand for wage laborers, and in particular, the demand for labor services from families who opt not to engage in interlinkage. In a principal-agent setup, such a failure on the part of individual households to coordinate child labor supply decisions can be used against the interests of households that are en-

[5]In the agrarian economies of South Asia and Latin America, interlinked credit-labor arrangement is pervasive and has been studied extensively. These studies focus on the *virtues* of interlinkage based on incentive and efficiency grounds, particularly when the problem of moral hazard in laborer's effort allocation is a concern. See Braverman and Stiglitz (1982), Bardhan (1983), Basu (1987), Braverman and Srinivasan (1984) and Sadoulet (1992). In none of these studies, however, is the possibility of bonded child labor accounted for as another outcome of interlinkage.

gaged in interlinked transactions, since the *reservation utility* of every household declines with a rising supply of bonded child labor.

In response to our second line of inquiry, we have, therefore, a case of exploitative child labor – agrarian households respond to the need to service outstanding debts by putting children work, only to realize that they are worse off in general equilibrium, relative to the case where no consumption smoothing device through interlinked transactions exist. The prevalence of bonded child labor can thus be looked upon as both a symptom, and a contributing factor in the cycle of poverty.

A third observation we make is the effect of debt bondage across generations.[6] In particular, individual generations in the agrarian economy are taken to be linked via intergenerational transfers (Becker (1981), Galor and Zeira (1993)). For altruistic parents, these transfers serve to smooth consumption and raise the welfare of the next generation. In the context of debt bondage, however, these transfers becomes the channel through which participation in interlinked transactions by one generation can set off a sequence of increasing indebtedness which affects the welfare, and the ability to break free from debt bondage for all subsequent generations. We show that if the degree of credit market imperfection (as measured by the difference between the interest rate that landlords have access to and the subjective time rate of discount of agrarian households) is sufficiently acute, the size of outstanding debt will eventually become large enough to justify putting children to work. Thereafter, intergenerational externalities due to interlinkage work both through a direct effect on the savings for future generations, as well as through the downward pressure on the market wage as child labor supply increases. Child labor in this context is thus endemic across generations, and prevails as a steady state phenomenon.[7]

Taken together, these observations highlight the features of the "second best" world in which debt bondage is shown to have adverse welfare consequences. These include the lack of access to credit markets that facilitates consumption smoothing, the inability to collectively bargain and finally, household decision-making that fail to internalize the

[6] In the context of credit market imperfection for the purpose of human capital accumulation, Hazan and Berdugo (2002) also demonstrate that child labor can prevail as a steady state outcome.

[7] Grote, Basu and Weinhold (1999) and Baland and Robinson (2000) study the welfare consequences of child labor in a context of credit market imperfection which puts limits on education undertakings. The appeal of removing child labor away from the work force thus lies in overcoming the undersupply of educated laborers. While we also take credit market imperfection as a starting point, we find that rational anticipation on the part of landlords that child labor supply will rise with interlinkage turns out to be sufficient for debt bondage to have perverse welfare implications for households.

intergenerational implications of debt bondage. In particular, even though debt bondage fills the gap left open by the lack of formal credit markets for consumption smoothing, agrarian households can in fact be made worse off, so long as the remaining failures (collective bargaining and intergenerational externalities) remain unaccounted for.[8]

Once the link between debt bondage and child labor is established, we find that the effectiveness of trade sanction as a policy response to eradicate child labor is no longer clear-cut. Specifically, policies that artificially deteriorate the terms of trade facing agrarian economies have two opposing effects. First, trade sanctions have an expected *impact* or demand-side effect, which directly depresses the the derived demand for labor. In addition, there is a *dynamic* or supply-side effect running contrary to the intended static disincentives of a trade ban, as low wages render households increasingly less capable of providing transfers to future generations. With lower wages and smaller transfers, subsequent generations are at once more susceptible to debt bondage, while the same amount of adult labor can command only a smaller amount of wage income. Thus, children are put back to work in subsequent generations. Indeed we find that this dynamic supply-side effect can completely offset the impact effect, leaving the steady state incidence of child labor strictly unaltered, but the steady state welfare of households strictly lower.

The rest of this paper is organized as follows: A number of common themes in three relatively well-documented cases of debt bondage are summarized in the next section. Section 3 develops a benchmark regime *without* interlinkage in order to evaluate the conditions that give rise to child labor. Sections 4 and 5 present a model that extends Bardhan (1989) by incorporating both endogenous child labor supply and the intergenerational externalities implied by interlinkage. In section 6, the impact and dynamic effects of trade sanctions on the incidence of bonded child labor is examined. The penultimate section discusses extensions and section 8 concludes.

[8]We thank an anonymous referee for pointing out the second-best interpretation of our results here to us.

2 Some Stylized Facts

Table 1 presents the economic, credit market and labor right indicators of 98 developing countries for which the existence (45 countries) / non-existence (53 countries) of child labor in debt bondage is reported in Bureau of Democracy, Human Rights and Labor (1999).[9] As shown, developing countries with reported incidence of bonded child labor have on average a much lower GDP per capita, a substantially larger share of the labor force engaged in agriculture, and a much higher percentage of economically active children (10 - 14 years of age). In addition, based on the average shares of private credit by deposit money banks and other financial institutions to GDP (Beck, Demirguc-Kunt and Levine 2000), credit markets are better developed in countries free from child labor in debt bondage.[10] In terms of basic worker rights, and based on the four-point score reported in OECD (2000)[11], the enforcement of freedom of association and rights to organize is relatively more adequate in countries free from debt bondage. Finally, in terms of trade links, more than 42% of the developing countries with positive reported incidence of children in debt bondage derive more than 50% of their export revenue from the export of non-fuel primary products.

This preliminary cross-national evidence notwithstanding, features such as the degree of reliance on agrarian production, access to credits, and the enforcement of workers' rights can similarly be singled out from a number of well-documented cases of bonded child labor. Since these features motivate the analytical framework developed in the sequel, we briefly discuss here child labor arising out of debt bondage in India, Nepal and Pakistan.

The Bonded Labor System (Abolition) Act of 1976 prohibits all bonded labor, by adults and children in India. Bonded child labor is nevertheless prevalent in rural India, particularly in the states of Bihar, Orissa, and Andhra Pradesh where agrarian production is the mainstay of economic activity (U.S. Dept. of Labor 1995). Official estimates put the number of bonded workers, children and adult combined, at 353,000,

[9] With very few exceptions, estimates of the size of the bonded child labor population on a national basis do not exist. See Basu and Chau (2002) for an empirical analysis based on a similarly constructed 0-1 indicator variable of bonded child labor in developed and developing countries as reported in Bureau of Democracy, Human Rights and Labor (1999).

[10] Basu and Chau (2002) makes use of three other alternative credit market indicators and arrives at similar conclusions.

[11] A score of 4 indicates that enforcement is adequate, while a score of 1 indicates severe violation of freedom of association and rights to organize.

and NGO estimates range from 2.6 million to 15 million workers. A specific form of bonded labor, referred to as the "Kuthias", for example, are bonded laborers ranging in age from 10 to 14, and pledged to employers by parents in exchange for a loan (U.S. Department of Labor 1995). These bonded child laborers perform agricultural tasks, and otherwise assist bonded adults in other agricultural chores for the creditor as payment. In a 1979 survey conducted in ten states of India, about 30 percent of families under debt bondage put one or more children into bondage mostly to cover debt repayment.

In terms of the ability of the agricultural work force to negotiate wages, the Indian Constitution provides for the right of association and the right to bargain collectively. In addition, discrimination against union members and organizers is prohibited. In practice, however, legal protections of worker rights are effective only for the 28 million workers in the organized industrial sector, out of a total work force of more than 397.2 million (Bureau of Democracy, Human Rights and Labor 1999a).

Like India, Nepal has ratified the UN Slavery Convention and Supplementary Convention on Slavery. The Nepal Labor Act specifically prohibits forced or bonded child labor (Bureau of Democracy, Human Rights and Labor 1999b). Bonded labor is a continuing problem, however, especially in agriculture. An estimated 100,000 people work under the "Kamaiya" or bonded labor system in the southern Terai region. These "Kamaiyas" are agricultural workers who may have worked for the same landlords for many generations. According to an NGO survey of bonded labor in three districts of Western Nepal, the "Kamaiya" family typically enters into a one-year binding verbal contract with an employer or a landowner, and borrows in cash or kind from land owners and perform agricultural tasks in exchange (Informal Sector Service Center 1992). In many cases, the entire family, including children, are involved in performing the tasks required, and bondage with the landlord is expected to terminate when the debt is paid off in full.

For these and other agrarian families, the Nepalese Constitution provides for the freedom to establish and to join unions and associations. However, union participation is significant only in the formal sector, and accounts for only a small portion of the labor force. Collective bargaining agreements cover an estimated 20 percent of wage earners in the organized sector (Bureau of Democracy, Human Rights and Labor 1999b).

In Pakistan, the Constitution of 1973 (article 11) bans the use of slaves and forced labor. In addition, the Bonded Labor System (Abolition) Act adopted in 1992 outlawed bonded labor, canceled existing bonded debts, and forbade lawsuits for the recovery of

existing debts (Bureau of Democracy, Human Rights and Labor 1999c). Nevertheless, debt-bondage in Pakistan is endemic and widespread (ILO 1993), and bonded child laborers are extensively used in labor intensive sugar cane and cotton farms. Poor harvests, agricultural input purchase along with the demand for other necessities constitute some of the reasons why households willingly incur debt (U.S. Dept. of Labor 1995).

In terms of workers' rights, the Industrial Relations Ordinance of 1969 provides for the right of industrial workers to form trade unions but is subject to major restrictions in some employment areas. The Essential Services Maintenance Act of 1952 covers sectors associated with the state administration (Karim 1995). However, there is no provision in the law granting the right of association for agricultural workers.

These cases will serve as motivations for three main features of the model. First, agrarian households and landlords have asymmetric access to formal credit markets. For an agrarian household, their only access to credit is through a local landlord who is also the employer of the household's labor services. Second, interlinked transactions of the credit-labor (adult / child labor) variety will be examined. Finally, we take as starting point the inability on the part agrarian households to organize and to collectively negotiate contract terms with employers, either due to coordination failure, standard free rider concerns or explicit legal restrictions on union activities. In the next section, we show that the emergence and persistence of the institution of bonded child labor can be understood with these features in place.

3 The Basic Model

Employers

Consider an agrarian economy in which a typical time period $t = 1, 2, ..., \infty$ is characterized by two seasons, lean and harvest.[12] During the lean season, a spot labor market does not exist. During the harvest season, N identical landlords compete in employing labor, $L_{it}, i = 1, ..., N$. Let T denote the endowment of land of the representative landlord. Output per landlord $F(L_{it}, T) = L_{it}^{1-\eta} T^{\eta}$ is increasing, twice continuously differentiable, and exhibits diminishing marginal products in the two inputs. Also, let p denote an exogenously given world price of the agricultural output.

[12]Seasonality in agricultural production is a common feature in South Asia and is deemed a primary cause behind the emergence and persistence of a variety of labor, land and credit market arrangements (See for instance, Bardhan (1983), Otsuka, Chuma and Hayami (1992), Eswaran and Kotwal (1985), Mukherjee and Ray (1995) and Basu (2002)).

We take adult and child labor as substitutes in harvest work, with each unit of child labor work equivalent to $0 < a < 1$ amount of adult labor work. The spot returns respectively to a unit of adult and child labor are w_t and aw_t during the harvest season of time period t, with $w_t = pF_L(L_{it}, T)$. Let $\bar{w}$ denote the spot wage when there is no child labor employment, $\bar{w} = pF_L(n/N, T)$.

Peasant Households

The supply side of the agrarian labor market comprises of overlapping generations of n identical peasant households. Each household consists of an adult and a child. Without access to credit market, households rely solely on inheritance from the previous generation to meet consumption needs during the lean season. During the harvest season, each household supplies inelastically one physical unit of adult labor, and has discretion over how much of one physical unit of the child's time is to be devoted to harvest work. Household utility over the two seasons (lt, ht) depends on (i) consumption in the two seasons (c_{lt}, c_{ht}), (ii) dis-utility of the child's time spent on harvest work (ℓ_t^k),[13] and (iii) transfers passed on to the child (B_t):

$$U(c_{lt}, c_{ht}, \ell_t^k, B_t) = logc_{lt} + \beta\left(\alpha logc_{ht} + (1-\alpha)\log(1-\ell_t^k)\right) + \beta^2 logB_t, \qquad (1)$$

where the fractions α and β respectively parameterize household dis-utility of putting the child to work and the subjective discount factor.

Pure Wage Contracts with No Access to Credit

Landlords have access to formal credit markets, and face an interest rate $r > 0$ per season. With respect to households, we begin with a benchmark with pure wage contracts, in which households do not have access to credit. Taking inheritance B_{t-1} as given, the household (i) allocates child labor time between leisure and work during the harvest season, and (ii) determines the amount of intergenerational transfers B_t devoted to support the consumption of the next generation during the lean season. We take the range of feasible inheritance to be $[0, \bar{w}/(\beta(\alpha+\beta))]$, which ensures that households do not lend in the lean season. As will become clear in the sequel, this condition is also necessary for the prevalence of debt bondage contracts.[14] Thus, the lean and harvest season budget

[13] The parameter $1-\alpha$ can be interpreted more generally as household dis-utility when the child spend time away from school, and engage in hazardous or disease-prone work environment.

[14] In what follows, it will also be shown that for any starting level of inheritance that falls within the range $[0, \bar{w}/(\beta(\alpha+\beta))]$, inheritance for *all* subsequent generations will stay within this range.

constraints respectively for each generation t household are:

$$c_{lt} = B_{t-1}, \quad c_{ht} = w_t(1 + a\ell_t^k) - B_t \tag{2}$$

where $w_t(1 + a\ell_t^k)$ denotes the disposable harvest season income of the household.[15]

Maximizing U with respect ℓ_t^k and B_t subject to the two budget constraints, we have

$$\ell_t^k = \max\{0, 1 - \frac{1-\alpha}{1+\beta}\frac{(1+a)}{a}\}. \tag{3}$$

Thus, $\ell_t^k = 0$ if and only if (i) the dis-utility of child labor work is sufficiently high, and (ii) child labor is relatively inefficient, so that $(1-\alpha)(1+a)/[(1+\beta)a] > 1$, or equivalently, if a is less than $(1-\alpha)/(\alpha+\beta)$. Harvest season consumption thus consists only of wage income from adult labor employment, net of transfers B_t, with

$$c_{ht} = \frac{\alpha}{\alpha+\beta}w_t, \quad \text{and} \quad B_t = \frac{\beta}{\alpha+\beta}w_t. \tag{4}$$

Total labor supply is equal to the n adult laborers, and the spot harvest wage is just

$$w_t = pF_L(\frac{n}{N}, T) \equiv \bar{w}.$$

In contrast, if $a > (1-\alpha)/(\alpha+\beta)$, total labor supply is made up of adult and child labor, with

$$c_{ht} = \frac{\alpha}{1+\beta}w_t(1+a), \quad \text{and} \quad B_t = \frac{\beta}{1+\beta}w_t(1+a). \tag{5}$$

In addition, total effective labor supply is equal to the n adult laborers plus child labor $an\ell_t^k = an(1-(1-\alpha)(1+a)/((1+\beta)a))$. This gives the equilibrium spot wage as:

$$w_t = pF_L(\frac{n(1+a)(\alpha+\beta)}{N(1+\beta)}, T) < \bar{w},$$

where the inequality follows from diminishing marginal product, and the fact that $\ell_t^k > 0$. Note that in both of these cases, transfers made in the harvest season, B_t, are independent of inheritance B_{t-1}, as B_{t-1} is fully consumed in the lean season. The supply of child labor ℓ_t^k is similarly independent of inheritance B_{t-1}. We have thus

[15]The household maximization problem examined here can be readily extended to a case where each generation makes consumption and child labor supply decisions over multiple years. Specifically, if inheritance is less than $\bar{w}/(\beta(\alpha+\beta))$, the discounted utility maximization problem of the household over T years simplifies to the maximization of equation (1) at the beginning of each year t, harvest season savings B_{t-1} is fully consumed during the lean season of year t, and thus have no impact on the utility of the household thereafter. Details are relegated to Appendix A.

Proposition 1 *When households do not have access to consumption smoothing credit, there is no equilibrium incidence of child labor at every t if and only if*

$$\frac{1-\alpha}{1+\beta}\frac{(1+a)}{a} > 1.$$

In addition, the utility of a typical household is given by:

$$V_o(B_{t-1}, \bar{w}) = \log B_{t-1} + \beta\left((\alpha+\beta)\log \bar{w} + K\right) \equiv \bar{V}_o(B_{t-1}),$$

where $K = \alpha\log(\alpha/(\alpha+\beta)) + \beta\log(\beta/(\alpha+\beta))$ *is a constant.*
The profit of the representative landlord is given by:

$$pF(\frac{n}{N}, T) - \bar{w}\frac{n}{N}.$$

4 Equilibrium with Interlinked Transactions

An interlinked debt bondage contract involves two parties, a household and a landlord. Each one of the n households is matched with a landlord. Let n_{it} denote the number of households that each landlord $i = 1, ..N$ is matched with in generation t, with $\sum_{i=1}^{N} n_{it} = n$. An interlinked credit-labor contract between the two parties at the beginning of the lean season stipulates the following terms:

- the landlord offers the household a loan of D_t amount to supplement lean period consumption;
- in return, the household repays the landlord $\bar{\ell}_t$ amount of *effective* labor during the harvest season, regardless of whether or not the household repays via adult labor solely, or a combination of adult and child labor.
- the household may search for harvest season employment elsewhere only after $\bar{\ell}_t$ amount of effective labor services is repaid in full to the landlord.

The terms of the debt bondage contract thus subsidize lean season consumption at the expense of harvest season consumption for participating households in the following way:

$$c_{lt} = B_{t-1} + D_t, \;\; c_{ht} = w_t(1 + a\ell_t^k - \bar{\ell}_t) - B_t. \tag{6}$$

Utility maximizing child labor supply is thus:

$$\ell_t^k \;\; = \;\; \max\{0, 1 - \frac{(1-\alpha)(1+a-\bar{\ell}_t)}{(1+\beta)a}\}, \tag{7}$$

where $\ell_t^k > 0$ if and only if

$$\frac{(1-\alpha)(1+a-\bar{\ell}_t)}{(1+\beta)a} < 1 \Leftrightarrow \bar{\ell}_t \geq 1 - \frac{a(\alpha+\beta)}{1-\alpha}. \tag{8}$$

Total effective household labor supply participating in debt bondage is increasing and piece-wise continuously differentiable with respect to outstanding debt $\bar{\ell}_t$. This is shown in Figure 1, where child labor supply is strictly positive and strictly increasing with respect to $\bar{\ell}_t$ if and only if the labor cost of the consumption loan $\bar{\ell}_t$ exceeds

$$\tilde{\ell} \equiv 1 - a(\alpha+\beta)/(1-\alpha). \tag{9}$$

In addition, as $\bar{\ell}_t$ tends to the maximal effective labor supply $(1+a)$, the household devotes all of the child's time to work. The left panel of Figure 1 plots the corresponding spot market wage in the agrarian economy given total adult and child labor supply by the n households.

Proposition 2 summarizes these observations, and makes use of the utility maximizing levels of harvest season consumption and transfers as given by:

$$B_t = \begin{cases} \beta w_t(1-\bar{\ell}_t)/(\alpha+\beta) & \text{if } \bar{\ell}_t \leq \tilde{\ell}; \\ \beta w_t(1+a-\bar{\ell}_t)/(1+\beta) & \text{otherwise,} \end{cases} \tag{10}$$

$$c_{ht} = \begin{cases} \alpha w_t(1-\bar{\ell}_t)/(\alpha+\beta) & \text{if } \bar{\ell}_t \leq \tilde{\ell}; \\ \alpha w_t(1+a-\bar{\ell}_t)/(1+\beta) & \text{otherwise.} \end{cases} \tag{11}$$

Proposition 2 *The incidence of child labor for households participating in debt bondage is strictly positive if and only if $\bar{\ell}_t > \tilde{\ell}$. The utility of such a household in generation t is:*

$$V_I(D_t, \bar{\ell}_t, B_{t-1}, w_t) \equiv \begin{cases} \log(B_{t-1}+D_t) \\ +\beta\left((\alpha+\beta)\log w_t(1-\bar{\ell}_t) + K\right), & \text{if } \bar{\ell}_t \leq \tilde{\ell}; \\ \log(B_{t-1}+D_t) \\ +\beta\left((\alpha+\beta)\log w_t + (1+\beta)\log(1+a-\bar{\ell}_t) + K'\right) & \text{otherwise.} \end{cases} \tag{12}$$

where $K' = \alpha\log(\alpha/(1+\beta)) + (1-\alpha)\log((1-\alpha)/((1+\beta)a)) - \beta\log(\beta/(1+\beta))$ is a constant.

4.1 Participation in Debt Bondage

Individual household's decision to engage in debt bondage would in general depend on whether the n households are able to collectively bargain with employers. Here, we

adopt the final observation discussed in section 2, and households are henceforth taken to be unable to collectively negotiate contract terms, either due to coordination failure, or explicit legal restrictions on unionization activities.

With rational expectation about the spot wage (w_t), therefore, a household with inheritance B_{t-1} voluntarily participates in debt bondage if and only if

$$V_I(D_t, \bar{\ell}_t, B_{t-1}, w_t) \;\geq\; V_o(B_{t-1}, w_t) \tag{13}$$

from Propositions 1 and 2. Since $V_I(\cdot)$ depends on the size of the household debt relative to the critical value $\tilde{\ell}$, inequality (13) along with the definitions of $V_I(\cdot)$ and $V_o(\cdot)$ imply a lean season loan requirement schedule $D(\bar{\ell}_t, B_{t-1}) =$

$$\begin{cases} D^1(\bar{\ell}_t, B_{t-1}) \equiv B_{t-1}\left(\left(1-\bar{\ell}_t\right)^{-\beta(\alpha+\beta)} - 1\right), & \text{if } \bar{\ell}_t \leq \tilde{\ell}; \\ D^2(\bar{\ell}_t, B_{t-1}) \equiv B_{t-1}\left(\left(1-\tilde{\ell}\right)^{-\beta(\alpha+\beta)}\left(\frac{1+a-\bar{\ell}_t}{1+a-\tilde{\ell}}\right)^{-\beta(1+\beta)} - 1\right), & \text{otherwise.} \end{cases} \tag{14}$$

$D(\bar{\ell}_t, B_{t-1})$ traces out the smallest loan required to induce households to voluntarily participate in debt bondage, given $\bar{\ell}_t$ and B_{t-1}. Note that $D(\bar{\ell}_t, B_{t-1})$ is continuous, piece-wise twice continuously differentiable and convex in $\bar{\ell}_t$.[16] $D(\cdot)$ is also increasing in $\bar{\ell}_t$, with

$$\begin{aligned} \frac{\partial D(\bar{\ell}_t, B_{t-1})}{\partial \bar{\ell}_t} &= \begin{cases} B_{t-1}\beta(\alpha+\beta)\left(1-\bar{\ell}_t\right)^{-1-\beta(\alpha+\beta)}, & \text{if } \bar{\ell}_t \leq \tilde{\ell}; \\ B_{t-1}\beta(\alpha+\beta)\left(1-\tilde{\ell}\right)^{-1-\beta(\alpha+\beta)}\left(\frac{1+a-\bar{\ell}_t}{1+a-\tilde{\ell}}\right)^{-1-\beta(1+\beta)} & \text{otherwise.} \end{cases} \\ &\geq 0. \end{aligned} \tag{15}$$

As such, the scope for landlords to impose strict labor service repayment terms is bounded above, as the marginal (loan) cost $\lim_{\bar{\ell}_t \to 0}(\partial D/\partial \bar{\ell}_t) = B_{t-1}\beta(\alpha+\beta) > 0$ and $\lim_{\bar{\ell}_t \to 1+a}(\partial D/\partial \bar{\ell}_t) = \infty$ for $B_{t-1} > 0$. As may be expected, $D(\bar{\ell}_t, B_{t-1})$ also depends on the desire for households to smooth consumption over the two seasons. In particular, an increase in B_{t-1} and β both increase the loan requirement $D(\cdot)$.

4.2 Terms of the Interlinked Contract

Consider therefore a typical landlord's problem in the lean season, which entails the choice of (i) an amount of lean season consumption loan D_t, and (ii) an amount of

[16] To see this, note that $D^1(\tilde{\ell}, B_{t-1}) = D^2(\tilde{\ell}, B_{t-1})$. Since $D^1(\cdot)$ and $D^2(\cdot)$ are individually twice continuously differentiable and strictly convex in $\bar{\ell}_t$, convexity of $D(\cdot)$ follows since $(\partial D^1(\bar{\ell}_t, B_{t-1})/\partial \bar{\ell}_t)\,|_{\bar{\ell}_t = \tilde{\ell}} = (\partial D^2(\bar{\ell}_t, B_{t-1})/\partial \bar{\ell}_t)\,|_{\bar{\ell}_t = \tilde{\ell}} = B_{t-1}\beta(\alpha+\beta)\left(1-\tilde{\ell}\right)^{-1-\beta(\alpha+\beta)}$.

effective labor service to be demanded from each borrowing household $\bar{\ell}_t$. The landlord has rational expectations about the spot market wage w_t in the harvest season, and correctly anticipates the minimal loan requirement and child labor supply decisions of the n_{it} households. In the harvest season, the landlord hires any additional workers (ℓ_{ht}) from the spot labor market at wage w_t that may be required to maximize profits given the effective labor input already available, $n_{it}\bar{\ell}_t$. Beginning with the harvest season decision making problem, and taking $\{D_t, \bar{\ell}_t\}$ as given, we have

$$\max_{\ell_{ht}} pF(n_{it}\bar{\ell}_t + \ell_{ht}, T) - w_t\ell_{ht} - n_{it}(1+r)D_t.$$

We have thus

$$pF_L(L_{it}, T) = w_t \tag{16}$$

where profit maximizing effective labor service $L_{it}(w_t, p)$ depends only on the spot market wage, with

$$\frac{\partial L_{it}(w_t,p)}{\partial w_t} = \frac{1}{pF_{LL}(L_{it}(w_t,p),T)} < 0, \quad \frac{\partial L_{it}(w_t,p)}{\partial p} = -\frac{F_L(L_{it}(w_t,p),T)}{pF_{LL}(L_{it}(w_t,p),T)} > 0.$$

The lean season decision problem of the landlord can accordingly be simplified as follows:

$$\begin{aligned} \Pi_t \quad &= \quad \max_{D_t, \bar{\ell}_t} pF(L_{it}(w_t,p),T) - w_t[L_{it}(w_t,p) - n_{it}\bar{\ell}_t] - n_{it}(1+r)D_t \\ &s.t. \quad D_t = D(\bar{\ell}_t, B_{t-1}). \end{aligned}$$

Equivalently, the landlord maximizes wage savings net of interest plus principal costs of the consumption loan in the lean season, $n_{it}\left(w_t\bar{\ell}_t - (1+r)D(\bar{\ell}_t, B_{t-1})\right)$ by choice of $\bar{\ell}_t$, with

$$\Pi_t = \max_{\bar{\ell}_t} \left[pF(L_{it}(w_t,p),T) - w_tL_{it}(w_t,p)\right] + n_{it}\left[w_t\bar{\ell}_t - (1+r)D(\bar{\ell}_t, B_{t-1})\right]. \tag{17}$$

The first order conditions are given by

$$w_t \quad \leq \quad (1+r)\frac{\partial D}{\partial \bar{\ell}_t}, \qquad \left(w_t - (1+r)\frac{\partial D}{\partial \bar{\ell}_t}\right)\bar{\ell}_t = 0. \tag{18}$$

Equation (18) simply requires that marginal wage savings be equal to the marginal cost of consumption loan for an interior maximum. In addition, since $\partial D(\bar{\ell}_t, B_{t-1})/\partial\bar{\ell}_t$ is monotonically increasing with no discrete jumps (equation (15)), there always exist a unique (corner/interior) solution to the landlord's problem.

Figure 2 illustrates. The upward sloping DD schedules plot a family of marginal loan requirement schedules $(1+r)\partial D(\cdot)/\partial \bar{\ell}_t$, with successively decreasing values of B_{t-1} from D_oD_o to D_2D_2. The downward sloping schedule WW is a translation of the WW schedule in Figure 1, and traces out the relationship between the spot market wage and $\bar{\ell}_t$. Note that since the DD schedules asymptotically approaches infinity as $\bar{\ell}_t$ approaches $1+a$ (equation (15)), while the WW schedule is nonincreasing, there is never more than one intersection point.

Starting from one end of the spectrum, where inheritance B_{t-1} is large enough so that the D_oD_o schedule applies, we have a case where the two schedules D_oD_o and WW do not intersect. In other words, landlords refrain from interlinked transaction, as wage savings are insufficient to cover marginal loan costs (equations (15) and (18)):

$$w_t\,|_{\bar{\ell}_t=0} = \bar{w} < (1+r)\frac{\partial D}{\partial \bar{\ell}_t}\,|_{\bar{\ell}_t=0} \Leftrightarrow B_{t-1} > \frac{\bar{w}}{\beta(1+r)(\alpha+\beta)} \equiv \hat{B}_0.$$

The D_1D_1 schedule illustrates the intermediate case where B_{t-1} is relatively small, where there is active labor-credit exchange between landlords and households, although the amount of outstanding debt is not high enough to justify putting children to work. From equations (15) and (18), this applies when

$$w_t\,|_{\bar{\ell}_t=0} = \bar{w} \geq (1+r)\frac{\partial D}{\partial \bar{\ell}_t}\,|_{\bar{\ell}_t=0} \quad \text{and} \quad w_t\,\Big|_{\bar{\ell}_t=\tilde{\ell}} = \bar{w} \leq (1+r)\frac{\partial D}{\partial \bar{\ell}_t}\,\Big|_{\bar{\ell}_t=\tilde{\ell}}$$

or,

$$\hat{B}_0 \geq B_{t-1} > \frac{\bar{w}}{\beta(1+r)(\alpha+\beta)(1-\tilde{\ell})^{-1-\beta(\alpha+\beta)}} \equiv \hat{B}_k.$$

The parameter $1-\tilde{\ell}$ is thus key to determining the distance between the right and left extremes of this range of inheritance, B_{t-1}, wherein interlinkage need not imply child labor. Since $1-\tilde{\ell} \equiv a(\alpha+\beta)/(1-\alpha)$, strong household preference against child labor $(1-\alpha)$ and relatively inefficient child labor (a) both contribute to widen the range of inheritance wherein children are not put to work in order to service outstanding debts.

The D_2D_2 schedule illustrates a third possibility, where B_{t-1} is small enough for the incidence of child labor to be strictly positive, and the equilibrium spot market wage is strictly less than the no child labor benchmark, $\bar{w}$. Any additional reduction in B_{t-1} shifts the D_2D_2 downwards even further. The equilibrium spot market wage thus *decreases* with decreasing inheritance B_{t-1}, since from equations (15), (16) and (18),

$$\frac{\partial w_t}{\partial B_{t-1}} = -pF_{LL}(1-\alpha)n/[B_{t-1}\left(\frac{\eta(1-\alpha)}{1+a\ell_t^k} + (1+\beta)\frac{1+\beta(1+\beta)}{1+a-\bar{\ell}_t}\right)] > 0,$$

at given land endowment for each employer, and $\eta \equiv -d\log pF_L/d\log L_{it}$ denotes the elasticity of labor demand in the harvest season. We have

Proposition 3 *There exist two critical levels of transfers, respectively $\hat{B}_0$ and $\hat{B}_k$, with $\hat{B}_0 > \hat{B}_k$, such that for all feasible values of*

1. *$B_{t-1} \geq \hat{B}_0$, landlords do not engage in interlinked transaction, and child labor does not exist. The equilibrium harvest season spot market wage is $\bar{w}$;*

2. *$B_{t-1} \in (\hat{B}_0, \hat{B}_k]$, landlords engage in interlinked transactions, but child labor does not exist. The equilibrium harvest season spot market wage is $\bar{w}$;*

3. *$B_{t-1} < \hat{B}_k$, landlords engage in interlinked transactions, and the incidence of child labor is strictly positive. The equilibrium harvest season spot market wage is strictly less than $\bar{w}$. Furthermore, the equilibrium spot wage is strictly increasing in B_{t-1}.*

Note that the two critical threshold levels of inheritance, $\hat{B}_0$ and $\hat{B}_k$, are both increasing in p and $1/\beta(1+r)$. Thus, the tighter the labor market, or the larger the size of credit market imperfection, the more likely that any given B_{t-1} is less than the two thresholds.

4.3 Welfare Effects

We now turn to an evaluation of the static and intergenerational welfare effects of debt bondage. Within a generation, and given bequests, the welfare of households depends critically on how aggregate labor supply, and hence the equilibrium spot wage, respond to household participation in debt bondage. In particular, from the participation constraint, debt bondage worsens the welfare of generation t households if and only if $\ell_t^k \geq 0$, or $B_{t-1} \leq \hat{B}_k$, since

$$\begin{aligned} V_I(D_t, \bar{\ell}_t, B_{t-1}, w_t) &= V_o(B_{t-1}, w_t) \\ &\leq V_o(B_{t-1}, \bar{w}) \equiv \bar{V}_o(B_{t-1}) \end{aligned}$$

if and only if $w_t \leq \bar{w}$. To recall, $\bar{V}_0(B_{t-1})$ denotes indirect household utility when households do not participate in debt bondage (Proposition 1). Since the welfare of households is pinned down to its reservation level in general equilibrium, the inequality above holds despite the fact that one of the virtues of interlinked contracts is precisely to smooth consumption over lean and harvest seasons. In comparison, landlords reap

the benefits of a lower spot wage, and the additional profits derived from lean season consumption loans (equation (17)).

We have thus a situation where households voluntarily participate in debt bondage, and child labor employment arises specifically to repay outstanding debts when inheritance is sufficiently small $B_{t-1} < \hat{B}_k$. Yet, the same condition also ensures that the contribution of child labor to harvest work necessarily leaves households worse off, compared to when there is no access to credit and no child labor. Two inter-related features of the model are in fact in play here: (i) coordination failure among households, and (ii) rational expectations on the part of landlords. The first problem is associated with the failure to coordinate actions among households to limit bonded child labor supply and thus to raise the harvest wage. The result is therefore a lower reservation utility for all households who chooses to opt out of interlinked transactions.

Second, landlords correctly anticipate that any ex-ante commitment by a single household, or groups of households, to refrain from putting children to work will fall through in the peak period due to the coordination failure. The resulting terms of the interlinked contract accordingly embody this rational expectation, so that a low reservation utility shows up in the debt bondage contract as a lower actual utility for bonded households. In sum:

Corollary 1 *The welfare of generation t households engaged in debt bondage $V_I(D_t, \bar{\ell}_t, B_{t-1}, w_t)$ is given by $V_o(B_{t-1}, w_t)$, with*

1. $V_o(B_{t-1}, w_t) = V_o(B_{t-1}, \bar{w}) = \bar{V}_o(B_{t-1})$ *for* $B_{t-1} \geq \hat{B}_k$,
2. $V_o(B_{t-1}, w_t) < \bar{V}_o(B_{t-1})$ *for* $B_{t-1} < \hat{B}_k$.

Turning now to intergenerational welfare effects, recall from the participation constraint that the welfare of a generation $t+1$ household, whether or not it participates in debt bondage, is given by:

$$V_o(B_t, w_{t+1}) = \log B_t + \beta\left((\alpha+\beta)\log w_{t+1} + K\right),$$

where K is defined in Proposition 1. As such, transfers decision of a generation t household can affect the welfare of the next generation via two distinct routes. First, a higher B_t has a direct impact on the minimal level of lean season consumption as $c_{lt+1} = B_t$ for households that do not resort to borrowing from landlords. The second effect never runs

contrary to the first, and operates through the indirect impact of an increase in B_t on the spot labor market wage, w_{t+1}. From Proposition 3, $w_{t+1} = \bar{w}$ is invariant to small changes in B_t for all $B_t \geq \hat{B}_k$. Otherwise, for $B_t < \hat{B}_k$, a lower B_t decreases the spot market wage w_{t+1}, as child labor employment rises reflecting an increase in the size of outstanding debt.

Thus, to determine the intergenerational externality generated by debt bondage in generation t, it suffices to confirm that the savings of generation t households for generation $t+1$, B_t, is less than the benchmark $\bar{B}_o$ which would apply if generation t households do not engage in interlinkage. To this end, equations (10), (14), (15) and (18) jointly imply that given any feasible B_{t-1}, $B_t = B(B_{t-1})$ is given by[17]

$$\begin{cases} \beta\bar{w}/(\alpha+\beta) \equiv \bar{B}_o, & \text{if } B_{t-1} \geq \hat{B}_0; \\ \bar{B}_o \left(\frac{B_{t-1}}{\hat{B}_0}\right)^{\frac{1}{1+\beta(\alpha+\beta)}} \equiv B^1(B_{t-1}), & \text{if } \hat{B}_o > B_{t-1} \geq \hat{B}_k; \\ \bar{B}_o(1-\tilde{\ell}) \left(\frac{B_{t-1}}{\hat{B}_k}(\frac{w_t}{\bar{w}})^{\beta(1+\beta)}\right)^{\frac{1}{1+\beta(1+\beta)}} \equiv B^2(B_{t-1}), & \text{otherwise.} \end{cases} \tag{19}$$

It is straightforward to verify that[18]

Corollary 2 *The welfare of generation $t+1$ households engaged in interlinkage $V_I(D_{t+1}, \bar{\ell}_{t+1}, B_t, w_{t+1})$ is given by $V_o(B(B_{t-1}), w_{t+1})$ from the participation constraint, and*

1. $V_o(B(B_{t-1}), w_{t+1}) \leq \bar{V}_o(\beta\bar{w}/(\alpha+\beta))$ *for* $B_{t-1} \geq \hat{B}_o$,
2. $V_o(B(B_{t-1}), w_{t+1}) < \bar{V}_o(\beta\bar{w}/(\alpha+\beta))$ *for* $\hat{B}_o > B_{t-1} \geq \hat{B}_k$,
3. $V_o(B(B_{t-1}), w_{t+1}) < \bar{V}_o(\beta\bar{w}/(\alpha+\beta))$ *for* $B_{t-1} < \hat{B}_k$.

5 Dynamics and Steady State

Our findings so far take transfers decision of generation $t-1$ as given. It remains to show how the incidence of child labor and the welfare of households that engage in debt bondage evolve over time, and whether the range of inheritance $B_{t-1} \in [0, \hat{B}_k)$ that entails positive incidence of child labor is purely transitional.

[17]The dependence of B_t on the price level, the number of agrarian households, preference and technological parameters are suppressed for notational economy.

[18]If $B_{t-1} \geq \hat{B}_0$, $B_t = \bar{B}_o$ from equation (19) since generation t is free from interlinkage. If $\hat{B}_o > B_{t-1} \geq \hat{B}_k$, however, it follows from equation (19) that $B_t = B^1(B_{t-1}) < \bar{B}_o$. Finally, since $w_{t+1} \leq \bar{w}$ holds with strictly inequality whenever $B(B_{t-1}) < \hat{B}_k$, $B^2(B_{t-1}) < \bar{B}_o$ again from equation (19). Consequently, Corollary 2 follows upon observing that V_o is increasing both in B_t and w_{t+1}.

Figures 3a and 3b plot B_t as displayed in equation (19) with respect to B_{t-1}. Note that the B_t schedule has two kinks, respectively at $\hat{B}_0$ and $\hat{B}_k$.[19] From equation (19), the transfer schedules $B^1(B_{t-1})$ and $B^2(B_{t-1})$, respectively for inheritance $B_{t-1} \in [\hat{B}_k, \hat{B}_0)$ and $B_{t-1} \in [0, \hat{B}_k)$, are both strictly increasing and concave in B_{t-1}. An interior steady state is given by the intersection of the 45^o line and the B_t schedule. It can be readily verified that an interior steady state $B^* = \{B|B(B) = B)\}$ exists, is uniquely determined and dynamically stable,[20] with $(\partial B_t/\partial B_{t-1})|_{B_{t-1}=B^*} < 1$.[21]

To examine the geometry of Figure 3 in greater detail, note that the range of inheritance B_{t-1} is divided into three subsets. For $B_{t-1} \geq \hat{B}_0$, transfers at time t is independent of inheritance at $\beta\bar{w}/(\alpha+\beta)$ and debt bondage does not arise. Indeed, the unique steady state B^* cannot be greater than $\hat{B}_0$ if and only if $B(\hat{B}_0)$ is less than $\hat{B}_0$:

$$B(\hat{B}_0) = \frac{\beta}{\alpha+\beta}\bar{w} < \frac{\bar{w}}{\beta(1+r)(\alpha+\beta)} = \hat{B}_0$$

or equivalently, if and only if credit market imperfection is sufficiently acute:

$$(1+r)\beta^2 < 1.$$

At the other extreme where $B_{t-1} < \hat{B}_k$, child labor prevails alongside debt bondage, and transfers $B^2(B_{t-1})$ are given by

$$\bar{B}_0(1-\tilde{\ell})\left(\frac{B_{t-1}}{\hat{B}_k}(\frac{w_t}{\bar{w}})^{\beta(1+\beta)}\right)^{\frac{1}{1+\beta(1+\beta)}}$$

from equation (19). It follows, therefore, that child labor arising out of debt bondage exists in a steady state, and B^* falls within the range $[0, \hat{B}_k)$ if $B(\hat{B}_k) < \hat{B}_k$, or

$$(1+r)\beta^2 < \left(\frac{a(\alpha+\beta)}{1-\alpha}\right)^{\beta(\alpha+\beta)} \tag{20}$$

[19] This follows from the definitions of $B^1(B_{t-1})$ and $B^2(B_{t-1})$ in equation (19). Routine manipulation yields $(\partial B^1(B_{t-1})/\partial B_{t-1})\,|_{B_{t-1}=\hat{B}_0} > 0$. In addition, $(\partial B^2(B_{t-1})/\partial B_{t-1})\,|_{B_{t-1}=\hat{B}_k} < (\partial B^1(B_{t-1})/\partial B_{t-1})\,|_{B_{t-1}=\hat{B}_k}$.

[20] The proof of these claims is relegated to Appendix B.

[21] To see this, note that

$$\left.\frac{\partial B_t}{\partial B_{t-1}}\right|_{B_t=B_{t-1}} = \begin{cases} 0, & \text{if } B_{t-1} \geq \hat{B}_0; \\ \frac{1}{1+\beta(\alpha+\beta)} < 1, & \text{if } \hat{B}_0 > B_{t-1} \geq \hat{B}_k; \\ (\frac{\eta(1-\alpha)}{1+a\ell^{*k}} + \frac{1+\beta}{1+a-\ell^*})/(\frac{\eta(1-\alpha)}{1+a\ell^{*k}} + \frac{(1+\beta)(1+\beta(1+\beta))}{1+a-\ell^*}) < 1, & \text{otherwise} \end{cases}$$

where an asterisk denotes steady state values.

by definition of $\hat{B}_k$ and equation (19). For intermediate values of $B_{t-1} \in [\hat{B}_k, \hat{B}_0)$, wherein debt bondage prevails but with no child labor, equation (19) gives:

$$B_t = \bar{B}_o \left(\frac{B_{t-1}}{\hat{B}_0} \right)^{\frac{1}{1+\beta(\alpha+\beta)}}.$$

It follows that for child labor to be a transitory phenomenon even in the presence of interlinkage, the extent of credit market imperfection must not be too severe, with

$$\left(\frac{a(\alpha+\beta)}{1-\alpha} \right)^{\beta(\alpha+\beta)} \leq (1+r)\beta^2 < 1. \tag{21}$$

This is shown in Figure 3a, wherein the inequality in (21) above holds, and child labor is purely transitory even though and debt bondage prevails in a steady state.

In contrast, consider a decrease in β (and hence $(1+r)\beta^2$), or an increase in preference weight attached to consumption α until the inequality in equation (20), requiring that credit market imperfection be sufficiently acute, is satisfied. The steady state level of inheritance is depicted in Figure 3b, and shows a $B(B_{t-1})$ schedule that is shifted downwards reflecting the change in α, β, or both.[22]

Proposition 4 *In the presence of interlinked transactions, there always exist a unique and dynamically stable steady level of intergenerational transfers, B^*. Incidence of bonded child labor is strictly positive in a steady state if and only if*

$$(1+r)\beta^2 < \left(\frac{a(\alpha+\beta)}{1-\alpha} \right)^{\beta(\alpha+\beta)}.$$

In addition, steady state intergenerational transfers B^* in the presence of bonded child labor is strictly less than $\bar{B}_o$, and is given by

$$B^* = \frac{\beta w^*}{\alpha+\beta} \left((1+r)\beta^2 \right)^{1/(\beta(1+\beta))} \left(\frac{a(\alpha+\beta)}{1-\alpha} \right)^{(1-\alpha)/(1+\beta)} < \bar{B}_o.$$

where $w^* < \bar{w}$ is the corresponding steady state spot wage. The utility of the typical household in a steady state is strictly less than

$$\bar{V}_o\left(\frac{\beta \bar{w}}{\alpha+\beta} \right).$$

Profit of the representative landlord is strictly greater than

$$F\left(\frac{n}{N}, T \right) - \bar{w}\frac{n}{N}.$$

[22]Note that the dynamics and steady state of the model illustrated here applies in the absence of factor accumulation (such as that of human capital and population growth), and factor mobility (such as inter-regional migration). In section 7, the basic model is extended to account for each one of these possibilities.

6 Trade Sanctions and Child Labor

We are now in a position to consider the oft-noted policy prescription in the face of child labor in debt bondage – a trade sanction on countries that export products made with child labor. Based on the model, we argue that wholesale implementation of such measures without due considerations of the underlying agrarian institutions that bring out the incidence of bonded child labor, can have *impact* and *dynamic* effects that run in opposite directions. Indeed, the results to follow apply whenever countries inflicted with bonded child labor face declining agricultural terms of trade. Thus, agricultural subsidies that encourage production in food importing / exporting countries, or an increase trade preferences given to countries where child labor is not an issue, can both have qualitatively similar welfare and child labor effects as a trade ban.

Figure 4 illustrates the impact effect of a ban or a tax on the export of the agrarian output. The resulting reduction in the terms of trade shifts the WW schedule downwards. The trade ban thus have the anticipated impact – the reduction in the demand for agrarian labor reduces landlords' incentives to engage in interlinked transactions, and the equilibrium labor service requirement $\bar{\ell}_t$ for any given level of B_{t-1} decreases.

For any given B_{t-1}, a trade ban issued at the beginning of time period t decreases the spot wage. Thus, intergenerational transfers B_t for every given B_{t-1} falls, and the subsequent generation $(t+1)$ will be willing to sacrifice even more harvest season labor services to service consumption loan incurred in the lean season. This is shown in Figure 4 as a downward shift of the D_2D_2 schedule, which indicates that the cost of extending consumption loans to households fall as inheritance from the previous period continues to decline. In fact, Proposition 4 guarantees that the steady state level of intergenerational transfer is proportional to the prevailing harvest season wage rate. Meanwhile, the steady state level of indebtedness ℓ^* in terms of the number of effective units of labor services owed to the landlord is in fact independent of p, since equations (15), (18) and (19) jointly imply that

$$\ell^* = \begin{cases} 0, & \text{if } B^* \geq \hat{B}_0 \\ 1-\left((1+r)\beta^2\right)^{1/\beta(\alpha+\beta)}, & \text{if } B^* \in [\hat{B}_k, \hat{B}_0); \\ 1+a-\frac{1+\beta}{\alpha+\beta}\left((1+r)\beta^2\right)^{1/(\beta(1+\beta))}\left(\frac{a(\alpha+\beta)}{1-\alpha}\right)^{(1-\alpha)/(1+\beta)}, & \text{if } B^* < \hat{B}_k \end{cases}$$

We thus have,

Proposition 5 *A trade barrier that adversely affects the price level p of the agrarian*

output has

1. *an impact effect that is effective in temporarily deterring the incidence of bonded child labor so long as* $B(\hat{B}_k) < \hat{B}_k$*, and*

2. *a dynamic effect that offsets the impact effect, leaving the steady state incidence of bonded child labor strictly unaltered, but the steady state welfare of the household strictly lower than when free trade prevails.*

Proposition 5 highlights the interactions between the short-term labor market implications of policy interventions to combat child labor, and the corresponding long-term consequences that depend on the institution of debt bondage. In addition, it shows that rather than relying on trade-based intervention that impacts the agrarian terms of trade p, measures that decrease the size of credit market imperfection (an increase in $(1+r)\beta^2$) will be effective in reducing size of $\bar{\ell}$ in a steady state, and hence the incidence of bonded child labor.

7 Discussion

Our analysis began with three observations with respect to the vulnerability of agrarian households to debt bondage: the lack of access to credit, the lack of collateral other than the promise of labor services, and the inability to collectively bargain and coordinate child labor supply. Within a generation, bonded child labor arises out of coordination failure, and the associated downward pressure on the spot wage (hence the welfare of households that refrain from bondage) is exploited by landlords via the participation constraint. Across generations, the same child labor induced wage reduction puts checks on intergenerational transfers, and perpetuates the institution of debt bondage.

We are now in a position to relax a number assumptions in the basic setup.[23] The objective here is to develop additional intuitions and insights with respect to the effects of debt bondage in a more general setting.

7.1 Heterogeneity

One extension that naturally suggests itself is that of heterogeneity amongst households. Specifically, suppose that inheritance from the previous generation differs across house-

[23] We are grateful to an anonymous referee for suggesting these extensions.

holds. From the participation constraint, and the decision problem of the landlord, the equilibrium number of households who borrow, along with the incidence of child labor, will depend critically on the left-hand tail of the distribution of inheritance. In addition, since inheritance is itself endogenous, the distribution of inheritance varies both with time, and with the incidence of debt bondage in the generation(s) prior. The question that becomes important, therefore, is whether debt bondage and debt-induced child labor can continue to prevail as a long run equilibrium outcome for all landless households, so long as credit market imperfection is sufficiently acute (Proposition 4).

To see that the answer is in fact in the affirmative, note that at any time t, a household whose predecessor remained free from bondage at time $t-1$ inherits $B_{t-1} = \beta w_{t-1}/(\alpha+\beta)$. For this household to continue to remain free from debt bondage, it must be the case, from equation (18), that

$$B_{t-1} = \frac{\beta w_{t-1}}{\alpha+\beta} > \frac{w_t}{\beta(1+r)(\alpha+\beta)}.$$

In a steady state, where $w_{t-1} = w_t$, the corresponding condition becomes,

$$\beta^2(1+r) > 1,$$

an impossibility given the condition stated in Proposition 4, with $\beta^2(1+r) < (1-\tilde{\ell})^{\beta(\alpha+\beta)} < 1$. Thus, while the sequence in which households eventually participate in debt bondage may change, heterogeneity in starting values of inheritance alone is not sufficient to affect the long run equilibrium outcome elaborated in Section 5.

7.2 Endogenous Fertility

Since labor services served as the only available means of debt repayment in our analysis, a natural question arises as to how and whether households may tailor their fertility decisions, and hence the maximal household supply of child labor, based on the anticipation of the need to repay outstanding debts. To fix ideas, let m_t denote the number of children in the household, and e be the amount of parental labor time required to care for each child.[24] Let preferences of a generation t household be represented by the utility

[24]See Hazan and Berdugo (2002) for the interplay between fertility, child labor (in the absence of debt bondage), and the transition process of economic growth, with particular attention to the possibility of development traps and the role of a ban on child labor on the transition process. Doepke (2003) also entertains the role of endogenous fertility in the context of child labor in the absence of debt bondage and economic growth, and provides several illustrative country examples of policies targeting child labor.

function

$$logc_{lt} + \beta\left(\alpha logc_{ht} + (1-\alpha)\log(1-\ell_t^k)\right) + \gamma \log m_t + \beta^2 \log B_t, \tag{22}$$

where $c_{lt} = (B_{t-1} + D_t)/(1+m_t)$, and $c_{ht} = (w_t(1 - em_t + am_t\ell_t^k - \bar{\ell}_t) - m_t B_t)/(1+m_t)$ denote respectively per capita consumption level during the lean and the harvest season for a household participating in debt bondage. Assume in addition that $e < 1$, and $\gamma > \beta(1-\alpha+\beta)$. The former implies that $1/e > 1$ is the maximal number of children that the parent can care for, while the latter ensures that the utility gains from having one more child is sufficiently large for m_t to be positive for a utility maximizing household, with $e \geq 0$.

By inspection of equation (22), the costs of increasing the size of the household involve the direct costs of parental marketable labor time forgone ($w_t e m_t$), along with an reduction in per capita consumption, all else equal. The benefits of increasing the size of the household include household preference for children as parameterized by $\gamma > 0$, and the increase in full income as the number of children increases ($am_t\ell_t^k$).

Given inherited transfers B_{t-1} and the size of adult population n_{t-1} as given at time period t, it can be readily verified that the utility maximizing fertility and child labor supply in the presence of bondage simultaneously solve:

$$m_t\ell_t^k = m_t\left(1 - \frac{1-\alpha}{1+\beta}\frac{a-e}{a}\right) - \frac{1-\alpha}{1+\beta}\frac{1-\bar{\ell}_t}{a} > 0, \tag{23}$$

$$\frac{1+\beta\alpha}{1+m_t} = \frac{\beta(1+\beta)(a-e)}{1+(a-e)m_t - \bar{\ell}_t} + \frac{\gamma - \beta(1-\alpha+\beta)}{m_t} \tag{24}$$

if $\bar{\ell}_t$ is sufficiently high so that the right hand side of equation (23) above is strictly positive. [25] Finally,

$$B_t = \frac{\beta}{1+\beta}\frac{w_t(1+(a-e)m_t - \bar{\ell}_t)}{m_t}. \tag{25}$$

With marginal productivity pricing in the harvest season, the spot market wage is given by

$$w_t = pF_L(n_{t-1}(1+am_t\ell_t^k)/N, T). \tag{26}$$

Routine manipulation of equations (23) - (26) yields a number of additional observations. To begin with, so long as the second order condition is satisfied, bondage has now two

[25] An in-depth analysis of the intricacies involved in the transition to long run equilibrium when population and bonded child labor are both endogenous warrants a separate full-length paper. The case we identify here applies whenever indebtedness, or $\bar{\ell}_t$ is sufficiently high so that ℓ_t^k is strictly positive.

mutually reinforcing effect on household welfare within a generation, via the size of the child labor population, and the amount of time each child devotes to harvest work. It can be readily verified that increasing indebtedness (via an increase in $\bar{\ell}_t$) provides incentives for households to increase the full income of the family by increasing the number children if an additional child increases the full income of the household, or if $a - e > 0$(equation (24)).[26]

This first round effect puts downward pressure on wages. With wages lower, the balance between the dis-utility of child labor work and household consumption is once again tilted, so that each child will be spending more time doing harvest work. Thus, endogenizing the fertility decision in the context of debt bondage only strengthens our earlier conclusion that coordination failure on the part of households implies that households are worse off within generation.

Across generations, the same increase in $\bar{\ell}_t$, and the subsequent reduction in the spot wage at time t naturally reduces the amount of household income that can be devoted to each member of the household's offspring. In addition, from equation (24), full income of the household per offspring $(1 + (a-e)m_t - \bar{\ell}_t)/m_t$ is strictly decreasing in the number of offsprings. Debt bondage thus perpetuates as B_t strictly decreases with $\bar{\ell}_t$, and the need for consumption smoothing for the next generation $(t+1)$ rises. A complete analysis of the dynamics of population growth and debt bondage is beyond the scope of this paper, but these preliminary observations suggest that incorporating fertility decisions may in fact reinforce the forces at work that contributes to the prevalence of debt bondage in a steady state.

7.3 Exit Options

Yet another way in which the population of landless households may vary in the face of debt bondage is rural-urban migration. Consider therefore the problem of an altruistic household head faced with the decision between providing (costly) education for the child, with the anticipation that this will enhance the urban employment prospects of the child when he migrates upon reaching adulthood. Specifically, let the cost of education be C per season, and the urban wage be given by θw^*, where θ denotes innate ability of the child. To make the problem as transparent as possible, let education be a fulltime

[26]To see this, implicit differentiation of equation (24) yields $\partial m_t/\partial \bar{\ell}_t = \Delta\beta(1+\beta)(a-e)/(1+(a-e)m_t - \bar{\ell}_t)^2$ where $\Delta > 0$ if and only if the second order conditions of utility maximization are satisfied.

endeavor, so that the utility of such a household is given by:

$$U^e = \log(c_{lt} - C) + \beta(\alpha \log(c_{ht} - C) + \beta \log \theta w^*). \tag{27}$$

where c_{lt} and c_{ht} are defined as in equations (2) and (6) above, depending on whether or not the household is engaged in debt bondage.

Making use of equation (27), the definitions of V_I and V_0 in Propositions 1 and 2, along with the participation constraint,[27] it is now a simple matter to see that a necessary and sufficient condition for households to refrain from putting children to work is[28]

$$B_{t-1} - C \geq B_{t-1} \left(\frac{\alpha}{\alpha + \beta} \frac{w_t}{w_t - C} \right)^{\beta\alpha} \left(\frac{\beta}{\alpha + \beta} \frac{w_t}{\theta w^*} \right)^{\beta^2} \tag{28}$$

In other words, education will be the preferred option if and only if inherited savings B_{t-1} is sufficiently large, and if innate ability is sufficiently high. What is less clear, however, is how the spot wage plays a role in education decision-making. Contrary to what may be expected, subsequent to a reduction in w_t – due either to trade sanctions, or debt bondage itself as child labor supply from other household rises – the right-hand side of equation (28) increases if and only if the following inequality is satisfied:

$$\frac{\beta w_t}{\alpha + \beta} < C \tag{29}$$

In other words, a reduction in rural wage can in fact stifle the incentives on the part of households to allow children to undertake education and migrate to the urban area. The intuition here goes back to our underlying theme of credit market imperfection. Specifically, a reduction in w_t has two opposing effects. First, it reduces B_t, and encourages the household in favor of education and migration as the child's income will be θw^*. However, the same reduction in w_t also decreases the household's ability to pay for education, as the marginal utility of an increase in household earnings rises. The latter effect dominates, naturally, whenever wages w_t are sufficiently low to begin with, as the inequality in equation (29) suggests.

[27]Note that there are now four groups of households. V_I and V_0 are the indirect utilities of households in which children do not undertake education, but respectively participate and refrain from debt bondage. Let V_I^e and V_0^e denote the indirect utilities of the two groups of households in which children undertake education, where the subscripts I and 0 again respectively denote those households that participate in bondage and those that do not. Formally, there are thus two participation constraints, requiring $V_I^e \geq V_0^e$, and $V_I \geq V_0$, depending on the education decision of the household.

[28]Equation (28) follows from the observation that landlords set debt bondage contract terms such that the two participation constraints are just satisfied. The equilibrium indirect utilities of households that undertake education is thus just V_0^e, and V_0 otherwise.

8 Conclusion

By accounting for the principal-agent interactions between landlords-cum-moneylenders and agrarian households, this paper examines the institution child labor in the face of debt bondage. The model takes as building blocks (i) asymmetric access to credit by households and landlords, (ii) interlinked transactions that exchanges consumption credit for labor services and (iii) inability to coordinate actions and negotiate interlinked contract terms among agrarian households. In view of recent campaigns to eradicate bonded child labor, a basic model is formulated to address a number of questions. Can poverty and credit market imperfection induced interlinked credit-labor market transactions be identified as root causes of bonded child labor? Can a reverse causality running from bonded child labor and poverty be identified? Can debt bondage be a steady state phenomenon? Finally, to what extent is international pressure such as a trade ban act as an effective tool in lowering the incidence of bonded child labor?

We find that as long as the degree of asymmetry in credit access is large enough, the answer to the first three questions are in the affirmative, and debt bondage turns out to be an important feature in the cycle of poverty and bonded child labor in agrarian economies. In particular, we show that the inability of agrarian households to coordinate actions play a key role in the analysis. Thus, basic labor rights such as freedom of association, and the rights to organize, complement efforts to eradicate forced and bonded child labor. These observations are consistent with the recent campaign to improve basic labor and human rights worldwide. Indeed, freedom of association, rights to organize, forced labor, and minimum wage constitute four core labor standards of the ILO.

Our analysis also highlights the role of agrarian institutions in determining the effectiveness of policy measures to combat child labor. In particular, while standard disincentives, such as a trade sanction, can be expected to reduce child labor on impact, the dynamic effect dictates that these policy measures have limited impact on the incidence of bonded child labor per se, and an unambiguous negative impact on the welfare of agrarian households. These results echo similar findings in the search of market-based mechanisms to eliminate child labor[29], in that unless measures are in place to enforce basic labor rights and employers' choice of technique of production, wholesale implementation of policy measures that put downward pressure on labor demand in developing countries can be counter-productive.

[29]See for instance Basu, Chau and Grote (2000) for an examination of social labeling schemes.

Appendix A

We show here that our findings remain robust even in an explicitly multi-period setting for each generation, wherein each generation lasts T years. Specifically, we show that as long as bequests from the previous generation is less than $\bar{w}/(\beta(\alpha+\beta))$, households' savings decision during the harvest season of each year is observationally equivalent to one in which households' planning horizon is cut short to include only the current harvest season, and the lean season of the following year, as displayed in the text.

To this end, let the lifetime utility of a household (as before, made up of an adult and a child) with T-period life be:

$$W = \sum_{t=1}^{T} \beta^{2(t-1)}(\log c_{lt} + \beta(\alpha \log c_{ht} + (1-\alpha)\log(1-\ell_t^k))) + \beta^2 T \log B_T,$$

where B_T denotes bequests to the next generation. Also, let (i) B_0 be the amount of bequests available from the previous generation, (ii) S_t be the amount of lean season savings at year $t = 1, ..., T$, and (iii) B_t, $t = 1, ..., T-1$ be the amount of harvest season savings at year $t = 1, ..., T$. The lean and harvest seasons' budget constraint of the household free from debt bondage can thus be written as:

$$c_{lt} \;=\; B_{t-1} - S_t, \;\; c_{h1} = w_1(1 + a\ell_t^k) + S_t - B_t, \;\; t = 1, ..., T.$$

Maximizing W with respect to S_t, B_t, and ℓ_t^k, $t = 1, ..., T$, subject to the budget constraints above, routine manipulations of the first order conditions yields a system of equations that characterize the size of lean and harvest seasons savings at each time t. In particular, it can be readily verified that $\ell_t^k = 0$ if $S_t \geq 0$ and if the inequality in proposition 1 holds. In addition, suppose that $S_t > 0$ and $B_t > 0$ for all $t = 1, ..., T$,

$$\frac{\beta^2}{B_T} \;=\; \frac{\alpha\beta}{w_T + S_T - B_T}$$

$$\frac{1}{B_{t-1} - S_t} = \frac{\alpha\beta}{w_t + S_t - B_t}, t = 1, ..., T, \qquad \frac{\beta}{B_{t-1} - S_t} = \frac{\alpha}{w_{t-1} + S_{t-1} - B_{t-1}}.$$

Solving backwards, we obtain:

$$S_1 = \frac{\sum_{s=0}^{T-1}(\beta(\alpha+\beta)\beta^{2s}B_0 - w_{T-s})}{1 + \beta(\alpha+\beta)\sum_{s=0}^{T-1}\beta^{2s}}.$$

Since $\beta < 1$, $S_1 < 0$ if $\beta(\alpha+\beta)B_0 < w_{T-s}$. Also, since $\ell_s^k = 0$, $w_{T-s} = \bar{w}$ for all $s = 0, ..., T-1$. We have a contradiction as S_1 cannot be less than zero with imperfect

credit markets. In addition, since $S_1 = 0$, we have from the budget constraints that $c_{l1} = B_0$ and $c_{h1} = \bar{w} - B_1$. Repeating the arguments above starting from $t = 2, ..., T$, and substituting $S_1 = 0$, we have $S_t \leq 0$ for each $t = 2, ..., T$. Summarizing these arguments, the lean and harvest seasons budget constraints are simply given by $c_{lt} = B_{t-1}$, and $c_{ht} = w_t(1 + a\ell_t^k) - B_t$ for $t = 1, ..., T$ and thus

$$\begin{aligned}\max_{\{B_t, S_t, \ell_t^k\}_{t=1}^T} U &= \log B_0 \\ &\quad + \sum_{t=1}^{T} \max_{B_t, \ell_t^k} \beta^{2t-1} \left(\alpha \log(w_t(1 + a\ell_t^k)) - B_t) + (1 - \alpha) \log(1 - \ell_t^k) + \beta \log B_t \right).\end{aligned}$$

As such, in the complete absence of lean season savings, the household behaves as though the planning horizon starting from any year t is cut short to include only the current harvest season, and the lean season of the next year. As a final note, if $B_0 > \bar{w}/(\beta(\alpha+\beta))$, S_t can be positive for at least some years t. However, we also have $B_0 > \bar{w}/(\beta(1+r)(\alpha+\beta))$, for any positive interest rate i, and from proposition 4, interlinkage will not be an equilibrium phenomenon.

Appendix B

Proof of Proposition 4: Note that since $B^1(\cdot)$ and $B^2(\cdot)$ are both continuous in B_{t-1}, $B(B_{t-1})$ is likewise continuous in B_{t-1} since $B^1(\hat{B}_o) = \bar{B}_o$ and $B^1(\hat{B}_k) = B^2(\hat{B}_k)$. Thus, at least one fixed point $B^* = \{B | B(B) = B\}$ exists for each $p > 0$. Existence of an interior steady state follows upon observing that $\lim_{B_{t-1} \to 0} \partial B(B_{t-1})/\partial B_{t-1} = \infty$ and $\lim_{B_{t-1} > \hat{B}_o} \partial B(B_{t-1})/\partial B_{t-1} = 0$. To demonstrate uniqueness of the interior steady state, we observe that (i) B^1 and B^2 are individually strictly concave in B_{t-1} in the relevant range and (ii) $B^1(B_{t-1}) = B^2(B_{t-1})$ if $B_{t-1} = \hat{B}_k$, or if $B_{t-1} = 0$.

Strict concavity of $B^1(B_{t-1})$ in B_{t-1} is immediate from equation (19). Strict concavity of $B^2(B_{t-1})$ in B_{t-1} follows since

$$\frac{\partial B^2}{\partial B_{t-1}} = \frac{B_t}{B_{t-1}} \left(\frac{\eta(1-\alpha)}{1 + a\ell_t^k} + \frac{1+\beta}{1 + a - \bar{\ell}_t} \right) / \left(\frac{\eta\beta}{1 + a\ell_t^k} + \frac{(1+\beta)(1+\beta(1+\beta))}{1 + a - \bar{\ell}_t} \right) \equiv \frac{B_t}{B_{t-1}} \Omega.$$

Substitute using equations (7) and (10), we have

$$\Omega = \frac{1 + a - (1-\alpha)(1-\eta)(1 + a - \bar{\ell}_t)/(1+\beta)}{(1 + \beta(1+\beta))(1+a) - (1-\alpha)(1-\eta)(1 + a - \bar{\ell}_t)/(1+\beta)} < 1.$$

Routine differentiation yields

$$\frac{\partial^2 B^2}{\partial B_{t-1}^2} = \frac{B_t}{B_{t-1}^2}\Omega(\Omega-1) + \frac{B_t}{B_{t-1}}\frac{\partial \Omega}{\partial \bar{\ell}_t}\frac{\partial \bar{\ell}_t}{\partial B_{t-1}} < 0 \tag{30}$$

where the inequality follows since Ω is strictly increasing in $\bar{\ell}_t$ and $\bar{\ell}_t$ is decreasing in B_{t-1} from equation (18).

The second observation follows by definition of B^1 and B^2 in equation (19). In particular,

$$\frac{B^1(\hat{B}_k)}{B^2(\hat{B}_k)} = \frac{\left(\hat{B}_k/\hat{B}_o\right)^{\frac{1}{1+\beta(\alpha+\beta)}}}{(1-\tilde{\ell})} = 1, \text{ and } B^2(0) = 0 = B^1(0). \tag{31}$$

Suppose therefore that there are two distinct interior steady states, denoted as B^{*1} and B^{*2}. By strict concavity of B^1 and B^2, and equation (31), there are three possibilities. First, $B^{*1} = \{B|B^1(B) = B\}$ and $B^{*2} = \{B|B^2(B) = B\}$, with $B^{*2} < \hat{B}_k < B^{*1}$. By strict concavity and equation (31), we have

$$B^1(\hat{B}^k) > \hat{B}^k, \text{ and } B^2(\hat{B}^k) < \hat{B}^k.$$

This contradicts equation (31). A second possibility is that $B^{*1} = \bar{B}_o$ and $B^{*2} = \{B|B^1(B) = B\}$. We have thus

$$\hat{B}_0 \leq \bar{B}_o. \tag{32}$$

Once again by strict concavity of $B^1(B_{t-1})$ and equation (31), we have

$$B^1(\hat{B}_0) < \hat{B}_0.$$

This contradicts equation (32) since $B^1(\hat{B}_0) = \bar{B}_o$ by definition (equation (19)).

Finally, suppose that the two steady states are $B^{*1} = \bar{B}_o$ and $B^{*2} = \{B|B^2(B) = B\}$. This requires simultaneously that

$$B^1(\hat{B}_0) > \hat{B}_0 \text{ and } B^2(\hat{B}_k) < \hat{B}_k.$$

Or equivalently, that

$$\beta^2(1+r) > 1 \text{ and } \beta^2(1+r) < \left(\frac{a(\alpha+\beta)}{1-\alpha}\right)^{\beta(\alpha+\beta)} = (1-\tilde{\ell})^{\beta(\alpha+\beta)}$$

an impossibility as $\tilde{\ell} > 0$. The rest of Proposition 4 follows straightforwardly from the definition of B^*, equations (13) and (17).

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Table 1: Economic, Labor and Credit Market Characteristics of Developing Countries with Debt Bondage

	I. No Reported Incidence of Child Labor in Debt Bondage			II. Positive Incidence of Child Labor in Debt Bondage			I & II		
Variable	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**	**Obs**
GDP per capita, 1995 (PPP$)	**5207.920**	3300.508	50	**2892.744**	4712.905	43	**4137.462**	4157.982	93
Labor Force in Agriculture, 1990 (%)	**25.936**	13.287	43	**62.703**	21.914	43	**44.319**	25.816	86
Child Labor, 1998 (% 10-14 years of age)	**1.054**	3.299	45	**23.674**	13.703	45	**12.364**	15.085	90
Private credit, 1990 - 1995 average (% GDP)	**0.404**	0.220	9	**0.217**	0.162	19	**0.277**	0.200	28
Freedom of Assoc. & Rights to Organize Score (1-4)	**2.769**	0.927	13	**2.133**	0.640	15	**2.429**	0.836	28
Exporters of non-fuel primary products (0,1)	**0.094**	0.295	53	**0.422**	0.499	45	**0.245**	0.432	98

Sources: US Dept. of State 1999; UNDP 1998; World Bank 2001; OECD 2000; Beck Demirguc-Kunt and Levine 2000.

Figure 1. Child Labor Supply and Indebtedness

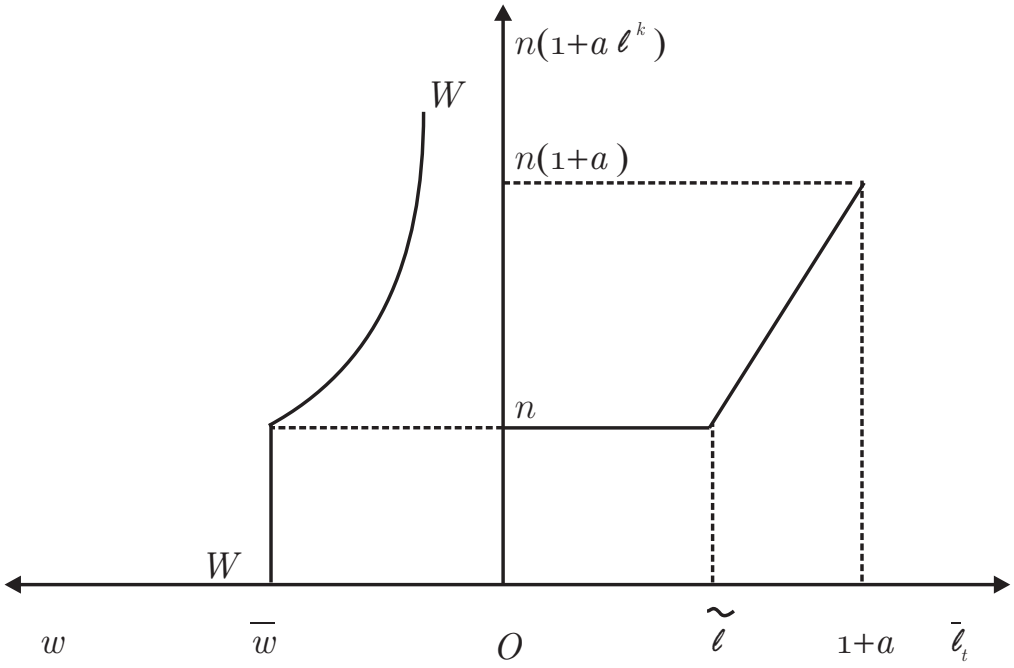

Figure 2. Harvest Season Spot Market Wage and Interlinkage

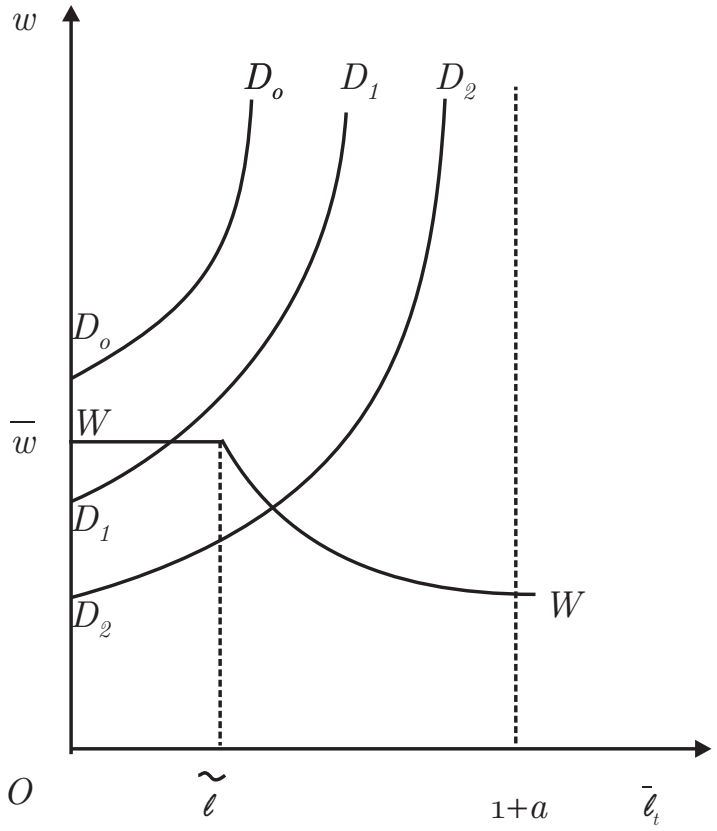

Figure 3a. Steady State Debt Bondage with no Child Labor

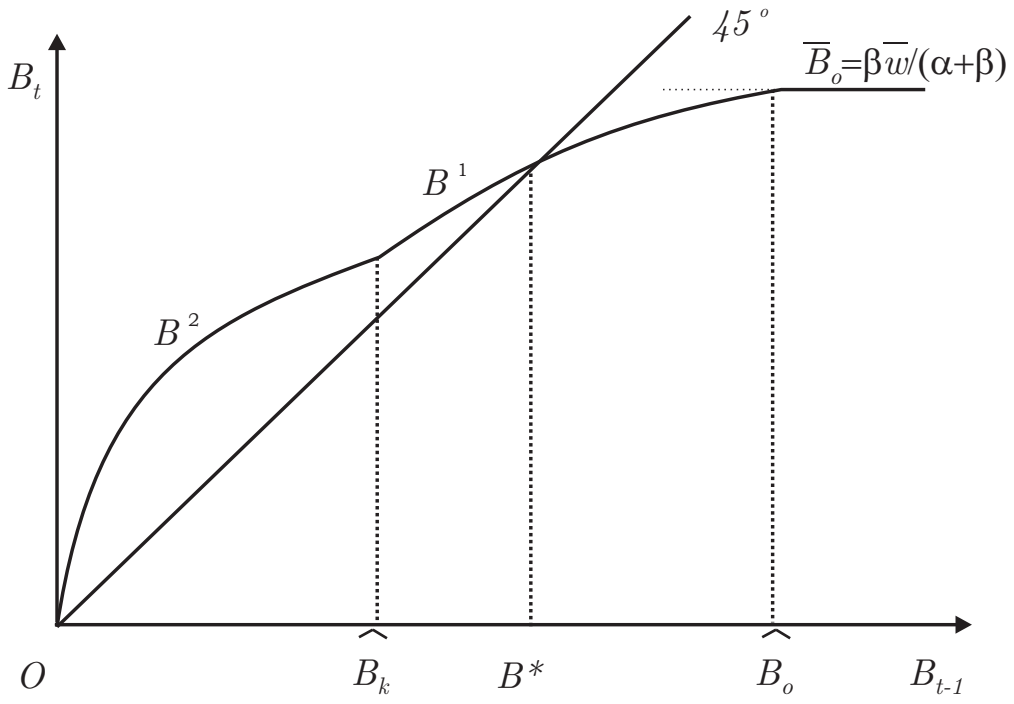

Figure 3b. Steady State Debt Bondage with Bonded Child Labor

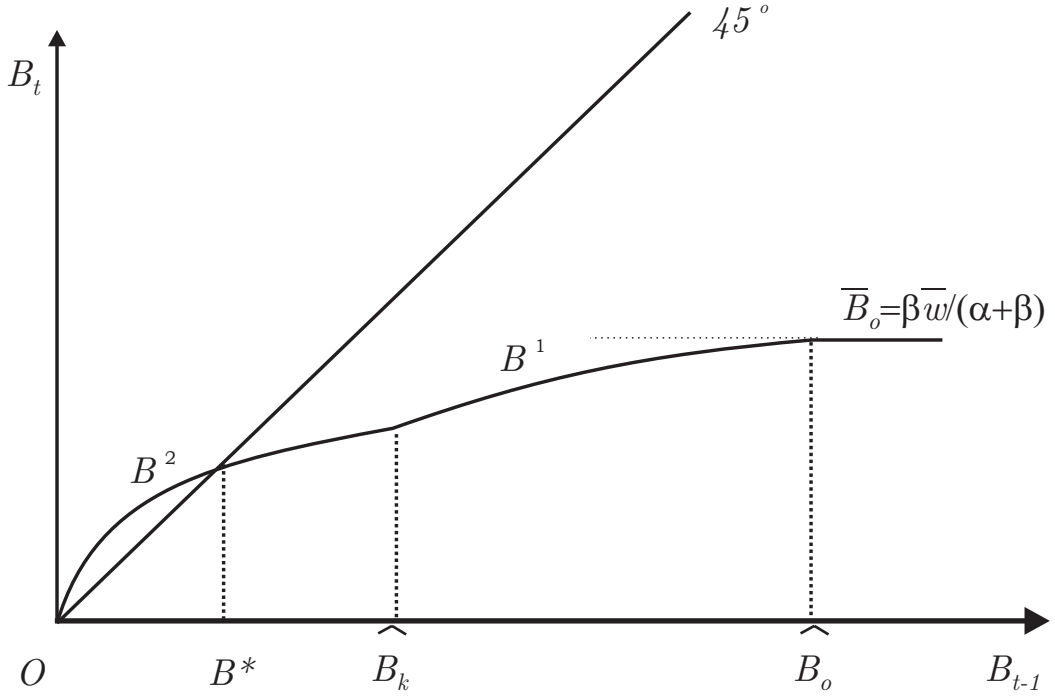

Figure 4. Impact and Dynamic Effects of Trade Sanction