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Investments in Children Vulnerable to Bondage[*]

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Abstract: A fundamental question in the human capital literature is whether property rights over human capital influence investments in children. Empirical work in this area has proven difficult, because it is a challenge to identify variation in property rights in the data. In this paper, we consider the importance of the ability to appropriate returns on investments in children by examining how vulnerability to debt-bondage affects education, child labor, and fertility. We observe substantially more child labor, lower schooling attendance and attainment, and significantly elevated fertility in families vulnerable to debt-bondage in the plains of Nepal. We argue that the inability of the debt holder and the parent to secure ownership of the child's human capital is important for understanding these increases in child quantity and declines in quality.

Keywords: Property Rights, Slavery, Child Labor, Education, Fertility

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1. Introduction

Well defined, secure property rights are a cornerstone of economic growth. While the extent to which insecure property rights distorts investments in physical capital has been discussed extensively (see Acemoglu and Johnson 2003 and Besley 1995 for recent macro and micro evidence respectively), there is little empirical evidence on what role insecure property rights over human capital play in investments in children. Discussion of property rights over human capital most often arises as an agency problem (for example, Dreze and Sen 1995) although Hall and Jones (1999) speculate that a country's "social infrastructure" could be important for growth in a number of ways. The standard agency problem is that because property rights over educational investments accrue to the child rather than the parent, the investor (the parent) may not invest optimally (under certain circumstances, Becker 1981). This study uses a unique opportunity to study empirically the effects of insecure property rights over human capital for investments in children in the context of debt-bondage.

Debt-bondage has been defined by the United Nations as a modern form of slavery, and its Working Group on Contemporary Forms of Slavery (1998) found that it is the most common form of modern slavery with as many as 20 million persons in debt-bondage today. In a typical debt-bondage situation, a worker takes out a debt from his employer and posts himself or his family as collateral for that debt (Bales 1999, Department of Labor 1995). In situations where the bondholder has market power in labor, credit, or product markets, it can be difficult for the bonded to repay the debt and exit bondage. This problem of market power is why debt-bondage is often characterized as a form of slavery rather than a solution to limited liability problems in credit markets as Galenson (1981, 1984) has argued for indentured servitude in colonial America. However, if the bondholder is properly viewed as a master, then he has an incentive to invest in his slaves as Fogel and Engermann (1974) have argued in the context of American slavery.

In this study, we consider empirically the impact of a debt-bondage system in the plains of Nepal on educational investments in children. We find that children vulnerable to bondage have dramatically lower education attendance, diminished schooling attainment, and substantially elevated labor force participation rates (both for wages and other types of work) than comparable populations who are less vulnerable. Accompanying these reduced investments is higher fertility in the vulnerable population. We argue that the bondholder's inability to appropriate returns on the child's education is important in understanding these findings. The appropriation problem takes three forms. First, education itself maybe inherently difficult for a master to appropriate. Second, unlike in the American south, formal legal protection for the bondholder is not available, so there is less institutional support to help the bondholder maintain his property rights. In fact, in the present case, despite more than 100,000 bonded individuals, the system is illegal. Third, education itself may be associated with an increased risk of losing the bonded. Education may increase the chance the family repays the debt, it may be associated with an increase in information that facilitates child migration, or it may put the child in contact with civil society organizations that aim to liberate the bonded. Moreover, in the present setting, the debt-bondage system prevalent in the plains of Nepal also diminishes the parent's ability to appropriate returns on investments in children. Debts are inherited so that a bonded parent faces the likelihood that the child will inherit the debt, and even among the non-bonded, the intrinsic risk of a child entering bondage is high with bondage rates above 50 percent of the eligible population in some areas.

While the institutional details of the debt-bondage system considered herein are not unusual, two unusual aspects of the Kamaiya system make it an excellent setting to consider the effects of appropriation problems on investments in children. First, the Kamaiya system is large in scale with roughly 100,000 bonded (Sharma 1999) and thereby measurable with census data. In this study, we use the 2001 Population and Housing Census of Nepal. Second, there are strong social constraints about who may be bonded in the Kamaiya system. The system is

largely confined to five western and mid-western districts in the plains of Nepal, and a 2003 survey of those in bondage found that 98 percent belonged to a single ethnic group, the Tharu (Sharma and Sharma 2004). We refer to members of this ethnic group living in districts where debt-bondage is prevalent as individuals *vulnerable to bondage*. Our analysis is based on comparing families vulnerable to bondage to members of other ethnic groups living in the same geographic areas, using information from other comparable regions of Nepal to control for latent ethnic group differences.

Why does the debt-bondage persist in one ethnic group in such a defined geographic area? In our field work, we were told that the Tharu are bonded, because they are the only group who can be trusted to honor the debt-bondage contract. We suspect that this "trustworthiness" owes to the history of the system's emergence. The Tharu have a genetic resistance to malaria, so they were the dominant ethnic group throughout the plains of Nepal until large-scale malaria eradication campaigns in the early and mid 1960s. As malaria ebbed, other ethnic groups and castes moved into the plains of Nepal. At the same time, the government took steps to end the Feudal system that had persisted in the plains (the Tharu were largely serfs). Included in these steps was a land registration system at this time that is alleged to have helped higher status ethnic groups (especially Brahmin) in securing legal control of the agricultural land worked by the Tharu. The debt-bondage system emerged at this time for the Tharu as a way for them to access credit. Why were other ethnicities not able to use themselves for collateral? We suspect that because other ethnic groups were new to the area and thereby revealed to be mobile, the risk of flight in other groups was high. The Tharu population would have had few external connections and, given the remoteness of these districts where the system persists, would pose little flight risk. The Tharu, then, could more credibly post themselves as collateral and thus the Kamaiya system of debt-bondage became concentrated in one ethnic group. Malaria eradication and the end of Feudalism occurred throughout the plains of Nepal. We suspect the Kamaiya system's persistence owes to the relative remoteness of the Western plains.

The observation that schooling is lower and child labor higher among those vulnerable to bondage is based on the attributes of children observed in one ethnicity in one location, an ethnicity*district effect. Why do we feel comfortable attributing this effect to the Kamaiya system of debt-bondage? First, one worries that because these districts are known to be special in the prevalence of bondage, they may be special in other ways too so that other disadvantaged ethnic groups, not vulnerable to bondage, are similarly worse off. However, the data suggest that this pattern of lower schooling, higher child labor, and higher fertility is unique to those vulnerable to bondage - it is not observed in any other prevalent ethnic group. Moreover, it does not appear to be driven by an association between any observable characteristics and vulnerability to debt-bondage, including several poverty correlates. Second, one should be concerned that there is something special about the ethnic group vulnerable to bondage in the locations where bondage is prevalent. Differential selection owing to the threat of debt-bondage is one obvious story. However, the basic findings in this study persist if we use place of birth rather than residence in our empirical work, and the migration rates of children vulnerable to bondage are low (less than 1 percent) and similar to other major ethnic groups in the same geographic area. Further, because the system of bondage considered herein evolved relatively recently, we can examine whether our educational attainment findings reflect some omitted ethnicity-district specific characteristic. The dramatic declines in educational attainment associated with bondage only appear in cohorts educated under the threat of bondage.

Why do we attribute the patterns in the data to the debt-bondage system rather than some lingering effect of the end of feudalism and the influx of new ethnic populations nearly 40 years ago? First, the disruptions in the early and mid 60s occurred throughout the plains of Nepal, not just in the area where bondage is prevalent. Hence, it is captured in part by our control strategy that uses ethnic differences from other areas where the Tharu are prevalent but bondage is not. Second, the patterns of decreased education, increased child labor, and elevated fertility persist when we control for observable family and parental characteristics, including education. Hence,

some omitted, persistent factor must exert an influence on educational decisions today beyond its affect on observable family and parental attributes. Third, in the historical literature, there is little evidence of any serious disruptions to the Tharu population with the end of feudalism. In fact, they experienced rising education throughout the sixties. Their masters changed from feudal lords to high status hill groups like the Brahmin, but other than the status of their master's property rights, there is no evidence of any lasting effects of the end of feudalism that might be confounded with the Kamaiya system of debt-bondage.

The next section provides institutional background on the Kamaiya system in greater detail and uses that to motivate our empirical approach. Section 3 describes the data and presents our main findings. Section 4 considers different explanations for the patterns documented in section 3. Section 5 concludes. Much of the robustness work for our main results of section 3 is in the appendix.

2. Background and Methodology

The debt-bondage system considered herein is generally known as the Kamaiya system of debt-bondage. Sharecroppers take out a debt from their landlord and agree to serve the landlord exclusively until the debt is repaid after the harvest.[1] Thus, bondage is entered voluntarily to access credit. Galenson (1981, 1984) describes a similar rational for indentured servitude in colonial America. Servants entered debt-bondage contracts with prospective employers to overcome limited liability problems that prevent credit markets from financing cross-Atlantic passage. In theory, the bonded is the residual claimant on all investment, and we might expect little effect of the debt-bondage system itself on investments in children except to the extent that

[1] Why don't debtors just leave? While in bondage, the sharecropper and his family often live in shelters near other bonded laborers and a supervisor. The presence of a supervisor suggests this is a concern. Within communities, land is sufficiently concentrated that other employment options are limited and the social stigma of breaking a contract could be very large (in discussions, we found some narrative accounts of beatings for those who attempted to escape). The areas where the Kamaiya system persists are remote, and travel to urban centers may be prohibitively costly and dangerous for a subsistence farmer with a family. Moreover, outsiders are generally treated with great suspicion in rural communities and finding employment in other rural communities may be very difficult. 95 percent of individuals (children and adults) born vulnerable to debt-bondage still live in the same location (authors' calculation from the 2001 census - a person is vulnerable to debt-bondage if they are of the Tharu ethnic group and are born in one of the 5 districts where the Kamaiya system persists).

the credit constraints it overcomes are important in child labor and schooling decisions (as in Baland and Robinson 2001).

However, market power on the part of the bondholder may affect the ability of the debtor to repay debts. A. Basu (2002) for example points out that when the bondholder has market power in credit and land or labor markets, the bond holder may suppress the income of the bonded. In the present case, sharecropping contracts are negotiated each year after the harvest season. When a debtor repays his debt, he is free to switch landlords, plots, etc., to the extent that he has multiple options. However, if the debtor does not repay his debt, he is tied to the bondholder, and his ability to negotiate future sharecropping contracts is severely limited.[2] In a survey of the Kamaiya, Guatam (2001) noticed that bonded sharecroppers received between one tenth and one third of their output while unbonded sharecroppers in the same region typically received half of each crop, and out of this reduced income, the bonded could try to repay his debts.[3] Moreover, beyond direct effects of the contract on the bonded, Basu and Chen (2004) argue for general equilibrium effects of the inelasticity of the labor supply of the bonded on local labor markets. This may further weaken the debtors ability to exit bondage. Moreover, in addition to reducing income, market power on behalf of the bondholder in multiple markets may lead to very high interest rates. K. Basu (1987) emphasizes that a lender may be able to charge usurious interest rates by offering an interlinked deal to a prospective sharecropper. Moreover, in the context of the Kamaiya system, these perpetual debt contracts may persist for generations as the debt is inherited. In fact, the government of Nepal estimates that over 100,000 were

[2] During the Maghi festival in January, agricultural contracts are re-negotiated. In principal, a bonded labor is free to depart one master for another if the new master will pay the debt.

[3] There is obviously a great deal of heterogeneity in types of Kamaiya relationships as with any labor contract. Typically, though, one segment of land is separated, and the Kamaiya receives all of output from that land. The size of this land is negotiated annually during the Maghi season and some suggest that it may reflect the number of working family members of the Kamaiya household. An in-kind wage payment known also typically accompanies the Kamaiya relationship. It is usually paid in rice paddy and varies with the number of workers in the household. Some narrative studies suggest that this payment also varies with family size. In some cases, cash payments have been reported. Landowners also generally provide Kamaiya with a shelter and a kitchen garden.

bonded in 1998 and Guatam (2001) reports that 90 percent of the bonded have been indentured for more than 10 years with many debts dating back to the system's emergence in the 1960s.

If market power can lead a temporary credit contract to turn into a tied relationship, debt-bondage can affect investments in children. Fogel and Engermann (1974) have emphasized how a tied relationship creates investment incentives for slave owners in the American South. For example, the average daily diet of southern slaves appeared to be 1.1 times that of free northern black males in caloric content, and the stature of southern slaves appeared normal and better than many contemporaneous European workers. This idea that a tied relationship can foster productive investments that are not otherwise possible because of the presence of credit constraints for example has been formalized in a number of settings, including in the nutrition based capacity curve model of Dasgupta and Ray (1985). More generally, tied relationships may have other contracting benefits that positively effect investments in children though consumption smoothing (Mukherjee and Ray 1995), risk sharing (Bardhan 1983), or resolving moral hazard problems inherent in agriculture (Braverman and Stiglitz 1982, Eswaran and Kotwal 1985).

However, the typical bondholder in the Kamaiya system may lack the relatively secure property rights over investments in education that the American slave owner had for nutritional investments. First, Returns on educational investments might be difficult to capture. Although it is not difficult to imagine contracts that might encourage the bonded to use their education productively, incentive constraints will likely force the bondholder to share some of this return with the bonded and thereby reduce the optimal investment. Second, unlike in the American south, the bondholder has little formal legal protection to enforce bondage. This might raise the uncertainty intrinsic to any investment in the bonded. Moreover, education may increase the chance the family repays the debt, it may be associated with an increase in information that facilitates child migration, or it may put the child in contact with civil society organizations that aim to liberate the bonded. Further, the Kamaiya system is not inherently a bonded child labor system. Children typically do not bring additional credit until they physically mature and can

enter their own debt-contract with the master, although children are sometimes employed as servants in the master's house, receiving clothing and meals as compensation.[4] Hence, the security of rights to investments in education of the bondholder is likely weak relative to the secure property rights over slaves held by American slave owners.

While insecure property rights on the part of the bondholder discourage education investments, similar issues attenuate parental incentives to invest in education. First and foremost, if a bonded parent fails to payoff debts before his death, his offspring inherits bondage. This inheritability is important to the bonded parent, because it is difficult for the bonded to buy back their freedoms after an initial default. Second, even parents that avoid bondage themselves will perceive a risk that their children will enter bondage which in turn may lead to a deteriorating labor contract that allows the master to capture the returns on investments in children. Basu (2002) shows formally that when landlords are sufficiently few (as in the present context), workers may have few options other than bonded labor contracts, and Genicot (2001) argue that general equilibrium effects of a debt-bondage system may limit other credit arrangements from developing. Thus, in to the usual agency problems that affect educational investments, the appropriation threat acts as a tax on the parent's expected return on investments in children, and yet the bondholder also does not have secure investment incentives. Hence, bondage in a contemporary setting is likely to be associated with diminished investments in children.

The empirical analysis of the consequences of debt-bondage for investments in children or fertility poses several challenges. First, bondage is endogenous. Compare two farmers, one who is in bondage because of an inability to pay past debts and the other who is free. The

[4] A 2001 rapid assessment survey of 650 bonded families found that 29 percent of children 5-18 work outside of their family (Sharma, Basnyat, and G.C. 2001). 20 percent of these children (or 6 percent of all children 5-18 in these 650 bonded families) reported that their parents took a loan against their employment. The age of these children is not clear in the tabulated survey results, but in consultation with people involved in this project, it was suggested that most of these children were older. The Kamaiya system is not itself a bonded child labor system. In fact, the same rapid assessment found that 33 percent of children 5-18 attended school without working, and that 38 percent were economically active for their parents alone.

bonded farmer differs systematically from the non-bonded, because he has been unable to pay his debts. Second, participation in a tied labor arrangement is voluntary (initially). This introduces selection into what type of households ever are at risk of defaulting and thus being bonded. Third, debt-bondage is typically difficult to identify in randomized surveys. Hence, most existing studies of debt-bondage around the world (see Bales 1999) are based on contaminated samples which pose challenges for inference.

Our identification relies on the structure of the Kamaiya debt-bondage system in Nepal. Roughly 100,000 ethnic Tharus (of middle social status) were believed to be bonded under the Kamaiya system in five Mid-West and Far-West plains districts (Sharma 1999).[5] With such a large group bonded, we can overcome the data availability problem by using census data. We use the accepted social norms about who may be bonded to address the problems of endogeneity and selection. Landless, Tharu laborers incur inheritable debts from their employers which binds the laborer to the employer until their debt is paid. This type of arrangement is an accepted for Tharu ethnicity in these Kamaiya districts, but it is not observed elsewhere. Our analysis is based on comparing Tharus in Kamaiya districts to Tharus in other districts, using observations on other ethnic groups to control for differences between Kamaiya and other districts.

A 2003 survey of those bonded in the Kamaiya system found that 98 percent of the bonded are Tharu (Sharma and Sharma 2004). Why is the debt-bondage so concentrated in a single ethnic group? In our field work, we were told that the Tharu are bonded, because they are the only group who can be trusted to honor the debt-bondage contract. As described in the introduction, we suspect that this "trustworthiness" owes to the history of the system's emergence and the relative immobility of the Tharu population in the 1960s when the plains transitioned from feudalism to its current state. Though the transition of the 1960s occurred throughout the plains of Nepal, the Kamaiya system persists in the West because of their relative isolation.

[5] The districts are Dang, Banke, Bardiya, Kailali, and Kanchanpur. The fraction of the Tharu population bonded under the Kamaiya system is estimated to be at 32 percent in Dang, 16 percent in Banke, 53 percent in Bardiya, 50 percent in Kailali, 27 percent in Kanchanpur, and 7 overall in Nepal (Gautam 2001).

In our empirical specifications, we make use of the ethnic group - geographic structure of the Kamaiya system. For outcome *y* of child (or female) *i* of ethnicity *e* in district *d*, we isolate how *y* differs for households vulnerable to bondage in the following way. We regress outcome *y* on a constant, a vector of ethnicity fixed effects λ_e, a vector of district fixed effects λ_d, a vector of individual attributes $\phi(A_i)$ that will vary across specifications, and the interaction of the Tharu fixed effect T_i with an indicator that is one if the child's district is a Kamaiya district K_i (this creates an indicator that an individual is vulnerable to debt-bondage,), TK_i :

$$(1) \qquad y_{i,ed} = \alpha + \beta TK_i + \lambda_e + \lambda_d + \phi(A_i) + \upsilon_{i,ed}$$

Errors are clustered at the district-ethnicity level as this is the level of our identifying variation.[6]

This empirical framework controls for several sources of endogeneity. First, there might be something special about the districts where the Kamaiya system exists. The district fixed effects control for omitted factors common to all ethnic groups in the district. Second, there might be something unusual about the Tharu ethnicity (or more generally the geographic distribution of ethnic groups in Nepal). The ethnicity fixed effects control for omitted factors common to each ethnicity in Nepal. β is the coefficient on our indicator if an individual is vulnerable to bondage, and is interpreted as the change in *y* after controlling for district invariant ethnicity characteristics and ethnicity invariant district characteristics as well as individual attributes *A*. Obvious concerns with this type of ethnic group - geographic location identification are that there may be factors common to lower social status groups that the district fixed effect does not fully capture and that there could be something special about the Tharu in Kamaiya districts that has nothing to do with the effects of the debt-bondage. We consider both these concerns in detail in the empirical work. The data do not provide any reason to suggest that

[6] A case could be made for clustering on the district, rather than ethnicity*district. In all main findings, standard errors are smaller when we cluster on district than ethnicity*district. Hence, we elect for the more conservative approach throughout.

these concerns drive the patterns of diminished schooling, elevated child labor, and greater fertility that we observe in subsequent sections.

3. Main Findings

3.1 Data

This study considers how the appropriation problems inherent in the Kamaiya system affects investments in children using the 2001 population and housing census (Central Bureau of Statistics 2002) that took place June 10-26, 2001. Census enumerators were recruited from local primary and secondary school teachers, and the census includes those with homes and the homeless. There were two census forms: a short form with 100 percent enumeration and a long form given to 1 out of every 8 households. Our data consist of the rural, non-mountain population in the 11.35 percent public use, a simple random sample of all households that completed the long form. We focus on the rural population, because that is where the Kamaiya system persists. Mountain areas are defined as areas where elevation exceeds 4,000 meters, and we exclude the mountain population because of their geographic isolation from the rest of Nepal. These two restrictions leave us with a sample size of 1,365,965 individuals (representative of 12 million people or 50 percent of Nepal's population) in 263,007 households.

Table 1A presents basic summary statistics for the data separately for boys and girls. We report the sample size, the fraction of the population that belongs to a high social status group (Brahman, Chhetri, and Thakuri), the fraction of the population that is the Tharu ethnic group ("Tharu"), the fraction of the population living in Kamaiya districts ("Kamaiya"), and the interaction of Tharu and Kamaiya. In analyzing how vulnerability to bondage affects child labor and schooling, we focus on the 181,651 children age 10-14 in the data, 6,317 of which are vulnerable to bondage. Our choice of ages is driven by the data. Below 10, we have no information about the activities of children. Above 14, our schooling data is incomplete. In our analysis, we focus on school attendance, educational attainment (years of completed schooling), and the child's principal usual activity. The child's principal usual activity is coded as student or

worker. A worker is a child whose principal usual activity is as a worker outside of the household, wage work, work on the family farm, work in the family business, or work as a domestic in either the child's or someone else's household. Coupled with the school attendance, Table 1A also reports what fraction of children that report being a worker who does not attend school.

Comparing the educational attainment of children is complicated by the fact that both the expected educational attainment and its variance increases with the age of the child. For this reason, educational attainment is analyzed by standardizing a child's observed educational attainment relative to that of a reference population for the child's age and gender. In the present case, children in rural households in hill and plains areas of eastern and central Nepal are used as a reference population.[7] Thus, for a child i of age *a* and gender *f*, educational attainment is measured as:

$$(2) \qquad ez_i = \frac{ed_i - \mu_{af}}{\sigma_{af}}.$$

This standardized educational attainment is reported in the rows labeled "Grade Deficit Z-score." Our analysis of child labor and schooling patterns focuses on the indicator of school attendance, the grade deficit z-score, and the indicator that a child is a worker who does not attend school.

Fertility data is collected for 275,910 ever-married women age 15-49.[8] 8,968 of these women are vulnerable to bondage. Descriptive statistics for these women are presented in Table 1B. 24 percent of women report being able to read and write. The census records the total number of births and number of deaths (after a live birth) for male and female offspring separately (we do not know the age of the child at time of death or the date of birth of non-resident children). In table 1B, we report the total number of births and deaths together and

[7] The choice of reference group is driven by a desire to have a reference group that is not affected by the Kamaiya system, but that still reflects the diversity of age specific educational attainment patterns in Nepal.

[8] Selection into marriage associated with debt-bondage is a concern. In unreported regressions, we have found that girls 15-17 are less likely to be married in families vulnerable to bondage although this result is small in magnitude and not robust. We do not observe differences in marriage patterns in older age groups.

broken down by sex of the child. In table 1A, there are 1.07 boys for every girl. In the Table 1B fertility responses, there are 1.1 male births for every female birth. We suspect this reflects some misreporting. Misreporting does not appear to vary with vulnerability to bondage (Appendix Table 2).

3.2 Child Labor and Schooling Findings

Our empirical strategy is to compare education and child labor outcomes of Tharus in Kamaiya districts to that of Tharus in other districts, using data on other ethnicities to control for ethnicity invariant district characteristics. Table 2 presents the basic results of this study (Appendix Table 1 contains unconditional means). Each cell in Table 2 contains the coefficient on the indicator that a child is vulnerable to bondage β from equation (1). The dependent variable for each regression is given by the row heading. The columns differ based on gender (columns 1-4 contain results just for boys, 5-9 for girls) and what controls are included in the regression. [9]

Column 1 (column 4) estimates question 1 on the full sample of rural hill and plain children age 10-14. In addition to ethnicity and district fixed effects, a vector of age effects are also included. Caste and ethnicity are very important in Nepal, and the control group in columns 1 and 4 includes both high caste and lower castes. With the inclusion of ethnicity and district fixed effects, we control for latent characteristics that are caste/ethnicity specific and district attributes that are common to all groups. In Kamaiya districts, high castes are often landowners (especially Brahman) and thereby masters of those in bondage. We are concerned that these high castes might make fundamentally different educational and child labor decisions in the Kamaiya districts because of the Kamaiya system. Thus, in column 2 (col. 5), we exclude high castes (Chhetri, Brahman, and Thakuri) from our data but otherwise replicate the specification of column 1 (4).

[9] In brackets, Table 2 reports t-statistics for the null hypothesis that the interaction on the Kamaiya indicator and the Tharu indicator is 0.

We focus our discussion on these results in columns 2 and 5 that exclude high caste households from the comparison group. Several noteworthy findings emerge. First, boys vulnerable to bondage are 8 percentage points less likely to attend school and girls are 13 percentage points less likely to attend school. These effects are not only statistically significant, but they also economically significant. For example, if the population means for Tharus outside of Kamaiya districts in Appendix Table 1 are taken as a baseline, these school attendance results suggest that boys are 9 percent less likely to attend school and girls are 18 percent less likely to attend school if they are vulnerable to bondage. Second, this lower attendance associated with vulnerability to bondage also appears in the schooling attainment data. After taking ethnicity, age, and district differences into account, boys have completed on average one fifth of a standard deviation less schooling than boys of the same age in the east and central areas of Nepal (the reference population), and girls vulnerable to debt-bondage have completed 3 tenths of a standard deviation less schooling than the reference population

Third, the lower schooling attendance and attainment of children vulnerable to bondage is mirrored in the child labor data. Children vulnerable to bondage are less likely to report their primary activity as being a student and are much more likely to report working and working while not attending any school. These effects are large in magnitude. For example, boys vulnerable to bondage are 8 percentage points less likely to be students, 8 percentage points more likely to report being a worker, and 8 percentage points more likely to be a worker that does not attend school.[10] Treating the (Appendix Table 1) Tharu in non-Kamaiya districts as a reference population, these results suggest that boys vulnerable to debt-bondage are 80 percent more likely to be a worker and 110 percent more likely to be a worker who does not attend any school. In magnitude, vulnerability to slavery is associated with a greater fraction of girls who are workers and who are workers that do not attend school. Because of generally higher incidence of child

[10] These questions are not constrained to be symmetric as a child may be neither a worker nor a student (a bit less than 10 percent of children 10-14 are neither workers nor students).

labor and work without schools for girls, in percentage terms, the elevated incidence of worker status is smaller for girls.[11]

An obvious question is how much of these patterns observed among children vulnerable to bondage can be attributed to variation in household head attributes. In evaluating this, we condition on several endogenous variables for the purpose of whether the means observed in the previous section persist. Columns 3 for boys and 6 for girls control for the age, gender, education, and marital status of the household head. Note that because most household heads (average age: 39) are also vulnerable to bondage and grew-up so, the thought experiment changes. No longer are we capturing the effect of vulnerability to slavery on these children. Rather, columns 3 and 6 contain the association between vulnerability to bondage and child outcomes after accounting for any effects of vulnerability to slavery on the child's parents. Controlling for these household head attributes attenuates the magnitude of the estimated effects by between 20 and 35 percent. Nevertheless, with or without controlling any effects of vulnerability to bondage on parents, the data suggest that vulnerability to bondage is associated with substantially reduced schooling attainment and attendance as well as elevated child labor.

3.3 Fertility Findings

The empirical methodology to examine fertility differences is the same as that used to look at child labor and schooling decisions and outlined in equation (1) of section 2. We compare ever-married women 15-49 vulnerable to bondage to Tharu women in other districts and use observations on other ethnic groups to control for district differences. High status women are excluded from our control group throughout the analysis, and age effects are again included throughout. Table 3 presents estimates of the coefficient on the indicator for vulnerability to debt bondage β, our basic fertility results (see Appendix Table 2 for unconditional means). Each cell in Table 3 is from a different regression. The dependent

[11] Girls 10-14 vulnerable to debt-bondage are 54 percent more likely to report being a worker as their principal usual status and 61 percent more likely to report being a worker that does not attend any school.

variable is indicated by the row, and columns 1-3 vary based on what controls are included; columns 4-9 focus on different subgroups in the population.

Column 1 of Table 3 reports estimates of equation (1) controlling for age fixed effects, district fixed effects, and ethnicity fixed effects. Several interesting findings emerge. First, vulnerability to bondage is associated with an additional 0.3 births. It is associated with slightly more male births than female births, but the estimate of the additional male births are within a 95 percent confidence interval of the estimate of the additional female births. Second, deaths are also higher to women vulnerable to bondage. There are 0.04 more deaths of children for women vulnerable to bondage. Considering that vulnerability to slavery is associated with an additional 0.3 births, the additional 0.04 deaths implies a death rate of 14 per 100 births among those vulnerable to bondage. For contrast, the death rate for births to Tharus outside of Kamaiya areas is 6 per 100 births. This elevated death rate is consistent with diminished investments in children, a finding consistent with our results in previous sections. However, these elevated deaths are not statistically significant under a Schwarz criteria, so we do not emphasize them in our discussion.

Third, neither the mother's education nor the household head attributes appear responsible for the association between births and vulnerability to bondage. In columns 2 and 3 we control for the education of the mother (both columns) and the household head's age, education, sex, age, and marital status (column 3). This specification partials out any effects on fertility that result from the effects of bondage on investments in parental education, etc. While these controls slightly attenuate the association between bondage and fertility, ultimately, most of the association between vulnerability to bondage and fertility appears to be driven by contemporaneous factors that are not captured in mother's or head's education. Fourth, the fertility results appear concentrated amongst illiterate women. In columns 4 and 5, we bifurcate the sample based on the mother's literacy. We suspect that illiterate Tharu are more likely to be

vulnerable to bondage, and in fact the elevated fertility among those vulnerable to bondage is concentrated among illiterate mothers (column 5).

Fifth, the rise in fertility is also most prevalent among elder age groups. In columns 6-9, we divide mothers into groups based on age. Teenagers vulnerable to bondage have on average 0.07 more births than those not vulnerable. Women vulnerable to bondage in their 40s have on average an additional half a child. The obvious question in interpreting columns 6-9 is whether these larger results for elder women reflect a constant, cumulative increase in births or a change in stopping behavior. If the extra margin experienced by Girls 15-19 is extended through time, we should observe an additional 0.13 births for the 20s age group, an additional 0.27 births for the 30s age group, and an additional 0.40 births for the 40s age group (assuming a uniform age distribution throughout these calculations). 0.4 births is within a 99 percent confidence interval of the additional 0.5 births observed in the data for women in their 40s. Thus, for women vulnerable to bondage, the data are consistent with constant, accumulating additional fertility throughout a woman's fertile life.

4. Discussion

The previous section documents that vulnerability to bondage is associated with reduced schooling attendance and attainment, elevated child labor, and significant increases in fertility. We first consider the robustness of these findings, then discuss their interpretation.

4.1 Robustness

Because the patterns documented herein are based on a specific ethnic group in a unique geographic location, we are concerned that they could reflect something special about those vulnerable to bondage other than bondage. In this section we consider the data for omitted factors common to disadvantaged castes and ethnicities, selection into vulnerability to bondage, and omitted ethnicity*district effects. Omitted ethnicity*district factors might include some intrinsic characteristics unique to the Tharu in Kamaiya districts or the effects of recent policies

towards the Kamaiya. All of this robustness evidence is consistent with the idea that these patterns documented in the data in the previous section reflect the effects of bondage.

The inclusion of district fixed effects captures ethnicity invariant district attributes, but one possibility might be that inequality is higher in Kamaiya districts so that all disadvantaged groups look as badly as those vulnerable to bondage. To examine this, we replicate our regression work on other ethnic groups prevalent in Kamaiya districts (Brahmin, Chhetri, Magar, Muslim, and Kami). If our results are driven by factors that are common to lower status groups, our results should appear for these other ethnic groups (Magars and Muslim are of similar status to the Tharu; Kamis are low caste).

In this analysis, we drop all Tharu households, because we do not want their relative disadvantage in Kamaiya districts to drive our robustness check. We regress outcomes *y* on age fixed effects λ_{a_i}, ethnicity fixed effects λ_e district fixed effects λ_d, and a false treatment indicator that is the interaction of the Kamaiya district indicator K_i with an indicator for if a child belongs to an ethnicity prevalent in a Kamaiya district this is not vulnerable to bondage E_i:

$$(3) \qquad y_{i,cd} = \alpha + \beta K_i * E_i + \lambda_e + \lambda_d + \lambda_{a_i} + \upsilon_{i,cd} .$$

We estimate (3) separately for each ethnic group prevalent in Kamaiya districts. Other than Tharus (36 percent), the most prevalent groups in Kamaiya districts are Chhetri (18 percent), Brahman (10 percent), Magar (6 percent), Kamai (5 percent), and Muslim (4 percent). Hence, we consider whether the patterns of lower schooling attendance and attainment as well as higher child labor that we observed for children vulnerable to bondage are apparent in any of these five populations in Kamaiya districts. Table 4 reports the coefficient β on the Kamaiya district - ethnicity interaction in equation (3) where the ethnicity used in the regression is in the column header (Appendix Table 3 contains means of the relevant child labor and schooling data for each of these groups). High caste households are again eliminated from the control group (though 2 of the populations considered for the falsification test are high caste). We do not find any of our

main child labor or schooling findings in other populations. In fact, where we observe any statistically significant differences in these falsification tests, it is in the opposite direction of what we find for the Tharu (Magar boys attending school, Brahman boys schooling attainment.

Other robustness checks possible in the education data are detailed in the appendix. First, we are concerned that debt-bondage introduces selection into what Tharus live in Kamaiya districts so that only the worse off Tharus stay behind in Kamaiya districts. A priori, we do not expect this to be an important problem, because 95 percent of all Tharu in the 2001 census that are born in Kamaiya districts still live in the same district. When we replicate our results on individuals born (rather than resident) vulnerable to bondage, we find the same magnitudes as reported in Table 2 (see Appendix A.1).

Second, we consider whether there is evidence of something special about Tharus living in Kamaiya districts. We limit the sample (initially) to Tharus alone and compare those educated when the debt-bondage system was in place (the young cohort) to those educated before the system is believed to have developed (the older cohort). In comparing these two different cohorts, we difference out anything that is cohort invariant and common to Tharus living in Kamaiya districts. We use Tharus living outside of Kamaiya districts to control for latent differences between these two age cohorts. We find that the declines in education are greatest in the younger cohort that is vulnerable to bondage. We also add a third difference by including other ethnicities to remove any age cohort-district effects. Again, we observe, large statistically significant declines in educational attainment for those vulnerable to bondage (see Appendix A.2).

Third, we consider whether our results reflect any recent policies aimed at the bonded by comparing children used in our analysis to older persons vulnerable to bondage but educated outside of the recent policy environment. We argue that it is unclear what impact recent policy would be expected to have on child labor and schooling, but the data suggest that the educational attainment results we observe for boys persist for all males educated when the bondage system is

in place, and our findings for girls also appear in the 18-22 year old cohort which is unlikely to be in school (see Appendix A.3). In sum, all of our results suggest that vulnerability to bondage is associated with lower schooling attendance, higher incidence of child labor, and lower educational attainment.

It is possible to evaluate the robustness of our fertility findings by looking at whether large increases in births exist in other disadvantaged ethnic groups in Kamaiya districts. They do not appear to. In Table 5, we regress the number of births to an ever married female on ethnicity fixed effects, district fixed effects, age effects, and the interaction of the woman's ethnicity with an indicator that she resides in a Kamaiya district (as in equation 3). Each cell reports the coefficient on this interaction term from a separate regression. The ethnic group is defined by the row, and the column headers are described in the context of Table 3. For brevity, we omit the specifications that control for the association between mother's education and head attributes and vulnerability to bondage. Thus column 1 of Table 5 corresponds to column 1 of Table 3 and columns 2-7 of Table 5 correspond to columns 4-9 of Table 3.[12]

We do not observe any ethnic groups with a fertility pattern that matches what we observe in those vulnerable to bondage. The ethnic group whose patterns seem closest to those vulnerable to bondage are the Muslims whose β is about third that of those vulnerable to bondage. The Muslim results are barely significant at 5 percent and would not be rejected as different from zero by the Schwartz criteria. Thus, while we do not think the fertility patterns are as clearly anomalous as the child labor and schooling results, we do not observe in other groups as large of an increase in total births as we find for those vulnerable to bondage.

Of course, the best we can do with our data is to limit our source of identifying variation for our educational attainment findings to the ethnicity*geography*cohort level (and ethnicity*geography for fertility). Hence, we would attribute to vulnerability to bondage any

[12] For the high caste Brahmin, we find significantly lower fertility for literate Brahmin females and Brahmin females in their 20s. Interestingly, the lower fertility among Brahmins is similar in magnitude to the increase in fertility of the Tharus. Of the high castes, Brahmins are most likely to be landowners, holding the Tharu in bondage.

latent factor that is unique to only the younger Tharu living in Kamaiya districts. One possible alternative explanation is something like the emergence of discrimination against the Tharu in only Kamaiya districts that happens to coincide with the emergence of debt-bondage. We cannot exclude this possibility in the data. However, our field work did not suggest any obvious discrimination. The stereotype of the Tharu in the Kamaiya districts (and more broadly in Nepal) is as a hardworking, trustworthy people. Moreover, the Tharu are not low caste; they are middle caste and welcomed in the homes of higher castes. Nevertheless, it is important to bear in mind that anything that is unique to younger Tharu cohorts in Kamaiya districts is attributed to vulnerability to bondage in our empirical work. That said, as we will discuss in the next section, the patterns of increasing fertility, declining education, and increasing child labor are exactly what theory would predict given our understanding of debt-bondage institutions.

4.2 Interpretation

We have argued that part of the explanation for the findings of reduced investment in children owes to the bondholders lack of secure property rights over the human capital of the child in a bonded family. An alternative interpretation is that perhaps there are no returns to education for children in agriculture and that bondage affects selection into agriculture. Most employment in the Kamaiya districts is in agriculture so the case for differential selection into occupations with bondage is not strong (relative to the control population). Moreover, in other data, there are clear returns to education in agriculture. For example, for a household head working principally in agriculture, each additional year of education is associated with an additional 7 percent increase in monthly per capita household expenditures. Thus, if education is a productive investment that the bondholder cannot secure a return on, it is possible that it might be a productive investment for parents. In this section, we consider why the incentive to invest in education or child quality more generally might be diminished for parents as a result of bondage.

We rely on the comparative statics in Becker and Lewis (1973) in our discussion. Let *n* represent the number of children.[13] Family preferences are represented by the lifetime utility function *U(q,n,z)* where *n* represent the number of children, *q* is the investment in each child, and *z* is a composite good. We view the utility from *n* as the enjoyment parents receive from reproducing, and any support role from having children is embedded in parental preferences over child quality, *q*. We make a number of simplifying assumptions for our discussion. Each child receives the same investment. Adult labor supply is inelastic, and the family's total debt burden is exogenous. Child time is divided between work and schooling, and families elect positive quantities of *q*, *n*, and *z*.

Each additional child has a constant marginal cost of p_n that includes the food and time costs of having a child. The price of investing in child quality p_q includes both the opportunity cost and direct costs of schooling. The full income constraint is then $\pi_z z + \left[p_q q + p_n \right] n = I$ where *I* is full income, π_z is the exogenous price of the composite good, and the solution to the household's problem gives demand functions for *n*, *q*, and *z* that depend on the shadow price of each child, π_n, and child quality, π_q, in addition to the price of consumption and full income: $q = D_q\left(\pi_q, \pi_n, \pi_z, I\right)$, $n = D_n\left(\pi_q, \pi_n, \pi_z, I\right)$, and $z = D_z\left(\pi_q, \pi_n, \pi_z, I\right)$ where $\pi_n = p_q q + p_n$ and $\pi_q = p_q n$.

The opportunity cost of each unit of investment in the child is the child's wage income w_c.[14] The return on each unit of investment is *r* and parents are able to capture some fraction *m* of that return. *m* varies based on a family's vulnerability to bondage. It may be known in advance or be viewed as some uncertainty parameter in which case *mr* is the expected return on

[13] We assume that parents are free to choose their fertility, but there is some anecdotal evidence of sexual abuse (by masters against domestics) in the narrative literature on the Kamaiya system. We do not have any information about the scale of this abuse.

[14] Often, children working as domestics are not paid cash but rather receive meals and clothing. In this later case, w_c reflects the additional expenditure parents must make to feed and cloth their children.

educational investment.[15] Thus, the budget constraint can be rewritten as

$\pi_z z + \left[\left(w_c - mr\right)q + p_n\right]n = I$ and $\pi_n = \left(w_c - mr\right)q + p_n$, $\pi_q = \left(w_c - mr\right)n$.

As debt-bondage reduces the household's ability to capture returns on investments in children, vulnerability to bondage raises the relative cost of investing in quality. Families substitute towards *n* and *z* and away from *q*, because the shadow price of child quality π_q increases relative to π_n and π_z. The interaction between *n* and *q* implies that the decrease in *q* lowers the shadow price of *n* further, while the increase in *n* raises the shadow price of *q* which encourages still more substitution from *q* toward *n*. Thus, the appropriation problem leads to elevated fertility and reduced child quality as a result of an inability to secure property rights over investments in the child.

How else might vulnerability to bondage affect investments in children? Families enter bondage in order to access credit. The interlinkage of labor and credit overcomes the limited liability problems that constrain credit access because the labor relationship acts as a kind of insurance for the creditor (K. Basu 1983, Sadoulet 1992) and enables the creditor to affect the debtor's effort indirectly (Braverman and Stiglitz 1982, Mitra 1983). Thus, we expect the system to be associated with improved credit.[16] Improved credit access affects investments in children through two channels. First, improved credit access may raise household incomes if credit is spent productively. While the elevated fertility observed in the data is consistent with increased income, the reduced investments are not. Second, improved credit access may lower the price of investing in children, because the household can borrow against the return on investing in children (see Baland and Robinson 2000 for a formal model). A decline in the price of child quality p_q induces families to substitute towards *q* and away from both *n* and *z*, because the

[15] We are modeling this as if parents receive a return on educational investments, but a similar set of comparative statics follow if children receive returns on investments and parents are altruistic.

[16] Genicot (2001) argues that the prevalence of debt-bondage prevents other credit arrangements from arising. This type of general equilibrium effect is not emphasized in the present analysis, because our identification approach below controls for factors common to both the bonded and non-bonded in regions where debt-bondage is prevalent.

shadow price of quality π_q decreases relative to π_n and π_z. The interaction between *n* and *q* implies that the decrease in *n* lowers the shadow price of *q* further, while the increase in *q* raises the shadow price of *n* which encourages still more substitution from *n* toward *q*. Thus, we expect the direct credit effect to result in lower fertility and more schooling (less child labor), the opposite of what we observe in the data.

Beyond the credit channel, debt-bondage contracts have an ambiguous effect on family income. The narrative literature on debt-bondage emphasizes the impoverished state of those in bondage. To observe that those who have defaulted on debt are poor does not mean that the system itself impoverishes. In fact, a large theory literature emphasizes the potential contracting benefits of a tied relationship. From the worker's perspective, a tied relationship may help smooth consumption during the lean season (Bardhan 1983) and guarantee employment during harvest seasons in a setting with involuntary employment like Dasgupta and Ray (1986). In a competitive labor market, the ability to tie labor may be then associated with increased permanent income to the worker. Also, the threat of potentially permanent bondage in the event of an initial default may create incentives for workers to maximize their productivity in ways that the standard sharecropping contract does not. For the employer, a tied contact may overcome moral hazard by credibly tying the worker to his output (Eswaran and Kotwal 1985) and mitigate hiring costs during harvesting seasons (Bardhan 1979). While there might be contracting benefits of a permanent labor relationship, debt-bondage systems might also leave workers worse off, because workers accept lower wages to access credit and then face the burden of debt-servicing as in K. Basu (1987) where the moneylender increases the surplus extracted from the borrowers by offering them an interlinked deal whereby they work as laborers at a wage below the normal rate and also take credit at high or 'usurious' interest rates if wages are downwardly rigid (perhaps for efficiency wage reasons).

The observed declines in investments are consistent with decreases in income, although the increase in fertility is the opposite of what theory would predict from a decline in income

(see Becker and Lewis for discussion).[17] Several pieces of evidence in addition to the fertility patterns suggest that our results do not solely reflect declines in income associated with vulnerability to bondage. First, the available data do not suggest a strong association between *vulnerability* to bondage and poverty (although we do not doubt the narrative evidence that says actually *being in* bondage is associated with poverty). The 2001 population census is also a housing census. We replicate our empirical approach of equation (1) at the household level to test whether there is an association between vulnerability to bondage and household attributes that are correlated with poverty.

Table 6 contains descriptions of all of the household attributes in our data that suggest that vulnerability to bondage is not necessarily associated with dramatically higher levels of poverty. Columns 1-4 contain means and standard deviations for each of the household attributes in the census by ethnicity and location. Column 5 contains estimates of β from equation (1) - the association between the listed (row) attribute and vulnerability to bondage after controlling for ethnicity fixed effects and district fixed effects. For most attributes, those vulnerable to bondage look like their peers. They are slightly more likely to operate agricultural land, have access to a protected (covered) water source, and own a radio. They are less likely to live in a permanent structure, have a non-farm enterprise, have electricity, or own a TV. Heads are similar in age, but less apt to be female and are less educated. Taken together, these results in this table do not suggest that households vulnerable to bondage are dramatically poorer in ways that are not likely a consequence of bondage (other than TV ownership). Note that this does not indict the narrative literature on the impact of bondage, because our identification is based on vulnerability to bondage rather than being in bondage. In fact, as discussed above, permanent labor contracts may be income improving so that Table 6 averages those who have not defaulted into bondage and thereby benefited from a permanent labor contract with those in

[17] A casual look across countries might lead one to infer that fertility declines with income. Much of the explanation for these cross-country patterns have been put on changes in the value of female time. The literature on male wage or non-labor income effects on fertility tends to find that increased income is associated with increased fertility. See Shultz (1997) for a survey.

bondage. Moreover, in unreported regressions, we have bifurcated the sample based on the literacy of the household head. The patterns that we observe in this study are concentrated in illiterate heads vulnerable to bondage.

Second, we include the household characteristics in table 6 as controls in our basic specification (equation (1)), and find a slight attenuation of our estimates of the association between vulnerability to bondage and child labor and schooling when we control for head attributes but little change in our estimates when we control for household attributes. These results are in Table 7.[18] Columns 1 and 4 replicate the results from columns 2 and 5 of Table 2 for boys and girls respectively. Columns 2 and 5 include controls listed as household attributes in table 6. Columns 3 and 6 include household attribute controls and controls listed as head attributes in table 6. We do not feel that the household attribute data is detailed enough to rule out an effect of vulnerability to bondage on income, but we do not find any obvious evidence in the available data that suggest a strong connection between vulnerability to bondage and poverty nor do we observe any substantive changes in our findings when we control for household attributes. Thus, the patterns in the data seem consistent with appropriation problems.

We are not comfortable attributing all of the rise in fertility to the appropriation problems that lower incentives to invest in children, because there are several reasons why debt-bondage may alter fertility incentives beyond a decline in the return on investments in children. The narrative literature on the Kamaiya system emphasizes scope for the Kamaiya system to lower the price of having children. First, there is anecdotal evidence that masters allocate more land or better rations of food to households with more children.[19] Second, children in bonded families often begin working as a domestic in the master's household at young ages (6 or 7) in exchange

[18] In unreported regressions, we have examined whether the fertility patterns of table 3 are robust to including these household attributes and head characteristics as controls. We find that conditional on these covariates, the association between vulnerability to bondage and total births increases by roughly 25 percent in the full sample and the illiterate sample.

[19] Some writers tend to view this as an implicit commitment of the children to the landlord. Alternatively, if masters are providing labor with a level of consumption that maximizes productivity and labor shares food with offspring in ways that are difficult for masters to constrain, the credible threat of lower worker productivity may coerce higher transfers from the master.

for meals. Whether this has any unique effect on fertility for those vulnerable to bondage depends on whether this employment opportunity is open to other non-bonded children (which it almost certainly is). Third, children do not have to work for the family's master and do not all need to inherent the parent's debt. Note, however, that this could also create additional incentives to invest in children vulnerable to bondage, so we regard the potential for additional food rations as the principal pro-natal incentive that is consistent with the data.

The Kamaiya system might also be associated with more indirect influences on fertility. First, female education is strongly correlated with fertility (Shultz 1997), and we have seen that females who have been raised under bondage are substantially less educated. However, the declines in fertility persist when we control for female education (table 3). Second, females are more likely to work outside of their own household in the Kamaiya system, often in the master's house. For example, 63 percent of women vulnerable to bondage list some form of market work (work outside of the household, work in the family business) as their principal usual activity in the Census, compared to 56 percent of non-Tharu in Kamaiya districts and 53 percent of Tharu in non-Kamaiya districts. Mammen and Paxson (2000) emphasize that an increase in work outside of the household is generally associated with diminished fertility by raising the value of female time (thereby increasing p_n,) or her influence in the household

Altogether then, the effect of debt-bondage on the price of a child is unclear although most arguments point to a decline in price. Declines in p_n induce a substitution towards children *n* and away from investments in children *q* and consumption *z*, assuming the positive income effects of the price decline are small. An increase in *n* in turn raises the shadow price of investing in quality π_q which further encourages a decline in *q*. Note that the rise in p_q with the appropriation problem has a direct effect on the shadow price of having children π_n whereas the decline in the price of a child p_n has only an indirect effect on the shadow price of child quality π_q through *n*. Consequently, we expect pro-natal incentives alone to be associated with

increases in fertility, but smaller declines in education than observed with increases in the costs of child quality.

Does the observed reduction in education and elevated incidence of child labor for those vulnerable to bondage just reflect the elevated fertility of this group? The data do not suggest this to be the case. In our data, we cannot match children to individual parents, only to households. Hence, we consider whether controlling for (endogenous) household fertility or household composition more broadly affects estimates of the association between vulnerability to bondage and education and child labor. Our findings are in table 8. The main child labor and schooling patterns persist when we condition on observed fertility or household composition. To our basic specification with district, ethnicity, and age fixed effects, we first add controls for the number of births ever reported in the household (via a set of dummies) and the fraction of those births that are female. The child labor and schooling results from this specification are in columns 1 (boys) and 3 (girls) of table 8. In columns 2 (boys) and 4 (girls), we include these fertility controls and controls for household size, the number of children 5 and under, the number of children 6-17 (all as dummies), the fraction of family members who are female, and the fraction of children 6-17 who are female. A comparison of these results to those of columns 2 and 6 in Table 2 suggests that estimates of the association between vulnerability to slavery and school attendance, schooling attainment, and child labor change very little once we condition on fertility and household composition. Hence, the association between vulnerability to bondage and elevated child labor / reduced schooling does not simply reflect the additional fertility that we observe among those vulnerable to bondage.

Our data then appears most consistent with increases in the cost of investing in education (or child quality more generally) because of the appropriation problem or declines in the cost of having children. Although we view the incentives of the debt-bondage system for children as ambiguous, our results could be consistent with a dominant role of the pro-natal aspects of bondage. However, the observed changes in schooling and child labor seem larger than we

would expect from pro-natal incentives alone, and the schooling and child labor associations with debt bondage are not affected by controlling for fertility.

If we are to interpret our findings as driven in part by rises in the cost of investing in children, what factors other than the appropriation problem might be responsible for increased costs of investing in children? An increase in the wage to children or a decline in the return to education would both have the same effect in our model of section 2. While we do not know of a convincing reason why the debt-bondage system would be associated with higher wages to children, data from the Department of Education (2001) suggests that there may be lower returns to education if we believe that pupil-teacher ratios are associated with school quality and thereby returns to education. In Nepal, the average primary school pupil teacher ratio is 37 students per teacher. All of the Kamaiya districts have pupil teacher ratios above 42, with the highest being 60.2 pupils per teacher in the district (Bardiya) where the indenture rate of those vulnerable to bondage is estimated to be highest (53 percent of Tharus in Bardiya are bonded according to Gautam 2001). Poorer quality schools may reflect the appropriation problem if that reduces incentives for communities to invest in schools. Lower returns to education, however, are unlikely to explain our findings, because they would affect ethnic groups other than the Tharu and thereby would be controlled for in our empirical work. The appropriation problem is unique to those vulnerable to bondage, and hence we view it as likely playing an important role in the

5. Conclusion

This study has found a large, negative association between vulnerability to bondage and both schooling attendance and educational attainment and a positive association between vulnerability and both fertility and child labor. The effects are not only statistically significant but also economically significant. For example, we find that by ages 10-14, vulnerability to bondage is associated with one fifth of a standard deviation less completed schooling for boys and 3 tenths of a standard deviation less completed schooling for girls. This reduced schooling is also associated with greater child labor. Boys 10-14 vulnerable to bondage are 110 percent more

likely to report being primarily a worker while also not reporting any school attendance. Fertility is also dramatically higher in women 15-49 vulnerable to bondage by roughly one quarter (or 11 percent) of a child per mother.

These findings of reduced investments in children contrast with the typical findings from the literature on American slavery. For example, Fogel and Engerman (1974) famously noted that the average daily diet of southern slaves was about 1.1 times that of free northern males in caloric content and that adults appeared to be nearly normal in stature (and better than many European workers). Obviously, investments in nutrition may be fundamentally different than investments in education, but is there anything inherent in the contemporary setting that might explain the contrast between our findings and that of Fogel and Engermann? They argue that the value of slaves as capital coupled with the owner's incentives to maximize the productivity of this capital might be responsible for their surprising findings. The distinction between slaves as capital rather than labor owes to the slave owner's secure property rights over the slave. In the case of debt-bondage, the master's property rights are much less secure with little formal legal enforcement, and productive investments like education may be associated with the loss of the bonded laborer. Further, whereas the American slave owner could appropriate returns on investments in slaves, Tharu parents in Nepal may not be able to do so if the child will inherent the debt or end up working in bondage for the same master. Thus, we view the insecurity of property rights over the slave and the child's human capital as fundamental in understanding why we see such dramatic, negative outcomes for contemporary bondage.

This appropriation problem has general lessons for the problem of development. Human capital accumulation is an important part of economic growth (Barro 1991), and policies aimed at stimulating human capital accumulation are one of the fundamental topics in development. Many interventions focus on improving schools or changing the opportunity cost of schooling. The results of this study illustrate another important aspect of decisions about investments in children: parents need to be able to expect that they or the child will be able to appropriate

returns on these investments. This paper provides some of the first empirical evidence of this classic insight. Economists have been extremely successful in incorporating attention to the institutional setting and market structure into policy designed to promote physical capital accumulation (see Acemoglu, Johnson, and Robinson 2004 for a survey). An implication of the present study is that these factors can be equally deserving of attention in policy designed to promote human capital accumulation.

Appendix on Identification Issues in the Child Labor and Schooling Findings

A.1 Selective Migration

One possible explanation for the large negative association between investments in and vulnerability to debt-bondage might be that the debt-bondage system introduces selection into who lives in Kamaiya districts. For example, let's say that a laborer defaults on a loan from his employer. If he is wealthy enough, he will flee rather than enter bondage. This means that the debt-bondage system induces selective migration so that only the worse off stay behind in Kamaiya districts. Their children then look dramatically worse off, not because of the impact of debt-bondage, but because of selection in who remains in Kamaiya districts. This explanation of our findings seems unlikely in the present context where 95 percent of all Tharu born in Kamaiya districts live in Kamaiya districts at the time of our data.

Nevertheless, the selective migration story can be examined by replicating our analysis from the previous section based on a child's ethnicity and district of birth rather than district of residence. These data are presented in Appendix Table 4. The first 5 columns contain data and results for boys and the last 5 for girls. Columns 1-4 (6-9) present summary statistics for each of our main outcome variables based on the child's ethnicity and district of birth. Column 5 (10) contains estimates of the how each of these outcomes differ for individuals vulnerable to bondage. That is, outcome *y* is regressed on ethnicity fixed λ_e, district of birth fixed effects λ_{db}, age fixed effects λ_{a_i}, and the interaction of an indicator if a child is Tharu Th_i and an indicator that the child was born in a Kamaiya district K_i^b:

$$(A1) \quad y_{i,cd} = \alpha + \beta K_i^b * Th_i + \lambda_e + \lambda_{db} + \lambda_{a_i} + \upsilon_{i,cd} .$$

High caste children are not included in the regressions.

In general, the results from Appendix Table 4 concord with those of Table 2 in statistical and economic significance. For example, for boys, being Tharu and born in a Kamaiya district is associated with one fifth of a standard deviation lower schooling attainment (column 5 of Appendix Table 4) as is being Tharu and resident in a Kamaiya district (column 2 of Table 2). Magnitudes of the differences in child labor and schooling outcomes associated with vulnerability to bondage are slightly larger in magnitude in Appendix Table 1 than in Table 2, but the differences between tables are not large enough to be either statistically or economically significant. From these results in Appendix Table 4, we infer that selective out migration of Tharus from Kamaiya districts is probably not driving our main findings.

A.2 Intra-ethnicity comparisons

The effects of vulnerability to bondage are measured based on the interaction of being ethnically Tharu and resident in Kamaiya districts. A concern is that unobserved factors other than debt bondage that are specific to Tharus in Kamaiya districts could be behind our findings. In the text, we have considered several possible sources of bias, but the possibility of an ethnic group - district effect remains a serious concern. We examine whether there is any suggestion of an important ethnic group - district effect other than vulnerability to bondage by relying on the history of the Kamaiya system in Nepal. In order to control for an ethnic group - district effect, we compare Tharus in Kamaiya districts educated when bondage is in place to Tharus in Kamaiya districts educated under the prior regime.

Specifically, we compare the educational attainment of Tharus who would have completed schooling before the mid 60s to those who would have started schooling after the Kamaiya system of bonded labor was in place.[20] We use Tharus living in other, non-Kamaiya districts to control for differences among Tharus between the older and younger cohorts. The completion of primary school would have been very unusual in the mid 1960s in Nepal, so we consider Tharus born on or before 1950 (who would have been 15 or older in 1965) as those who would have completed schooling before the mid 60s. Tharus born after 1965 but before 1982 in Kamaiya districts are the younger cohort who would have started schooling when the Kamaiya system is in place. The intermediate generation is omitted. Thus, the grade deficit z-score is regressed on a constant, district of birth fixed effects λ_{db}, age fixed effects λ_a including an indicator if the individual is from the young (post 1965) cohort $Young_i$, and an exposed to debt-bondage indicator which is the interaction of indicators for if an individual was born in a Kamaiya district K_i and if an individual is from the post 1965 cohort $Young_i$:

$$(A2) \quad GDZ_{i,cd} = \alpha_0 + \beta K_i^b * Young_i + \lambda_{db} + \lambda_a + \upsilon_{i,cd}$$

If our previous results simply reflect some unobserved Tharu-Kamaiya district specific characteristic, the coefficient β would be small in magnitude and statistically insignificant.

Estimates of β from equation (A2) are reported in the first row of columns 1 (men) and 2 (women) of Appendix Table 5. We find that for males, the cohort educated under slavery has educational attainment about 0.15 standard deviations below that observed in the older Tharu population educated before slavery after age-adjusting. For females, the cohort educated under slavery has one-fifth of a standard deviation less completed schooling. These findings are consistent with the idea that that our previous results reflect the impact of vulnerability to bondage rather than some unobserved, cohort invariant, attribute of Tharus living in Kamaiya districts.

The impacts of debt-bondage in appendix table 5 are identified by comparing the young generation to the old. The grade deficit z-score is age specific in its standardization. Hence, it already adjusts for the fact that younger individuals are more educated in Nepal and that there is greater variation in completed education among younger cohorts. Moreover, the inclusion of Tharus not in Kamaiya districts allows us to control for cohort differences that might be specific

[20] The computation of grade deficit z-scores for adults uses the same reference population as for children. However, because of age heaping in advanced ages, the reference mean and standard deviation is based on a 5 year moving average rather than that actually observed in the reference population for each age.

to the Tharu population. A second option is to add an additional difference to control for differences between the younger and older cohorts that is specific to the Kamaiya districts. Thus, we add ethnicity fixed effects λ_e, an indicator for if a Tharu is young $Th_i * Young_i$, an indicator for if a Tharu was born in a Kamaiya district $K_i * Th_i$, and the difference in difference in differences estimate of the effect of debt-bondage on educational completion $K_i * Th_i * Young_i$ is

$$(A3)\ GDZ_{i,cd} = \alpha_0 + \alpha_1 K_i^b * Th_i + \alpha_2 Th_i * Young_i + \beta K_i^b * Th_i * Young_i + \lambda_{db} + \lambda_e + \lambda_a + \upsilon_{i,cd}$$

The hypothesis that our schooling attainment findings reflect some unobserved Tharu-Kamaiya district specific characteristic and that the results from equation (A2) are influenced by Kamaiya district - younger cohort specific effect would imply that the coefficient β would be small in magnitude and statistically insignificant. The results from this specification are in columns 3 and 4 of Appendix Table 5. The last row reports estimates of β. Even after additionally controlling for latent Kamaiya district specific young cohort effects, we continue to find that those vulnerable to bondage have substantially reduced educational attainment. Thus, these within ethnicity-district of birth comparisons are consistent with the differences in differences finding that vulnerability to slavery is association with significantly lower educational attainment.

A.3 Recent Kamaiya policy

A number of NGOs have been active in recent years in providing assistance to families in bondage. We are not aware of anything sufficiently large in scale to be evaluated with census data, but NGO efforts at promoting schooling of children in bondage would attenuate our findings. A larger concern for our main findings is that shortly before the 2001 population census, the government of Nepal outlawed the Kamaiya system and ordered all outstanding debts canceled without compensation. Sharma, Basnyat, and G.C. (2001) find no effect of this law in their fieldwork in early 2001, but later studies report the gradual emergence of camps of ex-Kamaiya (Sharma and Sharma 2004). One possibility that we should nonetheless consider is that this legislation has been effective in ending the Kamaiya system, and that our results capture the resulting displacement of former slaves. The findings of the previous appendix section (where the young cohort is unlikely to be in school by 2001) are generally consistent with the magnitudes of the declines in schooling attendance that we observe for children 10-14.

We can examine this in greater detail by looking at how the lower educational attainment associated with vulnerability to debt-bondage varies with age. For children that have not completed schooling, the disruption associated with ending bondage could affect their schooling, but adults will have completed their education, so liberation is not likely to affect their completed schooling. For each age group (5 year intervals from age 20 to 60) and gender separately, we regress the individual's grade deficit z-score on ethnicity fixed effects λ_e, district of residence fixed effects λ_d, age fixed effects λ_a, and an indicator that the individual is vulnerable to bondage based on their residence ($K_i * Th_i$):

$$(A4)\quad GDZ_{i,cd} = \alpha + \beta K_i * Th_i + \lambda_e + \lambda_d + \lambda_a + \upsilon_{i,cd}\,.$$

Figure 1 plots the coefficient on the vulnerability indicator β for males age 20-60, and Figure 2 plots it for females 20-60. High castes have been excluded from the control group throughout this analysis.

Figure 1 illustrates that the decline in schooling attainment for Tharus in Kamaiya districts has been similar in all Tharus born after 1951. This is significant, because it is the cohort born in 1951 that would have been in primary school when bonded labor arose in Kamaiya districts. The relative decline in schooling attainment of about 3 tenths of a standard deviation is slightly larger than that observed for children 10-14 in Table 2. This suggests that if anything, the legislation directed at bonded labor might be attenuating our estimates of the impacts of vulnerability to slavery on child labor and schooling.

In figure 2, the data suggests a slightly different story for women. The disadvantage in educational attainment for women vulnerable to bondage has been increasing in more recent cohorts. This is likely driven by the secular rise in education of women over the last 30 years. The average education completed by a female (rural, non-mountain population) only rises above one year for females born after 1971, and the standard deviation of completed education is very small even in 1971 (2 completed years). In fact for women born in 1951, the mean completed years of education is 0.2 years with a standard deviation of 1.1 (compared to a mean of 1.4 and standard deviation of 3.2 for men born in the same year). Thus, until very recently, there is very little scope for vulnerability to slavery to impact the education of women. Estimates in Table 2 of the association between vulnerability to slavery and educational attainment of girls 10-14 are similar to that observed for girls 18-22 in Figure 2. Thus, while the data suggest that the decline in educational attainment for women is recent, nothing suggests that the decline in education evident in the 10-14 cohort is the result of some unique experience of that cohort. Hence, we do not find any compelling evidence that the declines in schooling and increases in child labor that we observe in children 10-14 have been created by the recent policy environment.

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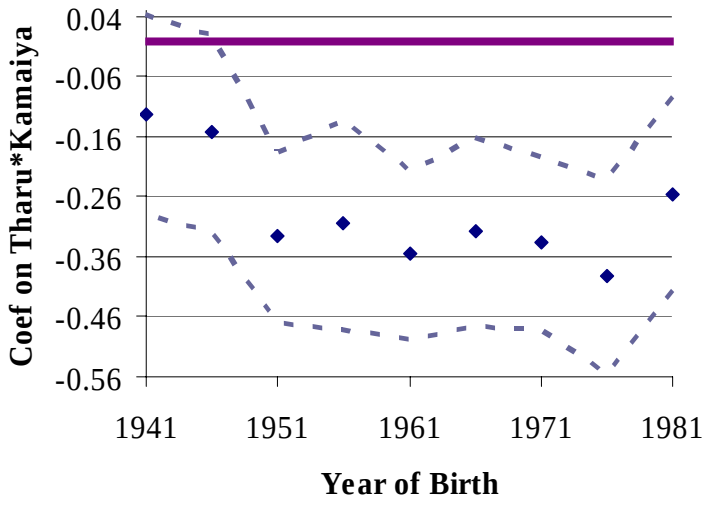
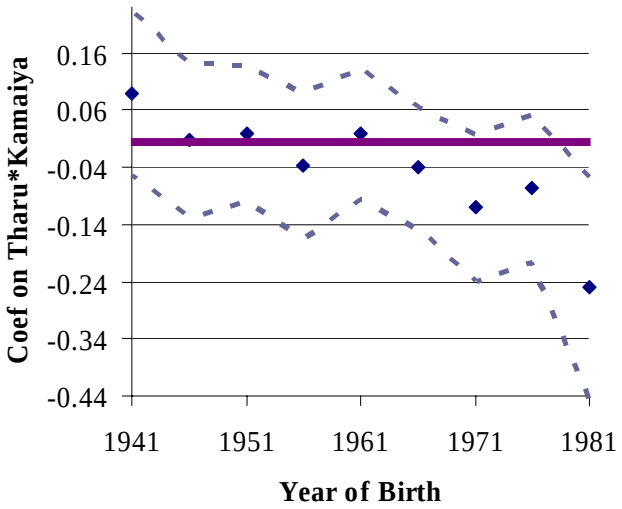


Note: 99 % Confidence Interval Pictured

Figure 1

Estimates of Effects of Being Tharu Born in Kamaiya Districts on Grade Deficit Z-Scores by Year of Birth, Males Age 20-60



Note: 99 % Confidence Interval Pictured

Figure 2

Estimates of Effects of Being Tharu Born in Kamaiya Districts on Grade Deficit Z-Scores by Year of Birth, Females Age 20-60

Table 1A: Descriptive Statistics, Children 10-14

	Boys		*Girls*	
	Mean	Std. Dev.	Mean	Std. Dev.
Sample Size	94,128		87,523	
Age	11.857	1.427	11.870	1.434
High Caste	0.298	0.457	0.310	0.463
Tharu	0.071	0.257	0.072	0.258
Kamaiya	0.096	0.294	0.096	0.294
Tharu*Kamaiya	0.035	0.183	0.035	0.184
Attends School	0.831	0.375	0.717	0.451
Educational Attainment	3.335	2.294	2.712	2.378
Grade Deficit Z-Score	0.014	0.952	0.018	0.971
Principal Usual Activity:				
Student	0.795	0.403	0.666	0.472
Worker	0.136	0.342	0.267	0.442
Worker, not attend School	0.100	0.299	0.215	0.411

Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Table 1B: Descriptive Statistics, Ever Married Women 15-49

	Mean	Std. Dev.
Sample Size	275,910	
Age	30.925	8.893
High Caste	0.295	0.456
Tharu	0.073	0.259
Kamaiya	0.094	0.291
Tharu*Kamaiya	0.033	0.177
Can Read and Write	0.242	0.428
Births	2.704	2.189
Sons	1.417	1.333
Daugthers	1.287	1.384
Deaths	0.254	0.743
Sons	0.137	0.470
Daugthers	0.117	0.429

Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Table 2: Child labor and Schooling Results

	Boys			Girls		
	Distict & Caste FE	Excluding High Caste	Head Controls	Distict & Caste FE	Excluding High Caste	Head Controls
	1	2	3	4	5	6
Attends School	-0.073	-0.077	-0.058	-0.124	-0.132	-0.102
	[5.544]**	[5.059]**	[4.689]**	[5.153]**	[5.347]**	[4.595]**
Grade Deficit Z-Score	-0.189	-0.204	-0.122	-0.232	-0.280	-0.161
	[3.993]**	[4.281]**	[2.916]**	[3.644]**	[4.578]**	[3.009]**
Principal Usual Activity:						
Student	-0.069	-0.075	-0.053	-0.126	-0.141	-0.102
	[4.189]**	[4.169]**	[3.464]**	[3.890]**	[4.531]**	[3.402]**
Worker	0.076	0.083	0.065	0.118	0.129	0.099
	[5.544]**	[5.379]**	[5.105]**	[3.590]**	[4.316]**	[3.232]**
Worker, Not attend School	0.071	0.079	0.062	0.113	0.116	0.095
	[6.342]**	[6.069]**	[5.841]**	[4.158]**	[4.783]**	[3.776]**
Age Effects	Yes	Yes	Yes	Yes	Yes	Yes
Caste & District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Head Controls	No	No	Yes	No	No	Yes

Coefficient on Kamaiya District*Tharu interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. Observation is a child in age 10-14. All regressions include a vector of age effects. All standard errors are clustered at the ethnic group * district level. High castes excluded from columns 2 and 5 are Chhetri, Brahman, and Thakuris. Head attributes include an indicator for the head's gender, head education fixed effects, head age (in 5 year intervals) fixed effects, and an indicator for the head's marital status. Schwarz critereon critical value for columns 1 and 3 is 3.38 and 3.33 for column 2. Schwarz critereon critical value for columns 4 and 6 is 3.37 and 3.32 for column 5. Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Table 3: Fertility Results

				Female Literacy		Female Age Groups			
	Distict & Caste FE	Education Controls	Head Controls	Literate	Illiterate	Teen	20s	30s	40s
	1	2	3	4	5	6	7	8	9
Births	0.281	0.263	0.239	-0.051	0.317	0.067	0.12	0.359	0.521
	[4.133]**	[3.950]**	[3.580]**	[0.688]	[4.615]**	[1.436]	[1.629]	[3.481]**	[4.460]**
Sons	0.149	0.141	0.13	0.036	0.157	0.061	0.062	0.178	0.284
	[3.941]**	[3.808]**	[3.427]**	[0.771]	[4.083]**	[2.300]*	[1.566]	[3.100]**	[4.207]**
Daugthers	0.132	0.122	0.109	-0.088	0.16	0.006	0.058	0.181	0.237
	[3.752]**	[3.504]**	[3.178]**	[1.992]*	[4.386]**	[0.205]	[1.324]	[3.129]**	[3.481]**
Deaths	0.042	0.038	0.029	0.023	0.044	0.007	0.02	0.063	0.049
	[1.878]	[1.727]	[1.318]	[1.450]	[1.755]	[0.658]	[1.055]	[1.906]	[0.936]
Sons	0.027	0.025	0.02	0.013	0.03	0.006	0.017	0.035	0.031
	[2.051]*	[1.892]	[1.535]	[1.238]	[1.964]*	[1.143]	[1.606]	[1.890]	[0.945]
Daugthers	0.015	0.014	0.009	0.009	0.014	0	0.003	0.027	0.018
	[1.405]	[1.280]	[0.865]	[0.915]	[1.185]	[0.007]	[0.258]	[1.492]	[0.686]
District & Caste Fixed Effe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education Fixed Effects	No	Yes	Yes	No	No	No	No	No	No
Head Controls	No	No	Yes	No	No	No	No	No	No

Coefficient on Kamaiya District*Caste interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. Observation is an ever married female age 15-49 in columns 1-5. Columns 6-9 restricted to ever married females 15-19, 20-29, 30-39, and 40-49 respectively. All standard errors are clustered at the ethnic group * district level. Head controls include an indicator for the head's gender, head education fixed effects, head age (in 5 year intervals) fixed effects, and an indicator for the head's marital status. High castes (Chhetri, Brahman, and Thakuris) excluded throughout. Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Table 4: Falsification Test for Child labor and Schooling Results

Caste	Chhetri	Brahmin	Magar	Kami	Muslim
	1	2	3	4	5
Boys	73,940	71,066	59,373	59,373	59,373
Attends School	0.017	0.02	0.036	-0.003	0.007
	[1.432]	[1.405]	[2.189]*	[0.093]	[0.219]
Grade Deficit Z-Score	0.029	0.09	0.129	0.022	-0.026
	[1.034]	[2.059]*	[1.450]	[0.426]	[0.315]
Worker, Not attend School	-0.009	-0.007	-0.035	0.01	0.015
	[0.728]	[0.493]	[1.690]	[0.345]	[0.510]
Girls	68,010	65,604	54,086	54,086	54,086
Attends School	0.012	0.013	-0.002	0.028	-0.025
	[0.569]	[0.606]	[0.051]	[0.969]	[0.668]
Grade Deficit Z-Score	0.024	-0.024	-0.055	0.127	-0.076
	[0.472]	[0.381]	[0.448]	[1.833]	[0.808]
Worker, Not attend School	-0.035	-0.018	-0.006	-0.015	0.034
	[1.671]	[0.703]	[0.147]	[0.557]	[0.888]
Age Effects	Yes	Yes	Yes	Yes	Yes
Caste & District Fixed Effects	Yes	Yes	Yes	Yes	Yes

Coefficient on Kamaiya District*Caste interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. Caste is indicated by column heading. Observation is a child in age 10-14. All standard errors are clustered at the ethnic group * district level. High castes excluded from columns 3-5 are Chhetri, Brahman, and Thakuris. Brahman and Thakuri are exlcuded from column 1. Chhetri and Thakuri are excluded from column 2. Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Table 5: Robustness of Fertility Results

		Female Literacy		Female Age Groups			
Caste:	Distict & Caste FE	Literate	Illiterate	Teen	20s	30s	40s
	1	2	3	4	5	6	7
1 Chhetri	0.07	0.045	0.068	0.014	0.016	0.11	0.094
	[1.773]	[1.230]	[1.438]	[0.363]	[0.408]	[1.374]	[0.938]
2 Brahmin	-0.139	-0.186	-0.117	0.038	-0.148	-0.13	-0.275
	[2.187]*	[6.025]**	[1.620]	[0.874]	[4.091]**	[1.125]	[1.753]
3 Magar	0.102	0.048	0.077	-0.055	0.172	0.128	0.03
	[1.547]	[1.094]	[0.964]	[1.130]	[2.559]*	[0.682]	[0.187]
4 Kami	-0.041	0.077	-0.054	0.101	0.017	-0.06	-0.23
	[0.453]	[1.162]	[0.521]	[1.943]	[0.211]	[0.325]	[1.720]
5 Muslim	0.122	0.131	0.119	-0.073	-0.008	0.241	0.257
	[2.053]*	[0.637]	[2.001]*	[1.544]	[0.082]	[1.763]	[1.012]

Dependent variable: total number of births. Coefficient on Kamaiya District*Caste interactions reported and T-statistics in brackets. All regressions include district fixed effects, caste fixed effects, and age of woman fixed effects. * Significant at 5 percent. ** significant at 1 percent. Caste is indicated by row heading. Observation is an ever married female age 15-49 in columns 1-5. Columns 6-9 restricted to ever married females 15-19, 20-29, 30-39, and 40-49 respectively. All standard errors are clustered at the ethnic group * district level. High castes excluded from rows 3-5 are Chhetri, Brahman, and Thakuris. Brahman and Thakuri are exlcuded from row 1. Chhetri and Thakuri are excluded from row 2. Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Table 6: Household Attributes

		Non-Kamaiya Districts		Kamaiya Districts		Coef on
		Tharu	Non-Tharu	Tharu	Non-Tharu	Tharu*Kamaiya
		-1	-2	-3	-4	-5
	Sample Size	15,701	251,784	15,090	12,369	294944
	Household Attributes					
1	Lives in a Permanent Structure	0.147	0.250	0.056	0.136	-0.049
		(0.354)	(0.433)	(0.230)	(0.343)	[2.788]**
2	Owns Residential Structure	0.968	0.960	0.965	0.961	0.004
		(0.176)	(0.196)	(0.185)	(0.194)	[0.526]
3	Operates Agricultural Land	0.819	0.852	0.889	0.860	0.027
		(0.385)	(0.355)	(0.315)	(0.347)	[1.333]
4	Operates Nonagricultural Enterprise	0.228	0.196	0.151	0.265	-0.076
		(0.420)	(0.397)	(0.358)	(0.441)	[2.770]**
5	Owns Livestock or Poulty	0.835	0.837	0.909	0.834	0.012
		(0.371)	(0.370)	(0.287)	(0.372)	[0.810]
6	Protected Water Source	0.974	0.909	0.947	0.879	0.053
		(0.158)	(0.287)	(0.225)	(0.326)	[1.940]
7	Toilet	0.109	0.252	0.116	0.141	0.033
		(0.312)	(0.434)	(0.320)	(0.348)	[1.176]
8	Electricity for lighting	0.286	0.170	0.069	0.125	-0.095
		(0.452)	(0.376)	(0.253)	(0.331)	[2.586]**
9	Cooks with Dung	0.275	0.224	0.050	0.049	0.027
		(0.447)	(0.417)	(0.217)	(0.217)	[0.735]
10	Cooks with Kerosene or Propane	0.027	0.040	0.016	0.026	-0.003
		(0.162)	(0.196)	(0.124)	(0.160)	[0.659]
11	Owns Radio	0.367	0.461	0.482	0.470	0.03
		(0.482)	(0.498)	(0.500)	(0.499)	[1.734]
12	Owns TV	0.169	0.085	0.037	0.064	-0.077
		(0.375)	(0.279)	(0.189)	(0.245)	[4.991]**
13	Household Size	6.906	6.724	8.755	6.739	1.944
		(3.023)	(2.713)	(4.559)	(2.671)	[15.987]**
	Head Attributes					
14	Head's Age	42.644	44.370	41.257	42.820	-0.162
		(11.063)	(11.889)	(11.033)	(11.735)	[0.382]
15	Head Female	0.061	0.115	0.026	0.120	-0.065
		(0.239)	(0.319)	(0.158)	(0.326)	[5.029]**
16	Head Married	0.990	0.987	0.987	0.985	0.006
		(0.100)	(0.113)	(0.113)	(0.121)	[1.663]
17	Head's Education	2.557	1.548	1.351	1.531	-0.968
		(3.789)	(3.157)	(2.819)	(3.009)	[7.177]**

Observation is a household. Standard deviations in parenthesis. T-Statistics in Brackets. Columns 1-4 contain means and standard deviations for each population group. Column 1 is Tharu in Non-Kamaiya districts. Column 2 is non-Tharu in Non-Kamaiya districts. Columns 3 and 4 are Tharu and Non-Tharu respectively in Kamaiya districts. Column 5 contains regression results including caste fixed effects, district fixed effects, and standard errors clustered at the district-ethnic group level. * Significant at 95%. ** Significant at 99%
Source: 2001 population and housing census, public use microdata. High castes (Chhetri, Brahman, and Thakuri) excluded. Rural hill and terai population only.

Table 7: Child labor and Schooling Results with Household Attribute Controls

	Boys			Girls		
Controls:	Table 2	Hh	Hh+Head	Table 2	Hh	Hh+Head
	1	2	3	4	5	6
Children 10-14	64,929			59,260		
Attends School	-0.077	-0.076	-0.061	-0.124	-0.127	-0.111
	[5.059]**	[5.345]**	[4.421]**	[5.153]**	[5.950]**	[5.253]**
Grade Deficit Z-Score	-0.204	-0.188	-0.127	-0.232	-0.262	-0.215
	[4.281]**	[4.465]**	[3.263]**	[3.644]**	[5.348]**	[4.657]**
Worker, Not attend School	0.079	0.077	0.067	0.113	0.111	0.099
	[6.069]**	[6.277]**	[5.609]**	[4.158]**	[5.063]**	[4.552]**
Age Effects	Yes	Yes	Yes	Yes	Yes	Yes
Caste & District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Household Controls (Table 6, rows 1-13)	No	Yes	Yes	No	Yes	Yes
Head Controls (Table 6, rows 14-17)	No	No	Yes	No	No	Yes

Coefficient on Kamaiya District*Tharu interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. Observation is a child in age 10-14. All standard errors are clustered at the ethnic group * district level. For columns 3 and 6: Head age is entered with dummies for 5 year groupings, and education is include with a vector of indicators for completed years of schooling. High castes (Chhetri, Brahman, and Thakuris) excluded throughout. Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Table 8: Child labor and Schooling Results, Conditional on observed household composition

	Boys Household Fertility	Household Composition	Girls Household Fertility	Household Composition
	1	2	3	4
Attends School	-0.079	-0.082	-0.131	-0.142
	[5.069]**	[5.306]**	[5.492]**	[6.212]**
Grade Deficit Z-Score	-0.212	-0.223	-0.269	-0.297
	[4.179]**	[4.509]**	[4.395]**	[5.152]**
Worker, Not attend School	0.076	0.077	0.111	0.119
	[5.827]**	[5.960]**	[4.738]**	[5.244]**
Age Effects	Yes	Yes	Yes	Yes
Caste & District Fixed Effects	Yes	Yes	Yes	Yes
Household Fertility Controls	Yes	Yes	Yes	Yes
Household Composition Controls	No	Yes	No	Yes

Coefficient on Kamaiya District*Tharu interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. Observation is a child in age 10-14. All standard errors are clustered at the ethnic group * district level. Household fertility controls include a vector of indicators for the number of births to ever married women in the household and the fraction of those births that are female. Household composition controls include the household fertility controls plus a vector of indicators for household size, the number of children 5 and under, and the number of children 6-17 in the household as well as the fraction of all residents who are female and the fraction of all children 6-17 that are female. High castes (Chhetri, Brahman, and Thakuris) excluded throughout. Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Appendix Table 1: Population means by gender for children 10-14

	Non-Kamaiya Districts		Kamaiya Districts	
	Tharu	Non-Tharu	Tharu	Non-Tharu
Boys				
Sample Size	3,449	81,662	3,261	5,756
Attends School	0.86	0.83	0.79	0.86
Grade Deficit Z-Score	0.06	0.02	-0.28	0.01
Principal Usual Activity:				
Student	0.82	0.79	0.77	0.82
Worker	0.10	0.14	0.18	0.12
Worker, not attend School	0.07	0.10	0.14	0.09
Girls				
Sample Size	3,232	75,921	3,056	5,314
Attends School	0.72	0.72	0.60	0.76
Grade Deficit Z-Score	0.02	0.03	-0.34	0.08
Principal Usual Activity:				
Student	0.68	0.67	0.57	0.72
Worker	0.24	0.27	0.35	0.23
Worker, not attend School	0.19	0.21	0.31	0.18

Columns 1 and 2 contain means for Tharu and non-Tharu ethnicities in districts where the Kamaiya system is not prevelant. Columns 3 and 4 contain means for Tharu and non-Tharu in Kamaiya districts. Source: 2001 population and housing census, public use microdata. Rural hill and terai population

Appendix Table 2: Fertility Descriptive Statistics for Ever-Married Women 15-49

	Non-Kamaiya Districts		Kamaiya Districts	
	Tharu	Non-Tharu	Tharu	Non-Tharu
Sample Size	11,037	239,005	8,968	16,900
Births	2.50	2.70	2.96	2.79
Sons	1.31	1.41	1.55	1.46
Daugthers	1.19	1.28	1.40	1.32
Deaths	0.16	0.25	0.31	0.31
Sons	0.09	0.14	0.17	0.16
Daugthers	0.07	0.12	0.14	0.15
Deaths/Births	0.05	0.06	0.07	0.07

Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Appendix Table 3: Population means for various castes by gender for children 10-14

	Boys		Girls	
	Non-Kamaiya	Kamaiya	Non-Kamaiya	Kamaiya
Chhetri				
Sample Size	12,876	1,691	12,386	1,539
Attends School	0.92	0.93	0.82	0.86
Grade Deficit Z-Score	0.23	0.20	0.23	0.28
Worker, not attend School	0.04	0.03	0.14	0.09
Brahmin				
Sample Size	10,835	859	10,684	835
Attends School	0.96	0.96	0.95	0.93
Grade Deficit Z-Score	0.51	0.48	0.67	0.54
Worker, not attend School	0.01	0.02	0.03	0.05
Magar				
Sample Size	7,733	532	7,351	515
Attends School	0.90	0.89	0.79	0.78
Grade Deficit Z-Score	-0.02	-0.01	0.06	0.01
Worker, not attend School	0.06	0.06	0.16	0.19
Kami				
Sample Size	3,769	438	3,746	429
Attends School	0.80	0.78	0.67	0.69
Grade Deficit Z-Score	-0.28	-0.36	-0.29	-0.21
Worker, not attend School	0.13	0.14	0.25	0.24
Muslim				
Sample Size	3,357	407	2,842	338
Attends School	0.57	0.63	0.37	0.41
Grade Deficit Z-Score	-0.48	-0.56	-0.62	-0.65
Worker, not attend School	0.25	0.26	0.47	0.50

Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Appendix Table 4: Child labor and Schooling Results by District of Birth
Sample Means and Coefficient on Born in Kamaiya District*Tharu interactions

	Non-Kamaiya Districts		Kamaiya Districts		Coef on Tharu*Born in Kamaiya
	Tharu	Non-Tharu	Tharu	Non-Tharu	
	-1	-2	-3	-4	-5
Boys	3,446	56,333	3,261	2,727	65,767
Attends School	0.856	0.782	0.790	0.776	-0.078
	(0.351)	(0.413)	(0.407)	(0.417)	[5.370]**
Grade Deficit Z-Score	0.057	-0.126	-0.275	-0.262	-0.208
	(0.900)	(0.976)	(0.890)	(0.942)	[4.351]**
Worker, Not attend School	0.073	0.130	0.142	0.141	0.080
	(0.260)	(0.337)	(0.349)	(0.348)	[6.280]**
Girls	3,231	51,256	3,052	2,503	60,042
Attends School	0.725	0.643	0.603	0.638	-0.135
	(0.447)	(0.479)	(0.489)	(0.481)	[5.474]**
Grade Deficit Z-Score	0.021	-0.162	-0.344	-0.226	-0.299
	(0.934)	(0.958)	(0.866)	(0.928)	[4.931]**
Worker, Not attend School	0.194	0.271	0.307	0.294	0.117
	(0.396)	(0.445)	(0.461)	(0.456)	[4.826]**

Observation is a child age 10-14. Columns 1-4 contain means and standard deviations for each population group. Column 5 contains regression results including caste fixed effects, district fixed effects, and standard errors clustered at the district of birth-ethnic group level. * Significant at 95%. ** Significant at 99%. Source: 2001 population and housing census, public use microdata. High castes (Chhetri, Brahman, and Thakuri) excluded. Rural hill and terai population only.

Appendix Table 5: Within Caste Differences in Schooling Attainment

	Tharus Only		All Non-High Castes	
	Male	Female	Male	Female
	-1	-2	-3	-4
Young*Kamaiya	**-0.154**	**-0.203**	-0.044	-0.069
	[2.327]*	**[4.661]****	[0.613]	[2.165]*
Tharu*Kamaiya			-0.123	-0.004
			[2.305]*	[0.212]
Tharu*Young			0.237	0.017
			[5.328]**	[0.546]
Tharu*Young*Kamaiya			**-0.219**	**-0.163**
			[2.601]**	**[3.804]****
Age Effects	Yes	Yes	Yes	Yes
District of Birth Effects	Yes	Yes	Yes	Yes
Caste Effects	Sample restricted to Tharus		Yes	Yes

Dependent variable: Grade deficit z-score. Coefficient on variable reported in the row are reported, and T-statistics in brackets. Young is an indicator that observations is age 20-35 in 2001. Kamaiya is an indicator than an observation is born in Kamaiya district. Tharu is an indicator that an observation is Tharu ethnicity. * Significant at 5 percent. ** significant at 1 percent. Observation is an adult of age 20-35 or 52-70. # observations are 16211, 16309, 149970, and 154992 in columns 1-4 respectively. Standard errors in columns 1 & 2 are clustered at the district of birth - age cohort (e.g. ages 20-35) level. Standard errors in columns 3 & 4 are clustered at the district of birth - ethnic group - cohort level. High castes (Chhetri, Brahman, and Thakuris) excluded throughout. Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.