

Institutional Influences on Human Capital Accumulation: Micro Evidence from Children Vulnerable to Bondage*

Eric V. Edmonds[†] and Salil Sharma[‡]

November 13, 2006

Abstract

How do weak private property institutions influence human capital investment decisions? Empirical challenges have limited research on this potentially important facet of how institutions influence prosperity. In this paper, we argue that a debt-bondage institution prevalent in the western plains of Nepal is an unusually good setting in which it is possible to explore how institutions affect investments in education. We observe substantially more child labor, lower schooling attendance and attainment, and significantly elevated fertility in families vulnerable to debt-bondage. The data are most consistent with diminished returns to education in the vulnerable population as an explanation for our findings. We argue that this diminished return to education owes to a substantive expropriation threat. That is, the absence of secure property rights over human capital's output is a significant deterrent to educational investments.

1 Introduction

Institutional differences between countries are often cited as a fundamental explanation for cross-country differences in prosperity. Understanding how institutions affect the behavior of microeconomic agents has become a major re-

*We are grateful to Arjun Karki, Bal Kumar, Uddhav Paudyal, Shiva Sharma, and Ashutosh Tiwari for their time and assistance in building our knowledge of the Kamaiya system. We are in debt to Patty Anderson, Kaushik Basu, Erica Field, Jim Feyrer, Douglas Miller, Nina Pavcnik, Bruce Sacerdote, Jay Shambaugh, Doug Staiger, Ken Swinnerton, and seminar participants at ASSA Meetings in Boston, BREAD, Cornell, Michigan State, NBER Children's Program Meeting, and NEUDC for helpful comments and suggestions. Both authors are grateful to the Rockefeller Center at Dartmouth College for their support of our time and sponsoring field work. Correspondence to Edmonds at 6106 Rockefeller Center, Department of Economics, Dartmouth College, Hanover NH 03755 USA, email: eedmonds@dartmouth.edu. <http://www.dartmouth.edu/~eedmonds/>.

[†]Dartmouth College, IZA, and NBER

[‡]Dartmouth College '05

search question. Acemoglu and Johnson (2005) for example argue that institutions which protect private property are critical for understanding the living standards-institutions connection. Good private property institutions enforce private property rights throughout a society, prevent powerful groups from expropriating the incomes and investments of others, and allow some degree of equal opportunity to make investments. Research tends to focus on the effect of property rights on investments in physical capital, and there is a supporting microeconomic literature that documents a relationship between the security of property rights over physical capital and investments in that capital (for example, Besley 1995 and Banerjee, Gertler, and Ghatak 2002).

However, the same concerns about access to investment and investment incentives can influence investment in human capital as well (Acemoglu, Johnson, and Robinson 2004). While it could be easier to physically seize an asset than human capital, the physical seizure of an asset is only one channel through which weak private property institutions might affect investment decisions. If powerful groups can expropriate income or restrict the opportunities of the less powerful, this will deter investment in both physical and human capital among the group facing the expropriation threat or lack of access. This idea that investments in human capital are influenced by the investor's ability to capture returns is also in the literatures on job specific human capital (Luttmer 2005 is an example) and parental agency in education decisions (for example, Baland and Robinson 2001).

Direct evidence of an influence of private property institutions on human capital accumulation is rare. Acemoglu and Johnson (2005) point out that in the cross-country setting it is difficult to separate impacts of institutions working through capital markets and those working through human capital channels because of the strong correlation between education and institutional quality. Recent work by Field (2004) finds an effect of an urban titling program in Peru on child time allocation working through the value of child and parent time in protecting their property. However, empirical evidence of the impact of expropriation threat or parental agency on human capital decisions is largely absent at the micro level because of the problem of codifying differences in expropriation threat and in explaining why it varies across population groups.

In this paper, we look for institutional influences on human capital accumulation among children vulnerable to a debt-bondage institution prevalent in Western Nepal. 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. There are approximately 20 million people in debt-bondage in the world today according to the United Nations' Working Group on Contemporary Forms of Slavery (1998). While debt-bondage has been of interest to economists (Bhaduri 1973, Braverman and Stiglitz 1982, Bardhan 1983, Eswaran and Kotwal 1995, Genicot, 2002, Basu 2002, Basu and Chau 2004, Lilienfeld-Toal and Mookerjee 2005), we believe this case study also can provide valuable illumination on the interconnection between private property institutions and human capital accumulation. First, the Kamaiya system of debt-bondage studied herein accentuates the main channels through which weak private property institutions

might influence human capital directly. The interlinked nature of the bonded and the bondholder in this setting make it easy for the bondholder to capture the income of the bonded. Once bonded, exit appears difficult and debts are inherited. More than a third of the population vulnerable to bondage is bonded. Hence, the intrinsic risk of bondage for children in the vulnerable population is high, and there is considerable threat of expropriation of returns to education. This idea is developed more fully in the next section of the paper. As the system supports local elites, it may also limit access to education and most of the theoretical work on bondage to date considers how it may prevent other credit systems from arising (e.g Genicot 2002). Thus, the channels through which poor institutions influence human capital investments will be augmented in the population vulnerable to bondage, and this case will allow us to explore which channel underlies our findings.

Second, unlike a general expropriation threat, vulnerability to debt-bondage in the Kamaiya system is straightforward to codify in the data. The Kamaiya system is large in scale with roughly 100,000 bonded (Sharma 1999) and thereby measurable with census data. Moreover, as discussed in detail in section 2, 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 (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 comparable members of other similar ethnic groups living in the same geographic areas, using information from other regions of Nepal to control for latent ethnic group differences. We focus on vulnerability to bondage rather than bondage in order to avoid concerns about the endogeneity of bondage. Our empirical work, discussed in detail in sections 3 and 4, focuses on controlling for confounding factors that might be associated with this type of ethnic group-geography variation. The patterns observed in the data for the population vulnerable to bondage do not appear in the vulnerable ethnic group in areas and sub-locations where bondage is not prevalent. In areas where bondage is prevalent, our findings do not appear in any other ethnic group or in older groups of the vulnerable population educated before the system is believed to have arisen.

We observe that children vulnerable to bondage have reduced schooling attendance and attainment and elevated child labor relative to what we would expect based on their observable characteristics in the 2001 population and housing census of Nepal. The variation in education and child labor associated with vulnerability to bondage is extremely large, similar in magnitude to the variation in schooling and child labor associated with the death of a father. The richness of the present data allows us to consider what aspect of these weak private property institutions explain the observed diminished human capital investment. The evidence herein is most consistent with the idea that when investors are uncertain about their ability to capture returns on investment in human capital, investment may be deterred in much the same way investment in

physical capital would be. That is, the expropriation threat appears most consistent with the data as the mechanisms through which weak private property institutions influence human capital investment.

In the next section of the paper we provide background on the Kamaiya system of debt-bondage and discuss how it can influence human capital investment. In section three, we describe the data and document the basic association between vulnerability to bondage and reduced schooling and increases in child labor. In section four, we disentangle the different paths through which weak institutions of private property might influence investments in children in our setting, and section five is our conclusion.

2 Background

2.1 Institutions and Education

Property rights institutions are typically defined “as the rules and regulations protecting citizens against the power of the government and elites” (Acemoglu and Johnson 2005). In the case of human capital, these institutions would protect investors against the forcible expropriation of labor’s output. For example, they would allow an entrepreneur to capture the extra income his education helps him generate in his business and prevent its theft by more powerful individuals in the community or the government. Taxes are a form of coerced expropriation of individual income, but the more general concern in understanding institutions is the extent to which incentives to invest in human capital can be deterred by the ability of local elites to capture the return on a worker’s efforts.

This issue of the effect on property rights institutions on human capital is central in the literature on investments in slaves in American history. 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 at the time). They argue that the master’s ownership of the slave makes it valuable as capital. These well defined property rights over the slave coupled with the owner’s incentives to maximize the productivity of this capital might be responsible for their surprising findings. 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).

This emphasis on the importance of appropriation for human capital investments is central in the literature on parental agency in education decisions. When altruistic parents do not plan to leave bequests and are unable to coerce transfers from their children, they may underinvest in education relative to what is privately optimal from the child’s perspective (Baland and Robinson 2000). For example, Dreze and Sen (1995) note that gender differences in educational investments in India may be influenced by the fact that boys tend to continue

to live in close proximity to their parents while girls tend to move away.

The inability of the child to credibly commit to transfers of future income to parents is critical for parental agency to result in underinvestment in education. By analogy, one might expect that a general expropriation threat in a country might not influence education investments if there are potential transfers from the expropriator to the person whose returns are expropriated. Consider a simple setting where there is one investor (parent) in education and one local elite with the possibility of capturing the investor's returns on investments in education. R is the present discounted return from educating a child for the investor. The return is the same to both the investor and the elite if he should capture it. Education is costly by an amount C and education is assumed to be a profitable investment, $R - C \geq 0$. p is the exogenous probability that the elite captures R . $0 < p < 1$. The expropriation threat diminishes investment incentives, because the investor's return $(1 - p)R - C$ and the elite's return $pR - C$ can be negative even though $R - C \geq 0$ if either the investor or the elite bear the full cost of education. However, a simple cost sharing solution to this problem is available: the elite pays the investor pC in order to make the education investment.

Basu (1989) shows that adverse selection can prevent a simple cost-sharing solution to this incentive problem. Suppose there is heterogeneity in the probability that an elite can capture the return to education investments. This heterogeneity is unobservable to the elite but known to the investor.¹ Heterogeneity may stem from differences in the child's outside options, mobility, or ability or competition from other elites. The elite cannot discriminate in his cost-sharing offer (for example, he might partially fund schooling in the area). If the elite commits to bearing a certain fraction of education costs, only investors with lower probabilities of expropriation choose to take the education. Depending on the distribution of p in the population, this can cause the elite to largely subsidize the education of those for whom he is least likely to capture the return. Consequently, his cost sharing offer may be unprofitable.

For example, assume that the probability that an elite captures an investor's return on education is uniformly distributed between 0 and 1. p_i is investor's draw from this distribution for the child in question, and p_i is only known to the investor. Denote p^*C as the elite's cost sharing offer. The investor choose to take this offer and educate the child when:

$$(1 - p_i)R - C + p^*C \geq 0 \tag{1}$$

The average probability that an elite captures the returns on an educated individual for the educated population is then less than p^* :

$$E[p | p^*] = \frac{R - C + p^*C}{2R} \tag{2}$$

¹Bardhan (1984) and Eswaran and Kotwal (1985) argue against asymmetric information in rural economies with high levels of interpersonal interaction. However, all that is necessary for Basu's argument is less than perfect information.

The elite then chooses p^* to maximize his profit: $E[p | p^*]R - p^*C$. In the uniform example, notice that expected profit is just:

$$\frac{R - C}{2} - \frac{1}{2}p^*C \quad (3)$$

which is maximized at $p^*=0$. Because of adverse selection, the elite does not offer cost-sharing in this case and .

The effects of weak private property institutions on education extend beyond this concern about expropriation. First, the expropriation of income may leave the affected population poorer, and investors may view education as a consumption good in addition to an investment. Second, weak private property institutions may affect occupational choice, influencing the investor's desired education if individuals are induced to select occupations with little return to education. Third, access to schooling may be influenced by the strength of institutions and the power of local elites to direct things like school spending. For example, even when the expropriation threat is very low, few may choose education if the low expropriation threat means that the politically powerful do not provide schooling access. Fourth, access to credit to finance educational investment may be limited by weak institutions. Fifth, the weak institutions may directly affect the cost of schooling by influencing the employment options open to children as Field (2004) observes in Peru, where a lack of title to urban property affected child time allocation through the family's need to protect their property.

2.2 Debt-Bondage

In the Kamaiya system of debt-bondage, adult sharecroppers take out a debt from their landlord and agree to serve the landlord exclusively until the debt is repaid after the harvest. Posting oneself as collateral to access credit is not novel. Galenson (1981, 1984) describes a similar rationale 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. If the bonded is the residual claimant on all investment, we might anticipate little effect of the debt-bondage system itself on investments in children except to the extent that the credit constraints it overcomes are important in child labor and schooling decisions (as in Baland and Robinson 2001).

However, in the contemporary setting, debt-bondage is often characterized as a type of slavery, because market power on the part of the bondholder affects the ability of the debtor to repay debts and exit bondage. Basu (2002) for example argues that when bondholders have market power in credit and land or labor markets, the bondholder can 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 at harvest time, he is tied to the bondholder and is not free to negotiate

alternative contracts with other landowners. While there is some evidence that bondholders trade debtors, we encountered nothing to suggest that the bonded can leverage this to exit bondage and thereby maintain their residual claim on investments. Implicit collusion is one obvious explanation for this failure to compete away bondage. 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. Moreover, in addition to reducing income, market power on behalf of the bondholder in multiple markets may lead to very high interest rates. Basu (1987) emphasizes that a lender may be able to charge usurious interest rates by offering an interlinked deal to a prospective sharecropper. 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 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. This difficulty in exiting bondage is why the government of Nepal, the International Labor Organization, and many other involved NGOs and IGOs consider the Kamaiya system as slavery rather than as a solution to the problem of an inability to post other forms of collateral. The government of Nepal has outlawed the Kamaiya system four times since 1974.²

Thus, market power on the part of the landlord creates a large intrinsic risk that a child born vulnerable to the Kamaiya system enters bondage. Specific rules govern who may be bonded in the Kamaiya system. It is prevalent in five Western and Mid-Western districts in the plains of Nepal and largely confined to the Tharu ethnic group.³ We refer to Tharu in these districts as the population that is "vulnerable to bondage." 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. 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 and are considered middle social status today). 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. Even

²Why don't the bonded just move? The remoteness of the area where the system is most prevalent, coupled with high transaction costs of moving for subsistence households and implicit intrafamilial collateral are important in this context.

³Guatam (2001) reports that 32 percent of the Tharu population in Dang district are bonded, 16 percent in Banke, 53 percent in Bardiya, 50 percent in Kailali, and 27 percent in Kanchanpur. Overall 7 percent of Tharu in Nepal are bonded in the Kamaiya system.

today, in the 2002 Agricultural census, 35 percent of the land in the Kamaiya districts is held by non-indigenous high castes, compared to 14 percent in other districts where the Tharu are prevalent.

The Kamaiya debt-bondage system emerged in the mid 60s for the Tharu as a way for them to access credit. Today, the Tharu in Kamaiya districts are 17 percent more likely to take out a loan than other ethnic groups living in the same geographic areas and 10 percent more likely to have an outstanding loan than the general rural population in Nepal (1996 Nepal Living Standards Survey). Why were other ethnicities not able to negotiate a similar collateral arrangement? We suspect that because other ethnic groups were new to the area in the mid 60s 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. The persistence of the Kamaiya system among one ethnic group through 2003 is a puzzle, because the mobility of all middle and low status ethnic groups in the Kamaiya districts is similar and very low. 95 percent of all the population born in Kamaiya districts still reside in their district of birth in the 2001 population census (high castes excluded). However, theoretical explanations for why a credit system may persist in one ethnic group abound, including implicit intra-familial collateral or “credit islands” along historical ties as in Basu (1987).

Nepal is a caste based society, and caste is intertwined with ethnicity much more so than in India. The Tharu ethnic group are viewed as middle social status. They can work with high status households and attend the same schools. Hence, they are not the most marginalized population in Nepal, and it is somewhat surprising that bondage persists in this population. In fact, the system does not appear to have survived in parts of the plains that are less remote. The Tharu are indigenous throughout the plains of Nepal, and the malaria eradication program and land registry that are believed to be important for understanding the system’s emergence also occurred throughout the plains. The districts where the Kamaiya system persists are remote to both major Indian cities and Nepal’s major population centers relative to other plains districts. Except for some Mountain districts (with elevations above 4000 meters), the fraction of the population born in the districts that still reside in these districts are among the highest in Nepal.

Moreover, assumptions of collusion and market power of the landed in the area where the Kamaiya system persists is plausible. Anecdotes abound about the extreme concentration of land ownership to high caste households in Kamaiya districts. Direct evidence on this is scarce as data on landholdings was stripped from the public use release of the population census. There is some suggestive statistical evidence. Land concentration in Kamaiya regions is such that a simple random sampling of households within sampled communities in the 1996 Nepal Living Standards Survey failed to capture any households that rented or sharecropped land out while 35 percent of households in Kamaiya dis-

districts reported sharecropping land owned by someone else. Those vulnerable to bondage (Tharu in Kamaiya districts) were 11 percentage points or 40 percent more likely to sharecrop than non-Tharu outside of Kamaiya districts but no more likely to sharecrop than other ethnicities in Kamaiya districts (author's calculations, high castes excluded). Some additional suggestive evidence comes from the aggregate statistics available from the 2002 Agricultural census. First, 35 percent of land in Kamaiya districts is held by high castes, none of whom are indigenous, compared to 14 percent in comparison districts. Second, less than 3 percent of land in Kamaiya districts is rented, compared to more than 12 percent in comparison districts. Third, 46 percent of land in Kamaiya districts has a hired manager, compared to 32 percent in comparison districts. Factors other than land concentration can also explain these later characteristics, but they are consistent with the anecdotal evidence.

We do not know the probability that a child enters into long-term bondage as an adult, but roughly 1 in 5 of the vulnerable population is bonded according to Guatam's (2001) estimates. Hence, the Kamaiya system accentuates the expropriation risk that we emphasize in the previous section. Neither the parent nor the bondholder has secure property rights over the child. The Kamaiya system is not 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.⁴ Thus, the bondholder cannot secure property rights over the child when educational decisions are being made. From the parents perspective, the probability that the child will inherit the parent's contract or enter a contract on his own if the parent is not bonded may be high enough so as to create uncertainty in whether the parent or child can appropriate returns on education. For example, Basu (2002) shows formally that when landlords are sufficiently few, workers may have few options other than bonded labor contracts, and this theoretical prediction is consistent with the prevalence rates observed in the vulnerable population.

The Kamaiya system may accentuate many of the other channels through which weak private property institutions might influence human capital accumulation. First, vulnerability to bondage may be associated with lower family incomes because of the contractual terms of those in bondage.⁵ Second, the

⁴A 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 although children are sometimes employed as servants in the master's house, receiving clothing and meals as compensation. 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.

⁵In theory, the association between vulnerability to bondage and family income is ambiguous because of the potential productive benefits of improved access to credit and the contracting benefits of tied relationships. There is a theoretical literature showing that tied relationships may facilitate consumption smoothing (Mukherjee and Ray 1995), risk sharing (Bardhan 1983), or the resolution of moral hazard problems inherent in agriculture (Braverman and

Kamaiya system may limit access to credit in the vulnerable population. This may seem surprising given that the system arises as a solution to the problem of a lack of collateralizable assets and that the vulnerable population are more likely to report having loans. However, Genicot (2001) argues that the general equilibrium effects of a debt-bondage system may limit other credit arrangements from developing. Other channels such as occupational choice, schooling access, or employment channels are also possible within the Kamaiya system, but our empirical strategy will not capture these channels.

3 The education and labor status of children vulnerable to bondage

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 primarily (we consider the urban population in a robustness check). 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 1 presents basic summary statistics for the data separately for boys and girls. There are 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. We report the sample size, the fraction of the population that belongs to a high social status caste (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 restrict the sample further to ethnic groups with at least 500 children 10-14, districts with at least a 100 Tharu 10-14, and we exclude high status groups. Though these restrictions are sensible in terms of improving the comparability of our control data, they have little practical relevance for the patterns observed in the data. Summary statistics for the data

Stiglitz 1982, Eswaran and Kotwal 1985).

used throughout this study are in the last four columns of table 1. As outcomes for children 10-14, 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, wage worker, market worker, or worker. A child engaged in wage work, as a domestic in another’s household, or in the family farm or business is a market worker. A worker includes children engaged in market work or as a domestic in the child’s own household. Coupled with the school attendance, Table 1 also reports what fraction of children that report being a worker who does not attend school. The questionnaire also includes a question about how many months a child worked in the last year. This is summarized in the final row although we do not emphasize findings using this variable as the questionnaire does not define what work means, so we are uncertain about what this captures.

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.⁶ For child i of age a and gender f , educational attainment is measured as:

$$ez_i = \frac{ed_i - \mu_{af}}{\sigma_{af}} \quad (4)$$

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.

In the restricted sample, slightly more than 10 percent of the population of children 10-14 are vulnerable to bondage. The large differences in sex-ratios in the data merit a note of caution. In table 1, there are 1.134 boys for every girl. A similar difference is observed in the fertility module. Women report having 1.135 male births for every female birth. Thus, the sex ratios in the fertility survey are consistent with the household registry, although we regard them as impossibly large given that the ratios from the fertility questionnaire reflect births, not residents or living children. These large sex-ratios are not unique to the Census and have been observed in other surveys in Nepal.

One concern in our analysis is the possibility that the presence of a girl is correlated with vulnerability to bondage. It is not, but our analysis of sex-ratios raised a data concern. Figure 1 plots the sex ratio in the household roster for children by child age for ages 0-14. We have labeled “KT” the Tharu households in Kamaiya districts and “OT” the Tharu households outside of Kamaiya

⁶The 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. We have compared all of our main findings with this standardization to one using the full population of Nepal for the reference population, and they appeared virtually identical.

districts. “00” refers to non-Tharu populations outside of Kamaiya areas, and “K0” indicates a non-Tharu household in a Kamaiya area. Note that in the non-Tharu population outside of Kamaiya districts, there is a large change in sex-ratios around age 10. It is not statistically significant. However, this sample selection in part of the control population comes from changes in the number of females and causes us to be concerned about the results for females. Accordingly, we emphasize our findings for boys primarily.

3.2 Education is lower and child labor higher in the population vulnerable to bondage

Debt-bondage in the Kamaiya system is largely confined to ethnic Tharu living in five districts. We compare the education and child labor outcomes of Tharus in these five Kamaiya districts to that of other similar ethnic groups in Kamaiya districts, using data from other districts to control for latent caste differences. Figure 2 plots the raw data used in this analysis. Schooling attendance (2A for boys, 2D for girls), schooling attainment (2B for boys, 2E for girls), and the fraction of children working without school (2C for boys, 2F for girls) is plotted for each ethnic group-district cell in the population. The horizontal axis in each picture is a district number. The five Kamaiya districts are emphasized with vertical lines. Each ethnic group-district cell is pictured with a bubble, the size of which is proportional to the number of children observed in that cell. All Tharu cells are shaded in dark grey. All ethnic groups, castes, and districts are included in figure 2, although only comparable castes in districts where Tharu are prevalent are used in the regression work.

The Tharu are not in general a disadvantaged ethnic group, and this is evident in all the figures by looking at the non-Kamaiya districts. In most of the rest of Nepal, the Tharu seem to be in the middle of the population distribution. However, it is evident in figures 2A-2C that they are relatively disadvantaged in Kamaiya districts, both relative to Tharu elsewhere and other ethnic groups in the Kamaiya region. While this also appears true for girls, it is evident in figures 2D-2F that the findings for girls will be less robust as the differences seem less distinct for girls vulnerable to bondage. It is also worth emphasizing that even though the Tharu in Kamaiya districts seem to work more and have less schooling, there are other ethnic group-district cells that have worst outcomes. Thus while the variation in child labor and schooling associated with vulnerability to bondage is large, other characteristics may even be more significant.

The patterns observed in the raw data are summarized in regression form in table 2. For outcome y of child i of ethnicity e in district d , we regress y on a constant, a vector of ethnic group fixed effects λ_e , a vector of district fixed effects λ_d , a vector of individual attributes that varies across specifications $\phi(A_i)$, and an indicator that a child is vulnerable to bondage TK_i , the interaction of the Tharu fixed effect with an indicator that the child is in a Kamaiya district:

$$y_{ied} = \alpha + \beta * TK_i + \lambda_e + \lambda_d + \phi(A_i) + \nu_{ied} \quad (5)$$

Errors are clustered at the district-ethnicity level.⁷ The Kamaiya districts are remote relative to other districts where Tharu are prevalent, and district fixed effects control for omitted factors common to all ethnicities in the district. The inclusion of ethnic group fixed effects controls for the possibility that the Tharu are somehow different in their tendency towards education or child labor and, more generally, the geographic distribution of castes and ethnic groups in Nepal. β is the coefficient on the indicator that an individual is vulnerable to bondage and is interpreted as the difference in y after controlling for district invariant caste and ethnic group characteristics and ethnicity and caste invariant district characteristics as well as individual attributes A . The outcome y of interest in table 2 is given by the row heading.

Children vulnerable to bondage are less likely to attend school, have lower schooling attainment, are more likely to work without attending school, and work more months of the year. The additional work is largely in wage work and agriculture. These patterns are evident in both boys (column 1) and girls (column 4). This simple difference in differences analysis suffers from bias if covariates are not balanced between those vulnerable to bondage and those who are not. This problem is potentially acute in the present context when being vulnerable to bondage is relatively rare in the population. To improve our comparisons, we take several steps. First, in all of our work (including columns 1 and 3 of table 2), we restrict our comparison group to districts where Tharu are prevalent and to large ethnic groups of similar social status to the Tharu. Second, we weight the population that is not vulnerable to bondage to have similar observable characteristics to the vulnerable population. Let Z denote the vector of covariates correlated with vulnerability to bondage. The propensity score is denoted: $d(z_i) = Pr(TK = 1 | Z = z_i)$ and estimated as a logit of the vulnerable to bondage indicator on the vector of controls Z which include the child attributes A but not ethnicity and district effects.⁸ The vector of controls included in estimating the propensity score are listed in the notes to table 2. Many of these covariates are likely the outcome of bondage and hence might attenuate our findings in Table 2 when included as a control variable. In fact, Figure 3 suggests relatively little reason to be concerned about this attenuation problem, at least for within region comparisons. Figure 3 contains the plot of the propensity score for each of the population groups as labeled in Figure 1. None of the observable characteristics stand out as a clear predictor that someone is vulnerable to bondage, hence the propensity score in even the KT population vulnerable to bondage is fairly smoothly distributed with a mass well below one. Further, other ethnicities within the same region have a similar distribution of observable characteristics, whereas observables look different outside of the

⁷A 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.

⁸The propensity score aims to balance covariates, but we are not trying to balance ethnicity and geography as that is our source of variation. Further, the only reason we have the option of including ethnicity and geography in the propensity score is because of parametric form of the propensity score as the outcome variable is simply an interaction term of each.

Kamaiya districts. Thus, upon reweighting, most of our variation comes from within region, rather than within ethnicity.

Our interest is in estimating how vulnerability to bondage diminishes educational investments in the population vulnerable to bondage, so we use the propensity score to create weights as follows:

$$w(TK_i, z_i) = TK_i + (1 - TK_i) \frac{\hat{d}(z_i)}{1 - \hat{d}(z_i)} \quad (6)$$

where $\hat{d}(z_i)$ are the predicted values from the propensity score. We use these weights 6 in estimating 5. We also modify 5 to include the vector Z as controls and to allow the association between Z and y to vary with vulnerability to bondage:

$$y_{ied} = \alpha + \beta * TK_i + \gamma_1 z_i + \gamma_2 (z_i - \overline{z_{TK}}) + \lambda_e + \lambda_d + \nu_{ied} \quad (7)$$

where $\overline{z_{TK}}$ is the vector of sample averages of covariates in Z for children vulnerable to bondage. Demeaning the data in this way allows the association between y and observable characteristics to vary within the vulnerable population, but the interpretation of β in 7 is comparable to that of 5. This combination of reweighting to balance the data and including the covariates as controls is called a “double robustness” estimator, because estimates of β are unbiased if either the propensity score is correctly estimated or if the controls in 7 are correctly specified and the usual conditional on observables assumptions are satisfied. Columns 2 and 5 of table 2 contain the results of this double robustness approach.

The double robustness approach of columns 2 and 5 of table 2 is our preferred specification despite the danger of over controlling as many of the control variables could be affected by the same factors that lead to declining educational investments with vulnerability to bondage. Child labor is higher and schooling lower for boys vulnerable to bondage. Boys appear 8 percentage points less likely to attend school. Given that 74 percent of boys 10-14 report attending school in our data, this corresponds to more than a 10 percent decline in schooling attendance. This decline in attendance is mirrored by a 0.2 standard deviation decline in schooling attainment associated with bondage. These declines in schooling are also accompanied by an elevated labor status. Wage work is more than 30 percent more prevalent in the population vulnerable to bondage. Participation in market work is 58 percent higher. Beneath this rise in market work is an increase in self-employment and work in agriculture in addition to wage work, although there is a slight decline in unpaid family work. This increase in work also results in an 8 percentage point increase in the probability the boy reports being a worker who does not attend school, a 54 percent increase. Corresponding to these reported increases in work is an increase in the number of months worked for the population vulnerable to bondage.

The unweighted patterns for girls are similar to that of boys, and the magnitudes are slightly larger. While the results for boys are very similar regardless of

whether we weight or weight and re-estimate results based on district of birth, this is not true for girls. In general, most of the patterns of increasing child labor and declining school are not robust to weighting by observable characteristics. This means that the patterns of reduced schooling and increased child labor observed in girls is driven more by an association between bondage and observable characteristics. This pattern of attenuation in girls when controlling for observables is consistent with the assertion that the patterns of increased child labor and declining schooling for girls reflects the poverty of the family's environment whereas the results for boys reflect something more intrinsic to vulnerable bondage. Interestingly, the apparent shift of girls from unpaid family labor to work in agriculture is one finding that is robust to weighting by observable attributes.

One way to assess the significance of the findings for boys of lower schooling and more child labor among those vulnerable to bondage is to compare the magnitude of the vulnerability to bondage indicator to other indicators included in the same regression. Note that all of the empirical work is devoted to controlling for confounding factors associated with vulnerability to bondage. It does not attempt to control for confounding factors associated with other characteristics. The magnitude of the relative decline in schooling and increase in child labor is similar to that observed in the data for having a dead father, and it is less than half the variation associated with moving from a head with no primary school to a head with completed primary school. Thus, while the data is consistent with vulnerability to bondage being important in the schooling and child labor decisions of effected households, it is not necessarily the most important determinant of variation in child labor and schooling.

Vulnerability to bondage is an ethnic group*geography effect, and one should be concerned about omitted factors correlated with this variation but independent of the large set of observable controls included in the propensity score and regression. Non-random selection of children into areas vulnerable to bondage is one obvious concern. Columns 3 and 6 of table 2 replicate our results for district of birth rather than residence, and the small changes in the magnitude of our estimates reflect the very low mobility rates of populations in the Kamaiya districts. Perhaps we are simply capturing something about inequality or disadvantage in Kamaiya districts. In Table 3, we replicate our approach of 6 and 7 for other ethnic groups prominent in the Kamaiya districts (excluding the Tharu entirely from our analysis).⁹ The patterns observed in the population vulnerable to bondage are not evident in any other major ethnic group.

Moreover, the patterns of elevated child labor and lower schooling in the population vulnerable to bondage appears to be more than something special about the Tharu living in kamaiya Districts. First, we do not observe our results in the urban population of Kamaiya districts. Table 4 reproduces our main results for the rural population (column 1) and replicates the same approach for

⁹The Tharu are 36 percent of the population in the Kamaiya districts. High status Chhetri (18 percent) and Brahman (10 percent), middle status Magar (6 percent), and low status Kamai (5 percent) and Muslim (4 percent) are the other main ethnic groups. The social status of the Magar in Nepali society is most similar to that of the Tharu.

the urban population (column 2). Second, we only observe diminished schooling attainment for the rural Tharu population in Kamaiya districts among Tharu educated since the system’s emergence in the mid 1960s. In table 5, the sample is restricted to young adults educated since the Kamaiya system’s emergence (age 20-35 in 2001) and an older group educated before the system’s emergence (age 52-70 in 2001). In column 1 and 2, we restrict the sample to Tharu only and observe that the younger Tharu population in Kamaiya districts has reduced educational attainment relative to the older Tharu in the same districts (using other districts to control for cohort effects). In columns 3 and 4, we add in other ethnic groups so that it is possible to control for both ethnic group*geography effects and cohort*geography effects. Though slightly attenuated relative to what we observe amongst children, vulnerability to bondage is associated with diminished educational attainment in the affected adult population as well.¹⁰

Thus, vulnerability to bondage is associated with lower schooling attendance, diminished school attainment, and increased child labor. The increased child labor appears to be associated with a shift for boys away from unpaid work for the family to wage work (especially in agriculture) and self employment. Results for girls are less robust than for boys, but girls seem to move away from unpaid family work into agricultural work. These patterns do not appear driven by differences in observable characteristics in the population vulnerable to bondage nor do we see similar patterns in other major ethnic groups in the same geographic location. Moreover, the patterns of diminished educational attainment in the vulnerable population appears to be confined to only cohorts whose education would have been affected by the Kamaiya system.

4 Mechanisms

The discussion in section 2 emphasizes several reasons why vulnerability to bondage might be associated with reduced educational investments. These can be loosely grouped into mechanisms that will be common to populations in areas with a high prevalence of bondage and channels that will be specific to the population vulnerable to bondage. Because our empirical work is based on comparing different ethnic groups within in the same geographic areas, our findings in the previous section do not capture general equilibrium channels or anything that will be common to both the vulnerable and not vulnerable populations. This rules our several plausible explanations for why vulnerability to bondage might be associated with reduced education such as general equilibrium effects

¹⁰Another issue that needs to be mentioned is that the Kamaiya system was outlawed in the year preceding the census. The 2000 resolution canceled all debts without compensation. Sharma, Basnyat, and G.C. (2001) find no effect of this law in their fieldwork in early 2001, and the actual law implementing the 2000 resolution was not passed until February 2002, 8 months after our data. Nonetheless, one possibility, albeit one that is inconsistent with field work from that time, is that the 2000 resolution disrupted the Kamaiya system, and that our results capture the resulting displacement of former slaves. The findings in table 6 where the young cohort is unlikely to be in school by 2001 are generally consistent with the magnitudes of the declines in schooling attainment that we observe for children 10-14.

on wages, reduced schooling availability, or undeveloped credit markets unless credit access is ethnic group specific (schooling is not). This leaves diminished income, increases in the value of female or child time, ethnic group specific credit constraints, or declines in the returns to education for the vulnerable population as the possible explanations for our findings. The comparative statics in Becker and Lewis (1973) are the basis for our discussion here. The data seem most consistent with a decline in the returns to education for the population vulnerable to bondage, and the expropriation threat seems the most likely channel for these lower returns for education.

4.1 Income

Most obviously, diminished schooling and elevated child labor could stem from an association between vulnerability to bondage and low income. Theoretically, the sign of bondage's effect on incomes is unclear (labor tying v. exploitation), and our empirical strategy based on comparing those vulnerable to other groups in the same areas would control for any general equilibrium effects (such as those emphasized by Basu and Chau 2004). Moreover, in the data, few of the regression controls differ for those vulnerable to bondage and controlling for all available observable characteristics, many of which are strong correlates of poverty, have little impact on our results.

Two additional pieces of evidence are inconsistent with diminished income as the explanation for our results. First, we observe declines in schooling even among children unlikely to contribute substantively to household income. Employment opportunities for children under 10 in Nepal are generally believed to be rare. If children 10-14 are working for poverty motives, then we should observe higher schooling among children 6-9 so as to raise the return on their subsequent employment. Table 6 replicates our basic schooling attendance in children 6-9. Magnitudes in table 6 are similar to what we observe in older boys in table 2 for boys. Primary schooling is supposed to be free in Nepal. In this case, it is hard to understand why households whose sole concern was income would not educate children when employment options are rare. However, in practice, schools are not truly costless, and we do not have strong priors about the returns to education by age.

Second, lower income should imply lower fertility (an inward shift in the budget curve in the Becker and Lewis model). However, we observe elevated fertility in married women born vulnerable to bondage. Fertility data is collected in the census for 275,910 ever-married women age 15-49. 8,968 of these women are vulnerable to bondage. There is some suggestion in the data that selection into marriage is negatively correlated with vulnerability to bondage in ages 15-17, so our analysis is restricted to women age 18 to 49. We also restrict our attention to districts and ethnic groups that meet the selection criteria described above. This leaves us a sample of 85,373 women, 8,590 of whom are vulnerable to bondage. Descriptive statistics for these women are presented in Table 7. 14 percent of women in our restricted sample 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 7, we report the total number of births broken down by sex of the child, whether the mother has lost any children who survived child birth, whether a mother has lost more than 1 child, whether she has lost a boy, and whether she has lost a girl.

The empirical methodology to examine fertility differences is the same as that used to look at child labor and schooling decisions. We compare ever-married women 18-49 vulnerable to bondage to Tharu women in other districts and use observations on other castes to control for district differences. High caste women are excluded from our control group throughout the analysis as are small ethnic groups and districts with few Tharu. Age effects and completed education effects are included throughout our fertility results. Hence, the observed increases in fertility with vulnerable to bondage are beyond any association between bondage and mother's education. Table 8 presents estimates of the coefficient on the indicator for vulnerability to debt bondage, our basic fertility results (see Appendix Table 3 for unconditional means). Each cell in Table 8 is from a different regression. The dependent variable is indicated by the row. Column 1 includes only district and caste fixed effects from equation 1. Columns 2-5 weight the population that is not vulnerable to bondage comparable to the vulnerable population as in equations 2 and 3. Column 3 replicates column 2 using district of birth rather than residence as an identifier, and columns 4 and 5 split the sample based on mother literacy.

Several interesting patterns are evident in the data. 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. 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). Hence, the data seem more consistent with a shift away from quality into quantity rather than a pure income effect.

4.2 Value of Female or Child Time

These increases in fertility and declines in educational investments could be driven by increased employment opportunities for children. However, children are not themselves bonded in the Kamaiya system. Hence, there is no reason why children vulnerable to bondage should have better employment options in the wage labor market (where their participation rates increase in table 2) than other children living in the same geographic area.

Another possibility is that the data reflect a substitution effect from lower female wages. In the Becker and Lews framework, reduced value of female time induces households to substitute away from quality into quantity. This effect might work through some direct effect of bondage on employment opportunities or it might follow from the fact that adult women born vulnerable to bondage are apt to have diminished education. Two pieces of evidence point away from this explanation of our findings. First, women are actually more likely to work outside of the household, in market work, and for more months in family's vulnerable to bondage. Table 9 replicates our basic comparison of the activities of individuals vulnerable to bondage to those born elsewhere or in other ethnic groups without weighting or additional controls for the adult population age 25-49. Column 1 describes changes in the labor supply of men who work less in wage work, more in agriculture, and more in unpaid work. Women work more in wage, market, and agricultural work and they do so for more months per year. However, none of these additional female labor supply results are statistically significant.

Second, the education and child labor results persist conditional on fertility and household composition. In table 10, we add the number of births ever reported in the household (via a set of dummies), the fraction of those births that are female, 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 to our control set Z from equations 6 and 7. Our basic findings for boys persist conditional on fertility. Hence, the data do not support the hypothesis that our schooling in child labor results solely reflect fertility changes.

4.3 Credit

Another option is that perhaps the Kamaiya system somehow restricts the access of the Tharu to credit in ways that other groups in the same location are not. Note this would need to be more than a general equilibrium effect on credit markets as emphasized in Genicot (2001), because general equilibrium effects would be captured by similar ethnic groups in the Kamaiya districts. At first glance, one would suspect better access to credit among those vulnerable to

bondage, because without it improving their credit access, why would a household enter bondage? However, declining schooling, increasing child labor, and increasing fertility is (together) consistent with a model of differential credit constraints (such as Baland and Robinson 2001), and an inability to finance investment is one channel through which weak private property institutions might reduce investment.

Several factors suggest that diminished access to credit alone cannot explain our findings. First, as documented in table 10, our findings persist conditional on fertility. If those vulnerable to bondage had worse access to credit, then their schooling investment decisions should depend more on household and family composition. Second, access to credit should be correlated with other observable household characteristics, but we have seen that our results are relatively independent of the characteristics that are in the census. Third, the data in the Nepal living standards suggests that vulnerability to bondage is associated with a greater probability of having a loan. Those vulnerable to bondage (Tharu in kamaiya districts) are 17 percent more likely to take out a loan than other ethnicities living in the same areas where bondage is prevalent, and 10 percent more likely than the general rural population (author's calculations from the 1996 Nepal living Standards Survey, high castes excluded, none of these differences are statistically significant). Of course, this could reflect the inability of the bonded to pay off their loans rather than improved access to credit relative to other groups living in the same geographic areas. Overall, though little in the data suggests that the Kamaiya system decreases investments in education because those vulnerable have worse access to credit than other families in the same locations. If anything, the data are consistent with improved credit access which would explain why the Tharu voluntarily enter bondage.

4.4 Returns to Education

The declines in schooling and increases in fertility are consistent with a fall in the return on education, and we have already discussed in detail how the threat of expropriation can reduce the returns on education for the vulnerable population relative to other ethnic groups living in the same geographic area. There are several other ways in which the Kamaiya system might lower returns to education in the vulnerable population. For example, weak institutions might deter investments in human capital through reduced investment options. In the present context this would translate into lower quality schools or less schooling access. There is some evidence of worst pupil-teacher ratios in the Kamaiya districts. Data from the Department of Education (2001) documents that pupil-teacher ratios are higher in Kamaiya districts. 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.

However, diminished schooling access or school quality is unlikely to drive our findings, because they would affect ethnic groups other than the Tharu and thereby would be controlled for in our empirical work.

Moreover, it is possible to examine directly whether fraction Tharu in a community alters our estimates of the association between vulnerability to bondage and diminished schooling investments. These results are in table 11. The top panel examines the full (restricted sample). The next panel limits the data to within the kamaiya region, and the remaining panels trifurcate the sample based on the fraction of the local population that is Tharu. In general, the fraction Tharu is not a statistically significant predictor of any outcome variables, and it tends to have an opposite sign of the vulnerability to bondage result. Hence, we do not appear to be capturing some confounding effect that owes to the fraction of Tharu in a child's community. Further, another interesting facet of table 11 is that our findings of reduced schooling and increased work in the vulnerable population seem to be concentrated in communities where the Tharu are most prevalent. This likewise is consistent with the appropriation explanation as these communities are where bondage is most likely to be observed.

Indeed one possible form of the appropriation problem might be that vulnerability to bondage influences occupational selection. For example, perhaps an important part of the return to education comes through the corresponding probability that the child is free to change occupations (most adults in Kamaiya regions are farmers), perhaps move out of subsistence agriculture, and suppose that vulnerability to bondage makes this transition less likely. Because of this immobility, from the child and parent's perspective, vulnerability reduces each's expected ability to capture a return to education. There is no way to separate this characterization of the appropriation problem from the any other, but it is consistent with the fundamental importance of property rights in investments in children.

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. These patterns are not apparent in older cohorts from Kamaiya regions, they are not in urban Tharu in Kamaiya regions, and they do not appear in any other similar social group. Fertility is also dramatically higher in women 18-49 vulnerable to bondage by roughly one quarter (or 11 percent) of a child per mother. Several pieces of evidence are

not consistent with a dominant role of lower income associated with bondage in explaining these patterns. Rather, the evidence seems most consistent with the idea that an inability to appropriate returns to education and other investments for the parent and child (as well as the master) plays a key role in explaining this diminished investment in children and elevated fertility.

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. Moreover, 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 inherit 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 negative outcomes for debt-bondage, where our priors might be that bondage would facilitate investments in children.

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.

References

- [1] Acemoglu, Daron, and Simon Johnson. 2005. "Unbundling Institutions." *Journal of Political Economy* 113, October, 949-995.

- [2] Acemoglu, Daron, Simon Johnson, and James Robinson. 2005. "Institutions as the Fundamental Cause of Long-Run Growth." in Handbook of Economic Growth, Philippe Aghion and Steve Durlauf, eds.
- [3] Baland, Jean-Marie, and James A. Robinson. 2000. "Is Child Labor Inefficient?" *Journal of Political Economy*. August, 108(4), 663-79.
- [4] Bales, Kevin. 1999. *Disposable People: New Slavery in the Global Economy*. University of California Press: Berkeley.
- [5] Bardhan, Pranab K. 1979. "Wages and Unemployment in a Poor Agrarian Economy: A Theoretical and Empirical Analysis." *Journal of Political Economy*. 87, 479-500.
- [6] Bardhan, Pranab K. 1983. "Labor-Tying in a Poor Agrarian Economy: A Theoretical and Empirical Analysis." *Quarterly Journal of Economics*. 98(3): 501-14.
- [7] Barro, Robert J. 1991. "Economic Growth in a Cross Section of Countries." *Quarterly Journal of Economics*, 106(2), 407-43.
- [8] Basu, Arnab K. 2002. "Oligopsonistic Landlords, Segmented Labor Markets, and the Persistence of Tied Labor Contacts." *American Journal of Agricultural Economics*. 84: 438-53.
- [9] Basu and Chau 2004. "Exploitation of Child Labor and the Dynamics of Debt Bondage." *Journal of Economic Growth* 9: 209-238.
- [10] Basu, Kaushik. 1983. "The emergence of isolation and interlinkage in rural markets." *Oxford Economic Papers*. 35, 262-280.
- [11] Basu, Kaushik. 1987. "Disneyland Monopoly, Interlinkage, and Usurious Interest Rates." *Journal of Public Economics* 34, 1-17.
- [12] Basu, Kaushik. 1989. "Technological Stagnation, Tenurial Laws, and Adverse Selection." *American Economic Review*
- [13] Becker, Gary, and H. Gregg Lewis. 1973. "Interaction between Quantity and Quality of Children." *Journal of Political Economy*, 81(2, pt.2), S279-S288.
- [14] Besley, Timothy. "Property Rights and Investment Incentives: Theory and Evidence from Ghana." *Journal of Political Economy*, 103(5), October 1995, 903-937.
- [15] Bhaduri, Amit, 1973. "A Study in Agricultural Backwardness Under Semi-Feudalism." *Economic Journal*, 83 (239): 120-37.
- [16] Braverman, Avishay and Joseph Stiglitz. 1982. "Sharecropping and the Interlinking of Agrarian Markets." *American Economic Review*. 72: 695-715.

- [17] Central Bureau of Statistics 2002. National Population and Housing Census 2001. His Majesty's Government of Nepal National Planning Commission Secretariat: Kathmandu.
- [18] Dasgupta, Partha and Debraj Ray. 1986. "Inequality as a determinant of malnutrition and unemployment: Theory," *The Economic Journal*, 96(384), 1011-1034.
- [19] Department of Education. 2001. Educational Statistics Yearbook. Kathmandu.
- [20] Department of Labor. 1995. "Force and Bonded Child Labor." in *By The Sweat and Toil of Children*, Volume 2. U.S. Department of Labor Bureau of International Labor Affairs: Washington DC.
- [21] Eswaran, Mukesh and Ashok Kotwal. 1985. "A Theory of Two-Tier Labor Markets in Agrarian Economies." *American Economic Review*. 75: 162-177.
- [22] Fogel, Robert W. and Stanley L. Engerman. 1974. *Time on the Cross: The Economics of American Negro Slavery*. Boston: Little Brown.
- [23] Galenson, David W. 1984. "The Rise and Fall of Indentured Servitude in the Americas: An Economic Analysis." *Journal of Economic History*. 49(1): 1- 26.
- [24] Galenson, David W. 1981. "The Market Evaluation of Human Capital: The Case of Indentured Servitude." *Journal of Political Economy*. 89(3). 446-467.
- [25] Gautam, Rudra. 2001. *Impacts of Interventions on Kamaiya*. GEFONT: Kathmandu.
- [26] Genicot, Garance. 2001. "Bonded Labor and Serfdom: A Paradox of Voluntary Choice." *Journal of Development Economics*. 67: 101-127.
- [27] Hirano, Keisuke and Guido Imbens. 2002. "Estimation of Causal Effects using Propensity Score Weighting: An Application to Data on Right Heart Catheterization," *Health Services and Outcomes Research Methodology* 2, 259-278.
- [28] Lunceford, Jared and Marie Davidian. 2004. "Stratification and Weighting via the Propensity Score in Estimation of Causal Treatment Effects: A Comparative Study," *Statistics in Medicine*, 23, 2937-2960.
- [29] Mitra, Pradeep. 1983. "A Theory of Interlinked Rural Transactions," *Journal of Public Economics*, 20, 167-191.
- [30] Mukherjee, Anindita. and Debraj Ray. 1995. "Labor-Tying." *Journal of Development Economics*. 47(2): 207-239.
- [31] Sharma, Shiva. 1999. *Nepalma Kamaiya Pratha*. ILO: New Delhi.

- [32] Sharma, Shiva, Bijendra Basnyat, and Ganesh G.C. 2001. Bonded Labour Among Child Workers of the Kamaiya System: A Rapid Assessment. ILO: Geneva.
- [33] Sharma, Shiva and Ram Sharma. 2004. Socio-economic information on ex-Kamaiya in Nepal. National Labour Academy: Kathmandu.
- [34] Wooldridge (2004). Portuguese Economic Journal.
- [35] Working Group on Contemporary Forms of Slavery. 1998. Debt Bondage. United Nations Economic and Social Council, Commission on Human Rights, Sub-Commission on Prevention of Discrimination and protection of Minorities, Working Group on Contemporary Forms of Slavery, 23rd Session: Geneva.

Figure 1: Sex Ratios by Age and Ethnic-District Cell

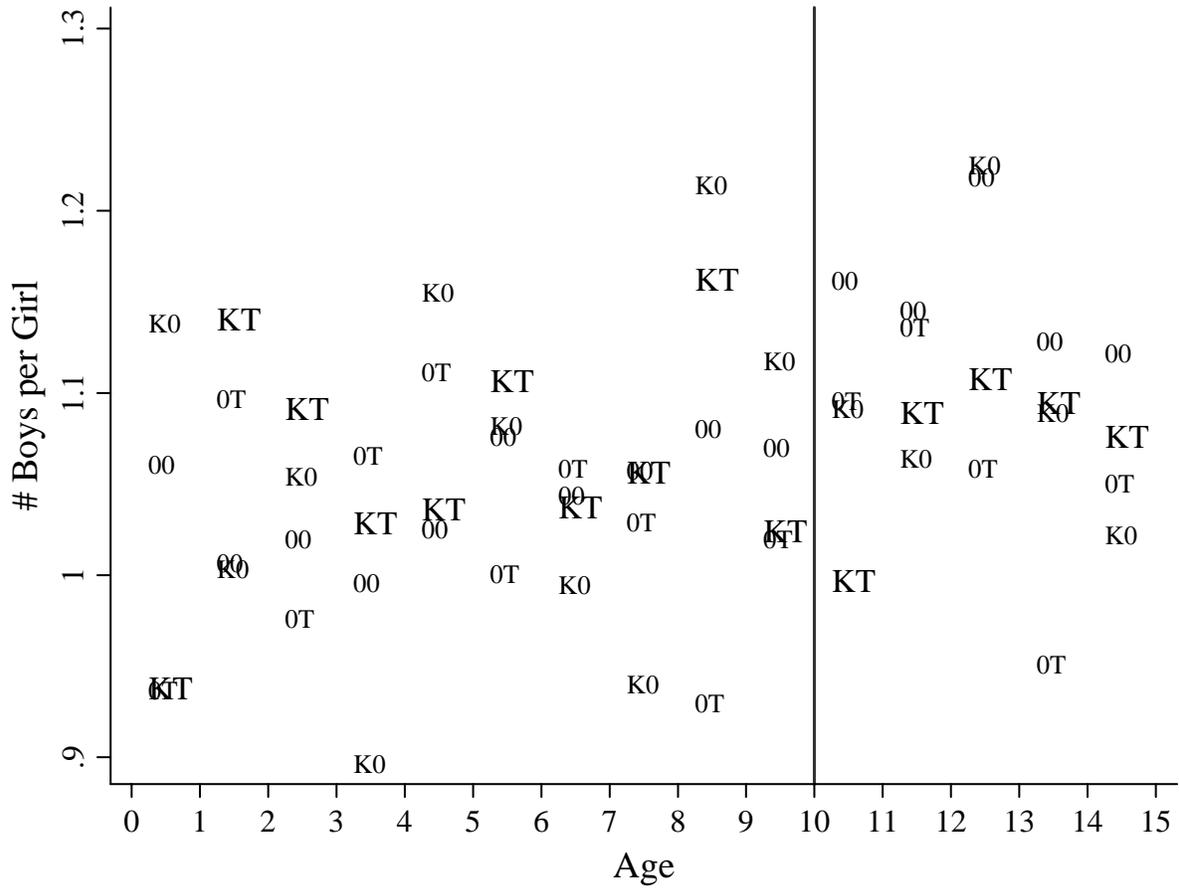


Figure 2A: Attends School by Caste and District
Males 10-14

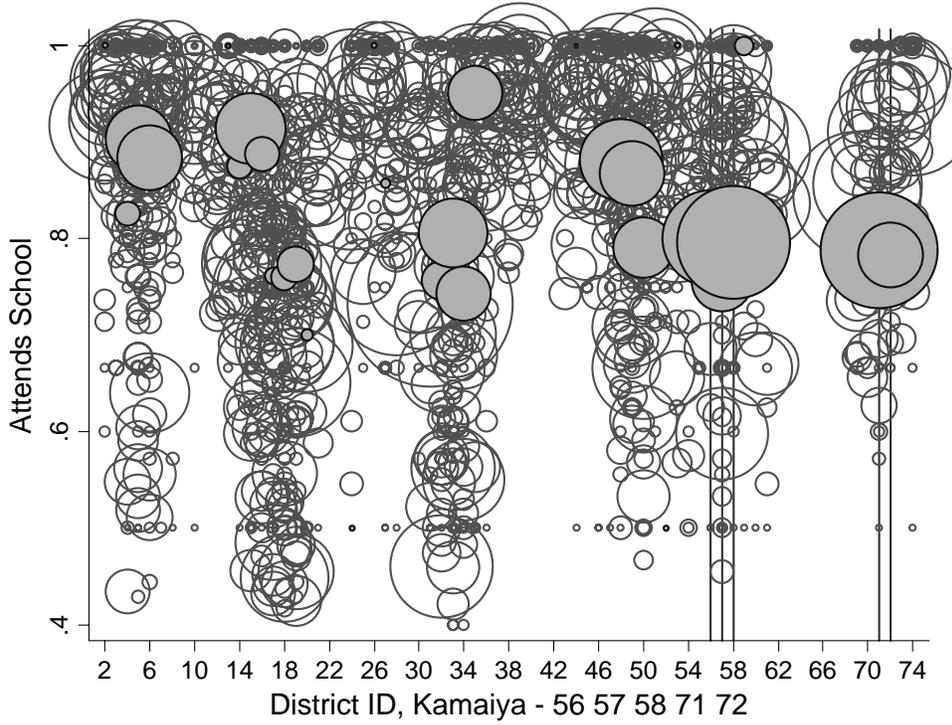


Figure 2B: Grade Deficit Z-Scores by Caste and District
Males 10-14

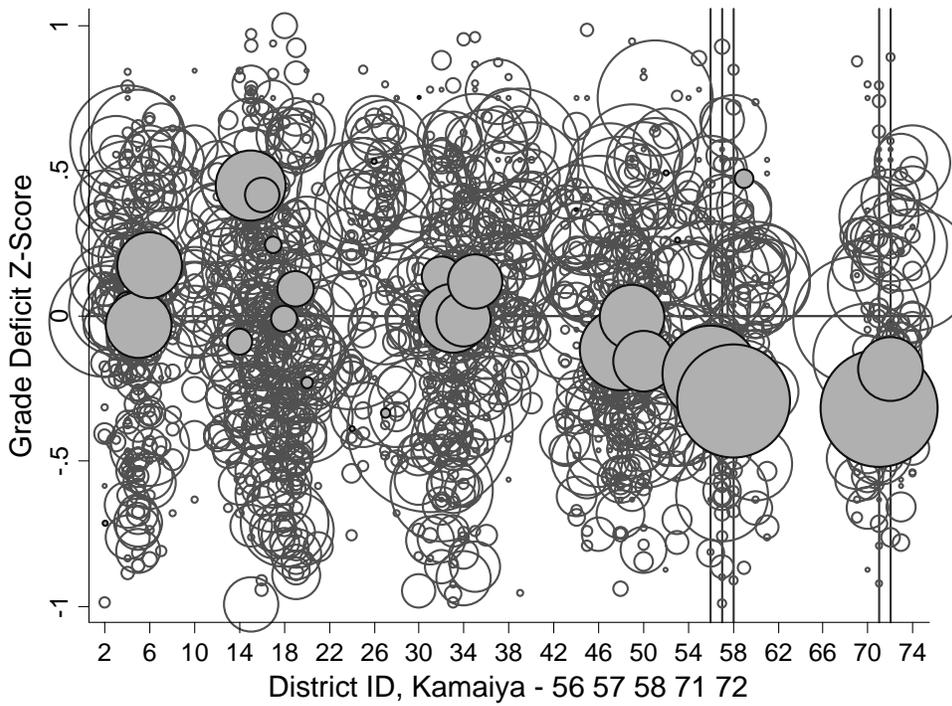


Figure 2C: Works without attending school by Caste and District
Males 10-14

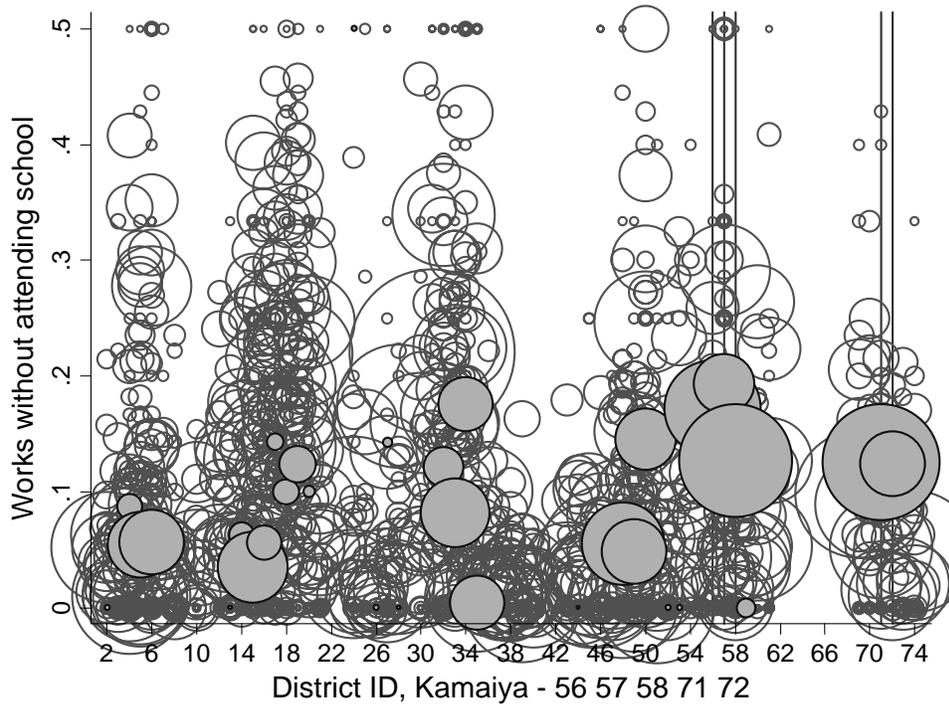


Figure 2D: Attends School by Caste and District
Females 10-14

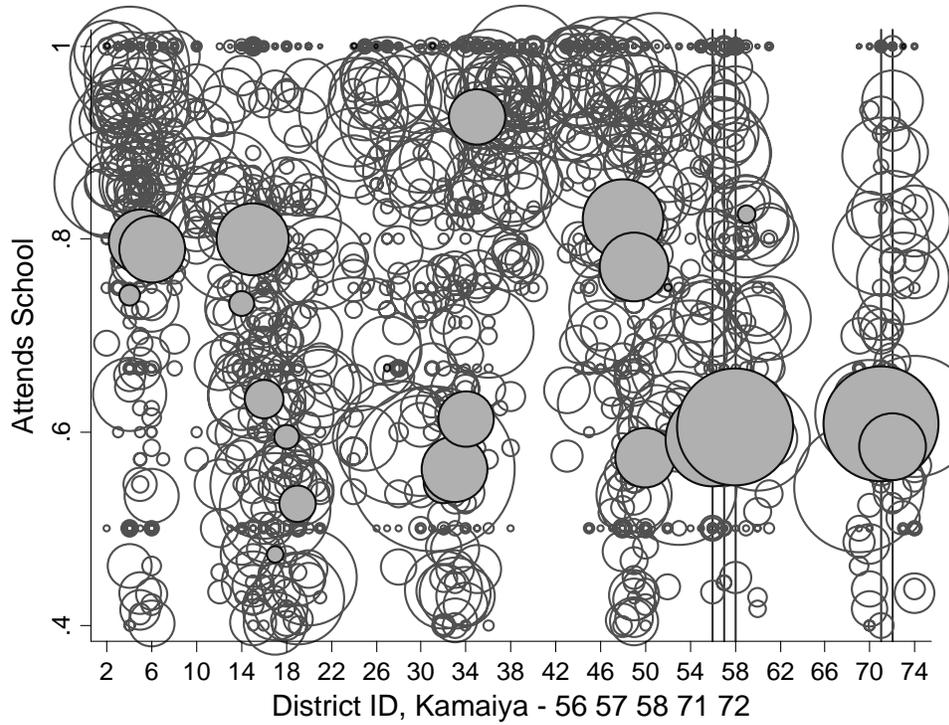


Figure 2E: Grade Deficit Z-Scores by Caste and District
Females 10-14

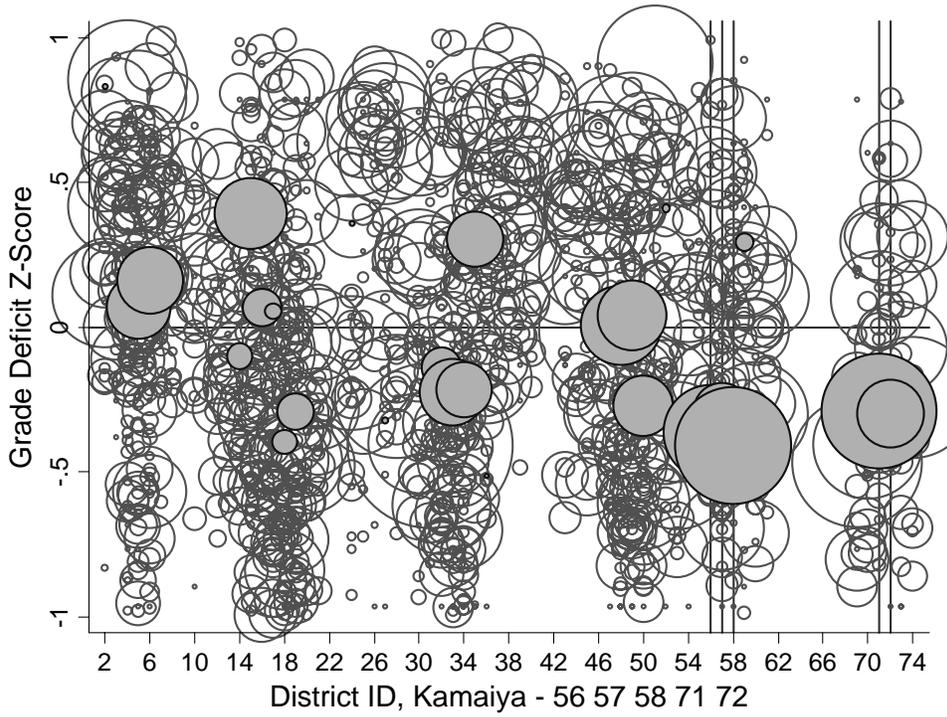


Figure 2F: Works without attending school by Caste and District
Females 10-14

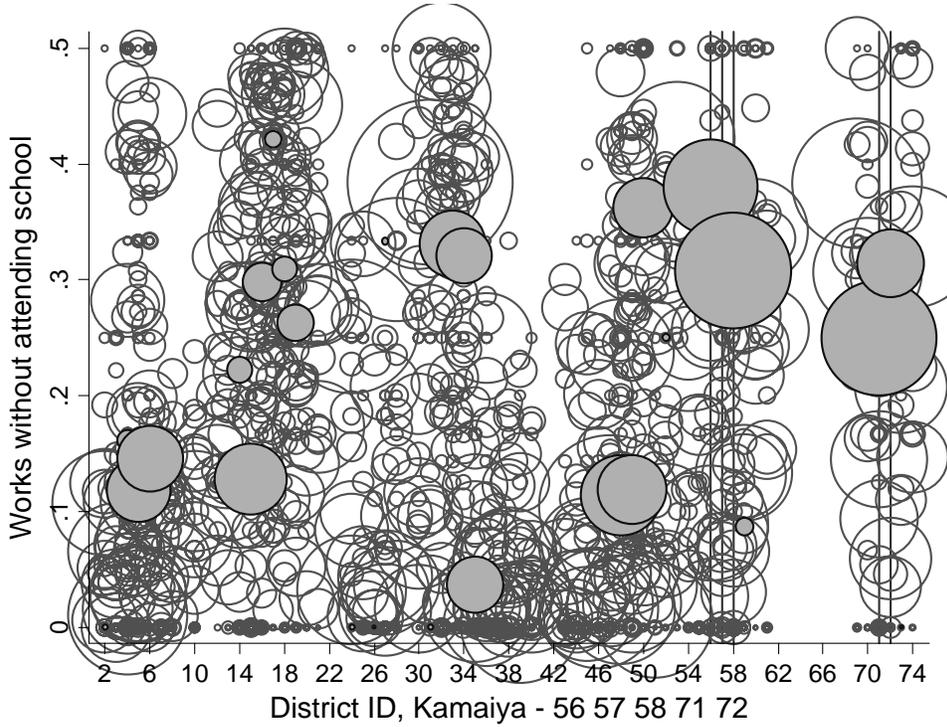


Table 1: Descriptive Statistics for Children 10-14*Rural Population*

	Full Sample				Restricted Sample			
	Male		Female		Male		Female	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Sample Size	94,128		87,523		28,944		25,530	
Age	11.857	1.427	11.870	1.434	11.738	1.443	11.752	1.456
High Caste	0.298	0.457	0.310	0.463	0.000	0.000	0.000	0.000
Tharu	0.071	0.257	0.072	0.258	0.224	0.417	0.239	0.427
Kamaiya	0.096	0.294	0.096	0.294	0.209	0.407	0.219	0.413
Tharu*Kamaiya	0.035	0.183	0.035	0.184	0.113	0.316	0.120	0.325
Attends School	0.831	0.375	0.717	0.451	0.744	0.436	0.580	0.493
Educational Attainment	3.335	2.294	2.712	2.378	2.854	2.373	2.028	2.313
Grade Deficit Z-Score	0.014	0.952	0.018	0.971	-0.164	1.022	-0.245	0.976
Principal Usual Activity:								
Student	0.795	0.403	0.666	0.472	0.710	0.454	0.523	0.499
Wage Work	0.026	0.159	0.016	0.124	0.051	0.220	0.032	0.175
Market Work	0.112	0.315	0.153	0.360	0.146	0.353	0.154	0.361
Worker	0.136	0.342	0.267	0.442	0.187	0.390	0.375	0.484
Worker, not attend School	0.100	0.299	0.215	0.411	0.150	0.357	0.316	0.465
Months Worked	1.014	2.796	1.170	2.918	1.306	3.292	1.130	2.977

The restricted sample is used throughout this study. High caste (Chhetri, Brahman, and Thakuris) households are excluded. Only districts with at least 100 Tharu 10-14 in the sample are included. Only ethnicities with at least 500 children 10-14 in the sample are included. Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Table 2: Child labor and Schooling Findings

	Boys			Girls		
	Distict & Ethnicity FE	Inverse Probability Weighted	District of Birth	Distict & Ethnicity FE	Inverse Probability Weighted	District of Birth
	1	2	3	4	5	6
Attends School	-0.084 [5.399]**	-0.082 [2.761]**	-0.066 [3.170]**	-0.131 [4.657]**	-0.024 [0.503]	-0.069 [1.624]
Grade Deficit Z-Score	-0.210 [4.169]**	-0.176 [2.205]*	-0.168 [2.836]**	-0.284 [4.267]**	-0.062 [0.802]	-0.092 [1.384]
Principal Usual Activity:						
Market Work	0.083 [4.966]**	0.091 [4.593]**	0.074 [3.563]**	0.093 [3.140]**	0.069 [1.725]	0.100 [2.378]*
Wage Work	0.029 [3.962]**	0.016 [1.999]*	0.017 [1.704]	0.037 [4.122]**	0.011 [0.828]	0.014 [1.193]
Agriculture	0.047 [3.577]**	0.074 [4.531]**	0.055 [3.233]**	0.054 [2.402]*	0.053 [2.299]*	0.076 [2.879]**
Self Employed	0.026 [1.614]	0.066 [3.740]**	0.038 [2.107]*	0.033 [1.226]	0.037 [1.559]	0.043 [1.533]
Unpaid Family Worker	-0.002 [0.136]	-0.026 [1.559]	-0.005 [0.318]	-0.035 [2.040]*	-0.068 [2.805]**	-0.050 [2.087]*
Worker	0.084 [4.875]**	0.089 [4.004]**	0.049 [2.060]*	0.126 [3.748]**	0.038 [0.702]	0.083 [1.654]
Worker, Not attend School	0.081 [5.749]**	0.086 [4.665]**	0.042 [2.130]*	0.113 [4.197]**	0.012 [0.250]	0.046 [1.161]
Number of Months Worked	0.774 [5.229]**	0.907 [4.415]**	0.759 [3.308]**	0.837 [3.518]**	0.530 [1.955]	0.617 [2.153]*
Age Effects	Yes	Yes	Yes	Yes	Yes	Yes
Ethnicity & District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Reweighted+Controls	No	Yes	Yes	No	Yes	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 age, ethnicity, and district fixed effects. All standard errors are clustered at the ethnic group * district level. Columns 2, 3, 5, and 6 also include head, family, and residence controls. In columns 3 and 6 Kamaiya * Tharu is based on district of birth rather than district of residence.

Head controls are indicators for the head's gender, age group, marital status, and education. Family controls include indicators for household size, the fraction of the household female, the fraction of the household of school age, the fraction of school age population female, the number under five years of age, the fraction of under 5 that are female, and indicators for whether the child's mother is present and father is present. Residence attributes include indicators for whether the structure has a roof, is permanent, has a toilet, a protected water source, electricity, radio, tv, cooks with dung, cooks with non-biomass fuel, owns livestock, how much livestock the household owns, how much poultry the household owns, whether the household has a nonagricultural enterprise, and whether it operates agricultural land. All of these controls are used to predict the probability a child is a Tharu in a Kamaiya district, and this prediction as a regression weight in columns 2, 3, 5 and 6 as described in the text.

High castes excluded throughout are Chhetri, Brahman, and Thakuris. Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Table 3: Falsification Tests

Inverse Probability Weighted, High Castes excluded from Controls

Caste	Chhetri	Brahmin	Magar	Kami	Muslim
	1	2	3	4	5
Boys	25596	25820	22421	22421	22421
Attends School	-0.005 [0.279]	0.027 [2.006]*	0.053 [1.845]	0.035 [0.845]	0.039 [1.009]
Grade Deficit Z-Score	-0.003 [0.057]	0.108 [2.390]*	0.295 [3.611]**	0.105 [1.310]	0.251 [3.338]**
Worker, Not attend School	-0.006 [0.384]	-0.025 [2.200]*	-0.078 [2.955]**	-0.025 [0.650]	-0.008 [0.207]
Age Effects	Yes	Yes	Yes	Yes	Yes
Ethnicity & District Fixed Effect	Yes	Yes	Yes	Yes	Yes
Reweighted+Controls	Yes	Yes	Yes	Yes	Yes

Coefficient on Kamaiya Ethnicity interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. Ethnicity 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 excluded 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 4: Rural - Urban Comparisons, Males 10-14
Inverse Probability Weighted, High Castes Excluded

	Rural	Urban
Attends School	-0.082 [2.761]**	0.021 [0.601]
Grade Deficit Z-Score	-0.176 [2.205]*	-0.052 [0.859]
Works without School	0.086 [4.665]**	-0.028 [1.086]
Age Effects	Yes	Yes
Ethnicity & District Fixed Effects	Yes	Yes
Reweighted+Controls	Yes	Yes

Coefficient on Kamaiya District*Tharu interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. All standard errors are clustered at the ethnic group * district level. High castes (Chhetri, Brahman, and Thakuris) excluded throughout. The control populations in all regressions are reweighted as described in the text. All regressions also include head, family, and residence controls as described in the notes to table 2. Source: 2001 population and housing census, public use microdata. Hill and terai population only. Column 1 is from table 2. Column 2 is based on 18,053 children in urban areas.

Table 5: Within Ethnicity Differences in Schooling Attainment

	<u>Tharus Only</u>		<u>All Non-High Castes</u>	
	Male	Female	Male	Female
	-1	-2	-3	-4
Vulnerable to Bondage	-0.15 [2.123]*	-0.207 [4.563]**	-0.234 [2.420]*	-0.164 [3.271]**
Age Effects	Yes	Yes	Yes	Yes
District Effects	Yes	Yes	Yes	Yes
Ethnicity Effects	Sample restricted to Tharus		Yes	Yes
Ethnicity * District Effects	n/a	n/a	Yes	Yes
Cohort * District Effects	n/a	n/a	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 15653, 15692, 70483, 66007 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.

Table 6: Schooling Attendance in Children 6-9
Inverse Probability Weighted

	Boys	Girls
	1	2
Sample Size	25898	24460
Attends School	-0.091 [3.069]**	-0.091 [2.814]**
Age Effects	Yes	Yes
Ethnicity & District Fixed Effect:	Yes	Yes
Reweighted+Controls	Yes	Yes

Coefficient on Kamaiya District*Tharu interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. All regressions include age, ethnicity, and district fixed effects. Observation is a child age 6-9. All standard errors are clustered at the ethnic group * district level. High castes (Chhetri, Brahman, and Thakuris) excluded throughout. See notes to table 2 for additional included controls.

Table 7: Descriptive Statistics for Ever Married Women 18-49

	Full Sample		Restricted Sample	
	Mean	Std. Dev.	Mean	Std. Dev.
Sample Size	266,316		85,373	
Age	31.452	8.599	31.024	8.534
High Caste	0.298	0.457	0.000	0.000
Tharu	0.072	0.259	0.216	0.412
Kamaiya	0.093	0.290	0.193	0.395
Tharu*Kamaiya	0.032	0.177	0.101	0.301
Can Read and Write	0.237	0.425	0.143	0.350
Births	2.795	2.172	2.694	2.118
Sons	1.465	1.331	1.432	1.315
Daughters	1.330	1.388	1.262	1.348
Any Death	0.182	0.386	0.165	0.371
Multiple Death	0.075	0.263	0.068	0.251
Son Death	0.142	0.349	0.127	0.333
Daughter Death	0.137	0.344	0.128	0.334

The restricted sample is used throughout this study. High caste (Chhetri, Brahman, and Thakuris) households are excluded. Only districts with at least 100 Tharu 10-14 in the sample are included. Only ethnicities with at least 500 children 10-14 in the sample are included. Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Table 8: Fertility Findings

	District & Caste FE	Inverse	District of Birth	Female Literacy	
		Probability Weighted		Literate	Illiterate
	1	2	3	4	5
Births	0.268 [3.596]**	0.155 [2.028]*	0.134 [1.055]	-0.004 [0.037]	0.150 [1.733]
Sons	0.144 [3.527]**	-0.086 [1.422]	0.069 [0.859]	0.123 [1.471]	-0.079 [1.272]
Daughters	0.124 [3.213]**	0.241 [3.332]**	0.066 [0.611]	-0.127 [1.232]	0.229 [2.998]**
Deaths					
Any Death	0.029 [1.926]	0.003 [0.199]	0.048 [1.027]	0.028 [1.145]	0.001 [0.044]
Multiple Death	0.020 [2.181]*	0.003 [0.254]	0.036 [0.887]	0.035 [2.064]*	0.001 [0.100]
Son Die	0.029 [2.346]*	0.015 [1.308]	0.060 [2.309]*	0.028 [0.884]	0.017 [1.366]
Daughter Die	0.017 [1.323]	-0.019 [1.217]	0.002 [0.049]	0.037 [1.827]	-0.025 [1.531]
District & Ethnicity Fixed Effec	Yes	Yes	Yes	Yes	Yes
Age Fixed Effects	Yes	Yes	Yes	Yes	Yes
Reweighted + Controls	No	Yes	Yes	Yes	Yes

Coefficient on Kamaiya District*Tharu interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. All regressions include age, ethnicity, and district fixed effects. Observation is an ever married female age 18-49. All standard errors are clustered at the ethnic group * district level. High castes (Chhetri, Brahman, and Thakuris) excluded throughout. The control populations in columns 2-5 are reweighted as described in the text. Columns 2-5 also include head, family, and residence controls as described in the notes to table 2. Source: 2001 population and housing census, public use microdata. Rural hill and terai population only.

Table 9: Vulnerability to Bondage and Adult Labor Supply, Ages 25-49

	Male	Female
Any Work	0.012 [1.723]	-0.002 [0.199]
Wage Work	-0.055 [2.704]**	0.013 [0.982]
Market Work	0.014 [1.867]	0.059 [1.716]
Agriculture	0.063 [2.439]*	0.048 [1.562]
Self Employed	0.045 [1.887]	0.012 [0.416]
Unpaid Worker	0.007 [2.997]**	0.001 [0.058]
Number of Months Worked	0.074 [0.393]	0.483 [1.490]
Age Effects	Yes	Yes
Ethnicity & District Fixed Effects	Yes	Yes
Rewighted & Controls	Yes	Yes

Coefficient on Kamaiya District*Tharu interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. All regressions include age, ethnicity, and district fixed effects. All standard errors are clustered at the ethnic group * district level. High castes (Chhetri, Brahman, and Thakuris) excluded throughout. See notes to table 2 for additional included controls.

Table 10: Child Labor and Schooling Results
 Conditional on Fertility and Household Composition
 Inverse Probability Weighted

	Males	Females
Attends School	-0.076 [2.588]**	-0.06 [1.547]
Grade Deficit Z-Score	-0.141 [1.836]	-0.091 [1.349]
Works without School	0.075 [4.381]**	0.038 [0.957]
Age Effects	Yes	Yes
Ethnicity & District Fixed Effects	Yes	Yes
Reweighted+Controls	Yes	Yes

Coefficient on Kamaiya District*Tharu interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. All regressions include age, ethnicity, and district fixed effects. Observation is a child age 10-14, boys in column 1, girls in 2. All standard errors are clustered at the ethnic group * district level. High castes (Chhetri, Brahman, and Thakuris) excluded throughout. See notes to table 2 for additional included controls. Additional controls in this table include the number of births ever reported in the household (via a set of dummies), the fraction of those births that are female, 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. These are included both as controls and in estimating weights.

Table 11: Results for Children 10-14 Controlling for Fraction Tharu in Census PSU

	Boys		Girls			
	Attends School	GDZ	Work w/o Sch.	Attends School		GDZ
Full Sample						
Tharu*Kamaiya	-0.081	-0.171	0.085	-0.023	-0.06	0.012
	[2.738]**	[2.163]*	[4.573]**	[0.489]	[0.784]	[0.249]
Fraction Tharu	0.042	0.208	-0.052	0.036	0.083	-0.002
	[1.778]	[2.793]**	[3.147]**	[1.377]	[1.492]	[0.075]
Within Kamaiya Region						
Tharu*Kamaiya	-0.079	-0.181	0.11	-0.163	-0.199	0.113
	[4.523]**	[2.434]*	[6.559]**	[3.885]**	[2.546]*	[2.075]*
Fraction Tharu	0.022	0.078	-0.037	0.031	0.095	0.014
	[1.809]	[0.852]	[1.781]	[0.912]	[1.307]	[0.312]
Less than 1/3 Tharu						
Tharu*Kamaiya	-0.058	0.012	0.128	-0.096	-0.39	0.079
	[1.474]	[0.087]	[2.596]*	[1.212]	[3.132]**	[1.083]
Fraction Tharu	0.289	0.174	-0.074	0.432	0.639	-0.385
	[1.809]	[0.613]	[0.466]	[2.603]*	[1.684]	[2.538]*
Between 1/3 and 2/3 Tharu						
Tharu*Kamaiya	-0.068	-0.137	0.122	-0.113	-0.068	0.116
	[1.282]	[0.826]	[2.025]*	[1.710]	[0.492]	[1.732]
Fraction Tharu	-0.145	0.312	0.207	-0.219	-0.115	0.398
	[0.690]	[0.782]	[1.303]	[1.709]	[0.496]	[1.745]
More than 2/3 Tharu						
Tharu*Kamaiya	-0.186	-0.728	0.075	-0.096	-0.179	0.108
	[3.037]**	[5.760]**	[1.624]	[1.236]	[1.470]	[1.787]
Fraction Tharu	0	0.223	0.008	0.106	0.235	-0.046
	[0.001]	[2.654]**	[0.256]	[0.947]	[0.874]	[0.294]
Age Effects	Yes	Yes	Yes	Yes	Yes	Yes
Ethnicity & District Effects	Yes	Yes	Yes	Yes	Yes	Yes
Reweighted + Controls	Yes	Yes	Yes	Yes	Yes	Yes

Coefficient on Kamaiya Ethnicity interactions reported and T-statistics in brackets. * Significant at 5 percent. ** significant at 1 percent. Ethnicity 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. See table 2 for a complete list of controls and the text for description of the reweighting procedure. A Census PSU corresponds politically to a local ward. 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

	<u>Non-Kamaiya Districts</u>		<u>Kamaiya Districts</u>	
	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 prevalent. 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: Population means for various castes by gender for children 10-14

	<u>Boys</u>		<u>Girls</u>	
	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 3: Fertility Descriptive Statistics for Ever-Married Women 15-49

	<u>Non-Kamaiya District</u>		<u>Kamaiya Districts</u>	
	Tharu	Non-Tharu	Tharu	Non-Tharu
Ever-Married Women 15-49				
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
Daughters	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
Daughters	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.