2009
OKSWP0903

Economics Working Paper Series
OKLAHOMA STATE UNIVERSITY

Income Risk and Household Schooling Decisions in Burkina Faso

Harounan Kazianga
Oklahoma State University
Department of Economics and Legal Studies in Business
Oklahoma State University
327 Business Building
Stillwater, OK 74078

Email: harounan.kazianga@oksatate.edu

Department of Economics
Oklahoma State
University
Stillwater, Oklahoma

339 BUS, Stillwater, OK 74078, Ph 405-744-5110, Fax 405-744-5180
Harounan Kazianga harounan.kazianga@okstate.edu
Abdul Munasib munasib@okstate.edu

Income Risk and Household Schooling Decisions in Burkina Faso

Harounan Kazianga*
Oklahoma State University
harounan.kaziange@okstate.edu

This version: February, 2009

Key words: human capital; education; income risk, Burkina Faso
JEL classification:D99; I21; O1

*I am grateful to Harold Alderman, Stefan Klonner, Leigh Linden, William Masters, Paul Schultz and Chris Udry, and two anonymous referees for useful comments. I also thank seminar participants at Michigan State University; University of Toulouse; the University of California, Davis; the SSRC's Risk and Development. I thank the UFR/SEG of the university of Ouagadougou and Kimseyinga Savadogo for support during the field work. I thank the Social Science Research Council and the Rockefeller Foundation Grant for Research on the Economics of the Family in Low Income Countries through Yale University for financial support. All remaining errors are my own.

Abstract

I study the effects of uncertainty in future income stream on household schooling decisions. The intuition is that households that face a more volatile income stream have more incentives to build up a buffer stock to insure against unforeseen adverse shocks, and non-enrollment can be part of such strategy. While there is a large literature which explores how negative income shocks impact human capital accumulation (especially education) when financial markets are incomplete and households can neither insure nor borrow to smooth their consumption, there has been little research on the cumulative effects of (perceived) income uncertainty on child education. This paper fills this gap on the literature which focuses on income shocks and education in developing countries. The empirical work uses data from rural Burkina Faso, an environment where school enrollment rates are low and households face frequent income shocks. Controlling for current economic shocks, household wealth levels and child characteristics, I find that income uncertainty reduces a number of educational outcomes, including current enrollment status, education expenditures per child, the number of years of education completed and the probability of having been ever enrolled. The estimation results suggest that income uncertainty might have large welfare costs in terms of human capital than implied by studies which focus on the *ex-post* response to economics shocks.

1 Introduction

In this paper, I examine a feature of households income in less developed areas that has received little attention in connection with investments in education: income uncertainty. If taking children from school is an option when households are exposed to negative income shocks (e.g. Beegle et al., 2005; Sawada, 2003) and negative income shocks are frequent[1], then prudent households may optimally choose to not enroll their children before the shocks even materialize. *A priori*, this would be of a lesser concern if returns to education were linear, i.e. if regardless at which grade a child drops out, her education were to generate some positive returns[2]. However, there is a growing evidence to suggest increasing returns to education in low income settings. Returns to education in the formal sector are typically small or non-existent at low levels of education attainment (Bennell, 2002; Kazianga, 2004; Shady, 2003; Schultz, 2003)[3]. In addition, in the absence of technological innovation, the return to education in the agricultural sector is small, especially in sub-Saharan Africa (e.g. Appleton and Balihuta, 1996; Canagarajah et al., 1998; Joliffe, 1998).

Low levels of human capital, including education, health and nutrition have direct consequences on welfare. Inequality in human capital outcomes, apart from being of interest *per se*, also has both direct and indirect impact on income inequality. Education is crucial for augmenting individual earnings and improving the prospects of economic growth in general. Hence a better understanding of which constraints poor households face when making decisions regarding education is critical for addressing poverty effectively. Exploration of which constraints are the most important and which policies can best promote education has generated a vast literature in economic research (see Schultz, 1988, for a review).

Education is an irreversible investment with delayed, and possibly increasing, returns. From an economic perspective, holding expected income constant, risk averse households that face unin-

[1] See Dercon (2005) for a recent review of the literature on income risk in developing countries.

[2] Note that this may still be sub-optimal since the marginal returns are not necessarily equalized to the marginal costs of investments.

[3] For instance, Bennell (2002) reports that completion of secondary school (or 6-8 years of education) is the minimum entry requirement for formal sector jobs in most sub-Saharan African countries.

surable risk would allocate more resources to liquid assets than to irreversible investments. This would result into lower investments in education. Hence, understanding how income uncertainty impacts decisions about schooling can shed light on barriers to schooling that poor households face in low income countries. I test the extent to which households facing higher income risk are more likely to reduce their investment in the human capital of their children in order to build saving stocks to offset future income shocks. More specifically, I test whether and to what extent income uncertainty acts as a barrier to education attainment in rural areas, given school supply, household wealth and child characteristics.

The empirical work uses data from rural Burkina Faso, an environment in which income risk is pervasive and education levels are among the lowest in the world (UNESCO, 2005). Burkina offers an interesting setting for testing the effects of income variance on education for two reasons.

First, levels of schooling in Burkina have been historically low. The total years of schooling average about 0.6 years for men aged 50 to 54 and 2.6 years among the youngest cohort (Schultz, 2003). Women in the same cohorts receive about half of the male schooling level, which suggests a persistent gender gap. For children aged seven to 15 years, the average enrollment rate was about 36 percent in 2003, with wide disparities between boys and girls, and between rural and urban areas (e.g. UNESCO, 2005; National surveys 2003). In the sample villages studied in this paper, the proportion of children between seven and 15 who have ever attended school increased from 29.1 percent in 1995 to 34.4 percent in 2004, which indicates that increase in education levels was modest. In light of the large evidence that links economic growth to education, it may be argued that such low levels of education are likely to have adverse effects on both individual welfare and long-term economic growth.

Second, households in Burkina face frequent crop failures due to essentially drought spells. In the 1990's, the country has been confronted to three major crop failures, in 1990/1991, 1995/1996 and 1997/1998, or roughly a major crop failure every three years (Zoungrana et al., 1999). Given that about 90% of the population lives in rural areas, and virtually all rural population depends on

rain-fed subsistence agriculture for their livelihoods, the frequent crop failures translate into high income volatility. The extent to which such income volatility (in addition to exposure to negative income shocks) impacts household education choices has received little attention in economic research in low income settings in general. In the specific case of rural Burkina Faso, Kazianga and Udry (2006) have shown that uncertainty about future income is an important determinant of current decisions on consumption and livestock holdings. In particular, they have established that conditional on current income shocks, households with higher income variance chose to dis-save less (in the forms of livestock sales and grain storage drawn-down). This paper extends these results to examine how income uncertainty affects households' education choices. Understanding how income uncertainty affects education choices can provide additional insights into the costs of incomplete financial markets in rural economies, and how the lack of insurance in risky environments can contribute to the perpetuation of poverty.

The paper fills a gap in the literature on financial market imperfections and human capital by showing how income uncertainty affects education. While there is a large literature that examines how negative income shocks can be detrimental to education when households are credit-constrained, the effect of income uncertainty *per se* on education is relatively under-researched. The closest related work is the study by Fitzsimons (2007) who tests the effects of income uncertainty on education in the context of Indonesia. I use, however, a different identification strategy than that used by Fitzsimons (2007). Furthermore, the settings are different. Enrollment rate in the study areas covered by Fitzsimons (2007) is about 80 percent, hence it is difficult to disentangle the effects of exposure to shocks which may have lead to temporary or permanent interruption from the effects of income uncertainty which influences the decision to enroll a child. In addition, while Fitzsimons (2007) finds a large impact of aggregate risk and a relatively small impact of idiosyncratic shocks, in the context of rural Burkina where households fail to insure against idiosyncratic income shocks (see Kazianga and Udry), one would anticipate a stronger impact of idiosyncratic risk.

The paper is related to two strands of literature. The first strand of literature tests how imperfect financial markets impact human capital acquisition (Duryea, 1998; Jacoby and Skoufias, 1997; Jensen, 2000). This branch of research shows that exposure to income shocks is detrimental to education when households cannot rely on formal or informal mechanisms to smooth out negative income shocks. In particular, in the face of negative income shocks, households divert child time away from education and towards labor in order to generate immediate income (Beegle et al., 2005). This paper differs substantially from this line of work, however. Instead of examining how parents alter (*ex-post*) child time reallocation when faced with negative income shocks, the paper is more concerned with the cumulative effects of in a risky environment. If, in anticipation to negative income shocks, households refrain from enrolling their children, then income uncertainty and not exposure to negative income shocks becomes the main cause of observed low enrollment rates. In fact, enrollment rates may remain low even if the shocks do not materialize. This line of reasoning would imply that using child time to cope *ex-post* with negative income shocks could lead to a succession of enrollment and de-enrollment and (or) low attendance. Ultimately, most individuals would have at least some levels of education. In contrast, income uncertainty implies that a large fraction of individuals would never enroll. Hence the welfare costs of income risk and incomplete financial markets might be higher when households *ex-ante* behavior is taken into account[4].

Second, the paper is related to a vast literature that examines how income uncertainty influences household saving and consumption behavior (e.g. Browning and Lusardi, 1996; Carroll, 1997; Carroll and Kimball, 2001; Kimball, 1991). A fundamental result in the precautionary savings literature is that the presence of uninsured risk leads prudent agents to save more than they would if there were no uncertainty (e.g. Aiyagari, 1994). The existing literature on precautionary savings focuses on the effects of income uncertainty on current consumption or asset portfolio allocation, with little attention to human capital acquisition. This paper departs from this strand of work by examining the effects of income uncertainty on education, in an environment where income risk is pervasive

[4]See Chetty and Looney (2005) for a recent related discussion.

and education levels are very low.

Controlling for current economic shocks, household wealth levels and child characteristics, I find that income variance consistently reduces a number of educational outcomes, including current enrollment status, education expenditures per child, number of years of education completed and the probability of having ever enrolled. My estimation results imply that one standard deviation increase in income variance reduces the probability of current enrollment by 49 percentage points for boys and by 10 percentage points for girls; starting from an average current enrollment of 30 percent for boys and 22 percent for girls. A similar increase in the income variance will reduce years of education completed by 0.50 year for boys and by 0.40 year for girls, starting from an average number of years of education completed of 1.40 for boys and .91 for girls. Households reduce school related expenditures by CFA 267 on boys education and by CFA 48 on girls education following a one standard deviation increase in income variance[5], starting from average education expenditures of CFA 1'629 for boys and CFA 959 for girls. Finally, the probability of "having ever enrolled" decreases by 19 percentage points for boys and by 15 percentage points for girls if income variance increases by one standard deviation, starting from an average "ever enrolled" rates of 40 percent for boys and 29 percent for girls. It is apparent that income volatility is detrimental to education, and the impact is larger on boys education than on girls education.

The results indicate that, in addition to current income shocks and wealth levels (which have been found to determine education choices), income uncertainty has a separate effect on households education choices. It is then plausible that the welfare and the long-term costs of incomplete financial markets and income risk are higher than previously implied by studies which were focused exclusively on the impacts of the use of child time to cope with negative income shocks *ex-post*. In particular *ex-post* adjustments to negative shocks imply a smaller (but positive) accumulated total years of education on average. On the other hand, income uncertainty can induce a situation in which a large fraction of the population never enrolls at all, especially when returns to education

[5]Approximately USD 1= CFA 500 at the time of the survey.

are non-linear.

The rest of the paper is organized as follows. The second section provides a brief review of the literature on parent income shocks and children's education. The third section introduces the theoretical model used to motivate the empirical work. The fourth section describes the surveys and the data used. The fifth section presents the empirical approach for deriving income shocks and variance. The sixth section discusses the empirical results and the seventh section concludes.

2 Income shocks and schooling decisions: a brief review

There is a large literature that examines the effects of income shocks on households (e.g. Alderman and Paxson, 1994; Deaton, 1992; Morduch, 1999; Rosenzweig and Wolpin, 1993; Townsend, 1994). A subset of this larger strand of work establishes a link between transitory shocks to parental income and children academic achievement. In particular, recent empirical work shows the role that shocks play in decisions regarding schooling. In one of the earliest studies, Jacoby (1994) examines the relationship between borrowing constraints and progression through school among Peruvian children. He concludes that lack of access to credit is detrimental to the acquisition of human capital because children in households with borrowing constraints begin withdrawing from school earlier than those with access to credit.

Jacoby and Skoufias (1997) provide further evidence on the relationships between human education and the incompleteness of financial markets. Using data on school attendance patterns from six Indian villages, the authors find that fluctuations in school attendance are used by households as a form of self-insurance. Sawada (2003) shows that children's propensity to join and drop out of school in rural Pakistan responds to transitory shocks. He finds that the transitory income is higher than that of permanent income, implying that transient income variation is a greater barrier to education than chronic poverty *per se*. Duryea (1998) examines the role of transitory shocks to household income on childrens advancement through school in Brazil. Her estimates suggest that children whose father experiences unemployment spell (her proxy for income shock) are less likely

to advance in grades. These findings corroborate results uncovered by Jacoby (1994) in Peruvian villages.

Conceptually, households education choices response to negative income shocks could operate in two ways. On the one hand, as in Jacoby and Skoufias (1997), when households are confronted with a negative income shock, parents may opt to have children engage in immediate income-generating activities, presumably at the cost of less time allocated to education. If time reallocation operates at the margin, it may lead to lower attendance rates without children dropping out from school. On the other hand, exposure to a negative shock may induce schooling (permanent or temporary) interruption, i.e. parents decide to take their children from school (Sawada, 2003). In either case, in the long run, attendance rates and early dropout would translate into lower number of years of education completed, but years of education would be non zero for most individuals.

More precisely, using child time as part of *ex-post* risk coping strategy would imply that years of education completed are smaller than it would have been under complete financial markets or in a risk free world, but only a small fraction of the population would never enroll since parents have the option of enrolling their children and taking them out when faced with negative income shocks. In contrast, income uncertainty, especially in conjunction with increasing rate of returns to education would induce a situation where forward looking households might choose to never enroll their children, i.e. at any point in time a sizeable fraction of the population (school age and above) never enrolls. The figures in table 1 illustrate this conjecture. The table shows the percentages of children who have withdrawn from school temporarily (for at least a year), but have already resumed their school participation at the time of the survey. I use three nationally representative surveys conducted in 2003 and in 2006. Across the three surveys, the probability of a child returning to school after withdrawing is very low, roughly .1 percent of all children aged 6 to 15 years, and less than .5 percent of children who were enrolled in school at the time of the survey. One would expect higher percentages if parents were responding to income uncertainty and income shocks by withdrawing and re-enrolling their children based on their actual income draws.

3 Conceptual Framework

The development follows Fitzsimons (2007) and is an extension of Baland and Robinson (2000) to allow for income uncertainty. Sandmo (1970)'s results are used to allow for income uncertainty in the model. To begin, I assume a unitary household model that lives two periods and maximizes the following utility:

$$\max_{c_1,e_1} U(c_1) + E_1[U(c_2)] + W(c_2^k) \tag{1}$$

Where c_1 and c_2 represent parents first and second periods consumption, c_2^k is children consumption in the second period, and $W()$ reflects the fact that parents value their children's consumption as adults. Children make no decisions in this environment. Children's consumption as adult depends on investments in education made by parents in the first period and is written as follows:

$$c_2^k = f(h(e_1)) \tag{2}$$

In the first period, parents' income is derived from their own labor y_1 as well as form the work of their children. Consumption in that period is equal to total income, net of education investments costs.

$$c_1 = y_1 + (1 - e_1)w_1 - p_e e_1 \tag{3}$$

Where w_1 is child wage, p_e is education costs and child time has been normalized to one. In the second period, parents receive an exogenous income y_2. The lifetime budget constraint is:

$$Y \equiv y_1 + y_2 = c_1 + c_2 + (1 - e_1)w_1 - p_e e_1 \tag{4}$$

Using 4 to express c_2 as a function of c_1, and substituting back in 1, the first order conditions with respect to the education level e can be expressed as follows:

$$(w_1 + p_s)E_1[U^{'}(c_2)] = W^{'}(c_2^k)f^{'}(h(e)) \tag{5}$$

The LHS component of 5 is the net costs of education weighted by the marginal expected utility of period 2 evaluated in period 1. The RHS component is the marginal utility derived from child period 2 weighted by additional earnings attributable to extra education received in period 1.

This setting can be used to explore the effects of parental income risk on schooling decisions. To introduce risk in the second period income, one can allow some dispersion around the mean income following Sandmo (1970). Future income stream is then expressed as $\gamma y_2 + \theta$, where γ and θ are multiplicative and additive shift parameters, respectively. Expected income follows as:

$$E[\gamma y_2 + \theta] \tag{6}$$

A requirement for this transformation to be mean-preserving is that $E[\gamma y_2 + \theta] = E[y_2 d\gamma + d\theta] = 0$, which in turns implies that (Sandmo, 1970, p.356)

$$\frac{d\theta}{d\gamma} = -E[y_2] = -\xi \tag{7}$$

$$\frac{\partial e_1}{\partial \gamma}|_{\frac{d\theta}{d\gamma}=-\xi} = (p_s + w_1)U^{''}(c_1)E_1[U^{''}(c_2)(y_2 - \xi)] \tag{8}$$

This simple model captures the essence of income variance on education investment. With a decreasing absolute risk aversion utility function, (8) is negative for all values of parents' second-period income (y_2) (Fitzsimons, 2007; Sandmo, 1970). First period education expenditures are decreasing in second period income uncertainty. Note that, if investment in education is treated like any other consumption good, then the precautionary saving model will lead to similar implications: higher uncertainty in future income induces higher saving and lower consumption in the current period. Note that the model abstracts from time discount, which may differ between poor

and rich households. Moreover, it does not allow for transfers from children to parents, which potentially reduces the second period income risk[6]. These assumptions would not influence the model predictions if negative shocks are frequent and shocks and returns to education are non-linear. Finally, the assumption that children are exogenous seems too restrictive since income uncertainty is likely to influence both fertility and education choices.

4 Data and descriptive statistics

The data come from two surveys conducted in rural Burkina Faso in 1995 and 2004/2005. The survey covers six villages in three different regions, with different agricultural and non-agricultural potential: the Namentenga province located in a Soudanian type region, the Soum province which is located in a Sahelian region and the Kossi province which is located in a Northern-Guinean type region. The main activity in the Sahelian region is herding. Agriculture and rearing small animals dominate in the Soudanian region. Overall, the population in the three location consists of subsistence farmers. Opportunities for cash crops are limited, except in the Northern-Guinean region where cotton farming is important. For the purpose of this paper, it is worth noting that there is a school in each of these villages, so distance to school should be a minor concern[7].

In each village, 50 households were randomly selected to be part of a general household survey in 1995. A follow up survey, which tracked the original households, was conducted between November 2004 and March 2005 by the author. Individuals who had left these households but still resided in the same villages at the time of the follow-up survey were also included. In total, 369 households were surveyed in the second round. This new sample consists of 125 newly formed households (from marriages and divisions of the 300 households) and 244 households which were part of the original

[6]Fitzsimons (2007) considers the implication of relaxing this assumption. This would contribute to attenuate the negative impact of income risk on education. Therefore the strong negative effect that I find in the empirical section implies that either parents do not value the income risk-reducing effect of their child education or the risk-reducing effect is not large enough to offset the negative of parents income risk.

[7]Given the dwelling pattern, especially in the soudanian region, distance to school is likely to vary substantially across households.

sample. In addition to general information on household income, wealth, and consumption the follow up survey collected detailed information on household size dynamics, education, fertility and immunization. This paper exploits the detailed information on land holdings history and education history of individual households members.

Tables 2 to 5 summarize keys education outcomes for school age children (i.e. children aged seven to 15), and table 19 shows the mean, the standard deviation, the minimum and maximum values of all variables used in the estimations. Table 2 shows education outcome in 1995 and 2004. The education variable contained in the 1995 survey is whether an individual has ever enrolled. While this variable may appear a priori limited, it still conveys useful information in an environment where approximately one in three children have ever attended school. The figures indicate that the likelihood of having ever enrolled increased for both boys and girls (from 29 percent in 1995 to 34.4 percent in 2004) although a sizeable gender gap still exits (40.1 percent of boys have been ever enrolled as opposed to 28.9 percent of girls). Enrollment rates improved in all villages, except in the Soudanian Niéga village where in comparison to 1995, fewer children had ever been enrolled in school in 2004.

Data on current enrollment status are only available for the 2004 round, and are summarized in table 3. The average current enrollment rate is about 26.3 percent, and this figure is consistent with figures from national surveys, which report an enrollment rate of 22 percent for rural areas (according to 2003 release of the Burkina Demographic and Health Survey data). Overall, villages located in the Northern Guinean region (villages 5 and 6), tend to have the highest enrollment rates. A potential explanation is that cotton (which is cash crop) provides farmers with a more reliable income source in these villages. In addition, given current farming technologies, the returns to education are potentially higher on cash crop farms (cotton) that on subsistence farms[8]. A puzzling result is the relatively higher enrollment rates in the Sahelian villages (villages 3 and 4). While not well documented in this version of paper, prolonged interventions from NGO's could

[8]This is because cotton farming necessitates the use of modern inputs (fertilizers and pesticides). Presumably, farmers with formal education could learn faster how to use these inputs.

explain this pattern. Another caveat is that being close to a local town does not necessarily imply higher enrollment rates. Villages 1 (Niéga), 3 (Béléhédé) and 5 (Kéréna) are closer to the local town than the other village from the same region. With the noticeable exception of Kéréna and Dissankuy[9], the enrollment rate is lower in villages that are closer to the local town.

Table 4 reports average years of education completed for children aged seven to 15. Column 1 contains average years of education for the whole sample. Column 2 shows the average years of education for children who have been ever enrolled [10]. While boys receive more education than girls on average (difference significant at the 1 percent level), boys and girls have approximately equal number of years of education conditional on enrollment[11]. There are several explanations for these enrollment patterns, two important ones being an inadequate supply of school infrastructure and extreme poverty. There is a school in each of the sample villages, however, suggesting that low enrollment may not be due to the lack of school infrastructures. In addition, the regressions will control for village dummies as well as household poverty through a number of wealth indicators.

Table 5 summarizes education-related expenses by student. Although primary education is officially free, parents are still required to pay for various fees, including parents associations fees, books and notebooks for example. The table shows the unconditional means, and the means conditional on being enrolled, at the time of the survey. Households spend about the equivalent of $3 a year on boys' education and about $2 on girls' education, although there are large differences across villages. Conditional on being enrolled, these figures increase to $8 for boys and $3 for girls. While these are not large amounts in absolute terms, they can still represent a significant constraint if cash-constrained households are required to make timely cash payments.

[9] Where cash crop -cotton- opportunities exist.

[10] If the sample is restricted to children between 10 and 15, then 31 percent have ever been to school, suggesting that the low rate of ever been enrolled is not due to delayed entry.

[11] This essentially concerns primary school. It is likely that gender inequality (conditional on having been ever enrolled) may surface at secondary and tertiary education levels.

5 Estimation Strategy

The theoretical discussion can be expressed by an empirical model in the following form, where it is assumed that income shock variance is a good proxy for income uncertainty.

$$s_{ihv} = \alpha_1 \widehat{var}_{hv} + \alpha_2 x_{ihv} + \alpha_3 x_{hv} + \alpha_4 x_v + \varepsilon_{ihv} \tag{9}$$

Where s_{ihv} is education outcome for child i in household h in village v, $\widehat{var}_{hv}$ is estimated income variance for household h in village v, x_{ihv} summarizes child characteristics, x_{hv} summarizes household characteristics, x_v summarizes village characteristics and ε is an error term. The $\alpha's$ are parameters to be estimated. The theory predicts that α_1 should be negative (i.e. higher income variance reflects more uncertainty). Estimating regression 9 requires a measure of income variance, whose derivation I discuss in subsection 5.2.

5.1 Attrition

While the 1995 sample was drawn randomly from villages census, the 2004 sample may not be random since households may leave selectively. The main concern is that land holdings (that I use in the identification strategy) and education (the outcome of interest) are potentially correlated with the decisions to leave the villages and hence the sample. This would in turn bias the estimation results. For these reasons, this sub section provides a discussion on sample attrition as it pertains to the data.

As previously discussed, among the 300 households included in the 1995 survey 248 of them remain in 2004. The attrition rate is about 17.33 percent over the 10 years interval which corresponds to an annual attrition rate of 1.88 percent[12]. This level of attrition rate is in the range of attrition observed for panel surveys with comparable interval length(see Alderman et al., 2001, for comparison attrition rates in developing countries).

[12] Annual attrition rate is calculated as $1-(1-q)^{1/T}$, where q is the overall attrition rate and T is the number of years covered by the panel (Alderman et al., 2001).

Table 7 presents the summary statistics by attrition status, using 1995 data. "Leavers" refer to households who dropped from the survey in 2004 and "stayers" refer to households that remained in the survey. The last row of the table reports the absolute t-value of the mean difference. This preliminary exploration implies that only female headship and household composition, in particular the presence of adult and school-age girls in 1995 are important for attrition. Significant differences between stayers and leavers in the observables suggests that they could also differ in unobservables. If this is the case, consistent estimations require that attrition be addressed appropriately (e.g. Fitzgerald et al., 1998).

To address attrition, I adopt the inverse probability weighting (IPW) method proposed by Wooldrige (2002). IPW is based on the key assumption that sample attrition is ignorable with respect to the dependent variable, conditional on the observables in the attrition equation (Wooldrige, 2002). The IPW consists of two stages. In the first stage, data from the first round are used to estimate the probability of remaining in the survey in the second round. The inverse of the predicted probabilities are used to weight the second round data, in essence giving more weight to households who are more likely to leave conditional on observables.

Table 8 presents Probit estimations of the conditional probabilities of being in the survey in the second round (I have excluded three households whose entire members died between the two rounds). The instruments exploit the assignment of enumerators and controllers to the survey sites and religion heterogeneity in these villages. Enumerators were selected and assigned to the villages based on experience and ethnic background (i.e. each enumerator was required to be able to communicate in the language spoken in the village), but religious beliefs were not a criterion. Since the survey required that both the enumerators and the controllers reside in the villages for a prolonged time, religion might have served as one of the networks that enumerators could rely on to track hard-to-find households. Hence, households whose head religion matches the enumerator or the controller religion would have been more likely to be resurveyed in the second round. In addition, although the religion of the household head enters the education regression,

the interactions between the household head religion and enumerators's religion do not belong to that regression. These interactions can then serve as exclusion restrictions. The estimation results imply that the probability of finding a household in the second round increases if the religion of the enumerator or the controller matches that of the household head. Although the individual coefficients are statistically significant only in two cases, they are jointly significant, implying that religion matches between survey enumerators and household heads contribute to explain the probability of attrition.

5.2 Measures of income shocks and variance

Where agriculture is essentially rain-fed, rainfall deviations and heterogeneity in households' land holdings (in terms of soil types and topo-sequence) can be used to recover a measure of income shocks. To the extent that production on different types of land responds differently to similar rainfall levels, and land allocation is made at the beginning of the season when the level of rainfall is unknown, the cross-product of soil types and rainfall realization provides a measure of the income shock that is both exogenous and unanticipated (e.g. Alderman and Paxson, 1994; Fafchamps et al., 1998; Paxson, 1992). Furthermore, absent of an active land market, a household stock (which may be different from land farmed in any given year) of land reflects its ability to cope with rainfall risk.

Following this line of literature, I use data from 1995 and 2004 to estimate the following regression.

$$y_{ivt} = z_{ivt}\beta_1 + F_{vt}X_{ivt}\beta_2 + \gamma_{vt} + \gamma_i + \varepsilon_{ivt} \tag{10}$$

where y_{itv} is the crop income (total output value net of all purchased inputs and hired labor), z_{ivt} is a set of household demographic variables, X_{ivt} represents the area of plots of specific soil types cultivated by the farmer, F_{vt} is current rainfall deviation from its long-term mean, γ_{vt} is a village-year fixed effect, γ_i is a household fixed effect and ε_{ivt} is an error term. Households are indexed by i, villages by v and time by t.

Estimation results of regression (10) are reported in Table 9. The first column does not control

for aggregate shocks. The second column includes village-year dummies in order to control for aggregate shocks. The third column allows village-specific effect of rainfall deviations. With data for only two years, this last specification assumes that rainfall deviations capture all village fixed effects. Note however, that the income response to rainfall variations interacted with land is stable between column 2 and 3, which suggests that rainfall deviations are the most important factors in explaining year to year variations across villages. Therefore, I treat column 3 as my preferred specification and use these estimates to predict income shocks for the remaining years and derive the variance of income shocks. In the last two rows, F-tests of the joint significance of the instruments are reported. In all regressions, the instruments are jointly significant. The null hypothesis that these interactions are jointly non-significant is rejected at the one percent level across all specifications (the F statistic ranges from 5.34 to 7.94).

Using estimates from regression 10, idiosyncratic shocks are given by $F_{vt}X_{ivt}\hat{\beta}_2$. If households have rational expectations concerning the distribution of income shocks due to rainfall that they can expect (Kazianga and Udry, 2006), then income variance is given as:

$$\widehat{var}(y^T_{ivt+1}) = \frac{1}{24}\sum_{t=1971}^{1994}(F_{vt}\bar{X}_{iv}\hat{\beta}_2 + \hat{\beta}_v F_{vt} - (\bar{F}_v\bar{X}_{iv}\hat{\beta}_2 + \hat{\beta}_v\bar{F}_v))^2. \tag{11}$$

The measures of both income shocks and variance are entirely characterized by land holdings and rainfall deviations, and do not require extra information at the household level. Hence, land holdings history can be used to derive the history of income shocks for each household. There is a number of concerns that could invalidate my identification strategy. First, risk averse households could change their mix of land holdings to reduce their volatility to risk, then my estimate would not get at the "raw" exposure to risk. To mitigate this concern, I use total land holdings instead of cultivated land. Assuming that there is no active land market, the household cannot change her mix of land holdings. Hence for each household, total land holdings provide a proxy of household income volatility over time. Table 6 summarizes average land holdings by household, including number of plots, average area in hectares and means of land acquisition. It is apparent that land

is acquired essentially through one's family or through the village as inheritance or gifts. Other means of land acquisition (including borrowing, purchasing) account for a small fraction of land stock. Information about the land areas and acquisition dates were then used to reconstruct the history of land holdings for each household between 1995 and 2004.

Before proceeding further, I check the robustness of estimated unpredictable income shocks by examining their correlation with self-reported shocks. The data contain directly solicited information on income shocks between 1995 and 2005. In each household, two adults (the head and another adult member) were asked independently to rate the years between 1995 and 2004 as good, average, or bad[13]. Table 10 summarizes this information. The first row reports the percentage of households who report at least one negative shock during the 5 year period (2000-2005), and the second row reports the frequency of negative shocks. It can be seen that on average, households are more likely to suffer from a negative shock in the northern villages (Béléhédé and Pétéga) than in the southwestern region (Kéréna and Dissankuy). Virtually all households report at least one negative shock in the northern villages (Béléhédé and Pétéga) as opposed to 63% and 36% in the Northern-Guinean villages.

To provide further insights, I run a logit regression where the dependent variable is 1 if a household reported a negative shock in a given year and zero otherwise, and the explanatory variables include predicted income shocks, household assets and village level-rainfall variations. The results are reported in table 11. From the first column, it can be seen that a household is less likely to report a negative shock when the predicted income shock is positive, although the coefficient is not statistically significant. In the second column, positive and negative income shocks are allowed to enter in the regression separately. It is apparent that households are less likely to report a negative shock in a year when predicted income shock is positive. In contrast, when predicted income shock is negative, it does not exert a discernable effect on self reported shocks. Despite this discrepancy, there are a number of reasons why predicted shocks would provide better

[13]Household members were also asked why a given year was rated "good" or "bad", and if a year was "bad", what they did to get by.

measures of shocks than self reported shocks.

First, one could conjecture that when rating a year as "good" or "bad", households do not make a distinction between income changes resulting from their own choices and that resulting from exogenous sources. Second, it is plausible that the memory of past shocks is associated with the extent to which these shocks impacted household well-being (Dex, 1991; Smith and Thomas, 2003), this would suggest that shocks which were small in magnitude or shocks that households were able to cope with would be under-reported. Since measures of land holdings and rainfall data are less subject to self reporting errors, I will use predicted income shocks for the rest of the analysis[14].

6 Results and discussions

6.1 Income Risk

I now examine the impact of income risk on education using regression 9. I use the 2004 cross-section, which has more detailed information on education. I estimate regression 9 for a range of education outcomes including current enrollment status, education-related expenditures per child, "ever enrolled" and number of years of education completed. In addition to income variance, the explanatory variables in all regressions include the child characteristics (gender, whether head child or not, number of siblings of school age, whether a child is a paternal or a maternal orphan), parents' characteristics (whether father and mother are literate), household current income, household wealth (expressed as the value of durable goods and farm equipment, land area measured in hectares per adult and livestock holdings), household structure (number of adult males and females, and senior males and females) as well as village and religion dummies.

Marginal effects from logit estimations of current enrollment status are show in table 12[15].

[14]These shocks measures are still subject to errors from many sources including functional forms, possible noise in land measures introduced by GPS devices, imprecise rainfall records from the rainfall station etc. These types of errors are less likely than self-reported shocks to contain unobserved individual heterogeneity, once one control for individual fixed effects.

[15]The estimations do not account for late entry (i.e. some of school age children who are not enrolled may enroll in

Columns 1 and 4 contain estimation results for boys and girls taken together. Columns 2 and 3, and 5 and 6 contain separate estimations for boys and girls. In the last three columns, I include contemporary income shocks, measured as crop income shocks and livestock losses (from theft and deaths), in order to control for any contemporary shock effects that might be confounded with the variance effects. The estimated marginal effects imply that for children whose households income variance is higher by one standard deviation than the average, the likelihood of being enrolled at the time of the survey is .48 lower for boys and .10 lower for girls (starting from an average enrollment of .30 for boys and .22 for girls and .26 for both boys and girls).

To complete the discussion on current education choices, I also run tobit regression of current education related expenditures by school age child. The unconditional marginal effects are reported in table 13, where the last three columns control again for current income shocks. As with the logit results, controlling for contemporary income shocks only improves the precision of the girl regression. From the marginal effects, one can infer that an increase of one standard deviation in income variance reduces education related expenditures by CFA 267 for boys, by CFA 49 for girls and by CFA 73 for boys and girls taken together.

Current enrollment status and education expenses reflect current household education choices, and do not account necessarily for past decisions that could provide useful information about the effects of income uncertainty. To account for previous decisions, I consider number of years of education and the probability of having "ever been enrolled". This is simply the discrete part of years of education completed.

Tobit estimation results (unconditional marginal effects) of years of education completed are reported in table 14. As in the previous tables, the last three columns control for current income shocks. Concentrating on columns 4 to 6, the mean estimates is apparent that the effect on boys education is larger and than that on girls, but less precisely estimated. The marginal effects imply

the future). Likewise, I do not address right censoring (that years of education completed is at least equal to current years of education for those who are still attending school) when estimating Tobit regressions of years of education completed. Instead, I include age dummies in all regressions.

a reduction of years of education in the order of .51 year for boys and .36 years for girls. (starting from an average years of education of for 1.36 boys and .91 for girls). These results are corroborated by logit estimations of "ever enrolled" which are shown in table 15. Children from household with income variance one standard deviation higher than average income variance are less likely to have been ever enrolled in school.

These basic estimates imply that boys education is more affected than girls education by income variance, although on average boys are more likely than girls to be enrolled at any given time (the male dummy, where included, is positive and significant at any conventional level). The effects of current income shocks (approximated by predicted crop income shock and livestock losses) are consistent with findings from previous studies, i.e., that negative income shocks are detrimental to child education (e.g. Beegle et al., 2005; Jacoby and Skoufias, 1997). This implies that income uncertainty exerts a separate effect on education in addition to exposure to negative shocks.

I now focus on selected few covariates. I start by looking at household wealth indicators (i.e. land holdings, livestock holdings, and value of durable goods and farm equipment). *A priori*, the effects of land holdings, livestock and farm equipment are ambiguous. These variables reflect higher wealth, indicating that more resources are available for investing in education, but they may also interact with child labor as substitutes or complements (e.g. Bhalotra and Heady, 2003). If they complement child labor, these variables would increase the opportunity cost of child time and then may reduce the likelihood of enrollment. Across all education outcomes, land holding has a significant and positive effect on girls education but has no discernable effects on boys education. In fact, the effects on boys accumulated education (tables 14 and 15) are negative but not significant. Livestock holdings (especially cattle) have, in general, a positive effect on education. Given that livestock husbandry is child labor-intensive in these settings, one could conjecture that the wealth effects outweigh the child labor demand effects. This must be interpreted with caution since these variables are potentially endogenous.

The regressions also control for a number of child characteristics that have been found to be

determinants in education choices (see, e.g., the review by Schultz, 1988). Being the household head child increases the likelihood of "having ever been enrolled" for boys only (table 15, column 5), but has no significant effects on education outcomes otherwise. To test for resource constraint, I include the presence of other school-age children, distinguished by gender. Overall, there is no evidence that the presence of other school age children impact education substantially.

The next set of covariates test the presence of parents and parents literacy (can read and write). The estimations imply that mother literacy has a positive and significant effect on boys education, but has no discernable on girls education. Father literacy increases girls education outcome, but has only a marginal impact on boys. This could be reflecting the fact that men have more bargaining power when the household is considering some potentially important decisions (such as enrolling a daughter). It could be also the case that women with some level of education marry educated men and since there are fewer educated women than educated men, the literacy effect vanishes for women. Nevertheless, if true, these findings have interesting policy implications in Burkina, where policy makers seek to improve girls education by promoting adult female literacy. I also control for orphanhood. While the effect of both paternal and maternal orphanhood is consistently negative, only maternal orphanhood is statistically significant for girls education outcomes (tables 12 and 15). This may reflect the role that mothers play in securing resources for their own children within large and polygamous households, as suggested by Case and Ardington (2005) in their study of orphanhood in South Africa.

7 Robustness Check

7.1 Household-lineage fixed effects

The dependent variable in equation (10) is the crop income of the household. However, this will include labor supply decisions that have been taken by the household to reduce risk (e.g. increased labor supply of members in periods when rainfall is very low), which will again not get at (in fact

under-estimate) the "raw" exposure of the household to risk.

It is likely that there are certain unobserved characteristics specific to each household that influence both land holdings (and hence income variance) and schooling decisions, thereby biasing the estimation results. In addition, if factors that make land more responsive to rainfall deviations make child labor also more productive on the farm, then this will raise the opportunity cost of child time, leading to low investments in education. Moreover, education is transmitted through generation, the estimations indicate that children whose fathers are literate are more likely to be enrolled than other children. This suggests that both land holdings and education of grandparents (which are unobserved in the data) would influence current education investments. To address this unobserved heterogeneity, I exploit household partition between 1995 and 2004 to re-estimate a lineage fixed effects version of regression 9. Formally, I estimate a regression as follows:

$$s_{ihv} = \alpha_1 \widehat{var}_{hv} + \alpha_2 x_{ihv} + \alpha_3 x_{hv} + \alpha_4 x_v + \zeta_l + \varepsilon_{ihv} \tag{12}$$

where ζ_l is lineage fixed effects and all other variables are as defined before. The motivation is that 2004 households who resulted from the partition of the same 1995 household can be considered as members of the same lineage l, and have been exposed to the unobserved household level factors up to the time of partition. After the household partitions, each resulting household receives its share of land and then faces its own shock distribution [16].

Estimation results are shown in tables 16 and 17, where I predicted income instead of observed income. The Logit fixed effects follows the method proposed by Chamberlain (1980), and for Tobit fixed effects, I use the method proposed by Honoré (1992). Because the sample becomes small, I no longer consider separate regressions for boys and girls. The results confirm the strong negative influence that income uncertainty exerts on education outcomes. Overall, while the identification strategy is not strong enough to warrant the postulation of causal relationships, there is enough

[16] Household partition might not be random (Foster and Rosenzweig, 2002), which implies that this is now a selected sample. Future versions will address this selection issue.

evidence to support at least the existence of a strong and negative correlation between income variance and households investment in education.

7.2 Distinguishing ex-ante and ex-post shocks

A priori, it could be hard to distinguish the story of households choosing ex-ante not to enroll children in school because of anticipated future income shocks from the more conventional story where negative income shocks lead to withdrawing children from school if children who withdraw are less likely to return even when income has improved[17].

In an attempt to address this concern, I look at the response of enrollment observed in 1995 to income variance measured using information available between 1996 and 2004[18]. Results using Logit specifications are reported in table 18. Consistent with my previous estimation results, income variance has a relatively negative impact on boys's enrollment but has no discernable effect on girls enrollment.

8 Conclusions

The objective of this paper was to evaluate to what extent households anticipations of future income fluctuations impact investments in their children education. Controlling for current income shocks, household wealth, child and parents characteristics, I find that income variance (my proxy for income uncertainty) has a significant and negative effect on a range of education outcomes which

[17]To help picture this concern, consider two children i and j who are 6 years old in 1995. Over the next 3 years, child i's family has incomes of 500, 0, 1000. Child j's family has incomes of 500, 500, 500. The means are the same, but the variance differs. Now we observe these children in 2004 and find that child i is less likely to be currently enrolled in school (plus has lower years and the family spends less on schooling). My interpretation is that child i's family knew it's income was more risky, so it chose to invest little in child education, preferring perhaps to put the resources away for savings in case of a shock. However, it could also be that when incomes are very low, kids are taken out of school, and once withdrawn from school they are less likely to return.

[18]The income variance is measured as:

$$\widehat{var}(y^T_{hvt+1}) = \frac{1}{9}\sum_{t=1996}^{2004}(F_{vt}\bar{X}_{hv}\hat{\beta}_2 + \hat{\beta}_v F_{vt} - (\bar{F}_v\bar{X}_{hv}\hat{\beta}_2 + \hat{\beta}_v\bar{F}_v))^2$$

reflect both current education choices and accumulated education.

The finding that income uncertainty is detrimental to education has both analytical and policy implications. From an analytical perspective, the finding implies that focusing only on household *ex-post* response to negative shocks may not take into account the full costs of income risk. First, income uncertainty is sufficient to maintain a low enrollment rate, even if negative shocks do not materialize frequently. Second, forward-looking households may allocate child time *ex-ante* (e.g. by enrolling only few of their children and having the other to work full time), so as to minimize the impact of negative income shock on school attendance and the probability of dropping out. Non-linearities in returns to education may exacerbate such behavior. It is then possible that empirical tests may find little (or no) response of education decisions to negative income shocks, while income uncertainty still has a significant negative impact.

References

Aiyagari, S. R. (1994). Uninsured idiosyncratic risk and aggregate saving. *Quarterly Journal of Economics 109*(3), 659–684.

Alderman, H., J. R. Behrman, H. P. Kohler, J. A. Maluccio, and S. C. Watkins (2001). Attrition in longitudinal household survey data: Some tests for three developing-country samples. *Demographic Research 5*(4), 79–123.

Alderman, H. and C. H. Paxson (1994). Do the poor insure? a synthesis of the literature on risk and consumption in developing countries. In E. L. Bacha (Ed.), *Economic in a Changing World*, Volume Development, Trade and the Environment, Chapter 3, pp. 48–78. London: Macillan.

Appleton, S. and A. Balihuta (1996). Education and agricultural productivity: Evidence from uganda. *Journal of International Development 8*(3), 415–466.

Baland, J.-M. and J. A. Robinson (2000). Is child labor efficient. *Journal of Political Economy 108*(4), 663–681.

Beegle, K., R. Dehejia, and R. Gatti (2005). Child labor and agricultural shocks. *Journal of Development Economics Forthcoming*.

Bennell, P. (2002). Hitting the target: Doubling primary school enrollments in sub-saharan africa by 2015. *World Development 30*(7), 1179–1194.

Bhalotra, S. and C. Heady (2003). Child farm labor: The wealth paradox. *World Bank Economic Review 17*(2), 197–227.

Browning, M. and A. Lusardi (1996). Household saving: Micro theories and micro facts. *Journal of Economic Literature 34*, 1797–1855.

Canagarajah, S., D. Mazumdar, and X. Ye (1998). *The Structure and Determinants of Inequality and Poverty Reduction in Ghana*. Washington DC: The World Bank.

Carroll, C. D. (1997). Buffer-stock saving and the life cycle/permanent income hypothesis. *Quarterly Journal of Economics 107*, 1–55.

Carroll, C. D. and M. S. Kimball (2001). Liquidity constraints and precautionary saving. Working Paper 2001, Department of Economics, The Johns Hopkins University, Baltimore, MD.

Case, A. and C. Ardington (2005). The impact of parental death on school enrollment and achievement: Longitudinal evidence from south africa. *Research Program in Development Studies Mimeo.*

Chamberlain, G. (1980). Analysis of covariance with qualitative data. *Review of Economic Studies 47*(1), 225–238.

Chetty, R. and A. Looney (2005). Consumption smoothing and the welfare consequences of social insurance in developing economies. *National Bureau of Economic Research Working Paper 11709.*

Deaton, A. (1992). *Understanding Consumption.* New York: Oxford University Press.

Dercon, S. (2005). *Insurance Against Poverty.* Oxford University Press.

Dex, S. (1991). The reliability of recall data: A literature review. *Working papers of the ESRC Research Centre of Micro-social Change,University of Essex WP 91-11.*

Duryea, S. (1998). Children's advancement through school in brazil: The role of transitory shocks to household income. Working Paper 376, Inter-American Development Bank, Office of the Chief Economist.

Fafchamps, M., C. Udry, and K. Czukas (1998). Drought and saving in west africa: Are livestock a buffer stock? *Journal of Development Economics 55*(2), 273–305.

Fitzgerald, J., P. Gottschalk, and R. Moffitt (1998). An analysis of sample attrition in panel data. *Journal of Human Resources 33*(3), 251–299.

Fitzsimons, E. (2007). The effects of risk on education in indonesia. *Economic Development and Cultural Change 56*, 1–25.

Foster, A. D. and M. R. Rosenzweig (2002). Household division and rural economic growth. *Review of Economic Studies 69*, 839–869.

Honoré, B. (1992). Trimmed lad and least squares estimation of truncated and censored regression models with fixed effects. *Econometrica 60*(3), 553–565.

Jacoby, H. (1994). Borrowing constraints and progress through school: Evidence from peru. *The Review of Economics and Statistics 76*(1), 151–160.

Jacoby, H. and E. Skoufias (1997). Risk, financial markets, and human capital in a developing country. *Review of Economic Studies 64*(3), 311–335.

Jensen, R. (2000). Agricultural volatility and investments in children. *American Economic Review Papers and Proceedings 90*(2), 399–404.

Joliffe, D. (1998). Skills, schooling and household income in ghana. *World Bank Economic Review 12*(1), 81–104.

Kazianga, H. (2004). Schooling returns for wage earners in burkina faso. *Economic Growth Center, Yale Univeristy Discussion Paper 892*.

Kazianga, H. and C. Udry (2006). Consumtion smoothing? livestock, drought and insurance in rural burkina faso. *Journal of Development Economics 79*, 413–446.

Kimball, M. (1991). Precautionary savings in the small and the large. *Econometrica 58*(1), 53–73.

Morduch, J. (1999, August). Between the state and the market: Can informal insurance patch the safety net? *World Bank Research Observer 14*(2), 187–207.

Paxson, C. H. (1992). Using weather variability to estimate the response of saving to transitory income in thailand. *American Economic Review 82*(1), 15–33.

Rosenzweig, M. R. and K. I. Wolpin (1993). Credit market constraints, consumption smoothing, and the accumulation of durable production assets in low-income countries: Investments in bullocks in india. *Journal of Political Economy 101*(2), 223–44.

Sandmo, A. (1970). The effects of uncertainty on saving decisions. *Review of Economic Studies 37*(3), 353–360.

Sawada, Y. (2003). Income risks, gender, and human capital investment in a developing country. Mimeo.

Schultz, T. P. (1988). Education investments and returns. In H. Chenery and T. N. Srinivassan (Eds.), *Handbook in Development Economics*. Amsterdam: North Holland: Elsevier.

Schultz, T. P. (2003). Human resource research agenda and survey evidence in africa: Monitoring efficiency and improving equity. Center Discussion Paper 875, Economic Growth Center, Yale University, New Haven, Connecticut, USA.

Shady, N. R. (2003). Convexity and sheepskin effects in the human capital earnings function: Recent evidence fot filipino men. *Oxford Bulletin of Economics and Statistics 65*(2), 171–196.

Smith, J. P. and D. Thomas (2003). Remembrances of things past: Test-retest reliability of retrospective migration histories. *Journal of Royal Statistical Society-Serie A 166*(1), 23–49.

Townsend, R. M. (1994, May). Risk and insurance in village India. *Econometrica 62*(3), 539–91.

UNESCO (2005). Global education digest 2005: Comparing education statistics across the world. Technical report, UNESCO Institute for Statistics, Montreal: Quebec, Canada.

Wooldrige, J. M. (2002). Inverse probability weighted m-estimators for sample selection, attrition, and stratification. *The Institute for Fiscal Studies, Department of Economics, UCL Cemmap Working Paper CWP11/02*.

Zoungrana, A., B. Sawadogo, S. Zerbo, I. Tagnan, N. Terpend, S. Sanon, and D. Michiels (1999). Plan national d'organisation et de coordination des secours d'urgence et de réhabilitation: Volet sécurité alimentaire. Rapport technique, Comité National de Secours d'Urgence et de Réhabilitation, Ouagadougou, Burkina Faso.

Table 1: Percentage of school age children (7-15 years) who return to school after dropping out for at least one year

	(1)	(2)	(3)
	2003-DHS	2003-EBCVM	2006-QUIBB
As perct. of all sample (%)	0.066	0.074	0.111
As perct. of currently enrolled (%)	0.383	0.327	0.295
Current enrollment rate (%)	20.899	22.531	37.533
Sample size	15068	11632	9762

DHS refers to the Demographic and Health Survey

EBCVM refers to national LSMS type survey

QUIBB refers to a core welfare indicators survey

Figures in the table are weighted averages

Table 2: Percentage of school age children (7-15 years) who ever attended school

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
1995					Village			6 villages
		Niéga	Kognéré	Béléhédé	Pétéga	Kéréna	Dissankuy	
	Boys	29.27	54.00	30.43	46.38	76.92	39.24	37.24
	Girls	16.18	6.94	22.97	25.00	42.22	19.72	20.63
	Boys& Girls	23.33	10.32	26.57	37.21	58.33	30.00	29.09
	n	150	126	143	117	84	150	770
2004								
	Boys	20.31	24.21	49.38	44.23	78.72	40.00	40.08
	Girls	10.67	14.46	22.83	40.00	64.29	35.71	28.66
	Boys& Girls	15.11	19.66	35.26	41.96	71.91	38.04	34.44
		139	178	173	112	89	276	967

Table 3: Current enrollment status in percentage for school age children (7-15 years)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Villages			6 villages
	Niéga	Kognéré	Béléhédé	Pétéga	Kéréna	Dissankuy	
Boys	10.94	20.00	33.33	34.62	61.70	32.67	30.47
Girls	4.00	13.25	17.39	36.67	42.86	27.78	21.97
Boys& Girls	7.19	16.85	24.86	35.71	52.81	30.43	26.27
n	139	178	173	112	89	276	967

Table 4: Average years of education

	(1)	(2)
	all sample	ever been enrolled
Boys	1.36	3.13
Girls	0.91	3.21
t-stat	3.70	0.39
n	967	333

Table 5: Education expenses per child, unconditional mean (CFA 1'000)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Village						6 villages
		Niéga	Kognéré	Béléhédé	Pétéga	Kéréna	Dissankuy	
Boys	unconditional mean	1.318	1.918	1.154	0.263	1.226	2.433	1.629
	conditional on beeing enrolled	6.132	9.375	2.320	0.760	1.987	5.691	4.254
Girls	unconditional mean	0.247	0.639	0.256	0.210	0.749	2.533	0.959
	conditional on beeing enrolled	2.833	4.495	1.141	0.573	1.625	8.412	3.928
Boys&Girls	unconditional mean	0.578	1.213	0.643	0.221	0.730	2.375	1.158
	conditional on beeing enrolled	5.143	7.586	1.881	0.657	1.848	6.824	4.119
n		139	178	173	112	89	276	967

Table 6: Summary of land characteristics in sample villages

Villages		Hh land	Received from:		Other forms
			Family	Village	of acquisition
Niéga	# plots	9.91	9.26	0.40	0.25
	Area (ha)	4.41	4.08	0.21	0.13
Kognéré	# plots	7.58	6.27	1.23	0.08
	Area (ha)	3.26	2.75	0.49	0.01
Béléhédé	# plots	3.81	3.46	0.35	0.00
	Area (ha)	7.01	6.21	0.80	0.00
Pétéga	# plots	2.57	2.11	0.41	0.05
	Area (ha)	4.18	2.96	1.08	0.14
Kéréna	# plots	4.58	3.15	0.55	0.89
	Area (ha)	4.91	3.46	0.45	1.00
Dissankuy	# plots	7.32	3.09	3.34	0.88
	Area (ha)	9.20	3.41	4.25	1.53
Total	# plots	6.37	4.80	1.19	0.38
	Area (ha)	5.61	3.77	1.33	0.51

Table 7: Summary statistics by attrition status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Attrition	Non food cons.	Female head	Head age	Crop income	Cattle	Goat/Sheep	Asset value	adults	pre-school	boys	girls	hhsize
Stayers	10.882	0.045	48.757	27817.640	0.462	1.571	13608.070	4.243	2.271	1.283	1.279	9.077
Leavers	10.706	0.135	46.231	20502.350	0.532	1.902	8426.704	3.135	1.750	0.923	0.788	6.596
Total	10.851	0.060	48.318	26545.420	0.474	1.629	12706.960	4.050	2.181	1.221	1.194	8.645
t-test ((abs.value)	0.061	2.500	1.125	1.458	0.458	0.853	0.854	3.875	2.005	1.755	2.792	3.4638

Table 8: Determinants of attrition

	(1)	(2)
	leaver=1	leaver=1
Head Female	0.669	0.72
	[0.352]*	[0.456]
Head literate	0.138	0.056
	[0.104]	[0.141]
Head age	-0.046	-0.065
	[0.037]	[0.040]
Head age squared	0	0.001
	[0.000]	[0.000]*
Crop Income	-0.009	-0.011
	[.004]**	[.004]**
Cattle	0.087	0.088
	[0.050]*	[0.070]
Goat & Sheep	-0.003	0.017
	[0.043]	[0.032]
Asset	-0.001	-0.001
	[.006]	[0.007]
pre-school	0.005	0.010
	[0.039]	[0.050]
boys 7-15	-0.044	-0.019
	[0.094]	[0.070]
girls 7-15	-0.207	-0.221
	[0.099]**	[0.102]**
adults	-0.099	-0.112
	[0.064]	[0.062]*
Head Christian		1.059
		[0.484]**
Enumerator Christ.		0.405
		[0.559]
Head christ. & Enum christ.		-0.727
		[0.964]
Head mus. & Enum mus.		-1.843
		[0.702]***
Controller christ.		0.383
		[0.183]**
Head christ. & Controller. christ.		-0.774
		[0.545]
Head mus. & Controller christ.		0.304
		[0.197]
Constant	0.416	1.325
	[0.931]	[1.079]
Observations	297	297
chi2-test instrum.		27.39

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Table 9: Determinants of income

	(1)	(2)	(3)
	Crop Income	Crop Income	Crop Income
Rainareac1	-0.048	-0.045	-0.045
	[0.012]***	[0.012]***	[0.012]***
Rainareac2	0.004	0.005	0.005
	[0.005]	[0.005]	[0.005]
Rainareac5	-0.003	-0.007	-0.007
	[0.014]	[0.014]	[0.014]
Rainareac7	-0.01	-0.011	-0.011
	[0.007]	[0.007]	[0.007]
Rainareac8	-0.03	-0.035	-0.035
	[0.020]	[0.021]*	[0.021]*
Rainareac9	-0.007	-0.008	-0.008
	[0.003]***	[0.003]***	[0.003]***
boys	-3.287	-3.233	-3.233
	[0.951]***	[0.958]***	[0.958]***
girls	-2.488	-2.402	-2.402
	[1.060]**	[1.073]**	[1.073]**
men	-1.029	-0.969	-0.969
	[0.985]	[1.004]	[1.004]
women	-0.906	-0.964	-0.964
	[1.063]	[1.074]	[1.074]
men 66 and more	-0.446	-0.271	-0.271
	[4.107]	[4.147]	[4.147]
women 66 and more	-2.493	-2.413	-2.413
	[3.533]	[3.543]	[3.543]
devrain	0.022		0.029
	[0.009]**		[0.013]**
Village dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	No
Village*year dummy	No	Yes	No
Village*devrain	No		Yes
Constant	49.116	51.201	49.269
	[9.229]***	[9.781]***	[9.553]***
Observations	657	657	657
Number of menage	240	240	240
R-squared	0.29	0.29	0.29
F-test instrum.	7.94	5.34	5.34

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Table 10: Summary of self reported shocks

	Béléhédé	Pétéga	Kéréna	Dissankuy
Hh reporting at least negative shock (%)	85.96	95.45	63.24	35.9
Frequency negative shocks (per hh)	0.32	0.58	0.24	0.20
Proportion of insurance-constrained hh (%)	35.09	79.55	51.47	24.62
number households	57	56	68	78

Table 11: Correlation between predicted and self reported income shocks

	(1)	(2)
Income shock	-0.0108	
	[0.0078]	
Positive shock		-0.0922
		[0.0286]***
Negative shock		0.0069
		[0.0099]
land holdings	-0.0282	-0.0068
	[0.0361]	[0.0372]
Value durables	-0.0526	-0.0425
	[0.0880]	[0.0872]
Value farm equp	-0.1494	-0.1546
	[0.1618]	[0.1648]
Observations	1780	1780

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Table 12: Logit estimation of current enrollment status (marginal effects)

	(1)	(2)	(3)	(4)	(5)	(6)
	both	boys	girls	both	boys	girls
Income Variance	-0.0005	-0.0018	-0.0003	-0.0006	-0.002	-0.0004
	[0.0002]***	[0.0004]***	[0.0002]	[0.0002]***	[0.0004]***	[0.0002]**
Current Income Shock				0.0012	0.0014	0.0011
				[0.0007]*	[0.0009]	[0.0008]
Livestock losses				-0.0199	-0.0233	-0.0162
				[0.0059]***	[0.0093]**	[0.0061]***
Land holdings	0.0885	0.0507	0.0806	0.0837	0.032	0.0771
	[0.0222]***	[0.0364]	[0.0246]***	[0.0229]***	[0.0359]	[0.0264]***
Goat/sheep	0.0013	0.0029	0.0003	0.0021	0.003	0.0014
	[0.0009]	[0.0014]**	[0.0010]	[0.0009]**	[0.0014]**	[0.0010]
Cattle	0.0034	0.0017	0.0032	0.0031	0.0021	0.0028
	[0.0014]**	[0.0020]	[0.0014]**	[0.0013]**	[0.0020]	[0.0014]**
Value durable goods	0.0008	-0.0003	0.0013	0.0014	0	0.0022
	[0.0010]	[0.0014]	[0.0012]	[0.0010]	[0.0014]	[0.0012]*
Value farm equp	0.0009	0.0015	0.0022	-0.0011	0.0002	0
	[0.0031]	[0.0040]	[0.0033]	[0.0030]	[0.0039]	[0.0032]
head child	0.0385	0.0604	0.01	0.0316	0.0674	-0.0106
	[0.0372]	[0.0489]	[0.0438]	[0.0368]	[0.0446]	[0.0441]
other boys	-0.0367	-0.0329	-0.0252	-0.034	-0.0239	-0.0252
	[0.0166]**	[0.0220]	[0.0204]	[0.0169]**	[0.0207]	[0.0206]
other girls	-0.0013	-0.0079	-0.0127	0.0032	0.0022	-0.0125
	[0.0154]	[0.0217]	[0.0176]	[0.0152]	[0.0209]	[0.0171]
male	0.0865			0.081		
	[0.0279]***			[0.0273]***		
mother literate	0.1744	0.3886	-0.0175	0.132	0.3236	-0.0402
	[0.0973]*	[0.1489]***	[0.0781]	[0.0919]	[0.1538]**	[0.0609]
maternal orphan	-0.107	-0.0534	-0.1151	-0.0929	-0.0376	-0.105
	[0.0441]**	[0.0714]	[0.0347]***	[0.0457]**	[0.0715]	[0.0341]***
father literate	0.1136	0.0844	0.154	0.1053	0.057	0.1688
	[0.0543]**	[0.0686]	[0.0852]*	[0.0530]**	[0.0622]	[0.0876]*
paternal orphan	-0.0142	-0.0779	0.0557	-0.0201	-0.0632	0.0346
	[0.0556]	[0.0535]	[0.0832]	[0.0530]	[0.0530]	[0.0746]
male adults	0.0066	-0.0138	0.0262	0.0034	-0.0165	0.0225
	[0.0138]	[0.0175]	[0.0165]	[0.0135]	[0.0166]	[0.0159]
female adults	0.0021	0.017	-0.0115	0.0026	0.0158	-0.0102
	[0.0111]	[0.0142]	[0.0136]	[0.0107]	[0.0134]	[0.0127]
male seniors	0.033	0.0173	0.0417	0.0304	-0.0016	0.0453
	[0.0411]	[0.0511]	[0.0519]	[0.0397]	[0.0481]	[0.0482]
female seniors	0.0339	0.0505	0.0033	0.0329	0.0483	-0.0021
	[0.0294]	[0.0384]	[0.0363]	[0.0290]	[0.0369]	[0.0351]
dependence	0.1051	0.0678	0.0697	0.112	0.0662	0.078
	[0.1481]	[0.2021]	[0.1660]	[0.1436]	[0.1910]	[0.1565]
Observations	944	475	469	944	475	469

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Regressions also include age, village and religion dummies.

Table 13: Tobit estimation of education expenditures (unconditional marginal effects)

	(1)	(2)	(3)	(4)	(5)	(6)
	both	boys	girls	both	boys	girls
Income Variance	-0.0003	-0.0011	-0.0002	-0.0003	-0.0011	-0.0002
	[0.0001]**	[0.0004]***	[0.0001]	[0.0001]***	[0.0004]***	[0.0001]**
Current Income Shock				0.001	0.001	0.001
				[0.0005]	[0.0006]	[0.0006]
Livestock losses				-0.013	-0.013	-0.010
				[0.0042]***	[0.0059]**	[0.0042]**
Land holdings	0.0698	-0.0106	0.0722	0.067	-0.014	0.066
	[0.0161]***	[0.0260]	[0.0148]***	[0.0162]***	[0.0260]	[0.0144]***
Goat/sheep	0.0007	0.0016	-0.0003	0.001	0.002	0.000
	[0.0007]	[0.0010]	[0.0007]	[0.0007]	[0.0009]*	[0.0007]
Cattle	0.0019	0.001	0.0013	0.002	0.001	0.001
	[0.0010]*	[0.0014]	[0.0010]	[0.0010]*	[0.0013]	[0.0010]
Value durable goods	0.002	0.0012	0.0012	0.002	0.001	0.002
	[0.0008]***	[0.0009]	[0.0008]	[0.0007]***	[0.0009]	[0.0008]**
Value farm equp	0.0025	0.0001	0.0049	0.002	0.000	0.004
	[0.0023]	[0.0029]	[0.0023]**	[0.0022]	[0.0028]	[0.0023]
head child	0.0091	0.0216	-0.0124	0.003	0.024	-0.025
	[0.0283]	[0.0361]	[0.0300]	[0.0276]	[0.0344]	[0.0288]
other boys	0.001	-0.005	0.0033	0.002	-0.001	0.002
	[0.0109]	[0.0139]	[0.0115]	[0.0107]	[0.0134]	[0.0113]
other girls	0.0181	0.0149	0.0016	0.019	0.018	0.001
	[0.0120]	[0.0156]	[0.0128]	[0.0117]*	[0.0150]	[0.0122]
male	0.0829			0.079		
	[0.0212]***			[0.0206]***		
mother literate	0.0883	0.2387	-0.0424	0.067	0.203	-0.050
	[0.0476]*	[0.0522]***	[0.0631]	[0.0463]	[0.0501]***	[0.0606]
maternal orphan	-0.0922	0.0552	-0.0807	-0.083	-0.045	-0.074
	[0.0549]*	[0.0231]***	[0.0654]	[0.0533]	[0.0603]	[0.0621]
father literate	0.0622	0.0544	0.0929	0.055	0.043	0.096
	[0.0314]**	[0.0367]	[0.0363]**	[0.0305]*	[0.0352]	[0.0345]***
paternal orphan	-0.0622	-0.0743	-0.0298	-0.065	-0.069	-0.036
	[0.0450]	[0.0554]	[0.0488]	[0.0439]	[0.0532]	[0.0467]
male adults	-0.0371	-0.0492	-0.0077	-0.038	-0.049	-0.009
	[0.0113]***	[0.0141]***	[0.0121]	[0.0110]***	[0.0136]***	[0.0115]
female adults	-0.0042	0.0072	-0.0083	-0.004	0.006	-0.007
	[0.0085]	[0.0106]	[0.0097]	[0.0082]	[0.0102]	[0.0092]
male seniors	-0.0636	-0.0653	-0.0449	-0.064	-0.073	-0.039
	[0.0318]**	[0.0365]*	[0.0378]	[0.0309]**	[0.0353]**	[0.0356]
female seniors	0.0146	0.0163	0.0062	0.014	0.019	0.002
	[0.0233]	[0.0278]	[0.0265]	[0.0227]	[0.0268]	[0.0255]
dependence	-0.1985	-0.1902	-0.1138	-0.192	-0.188	-0.101
	[0.1149]*	[0.1468]	[0.1213]	[0.1116]*	[0.1420]	[0.1142]
Constant	-0.1256	0.1094	-0.214	-0.118	0.114	-0.195
	[0.0934]	[0.1140]	[0.1183]*	[0.0904]	[0.1100]	[0.1102]*
Observations	944	475	469	944	475	469

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Regressions also include age, village and religion dummies.

Table 14: Tobit estimation of years of education completed (unconditional marginal effects)

	(1)	(2)	(3)	(4)	(5)	(6)
	both	boys	girls	both	boys	girls
Income Variance	-0.0007	-0.0018	-0.0007	-0.0011	-0.0021	-0.0015
	[0.0005]	[0.0014]	[0.0006]	[0.0006]**	[0.0015]	[0.0006]**
Current Income Shock				0.007	0.0048	0.0085
				[0.0026]***	[0.0042]	[0.0031]***
Livestock losses				-0.0943	-0.1301	-0.0747
				[0.0225]***	[0.0399]***	[0.0238]***
Land holdings	0.2341	-0.104	0.3084	0.178	-0.1518	0.251
	[0.0792]***	[0.1686]	[0.0832]***	[0.0817]**	[0.1694]	[0.0806]***
Goat/sheep	0.0007	0.0027	-0.0017	0.0038	0.0045	0.0031
	[0.0037]	[0.0066]	[0.0040]	[0.0036]	[0.0065]	[0.0039]
Cattle	0.0172	0.0205	0.0088	0.0157	0.0221	0.0072
	[0.0052]***	[0.0089]**	[0.0056]	[0.0050]***	[0.0086]**	[0.0052]
Value durable goods	0.0077	0.0104	0.0017	0.0095	0.0107	0.0061
	[0.0040]*	[0.0063]*	[0.0049]	[0.0039]**	[0.0061]*	[0.0047]
Value farm equp	0.0004	0.0053	0.0084	-0.0079	0.0011	-0.0033
	[0.0119]	[0.0193]	[0.0133]	[0.0116]	[0.0187]	[0.0128]
head child	0.2275	0.2762	0.0951	0.185	0.3033	0.0059
	[0.1475]	[0.2426]	[0.1685]	[0.1419]	[0.2340]	[0.1575]
other boys	-0.0118	-0.0407	0.0203	0.0089	0.0036	0.0291
	[0.0537]	[0.0860]	[0.0621]	[0.0525]	[0.0837]	[0.0597]
other girls	-0.0001	-0.0064	-0.0323	0.0145	0.0464	-0.0398
	[0.0599]	[0.1012]	[0.0677]	[0.0578]	[0.0991]	[0.0634]
male	0.55			0.534		
	[0.1084]***			[0.1041]***		
mother literate	0.3798	1.1525	-0.2152	0.2087	0.9346	-0.3065
	[0.2565]	[0.3625]***	[0.3641]	[0.2462]	[0.3517]***	[0.3401]
maternal orphan	-0.6218	-0.7066	-0.4734	-0.5494	-0.611	-0.4146
	[0.2816]**	[0.4412]	[0.3151]	[0.2694]**	[0.4265]	[0.2932]
father literate	0.5958	0.4221	0.8874	0.5418	0.3294	0.9664
	[0.1645]***	[0.2484]*	[0.2043]***	[0.1574]***	[0.2406]	[0.1902]***
paternal orphan	-0.2442	-0.4414	-0.1015	-0.2864	-0.4398	-0.1585
	[0.2273]	[0.3570]	[0.2626]	[0.2202]	[0.3489]	[0.2470]
male adults	-0.1382	-0.2774	0.0124	-0.1538	-0.3009	-0.0133
	[0.0536]***	[0.0856]***	[0.0617]	[0.0519]***	[0.0845]***	[0.0579]
female adults	0.0446	0.0689	0.0183	0.0455	0.0573	0.0229
	[0.0422]	[0.0694]	[0.0504]	[0.0405]	[0.0675]	[0.0469]
male seniors	-0.1189	-0.1271	-0.1544	-0.1228	-0.2069	-0.0978
	[0.1587]	[0.2363]	[0.2043]	[0.1519]	[0.2303]	[0.1879]
female seniors	0.1651	0.0846	0.1913	0.1703	0.1119	0.1661
	[0.1155]	[0.1791]	[0.1386]	[0.1115]	[0.1742]	[0.1301]
dependence	-0.1587	-1.2663	0.6007	-0.1337	-1.3547	0.6058
	[0.5791]	[0.9434]	[0.6729]	[0.5569]	[0.9224]	[0.6211]
Constant	-1.7784	0.038	-2.3908	-1.7248	0.1624	-2.196
	[0.4738]***	[0.7370]	[0.5928]***	[0.4546]***	[0.7209]	[0.5440]***
Observations	944	475	469	944	475	469

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Regressions also include age, village and religion dummies.

Table 15: Logit estimation of "ever enrolled" (marginal effects)

	(1)	(2)	(3)	(4)	(5)	(6)
	both	boys	girls	both	boys	girls
Income Variance	-0.0002	-0.0005	-0.0003	-0.0005	-0.0008	-0.0006
	[0.0002]	[0.0005]	[0.0002]	[0.0002]**	[0.0005]	[0.0003]**
Current Income Shock				0.003	0.0034	0.0025
				[0.0009]***	[0.0015]**	[0.0012]**
Livestock losses				-0.034	-0.0454	-0.0293
				[0.0077]***	[0.0137]***	[0.0089]***
Land holdings	0.0836	-0.0153	0.119	0.0678	-0.0504	0.1157
	[0.0271]***	[0.0567]	[0.0348]***	[0.0289]**	[0.0588]	[0.0381]***
Goat/sheep	0.0009	0.0032	-0.0009	0.0021	0.0038	0.0009
	[0.0012]	[0.0022]	[0.0015]	[0.0013]*	[0.0023]*	[0.0015]
Cattle	0.0075	0.0084	0.0052	0.0075	0.0106	0.0049
	[0.0020]***	[0.0038]**	[0.0021]**	[0.0021]***	[0.0043]**	[0.0022]**
Value durable goods	0.0016	0.0021	0.0006	0.0025	0.0025	0.002
	[0.0013]	[0.0021]	[0.0017]	[0.0013]*	[0.0022]	[0.0017]
Value farm equp	-0.0029	-0.0012	-0.0008	-0.0073	-0.0046	-0.0051
	[0.0039]	[0.0063]	[0.0047]	[0.0040]*	[0.0065]	[0.0048]
head child	0.0845	0.1417	0.0175	0.0776	0.1616	-0.0132
	[0.0447]*	[0.0707]**	[0.0588]	[0.0449]*	[0.0685]**	[0.0597]
other boys	-0.0034	0.0017	0.0032	0.0072	0.0176	0.0112
	[0.0178]	[0.0287]	[0.0223]	[0.0183]	[0.0293]	[0.0228]
other girls	0.0015	-0.013	-0.0031	0.0111	0.0128	-0.0045
	[0.0204]	[0.0342]	[0.0248]	[0.0210]	[0.0352]	[0.0249]
male	0.159			0.1595		
	[0.0345]***			[0.0345]***		
mother literate	0.1596	0.4761	-0.1117	0.081	0.4241	-0.139
	[0.1130]	[0.1194]***	[0.0803]	[0.1066]	[0.1495]***	[0.0578]**
maternal orphan	-0.1996	-0.2109	-0.1872	-0.1807	-0.1905	-0.1743
	[0.0517]***	[0.0935]**	[0.0465]***	[0.0540]***	[0.0983]*	[0.0461]***
father literate	0.2898	0.3041	0.3544	0.2854	0.2717	0.3918
	[0.0668]***	[0.0926]***	[0.1059]***	[0.0684]***	[0.0983]***	[0.1071]***
paternal orphan	-0.0575	-0.1235	-0.0142	-0.0736	-0.1229	-0.0418
	[0.0641]	[0.0907]	[0.0863]	[0.0612]	[0.0912]	[0.0763]
male adults	-0.0415	-0.0906	0.0116	-0.0501	-0.1036	0.0044
	[0.0174]**	[0.0275]***	[0.0225]	[0.0176]***	[0.0284]***	[0.0225]
female adults	0.0163	0.0297	-0.0042	0.0192	0.0307	-0.0032
	[0.0139]	[0.0225]	[0.0182]	[0.0138]	[0.0230]	[0.0176]
male seniors	-0.0345	-0.04	-0.0434	-0.0385	-0.0704	-0.0286
	[0.0516]	[0.0754]	[0.0738]	[0.0506]	[0.0757]	[0.0696]
female seniors	0.0594	0.061	0.047	0.0637	0.0667	0.0412
	[0.0370]	[0.0580]	[0.0481]	[0.0370]*	[0.0590]	[0.0476]
dependence	-0.0537	-0.2736	0.0551	-0.0313	-0.2726	0.0641
	[0.1882]	[0.3080]	[0.2335]	[0.1865]	[0.3128]	[0.2267]
Observations	944	475	469	944	475	469

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Regressions also include age, village and religion dummies.

Table 16: Ever Enrolled, Logit with Lineage Fixed Effects

	(1)	(2)
	Current Enroll.	Ever Enrolled
Income variance	-0.0043	-0.0073
	[0.0016]***	[0.0044]*
Current Income	0.0167	0.0901
	[0.0080]**	[0.0544]*
Observations	547	547
Number of groups	73	73

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Regressions also include demographic variables (adult males, adult females, boys, girls, household size, age of household head and age of household head squared) and household wealth.

Table 17: Education Expenditures and Years of Education, Tobit with Lineage Fixed Effects

	(1)	(2)
	Expenditures	Years of Ed
Income variance	-0.0029	-0.0016
	[0.0011]***	[0.0009]*
Current Crop Inc.	0.0649	0.0224
	[0.0322]**	[0.6500]
Number observations	547	547
Number of groups	73	73

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Regressions also include demographic variables (adult males, adult females, boys, girls, household size, age of household head and age of household head squared) and household wealth.

Table 18: Ever Enrolled in 1995

	(1)	(2)	(3)
	Boys and girls	Boys	Girls
VarShock1	-0.0018	-0.0048	0.003
	[0.0007]**	[0.0010]***	[0.0021]
Current income	0.0134	0.0074	0.0182
	[0.0043]***	[0.0055]	[0.0095]*
Boy	0.1463		
	[0.0276]***		
Household size	0.0005	-0.0003	0.0016
	[0.0032]	[0.0042]	[0.0024]
HeadChild	-0.0227	-0.067	0.0488
	[0.0296]	[0.0483]	[0.0405]
Observations	714	370	344

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Regressions also include demographic variables (adult males, adult females, boys, girls, household size, age of household head and age of household head squared) and household wealth.

Table 19: Summary statistics of variables used

	(1)	(2)	(3)	(4)
Variables	Mean	St. deviation	Minimum	Maximum
Dependent variables				
Education expenses (CFA 1'000 per child)	1.107	4.273	0.000	5.175
Currently enrolled (fraction)	0.263	0.440	0.000	1.000
Ever been enrolled (fraction)	0.344	0.475	0.000	1.000
Years of education (years)	1.135	1.891	0.000	8.000
Independent variables				
Income Variance	75.372	243.071	0.781	1633.969
Livestock losses (CFA 1'000 per AE)	1.556	4.108	0.000	66.606
Current Income (CFA 1'000 per AE)	21.572	33.597	0.000	194.017
Land holdings (hectares per AE)	0.703	0.927	0.000	6.578
Goat/sheep (number hh)	11.565	16.838	0.000	110.000
Cattle (number hh)	5.048	12.254	0.000	94.000
Durable goods (CFA 1'000 per AE)	8.959	14.336	0.000	92.734
Farm equipment (CFA 1'000 per AE)	1.909	5.908	0.000	132.365
Age (years)	10.960	2.637	7.000	15.000
Head child	0.688	0.464	0.000	1.000
number of other boys	0.640	1.389	0.000	9.000
Number of other girls	0.552	1.103	0.000	8.000
Child is Male	0.507	0.500	0.000	1.000
Mother is literate	0.037	0.189	0.000	1.000
Maternal orphan	0.057	0.232	0.000	1.000
Father is literate	0.101	0.302	0.000	1.000
Paternal orphan	0.073	0.261	0.000	1.000
Number of adult males	2.322	1.881	0.000	12.000
Number of adult females	3.265	2.468	0.000	14.000
Number of senior men	0.165	0.383	0.000	2.000
Number of senior women	0.235	0.472	0.000	2.000
Dependence ratio	0.572	0.136	0.100	1.000