Human Capital Investment When Sheepskin Effects Matter: Evidence from Income Shocks in Indonesia*

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Abstract

Developing countries spend substantial resources inducing individuals to attend school. Despite this, high dropout rates are common, particularly when students transition between education levels. To explain this pattern, previous research has focused on supply side factors, such as decreased number of school slots or longer commute times. In contrast, this paper explores a demand side reason for high dropout rates between schooling levels: a nonlinear increase in wage returns from completing the final grade of an education level – a sheepskin effect. I investigate whether schooling decisions in Indonesia are consistent with perceived sheepskin effects. Using four types of income shocks that range from idiosyncratic to systemic (unemployment, crop loss, drought, and financial crises), I test if negative shocks affect enrollment differentially across different grade levels. As in the previous literature, negative shocks reduce children's enrollment probabilities on average. However, consistent with perceived sheepskin effects, this impact is strongly mitigated for students who enter the final grades of junior or senior high school. Moreover, even poor households exhibit this behavior– indicating that even the poor are able to continue investments in education when they perceive returns to be sufficiently high.

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1 Introduction

Developing countries spend substantial resources to induce individuals to attend school and accumulate human capital. Despite this, high dropout rates are common, particularly when students transition between education levels as illustrated in Figure 1.[1] Previous research has studied supply side factors as the main reason for this pattern, e.g., students transitioning to a new level might encounter barriers to progression such as decreased number of slots, minimum score requirements, or longer commute times (World Bank, 2009; UNESCO, 2012).

Much less attention has been paid to whether factors related to demand for schooling can partially account for these schooling patterns. Recent research suggests that understanding individuals' responsiveness to real and perceived returns to schooling is indeed important to education policy (e.g., Macleod and Urquiola, 2009; Jensen, 2010; 2012; Oster and Steinberg, 2013). Specifically, empirical investigation has found that increases in the perceived returns to education increase the likelihood of enrollment. However, little attempt has been made to apply this insight to understanding dropout or transition decisions.

I address this gap by testing whether the timing of dropout behavior is consistent with the perception of sheepskin effects in the labor market. A sheepskin effect exists when the wage return to an additional year of schooling is higher if that year allows a student to complete a school level (Card, 1999).[2] If parents believe that there are sheepskin ef-

[1] Figure 1 illustrates this using data from Indonesia; the observed pattern is common to other developing countries. Each point on the graph denotes the enrollment probability of students entering the given grade conditional on enrollment in the previous grade. The probabilities remain above 95% up to 6th grade–the end of primary school–but then fall below 95% for the 7th grade. For 10th grade, the beginning of senior high school, they fall below 90%.

[2] In other words, a sheepskin effect is a wage premium associated with a completion of an education level, in addition to the usual linear returns to accumulated years of schooling implied a là Mincer. Sheepskin effects could be present if credentials have a signaling value, or if there is actual productivity gain in obtaining the degree. Regardless of whether schooling signals or augments productivity, it increases lifetime earnings and hence represents a good investment for individuals (Psacharopoulos, 1994). The origin of the term relates to

fects, then one should expect their education investment choices to differ depending on how close their child is to completing an educational level. In other words, perceived sheepskin effects provide a source of variation in the demand for schooling by grade level. While sheepskin effects have been extensively studied using wage data, there has been no evidence on how they affect human capital investment decisions.[3]

The central challenge in addressing this question is disentangling demand from supply side factors that determine individual decisions. To overcome this challenge, I exploit variation in the timing of income shocks that affect households. If households are credit constrained, then shocks may substantially increase their marginal utility of current consumption, raising the cost, in terms of utility, of keeping their children in school. This increase in the opportunity cost of enrollment holds for all grade levels. However, returns to an extra year of schooling will be higher closer to the final years of schooling if there are sheepskin effects. Thus, the cross-grade variation in enrollment decisions in the face of these shocks is informative about the strength of demand factors. The idea is that if enrollment decisions at a given grade are less responsive to negative income shocks than in other grades, it must be that the benefit from completing that grade is relatively high. Specifically, I argue that a perception of sheepskin effects causes enrollment decisions to be least responsive to income shocks in the last grade of a given education level.

I implement this strategy using data from the Indonesia Family Life Survey (IFLS) for 1997 and 2000. Formally, I construct two binary variables. The first identifies households suffering a negative income shock; the second identifies students who will enter the final grade of a given education level. The perception of a sheepskin effect is identified by the interaction of the two variables, which captures the differential response to income shocks for students entering the last grade relative to others. The hypothesis is that sheepskin

the fact that diplomas were once printed on sheepskin.

[3]Earlier work using wage data include Hungerford and Solon (1987) and Belman and Heywood (1991). For recent work, see for example, Jaeger and Page (1996) and Tyler et al. (2000).

effects induce perceived returns to schooling to be higher for the last grade of an education level. Therefore, while a negative income shock may lead parents to withdraw students from school on average, this reduction in investment should be smaller if the child faces enrollment in the final grade.

The Indonesian setting allows me to consider shocks that range from idiosyncratic to systemic: unemployment spells, crop loss, drought, and the Indonesian financial crisis. Unemployment may affect households idiosyncratically, whereas crop loss and drought have aggregate effects at the local level. The financial crisis affects the entire country. Previous research has often used aggregate shocks, especially rainfall (Jensen, 2000; Björkman, 2006), which may affect the opportunity cost of schooling through changes in the outside labor market. Therefore, finding consistent results across both idiosyncratic and aggregate shocks is desirable and helps dispel concerns specific to each type of shock.

As expected, I find that shocks adversely impact the probability of enrollment in the subsequent year for affected students. This impact, however, is mitigated for students who expect to enter the final grades of junior and senior high school. For instance, students whose households experience unemployment are about 6 percentage points more likely to drop out, on average. This effect essentially disappears, however, for students who suffer the shock but are entering the last grades of junior or senior high school. Moreover, I find that even poor households that do not hold any buffer stocks and hence might be more credit constrained exhibit this pattern of human capital investment decisions. The findings are consistent across the different income shocks.

To further explore this idea, I utilize the fact that when the Asian financial crisis hit Indonesia in early 1998, the households at the bottom of the income distribution were the most affected (Thomas et al, 2004). Consistent with the previous patterns, I find that grade progression was hindered for students in households most vulnerable to the financial crisis, but students entering the last grade did not drop out in response to the crisis.

The identifying assumption behind my research design is that the timing of the shock is exogenous to the grade the student is in. While this seems plausible, it is difficult to guarantee for all the shocks I consider, particularly since unemployment and crop loss are self-reported. Suppose, for example, that parents whose children are in the last grade of a given school level are less likely to experience unemployment – perhaps they realize this is an important moment and exert extra effort to stay employed. In this scenario the shocks are not as good as randomly assigned and the estimates may be biased. Two pieces of evidence help rule out such concerns. First, I show that the likelihood of households' reporting a shock is uncorrelated with their children's grade level. Second, I implement the strategy using rainfall shocks and the Asian financial crisis, which are likely to be exogenous, and find similar results.

Could the above findings be explained by demand factors other than perception of sheepskin effects? One possibility is selection on ability. This implies that more able students will have more years of schooling conditional on other observable characteristics, i.e., average ability is increasing in grade. Then, faced with a negative income shock, parents are more likely to keep the child closer to completing an education level enrolled because the perceived returns to a year of schooling is higher for students with higher ability and not because returns are particularly high in the last grade due to sheepskin effects. My research design overcomes this concern by comparing students who are in their final year to those in both the grade before and the grade after. If the results are driven by selection, I should find enrollment responsiveness to be monotonically decreasing in grade. However, the estimated response to income shocks exhibits a non-monotonic relationship in grade around the last grade of junior high school. Specifically, I observe that enrollment in the last grade of junior high school is less sensitive to income shocks relative to not only the penultimate grade of junior high but also the first grade of senior high school. This pattern of enrollment responses is consistent with sheepskin effects, but not with selection

on ability.

Another possibility for returns to schooling to vary by grade is changes in outside opportunities. If physical strength or years of schooling matter in the labor market, average foregone earnings are expected to monotonically increase by grade. This would imply that the responsiveness of enrollment to income shocks should monotonically increase by grade, which again is inconsistent with observed patterns.

In short, the pattern of grade-related heterogeneous responses to income shocks suggests that my results are not driven by these alternative explanations. Sheepskin effects are most consistent with the observed patterns.

This is the first paper to study how sheepskin effects might influence human capital investment decisions. This approach complements the previous literature which tests for sheepskin effects directly, i.e. using wage data for individuals who have already completed their schooling (e.g., Jaeger and Page, 1996; Park, 1994; Tyler et al., 2000). These papers document the presence of additional wage returns to completion of an education level.[4] In contrast, this paper provides the first evidence that schooling decisions themselves respond to perceived sheepskin effects.

Previous research has found that households in developing countries cannot fully smooth their expenditure across periods when they suffer a negative income shock (Jacoby, 1994; Jensen, 2000).[5] As a result, investment in their children's education was found to be sensitive to income fluctuations. I find that while this is true, there is heterogeneity in how much education investment is reduced due to nonlinear returns to schooling, such that students in the final years are essentially not affected by these shocks.

[4]Using data from the 1991 and 1992 March CPS, Jaeger and Page (1996) estimate that the return to a high school diploma conditional on having 12 years of schooling is 18 percent; similarly, the return to receiving a Bachelor's degree conditional on having 16 years of schooling is 33 percent. Tyler et al. (2000) find that the General Education Development credential (GED) itself has value in the labor market and increases annual earnings of young white dropouts by 10 to 19 percent. They use state variation in GED granting score, so the estimates measure the wage premium for those who marginally passed the GED.

[5]Similar findings emerge in Thomas et al. (2004) and Duryea et al. (2007)

My findings are also related to the literature on long term consequences of an adverse event before adulthood (Almond and Currie, 2011). Specifically, I observe that where individuals are in the human capital investment process– e.g. if they are facing enrollment in a final grade within an education level– can determine how they fare when adverse circumstances hit. Particularly in the case of the financial crisis, the timing of the shock not only affects human capital accumulation, but may also affect when individuals enter the labor market. If students are hit in a non-sheepskin grade, they are more likely to enter the labor market at an unfavorable point with potential long term consequences (Oreopoulos et al., 2012).

The remainder of the paper is organized as follows. Section 2 provides an overview of the education system in Indonesia. Section 3 presents the data and the construction of the household shock variables. Section 4 lays out the empirical strategy followed by discussion of the results in Section 5. Section 6 concludes.

2 Background on the Indonesian School System

The Indonesian education system consists of six years of elementary school, three years of junior high school and three years of senior high school. In 1984, the government of Indonesia declared 6 years of compulsory schooling to be mandatory. In 1994, the government further announced the goal of reaching 9 years of compulsory schooling by the late 1990s, thereby ensuring all children finish junior high school. However, enforcement has not been as strong as primary compulsory schooling, and many children still get fewer than 9 years.

While Indonesia has primary net enrollment rates well over 90 percent and has achieved universal primary education, completion rates in junior and senior high school are still far below the average for developed countries. Out of all students who entered elementary school in the 1991/1992 school year, 71 percent graduated from elementary school and

only 51 percent reached the first year of junior high school (Jones and Hagul, 2001). In particular, sharp attrition occurs in the transitions between elementary school and junior high school and between junior and senior high school, as displayed in Figure 1.

By the mid 1990s, the gender disparity in education attainment, particularly in terms of enrollment, had been nearly eliminated. The female-to-male net enrollment ratio at the elementary and junior high level has been around 100 percent since 1995, and for senior high level has fluctuated between 95 and 104 percent in the same period. Even for the households in the lowest income quintile, there is a negligible difference in net enrollment rate between girls and boys up to senior high school. Consistent with these facts, the findings in the paper do not display different patterns between girls and boys.

Pecuniary factors seem to be one of the main reasons for non-enrollment. Out of the 363 individuals who reported a reason for stopping school in the 2000 wave of Indonesia Family and Life Survey (IFLS), 45 percent chose either not being able to afford schooling or helping parents earn money as the answer.

3 Background on the Indonesian Labor Market

The demand for skill in Indonesian labor market suggests presence of perceived return to a diploma, particularly in the formal labor market sector. According to a world bank report, most jobs in the formal sector require a minimum education level, even for the relatively unskilled sector including machine operation and crafts worker (World Bank, 2008). For instance, minimum education required for machine operators is the completion of junior high school. Crafts, sales are clerical workers are expected to hold at least senior high school degree. For more skilled positions such as managers and technicians, employers expect potential workers to have diploma, which is similar to a two-year college or university education.

The patterns for new hires in the labor market show a similar picture, as most new

hires are concentrated in the secondary and tertiary school graduates. Specifically, Employer Survey of Skills (2008) reports that 73.7 percent of total hires are secondary school education level. Not only is there a large reduction in the new hiring of primary school graduates, but they are also more likely to lose their jobs.

Minimum education requirement and the realized new hires combined suggest a non-negligible return to the completion, or receiving a degree from junior high and senior high school.

4 Data and Construction of Negative Income Shocks

4.1 Data

The Indonesia Family and Life Survey (IFLS) is an on-going longitudinal household and community survey, which is representative of 83 percent of the Indonesian population.[6] I use two rounds of this survey, 1997 and 2000. I exclude college students from the sample as Indonesian higher education consists of various institutions that take anywhere from 1 to 4 or more years to complete, which makes it difficult to determine which students will enter the final grade before completion. Therefore, I restrict my analysis to students who are enrolled in a given school year and can potentially enter an elementary, junior, or senior high school in the subsequent school year.

My empirical strategy is to take a sample of students enrolled in a given school year and investigate whether those students whose household suffered a shock in that year are more or less likely to enroll in the subsequent year, depending on their grade level. Note that in Indonesia the school year begins in late July and ends in June. IFLS asks

[6]The sample was randomly chosen from a nationally representative sample from used in the 1993 SUSENAS, which is a socioeconomic survey of Indonesia. IFLS contains about 30,000 individuals living in 13 of the 27 provinces in the country. The 13 provinces are North Sumatra, West Sumatra, South Sumatra, Lampung, DKI Jakarta, West Java, Central Java, DI Yogyakarta, East Java, Bali, West Nusa Tenggara, South Kalimantan and South Sulawesi.

individuals whether they are currently enrolled and whether they attended school in the previous school year. I use this information to construct my sample. From IFLS 1997, I take students enrolled in the 1996/1997 school year; from IFLS 2000 I take students enrolled in the 1999/2000 school year. The survey elicits completed grade and the final education level for each individual. I use this information to compute the grade level a student will enter in the following school year. The outcome of interest is enrollment status in the subsequent school year, which corresponds to enrollment status in 1997/1998 and 2000/2001 school year for IFLS 1997 and IFLS 2000 students, respectively.

The survey also contains self-reported information about negative income shocks at the household level; namely, whether the household members experienced unemployment or whether the household suffered from crop loss. It also records the corresponding month and year of the incidence if the shock occurred. In the next section, I explain in detail the construction of the shock in relation to the empirical strategy.

To explore whether the impact of the shock varies depending on the household's ownership of buffer stocks, I use ownership of savings information from IFLS to distinguish households with and without buffer stocks.

Rainfall data is constructed using University of Delaware *Terrestrial Precipitation: 1900-2010 Gridded Monthly Time Series (version 3.01)*. Rainfall is measured for 0.5 degree latitude by 0.5 degree longitude grids from 20 nearby weather stations. I match the latitude and longitude of Indonesia district centroids to the nearest latitude and longitude grid node in the rainfall data, which allows construction of monthly rainfall data for each district.[7] The measure of interest is rainfall during the first three months of the monsoon season, following Skoufias et al. (2011). Rainfall shocks are defined as deviations from the district's usual rainfall, where the district specific rainfall distribution is computed over the years 1970 to 2000. Details can be found in the next section.

[7]The district coordinate information is from online dataset of Maccini and Yang (2009).

Table 1 reports summary statistics. It shows that 53 percent of the sample students reside in rural villages and the mode of schooling level for household heads is elementary school, consisting of 47 percent of the sample. The majority of the households in the sample own their home and uses electricity at home. About 30 percent of the students live in a household that holds any savings.

4.2 Negative Income Shock Construction

I consider four measures of negative income shocks that households can experience: i) a member of the household becomes unemployed, ii) crop loss, iii) rainfall shortage in the household's district and iv) financial crisis in the entire country. I define an indicator variable *Shock*, that takes a value of one if the shock occurred in a given school year, before the beginning of the subsequent school year.

To be more specific, for IFLS 1997, I take students who were enrolled in 1996/1997 school year and explore how a shock during that school year affects these students' enrollment probability in the subsequent 1997/1998 school year. I construct a shock variable in this way to account for the fact that dropping out tends to occur between school years rather than during a given year. This is likely to stem from the fact that beginning a new year might require fixed costs such as buying supplies, text books, etc. This implies that if a shock occurs during a given school year that the student is already enrolled in, the next dropout decision is likely to occur at the beginning of the new school year. Following the same logic for IFLS 2000, conditional on enrollment in 1999/2000 school year, the outcome variable is the probability of enrollment in the subsequent 2000/2001 school year with the shock variable equal to one if the shock occurred during 1999/2000 school year.

The IFLS questionnaire asks the most knowledgeable household member about the occurrence and the timing of the following incidences: unemployment of household members and crop loss. Using this information, I construct an indicator variable for negative

income shocks that takes a value of one if the household reports to have experienced either type of incidence in a given year. I also create separate indicators for unemployment of household members and crop loss.

While the timing of the household income shock should be arguably exogenous to the grade that the child is in, because the central identification assumption is the orthogonality between the two, I employ two additional sources of income shocks that are not self-declared in IFLS. First, I construct a shock using an observable source, namely rainfall. It is natural to use rainfall shortage, given the prevalence of participation in agriculture with about 45 percent of the population employed in this sector during the period of analysis and the importance of rice farming in Indonesia. For example, both Maccini and Yang (2009) and Skoufias et al. (2011) point to lack of rainfall as a potent shock that affects households' welfare and resource allocation in Indonesia. Studies using rainfall shocks in rice farming regions point out that wet season or monsoon season rainfall shocks are particularly important for rice production.[8] To specify a shock similar to Skoufias et al. (2011), I define post-onset rainfall as total amount of rainfall during the first three months of the rainy season.[9] Since each province in Indonesia experiences the monsoon onset at different months ranging from September to November, I use the onset month information used in Maccini and Yang (2009) and create post-onset rainfall data accordingly for each district.

To create the rainfall shock variable, I first create post-onset rainfall for each district and year between 1970 and 2000. Based on this, I calculate a 30 year post-onset rainfall distribution for each district. I define a district to experience a negative rainfall shock if the post-onset rainfall in a given year falls in the first decile of the historical distribution in that district.

Figure A.1 shows a nonparametric relationship between post-onset rainfall and farm

[8]Jensen (2004), Skoufias et al. (2011), Kaur (2012)

[9]The paper finds that for rural households in Indonesia Java province, negative rainfall shocks defined as shortage of post monsoon onset rainfall have an adverse impact on farming households' welfare.

revenue for the agricultural households in the sample. I regress log farm revenue on post-onset rainfall decile dummies and controls including year and district fixed effects. Each decile dummy is an indicator for whether the district's post-onset rainfall in that year fell within the given decile of the district's historical post-onset rainfall distribution. This figure plots the coefficient estimate for each decile dummy and its corresponding 95 percent confidence intervals. It provides verification that a post-onset rainfall in the first decile is associated with lower average farm revenue and hence appropriately identifies an income shock. To confirm the validity of the rainfall shock, I also perform a regression of farm revenue on the post-onset rainfall shock variable with controls, finding that the estimate of rainfall shock has a negative and significant effect on the farm revenue with an 10.99 F-stat value.

Finally, I construct an income shock measure utilizing the Asian Financial Crisis. The Asian Financial Crisis hit Indonesia starting at the end of 1997 and worsened during early 1998. Relative to its level in 1997, GDP in 1998 declined by over 12 percent (Thomas et al. 2004). Findings in Thomas et al. (2004) suggest that the Indonesian financial crisis had a particularly severe impact on poorer households. Therefore, I define the variable *Shock* to indicate households that are located at the bottom pth percentile of the income distribution. p takes values of 5, 10 and 25. The household income measure I use is pre-crisis (IFLS 1997) log per capita expenditure. The reason for using a pre-crisis measure rather than post is to take into account that households' expenditure rankings may have shifted as a result of the crisis, such that IFLS 2000 per capita expenditure may not be informative about financial vulnerability during the crisis.

5 Empirical Strategy

The goal of my empirical strategy is to identify the impact of the perception of sheepskin effects on enrollment decisions. To isolate the effect of perceived returns while holding

other supply factors constant, I exploit income shocks that increase the relative cost of enrollment for all grades. I then infer the strength of the demand factors determining schooling decisions from cross-grade variations in enrollment decisions following these income shocks.

My hypothesis is that if households believe that returns to schooling are higher for final grades that allow the completion of an education level, then students will be less likely to drop out in response to adverse income shocks, consistent with sheepskin effects.

To examine if this pattern of schooling decisions exists, I explore, conditional on enrollment in a given school year, the probability that a student whose household suffered a negative income shock will maintain enrollment in the subsequent school year. I test whether this enrollment responses to income shocks differ depending on whether the grade that a student enters in the subsequent school year is the final one in an education level.[10]

Since the outcome is an indicator for enrollment, I expect the coefficient on the shock variable to be negative, as declines in their households' income should drive students to drop out of school. I assume that at least some households are credit constrained, and thus their limited ability to smooth consumption forces them to withdraw their children from school.

In the estimation, investment behavior consistent with the perception of a sheepskin effect is identified by the interaction between an indicator for entering the last grade of an education level and an indicator for suffering an income shock. My hypothesis predicts that the coefficient on the interaction term is positive, i.e. the student's probability of dropout in the presence of a negative shock is less if he or she is entering the last grade of

[10]Normally, without sheepskin effects, the returns to an additional year of schooling are linear. If individuals are optimizing over their lifetime, all students- not only those in the final year of a given level- would take sheepskin effects into account when calculating the returns to an addition year of schooling; i.e. the impact of sheepskin effects would be continuous. However, in fact the returns to schooling may be convex or concave in some grade ranges, and the exact shape is theoretically ambiguous because of income volatility or other uncertainties. Due to concerns with statistical power, I make a reasonable assumption that returns are linear for other grades, and nonlinear for the final ones; I thus focus on final grades to identify sheepskin effects.

a given education level.

The basic specification is the following:

$$Enroll_{iht} = \alpha + \beta Last_{it} + \gamma Shock_{ht} + \delta Last_{it} * Shock_{ht} + X_{ht} + \phi_t + \epsilon_{iht} \quad (1)$$

$Last_{it}$ is an indicator variable that equals one if the grade student i will enter at year t is the final grade of a given education level. Students who will enter grades 6, 9 and 12 for elementary, junior high and senior high school respectively, are assigned a value of one and zero otherwise. $Shock_{ht}$ is an indicator for students' household h experiencing a negative income shock at year t. My hypothesis implies that γ is negative and δ is positive; the direct impact of the shock reduces the likelihood of enrollment by γ, but the impact of the shock is lessened by δ for students with $Last_{it}$ equal to one. Controls include district fixed effects, year fixed effects and dummies for household head's education levels, an indicator for rural residence and an indicator for female. Standard errors are clustered at the household level using unemployment, crop loss and financial crisis shock. For estimations using rainfall shock, standard errors are clustered at the district level.

As the additional wage premium from completing a given education level is likely to differ across education levels, the magnitude of the perception of sheepskin effects can be expected to vary as well. Therefore, I estimate equation (2), which allows the direct impact of the shock as well as the perceived sheepskin effect to vary for elementary, junior high and senior high school. I set senior high level as the omitted category, hence the coefficient on $Last_{it} * Shock_{ht}$ estimates the impact of perceived sheepskin effects for enrollment decisions in senior high school. I additionally include interactions of the variables in equation (1) with an indicator for elementary school, ES_{it}, and junior high school, JH_{it} to construct equation (2). The coefficients on the interactions $Last_{it} * Shock_{ht} * ES_{it}$ and $Last_{it} * Shock_{ht} * JH_{it}$, will capture the relative magnitude of sheepskin effect perception for elementary school and junior high school relative to high school.

The resulting specification is the following:

$$Enroll_{iht} = \alpha + \beta_1 Last_{it} + \beta_2 Last_{it} * ES_{it} + \beta_3 Last_{it} * JH_{it} + \gamma_1 Shock_{ht} + \gamma_2 Shock_{ht} * ES_{it} + \gamma_3 Shock_{ht} * JH_{it} + \delta_1 Last_{it} * Shock_{ht} + \delta_2 Last_{it} * Shock_{ht} * ES_{it} + \delta_3 Last_{it} * Shock_{ht} * JH_{it} + ES_{it} + JH_{it} + X_{ht} + \phi_t + \epsilon_{iht} \quad (2)$$

The identifying assumption necessary to estimate the perceived sheepskin effect on schooling decisions is that the timing of the negative household shock is exogenous to the grade that students are in. A possible threat to identification arises from the fact that the shock is self-reported in the IFLS dataset. For example, the results could be biased if a parent is more or less likely to report a shock when her child is in the last grade. I resolve this possible concern in appendix Table A.1, which shows that being in the last grade is uncorrelated with an incidence of negative household income shocks.

In addition, two pieces of evidence using a non self-reported income shocks help alleviate this concern. I execute similar estimation exercises using shortage of rainfall and the Asian financial crisis as sources of exogenous negative income shocks and obtain qualitatively equivalent findings. The results are presented in Section 5.3. and Section 5.4., respectively.

6 Results

I present findings on (i) the adverse impact of negative household income shocks on human capital decisions (ii) how human capital investment response is consistent with perception of sheepskin effects, i.e., the negative impact of shocks on enrollment decisions is mitigated for students in the final grades of junior and senior high school (iii) how even the poor households without buffer stocks exhibit this pattern of schooling decisions.

6.1 Unemployment and Crop Loss Shocks

In this section, I estimate heterogenous enrollment responses to household income shocks, using self-reported information in IFLS. A binary negative income shock variable takes a value of one if household experiences either unemployment of household members or crop loss.

Table 2 provides evidence that enrollment responses to income shocks in Indonesia are consistent with the perception of sheepskin effects. Column 1 displays the estimation result of equation (1), which is the basic specification with *Last*, *Shock* and an interaction between the two, *ShockxLast*. As expected, students whose households experience negative income shocks are about 2.3 percentage points less likely to be enrolled in school compared to students whose households do not experience income shocks, indicated by the coefficient on *Shock*. Consistent with a belief in sheepskin effects, the estimate for the main coefficient of interest, *ShockxLast* is positive and significant. It indicates that among the students whose households suffer negative income shocks, those in the last grade of a given school level are about 4.5 percentage points more likely to be enrolled. The adverse impact of negative income shocks essentially disappears for these students. The positive coefficient on the control variables ES and JH shows that relative to senior high school –which is the omitted category– the probability of enrollment is on average highest if the student enters elementary school and that this probability decreases for higher levels of schooling.

As pointed out earlier, since sheepskin effects reflect the wage value of completion of an education level, the size of enrollment behavior explained by sheepskin effects could be different for each education level if its perceived labor market rewards are different. Therefore, in column 2, I present triple difference results from estimating equation (2) to examine how human capital investment behavior differs across different education levels.

In column 2, I find evidence consistent with perceived sheepskin effects for enrollment

decisions in junior and senior high school, but not for elementary school. The omitted education level category is senior high school. Accordingly, the coefficient on *Shock* is the effect of a negative income shock on enrollment in senior high school. The coefficient estimate indicates that an income shock reduces the probability of enrollment by about 12 percentage points for students deciding to enter grade levels in senior high school. The coefficients on *ShockxES* and *ShockxJH* estimate the impact of the shock in elementary and junior high school relative to senior high school, respectively.[11] The estimates suggest that the *Shock* reduces the enrollment probability in junior high school by about 8 percent, and the adverse impact of *Shock* on enrollment is trivial in elementary school. This is consistent with elementary school being the least costly level to attend and also the opportunity cost of foregone earnings being lowest, such that near universal enrollment has been achieved at this level.

Now let's turn to the main coefficients of interest, which measure the size of the perceived sheepskin effects differentially for each education level, i.e. coefficients on the interaction terms with *Last*. Senior high school being the omitted category, the coefficient on *ShockxLast* captures the effect of perceived sheepskin effect for enrollment decisions in senior high school. The coefficients on *ShockxLastxES* and *ShockxLastxJH* estimate the impact of a shock in elementary school and junior high relative to that of the senior high school respectively. The estimates suggest that the magnitude of the perceived sheepskin effect mitigating enrollment reduction in the presence of a negative shock is largest in senior high school with 15 percentage points, and about half the size in junior high school, although the difference is insignificant. On the other hand, the perception of sheepskin effects seems weakest, or nonexistent at the elementary school level, as the F-test cannot reject that the sum of *ShockxLast* and *ShockxLastxES* are equal to zero.

In sum, the results in column 2 imply that human capital investment behavior consis-

[11] This implies that in order to obtain an estimate for the impact of *Shock* on enrollment in elementary school, for example, one should sum the coefficient estimate on the omitted category *Shock* and *ShockxES*.

tent with the perception of sheepskin effects is mainly found at higher levels of schooling, which is junior and senior high school. Since returns to credentials are expected to be larger for junior and senior high school relative to elementary school as completing higher levels of education are more valued in the labor market, and skilled occupations in developing countries usually require more than an elementary school degree, the result seems consistent with labor market conditions.[12]

To verify that the positive and significant coefficient on *ShockxLast* in Table 2 is indeed capturing the underlying differential response to shock in the last grades of junior and senior high school, I estimate the following equation to better understand heterogeneous responses to income shocks by each grade:

$$Enroll_{iht} = \alpha + \beta Shock_{ht} + \sum_{j=2}^{12} \gamma_j 1(grade_{it} = j) + \sum_{j=2}^{12} \delta_j 1(grade_{it} = j) * Shock_{ht} + X_{iht} + \epsilon_{iht}$$

$Shock_{ht}$ follows the usual definition. $1(grade_{it} = j)$ is a dummy variable that takes a value of one if the student i will enter grade j in the subsequent school year. The omitted grade category is grade 2. Therefore, the coefficients on the interaction terms between each grade dummy and the shock indicator, δ_js, should be interpreted as the differential effect of entering grade j relative to entering grade 2 on enrollment probabilities when the household experiences negative income shocks. These δ_js are of main interest as they indicate the differential enrollment responsiveness to negative shocks by each grade.

Figure 2 displays these coefficients and their 95 percent confidence intervals by each entering grade. I label δ_j as grs_j in the figure. It provides evidence that the the estimation results are indeed driven by differential enrollment decision behaviors in the last grade of each education level in junior and senior high school, marked by jumps in coefficients for

[12] According to 2011 World bank report on Indonesian labor market, most jobs in the formal sector require a minimum education level. Even for the relatively simple occupations such as machine operations, completion of junior high level is expected by the employers. For occupations in craft, sales and clerical work, most employers expect employees to be educated at or above senior high school level.

grade 9 and grade 12, labeled as $grs9$ and $grs12$.

To reiterate, the Indonesian education system consists of 6 years of elementary school, 3 years of junior high and 3 years of senior high school. Therefore, if parents believe that sheepskin effects exist in the labor market and adjust human capital investment behavior accordingly, one expects larger values of grs_j for grades 6, 9 and 12 for elementary, junior high and senior high school, respectively.

In Figure 2, I find particularly higher estimates for students entering grades 9 and 12. The figure illustrates education decision patterns that are consistent with a parental belief in sheepskin effects for junior high school and senior high school. On the other hand, I observe that $grs6$ is not statistically different from adjacent years and lower levels of elementary school in times of shock. This enrollment pattern is inconsistent with perception of sheepskin effects at the elementary school level, suggesting an absence of anticipation of sheepskin effects at this level. These estimates are congruous with the findings from triple interaction regression results found in column 2 of Table 2.

It is now clear that the estimates from equation (1) and equation (2) are capturing the underlying heterogeneous response to income shocks in the last grades of junior and senior high school, consistent with parental perception of sheepskin effects. One might ask if this differential pattern by grade could be driven by factors of demand for schooling other than sheepskin effects, such as selection on ability or outside labor market opportunities that might differ by grade. However, factors other than sheepskin effects would predict a monotonic pattern of cross-grade response to shocks. For instance, with selective attrition by ability, children's average ability would increase with grade.[13] This implies that students in grade 10 should be more likely to be enrolled than students entering grade 9 according to this alternative explanation. However, in fact what I find is a non-monotonicity

[13]This may occur if students learn about their ability through performance at school and drops out if the ability they expect to be required at the next grade is higher than their ability. This may generate differential response to shocks by grade if parents are more likely to protect enrollment for children with higher ability.

around the last grade of junior high, indicated by the differential coefficient of $grs9$ in Figure 2, which rules out these other demand factors in explaining the observed schooling patterns. I discuss this in detail in section 5.5.

Altogether, the results so far suggest that the perception of sheepskin effects operates at the junior and senior high school level.[14] Therefore, for the analysis henceforth, I exclude elementary school and focus on human capital investment behavior at the secondary school level. In addition, to ascertain that the estimation results are driven by sheepskin effects rather than other demand factors, I further present estimation results restricted to grade 9 and the adjacent grades before and after grade9 (grades 8 and 10) to verify the aforementioned non-monotonic relationship.

The schooling responses to income shocks may vary depending on whether the nature of the income shock is idiosyncratic or systemic; i.e., responses to household members' unemployment and crop loss might differ. In Table 3, I present the result of estimating equation (1) separately by sources of income shock. Column 1 presents estimates using the previously defined income shock, which I refer to as combined shock. Columns 2 and 3 separately report results for unemployment shock and crop loss shock, respectively. The main coefficient of interest that identifies the differential response to the income shock due to a perception of a sheepskin effect is always positive, and significant in all columns except column 8. The first column of each shock – columns 1, 3 and 5 – presents estimation of equation (1) for secondary school enrollment decisions and the second column of each shock – columns 2, 4 and 6 – repeats the same estimation restricting to the last grade of junior high school (grade 9) and the adjacent two grades (grades 8 and 10).

Column 1 confirms the findings in the previous analysis, and shows that students in the households that have suffered either an unemployment shock or crop loss are on average less likely to transition to the next grade compared to those students who do not

[14] I continue to find the result of no effect of income shocks on enrollment in elementary school across other types of income shocks.

experience a shock. However, the students entering the last grades of junior and senior high school are not less likely to enroll despite the negative shocks relative to those devoid of shocks. Since income shocks increase relative cost of enrollment for all grades, the observed enrollment pattern suggests that households perceive higher returns to education in these grades relative to other grades. I interpret this as an evidence of a perception of sheepskin effects. The positive and significant coefficient on the interaction term in column 2 suggests that this result is explained by perceived sheepskin effects rather than other demand factors such as selection on ability that induce differential shock responsiveness for those in the last grades of secondary school.

Column 3 displays the estimation result using the unemployment shock only. It shows that the direct impact of this shock reduces the likelihood of a student enrolled in a given school year maintaining enrollment in the subsequent school year by 6.1 percentage points. However, the adverse impact essentially disappears if the affected student is in the last grades of secondary school. These students are 8.5 percentage points more likely to enroll relative to those who suffered a shock and are not in the last grade. In column 4, I find that these results are robust to restricting the estimation sample to grades before and after the last grade of junior high school.

I present estimation results using crop loss shock in columns 5 and 6. The schooling decision pattern previously observed with the unemployment shock continues to hold. Again, the shock exerts a negative influence on schooling decisions on average. The coefficient estimates on the interaction term that captures the differential enrollment response to income shocks in the last grades are positive and significant in both columns. The size of the estimates are comparable in magnitude to those using unemployment shock.

6.2 Schooling Decisions by Ownership of Buffer Stocks

In this section, I explore how the responses to perceived sheepskin effects differ by ownership of buffer stocks. Theoretically, the decisions to maintain enrollment or to dropout would be independent of income shocks if parents could borrow against future earnings of their children (Jacoby, 1994). However, when households have borrowing constraints, buffer stocks provide a medium for self-insurance such that the households can draw down their assets to generate liquidity in times of income shocks. Intuitively, this suggests that the direct impact of negative income shocks on enrollment decisions would be larger for households without buffer stocks because they allow households to smooth consumption. I take one step further and probe whether the responsiveness of enrollment to income shocks varies depending on the extent of self-insurance.

I use household savings to proxy for buffer stocks. IFLS solicits the most knowledgeable household member whether they own any form of savings, which I use to construct a variable that indicates whether the household has any savings. I estimate equation (1) separately by ownership of savings and focus on the interaction term to explore how enrollment decisions reflecting the perception of sheepskin effects might differ across the two groups of households. One might expect that the shocks induce a larger reduction in enrollment probability for households without buffer stocks, and the mitigating effect of being in the last grades might be smaller for these households because they have less means to smooth expenditure relative to others with buffer stocks.

Table 4 presents the estimation result. For each type of shock, the first column presents estimation result for households without any savings and the second column shows the result for households that have savings. Surprisingly, I find that even for the the more financially vulnerable households, the adverse impact of income shock on enrollment essentially disappears if student enters final grades of junior or senior high school. Specifically, comparing columns 1 and 2, I find that adverse impact of income shock on likelihood of

enrollment is larger for the more financially vulnerable households, consistent with the expectation that these households face tighter borrowing constraints.[15] Moreover, estimates imply that these households also exhibit differential response consistent with perception of sheepskin effects by being more likely to maintain their children's enrollment in times of shock if they enter the last grades of secondary school. This suggests that even the poor households find means to continue investment in education, if they think the returns from doing so are sufficiently high.

I also repeat the analysis using a broader measure of buffer stocks, which includes ownership of jewelry as an additional form of buffer stocks that could provide liquidity in addition to savings. I find qualitatively similar results using this definition of buffer stocks.

6.3 Rainfall Shocks

Given the importance of agriculture, particularly rice farming in Indonesia, rainfall shortage is a potential source of negative household income shocks. In this section, I repeat the empirical analysis using rainfall shocks, constructed from University of Delaware Terrestrial Precipitation data. The rainfall measure used to create the rainfall shock variable is post-onset rainfall – rainfall during the first three months of the monsoon season. The rainfall shock variable is defined to take a value of one if the post-onset rainfall in a given year falls into the first decile of the districts' historical post-onset rainfall distribution. Details were discussed in section 3.2.

In Table 5, I present estimation results using rainfall shocks, first with the full sample and then focusing on agricultural households in the rural districts. Column 1 shows enrollment decisions consistent with perceived sheepskin effects in response to rainfall shocks.

[15]The estimates are negative but insignificant, likely because of power issues due to sample size. Also, measurement error could be present, since savings is an incomplete measure of assets, or buffer stock due to data limitations.

Given that rainfall shocks influence schooling decision through changes in household income, these shocks may be more relevant for households whose main income source is agriculture. Therefore, in columns 3-6, I repeat the analysis focusing on rural households whose head's primary or secondary occupation is related to agriculture.[16]

As expected, compared to column 1, coefficient estimates in column 3 display that the direct effect of the rainfall shock in reducing enrollment is larger and more significant for agricultural households. The results indicate that for students in rural agricultural households, rainfall shocks reduce the probability of enrolling in the subsequent school year by 14 percentage points. However, among students affected by the shock, those entering the last grades of junior and senior high school are 14 percentage points more likely to maintain enrollment and hence fully protected from the shock, consistent with previous results. Column 4 shows that this result is robust to restricting to grade 9 and its adjacent grades, despite the estimates being insignificant due to small sample size.

The aforementioned patterns of human capital investment responses to adverse rainfall shocks seem more salient for households without savings (columns 5 and 6). The division of sample suggests that most of the rural agriculture households do not own savings and hence may be financially vulnerable. Due to the small sample size, the results are only suggestive, but it is consistent with the previous results that the shock causes larger reduction in schooling for households without savings but these households find a means to maintain a child in school when they perceive the returns are sufficiently high, e.g. in the last grades of junior and senior high school.

6.4 Financial Crisis Shocks

In this section, I explore grade progression of Indonesian students using Asian financial crisis and the panel structure of the IFLS. I show that the timing of the income shock could

[16]Occupation codes are provided in the IFLS survey at two-digit level.

have long-term consequences for human capital accumulation; I find that the adverse affect of a shock induced by financial crisis on grade progression is moderated for children entering the final grade of a given education level.

The Asian financial crisis hit Indonesia starting at the end of 1997 and worsened during early 1998. This implies that households whose children were enrolled in 1997/1998 school year experienced the crisis towards the end of this school year. Some of the households may have suffered reduction in household income, which would have affected their decision to enroll their child in the following school years. In particular, Thomas et al. (2004) find that the financial crisis had more severe impact on the poorer households in Indonesia. Combined with the information on grade enrolled in 1997/1998 school year, this setting allows a similar empirical investigation of heterogeneous education investment response with respect to income shocks, with grade progression as the outcome variable.

I investigate progression of grade levels utilizing the panel structure of the dataset. I take students who were enrolled in 1997/1998 school year in IFLS 1997 and measure grade progression by the difference between the completed grade in IFLS 2000 and grade in 1997. If a student enrolled in 1997/1998 school year follows a normal path of grade progression without dropping out, she would obtain two more years of education by 1999/2000 school year. For example, student in grade 6 in 1997/1998 school year would have completed grade 8 by the end of 1999/2000 school year.

In the previous empirical exercise, I excluded students who completed secondary schooling and will enter higher education from the sample. Following the same logic,[17] I restrict my analysis to students who were 10th grade or below in 1997/1998 school year for the estimation, i.e. students who would have not entered higher education by 1999/2000 school

[17] I exclude college students from the sample as Indonesian higher education consists of various institutions that take anywhere from 1 to 4 or more years to complete, which makes it difficult to determine which students are facing the final grade before completion. See Data section for details.

year.[18] I further restrict my sample to students who are not in elementary school, as earlier findings suggest that both the direct impact of the negative shock and the differential education decision from perception of sheepskin effect are negligible at that level. The finalized sample consists of students who were enrolled between grade 6 and grade 10 in 1997/1998 school year.

This data construction narrows the focus to differential investment associated with the perceived sheepskin effects for the completion of junior high school only, since students entering grade 12 would be excluded from the sample. This is similar to previous empirical exercises focusing on the adjacent grades of the last grade of junior high school.

If the perception of sheepskin effects matters for schooling decisions, it would mitigate the negative impact of the crisis on grade progression for students entering the last year of junior high school (grade 9) after the crisis. Hence I set the indicator variable *Last* equal to one for these students. To define the income shock resulting from the financial crisis, I use the findings from Thomas et al. (2004) that poorer households suffered the most from the crisis. Therefore, I define *Shock* to indicate households that are located in the bottom pth percentile of the income distribution in 1997 using real log per capita income as a measure of pre-crisis household income.[19] I let p take values of 5, 10 and 25.

Table 6 displays regression results for 3 different definitions of income shock on number of grades progressed. The estimates confirm that the direct impact of the shock was largest for the poorest households. The coefficient estimate on *Shock* is largest for the bottom 5th percentile shock and decreases henceforth. Comparing across the three columns,

[18] A student in grade 11 in 1997/1998 school year, would have finished secondary education and moved on to either college or the labor market by 1999/2000 school year. Therefore, these students are excluded from the sample. Details for normal grade progression for students enrolled in 1997/1998 school year is summarized in Appendix Table A.2.

[19] The household income measure I use is pre-crisis (IFLS 1997) log per capita expenditure because the households' rankings in the income distribution might have shifted as a result of the crisis. This implies that IFLS 2000 per capita expenditure may be less informative about financial vulnerability at the time of the crisis. See Negative Income Shock Construction section for details.

the shock variable is only significant for the bottom 5 or 10 percentile shock and not for the 25th percentile shock. This implies that the reduction in education from experiencing the crisis pertained to households in lower than 25 percentile of the income distribution and the effect dampens as income percentiles increase. Column 1 shows that the students in the bottom 5 percentile households progressed less by slightly less than half a year.

Most important are the positive and significant estimates on the coefficients of interest, *ShockxLast*. The results show that students entering grade 9 attain little less than half a year more, relative to students who suffered income shock but entering other grades; i.e. grade progression is less hindered for students entering the the final grade of junior high school after the financial crisis. The sample construction does not allow analysis for the last grade of senior high school, but this differential response for grade 9 is consistent with household responding to sheepskin effects as found in previous sections. The underlying differential response to financial crisis shock by grade is indeed driven by enrollment being less sensitive to shocks in grade 9, illustrated in appendix Figure A.2.

These findings suggest that while income shocks could have a lasting effect on human capital accumulation, the students who expect to enter the final grade of an education level after the income shock are relatively more fortunate as grade progression is less obstructed for these students. This relates to the literature that the timing of shocks during childhood having long-term consequences throughout life cycle (Almond and Currie, 2011), and suggests that timing of an adverse shock not only matters for only early childhood but also for early adolescent period as well.

In addition, in the particular context of financial crisis or recessions, my findings imply that students who suffer shock in non-sheepskin grades, have higher likelihood of entering the labor market in the aftermath of the crisis as their education investment is less protected than those entering the last grades of secondary school. According to Oreopoulos et al. (2012), because initial labor market experience has a long term effect on lifetime

earnings, individuals entering the labor market for the first time during the recession suffer from persistently lower wages. Combined, this implies that the impact of the timing of an income shock on lifetime earnings may be amplified during periods of bad labor market through two channels: first, by deterred schooling investment and second, reinforced by lower starting wage in the labor market.

6.5 Alternative Explanations

Could the pattern of differential response to income shocks for students entering the last grades of junior and senior high school be driven by demand side explanations other than the perception of sheepskin effects? In this section, I address two potential factors that could generate enrollment responses that vary by grade: selection on ability and outside opportunities in the labor market.

First possibility is selection on ability. If higher grade levels require higher ability, or if students learn about their ability through schooling, students with the lowest ability will not transition to the next grade, i.e. average ability is increasing in grade. If parents are more likely to maintain enrollment for children with more ability, this raises a concern that the smaller likelihood of dropping out in response to income shocks found in the last grades of junior and senior high school, may be explained by higher average ability in these grades relative to other grades. In this case, I should find income shocks to be less likely to reduce enrollment, the higher the grade level. To measure students ability, in appendix Figure A.3, I present household heads' completed education for each grade as a proxy for students' ability.[20] It shows that household head's education level monotonically increases with grade.

However, my results exhibit non-monotonic relationship in the last grade of junior high level, which rules out ability as an alternative story for the observed findings. Specifically,

[20]Household heads' education level is used as a proxy for students' ability because it is highly predictive of their enrollment status and is also available for all sample.

students entering the last grade of junior high (grade 9) are less likely to drop out relative to the penultimate grade of junior high (grade 8) as well as first grade of senior high (grade 10) when an income shock occurs. If the ability story holds, since the average ability would be higher for students entering the first grade of senior high school, enrollment should be less sensitive to shocks for the first grade of senior high than last grade of junior high; This is not what I see in the data as presented in Figure 2 , which rules out selection in explaining smaller drop in enrollment in the last grades of junior and senior high school in response to negative shocks.

Another factor that could generate variations in returns to schooling by grade is differences in outside opportunities. The return to an additional year of schooling is lower if the opportunity cost of schooling is higher that year. Therefore, if the labor market values physical strength, or years of schooling, the average foregone earnings would increase by grade. This implies that responsiveness of enrollment to income shocks should monotonically increase by grade, which is also inconsistent with the pattern I observe in current analysis. As a result, the pattern of heterogeneous responses to income shocks that I find in Indonesian data rules out the alternative explanations, and provides evidence of sheepskin effects as the main mechanism.

7 Conclusion

This paper is the first paper to explore the impact of perception of sheepskin effects in a human capital investment context, which has important implications for human capital accumulation in developing countries, particularly when income is volatile.

I argue that demand for education influences human capital accumulation decision in Indonesia. Particularly, in the presence of a perception of sheepskin effects –additional wage premium associated with completion of an education level– the demand for an extra year of schooling varies depending on whether the student will finish an education level

with the additional year of schooling. I test my hypothesis using negative income shocks to isolate the effect of perceived returns to education and analyze the cross-grade variation in enrollment responses to these shocks.

I find that negative household income shocks reduce the probability of children advancing to the next grade level on average, consistent with previous literature on credit constraints and limited consumption smoothing in developing countries. Moreover, I find heterogenous response to negative income shocks by grade level, consistent with a perception of sheepskin effects. Specifically, I find that this adverse impact of income shocks on schooling investment is reduced for students who enter the last grades of junior and senior high school. This finding is robust across various types of income shocks, ranging from idiosyncratic unemployment shocks to systemic shocks including crop loss, rainfall shocks and the Asian financial crisis. Particularly surprising is that even poor households, which may be more credit constrained due to a lack of sufficient buffer stocks, exhibit a similar schooling behavior of protecting education investment for children in the last grades of secondary school. This implies that even the poor find means to maintain their children in school, when they think the returns are sufficiently high.

Overall, my findings shed light on the underlying demand factor for schooling decisions, particularly transition decisions. The evidence of differential responsiveness to negative income shocks suggests that the timing of negative income shocks may matter in terms of human capital accumulation in developing countries. Previous research has discussed that timing of shocks matter in utero or in early childhood (Almond and Currie, 2011). In addition, the results I find suggest that the timing of shock during early adolescence may also have long term consequences. The goal of developing countries' education is to increase the stock of human capital, which is beneficial for individuals as well as the economy as the stock of skilled labor increases. Yet, still many countries face stagnation in attained years of schooling beyond primary or compulsory level. The observed schooling

decisions at the lower and upper secondary education level in the current study suggests that further explorations of the actual size of sheepskin effects in the labor market, the corresponding schooling response and their implications on education policies would be an interesting direction for future research.

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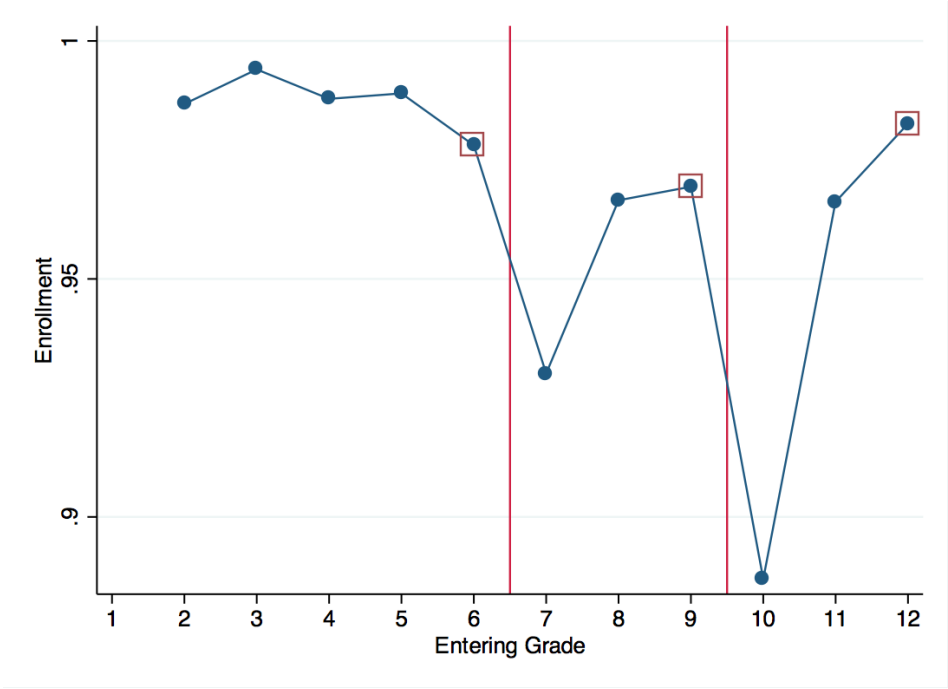
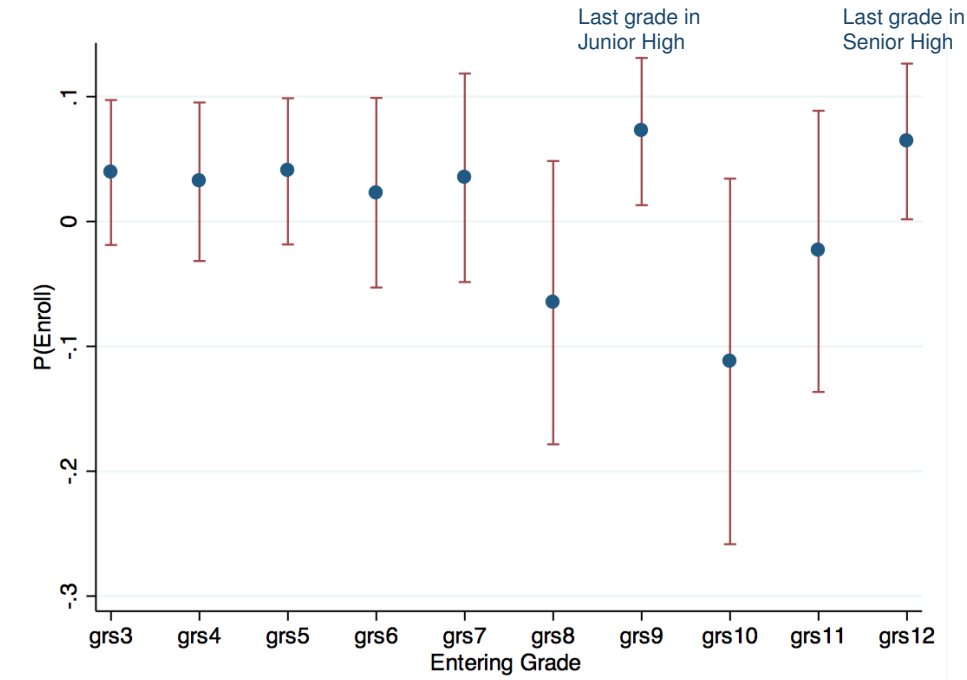
Figure 1: Grade Transition Pattern in the Cross Section



Notes:
1. This figure illustrates the grade transition pattern of the sample in the cross section.
2. Each point on the graph denotes the enrollment probability of students entering the given grade conditional on enrollment in the previous grade. For instance, the plotted point for grade 6 is the conditional probability of student enrolling in grade 6 conditional on completing grade 5.
3. Vertical red lines separate the three education levels of focus; elementary school (grades 1-6), junior high school (grades 7-9) and senior high school (grades 10-12).

Figure 2: Differential Responses to Negative Income Shocks by Grade



Notes:
1. This figure illustrates the differential enrollment response to negative income shocks by each grade.
2. Grade 6 is the last grade of elementary school. Grade 9 and grade 12 refer to the last grades of junior and senior high school, respectively.
3. This figure plots the coefficients on the interaction terms of shock and grade dummies from the following equation, δ_j, labeled as grs_j for each grade j and the corresponding 95% confidence intervals :

$$Enroll_{iht} = \alpha + \beta Shock_{ht} + \sum_{j=2}^{12} \gamma_j 1(grade_{it} = j) + \sum_{j=2}^{12} \delta_j 1(grade_{it} = j) * Shock_{ht} + X_{iht} + \epsilon_{iht}$$

4. $Enroll_{iht}$ is probability of enrollment in the subsequent school year conditional on enrollment in a given year. $1(grade_{it} = j)$ is a dummy for students entering grade j. Omitted grade category is grade 2.
5. Standard errors are clustered at the household level.

Table 1: Summary Statistics

Variable	Mean	SD
Female	0.50	0.50
Age	12.21	3.16
Rural	0.53	0.50
Head less than elementary school	0.19	0.39
Head elementary school	0.47	0.50
Head junior high school	0.13	0.33
Head senior high school	0.16	0.36
Head college or more	0.06	0.23
Own home	0.85	0.36
Own savings	0.28	0.45
Use electricity	0.89	0.31
Head engaged in agriculture	0.33	0.47
Unemployment shock	0.01	0.12
Crop loss shock	0.03	0.17
Rainfall shock	0.06	0.24
N	12941	

Notes:
1. This table presents summary statistics for variable used in the analysis. Means and standard deviations are presented for each variable.
2. I define buffer stock to be assets that could immediately generate liquidity for the household; e.g. households that declare their ownership of savings are defined as households with buffer stocks.
3. Household head is defined to be engaged in agriculture if head's primary or secondary occupation is in the agriculture category.
4. Households experience an unemployment shock if household members becomes unemployed. Rainfall shock occurs if rainfall falls in the first decile of the district's usual rainfall distribution, using measure of rainfall during the first 3 months of the monsoon season.

Table 2: Effect of Income Shocks on Probability of Enrollment

Dependent Variable: Probability of Enrollment		
	(1)	(2)
Last	0.0133***	0.0541***
	(0.00357)	(0.0080)
LastxElementary		-0.0664***
		(0.0092)
LastxJuniorHigh		-0.0349***
		(0.0104)
Shock	-0.0233**	-0.115**
	(0.0114)	(0.0470)
ShockxElementary		0.116**
		(0.0481)
ShockxJuniorHigh		0.0888*
		(0.0539)
ShockxLast	0.0456***	0.151***
	(0.0159)	(0.0488)
ShockxLastxElementary		-0.157***
		(0.0563)
ShockxLastxJuniorHigh		-0.0809
		(0.0566)
Elementary	0.0664***	0.0796***
	(0.0056)	(0.0070)
JuniorHigh	0.0206***	0.0279***
	(0.0059)	(0.0076)
N	12,885	12,885
District FE	Yes	Yes
Year FE	Yes	Yes

Notes:
1. This table tests whether households make differential enrollment decisions in response to income shocks when children are entering the last grade of a given education level, capturing the perception of sheepskin effects.
2. Perception of sheepskin effects is captured by the coefficient on ShockxLast
3. Dependent variable is probability of enrollment in the subsequent school year conditional on enrollment in a given year (Transition probability, or conditional enrollment).
4. Shock variable takes a value of one if household experiences either unemployment of household member or crop loss in a given year. The variable *Last* indicates whether the student will enter the last grade of an education level. *Last* takes a value of one if the student faces enrollment decisions of entering grade 6 for elementary, grade 9 for junior high and grade 12 for senior high school.
5. Each regression includes year and district fixed effects. Standard errors are clustered at household level. Controls include indicator for female, urban/rural residence and household head's education level.

Table 3: Effect of Income Shocks on Probability of Enrollment

Dependent Variable: Probability of Enrollment

Shock Type	Combined Shock		Unemployment		Crop Loss	
	(1)	(2)	(3)	(4)	(5)	(6)
Last	0.0286***	-0.0039	0.0311***	0.0006	0.0300***	-0.0016
	(0.0055)	(0.0089)	(0.0055)	(0.0086)	(0.0055)	(0.0089)
Shock	-0.0386*	-0.0943***	-0.0613*	-0.1036*	-0.0233	-0.0808*
	(0.0215)	(0.0356)	(0.0366)	(0.0603)	(0.0259)	(0.0424)
ShockxLast	0.0883***	0.1347***	0.0851**	0.1151*	0.0847***	0.1332***
	(0.0234)	(0.0380)	(0.0384)	(0.0616)	(0.0284)	(0.0459)
N	6,199	3,119	6,195	3,118	6,198	3,118
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes:
1. This table tests separately for each shock type whether households make differential enrollment decisions in response to income shocks when children are entering the last grade of a given education level
2. Dependent variable is probability of enrollment in the subsequent school year conditional on enrollment in a given year (Transition probability, or conditional enrollment).
3. Columns (1), (3), (5) look at enrollment for secondary school sample. Columns (2), (4), (6) restrict the sample to grades before and after the last grade of junior high school, grades 8, 9 and 10.
4. Shock variable takes a value of one if households experience negative income shocks in a given year. Combined shock takes a value of one if either unemployment or crop loss shock occurs. The variable *Last* indicates whether the student will enter the last grade of an education level.
5. Each regression includes year and district fixed effects. Standard errors are clustered at household level. Controls include indicator for female, urban/rural residence and household head's education level.

Table 4: Effect of Income Shocks on Probability of Enrollment: Buffer Stocks

Dependent Variable: Probability of Enrollment						
	Combined Shock		Unemployment		Crop Loss	
	No Savings	Has Savings	No Savings	Has Savings	No Savings	Has Savings
	(1)	(2)	(3)	(4)	(5)	(6)
Last	0.0316***	0.0181**	0.0354***	0.0172**	0.0333***	0.0194***
	(0.00727)	(0.00746)	(0.00713)	(0.00728)	(0.00722)	(0.00745)
Shock	-0.0433*	-0.0183	-0.0502	-0.0686	-0.0367	0.0345*
	(0.0261)	(0.0309)	(0.0459)	(0.0531)	(0.0313)	(0.0178)
ShockxLast	0.105***	0.0205	0.0983*	0.0784	0.101***	-0.0324
	(0.0289)	(0.0294)	(0.0510)	(0.0545)	(0.0340)	(0.0204)
Observations	4,331	1,868	4,327	1,868	4,330	1,868
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes:
1. This table tests whether households make differential enrollment decisions in response to income shocks when children are entering the last grade of a given education level, separately by buffer stocks ownership.
2. Ownership of buffer stocks is defined as whether or not the household holds any savings.
3. Dependent variable is probability of enrollment in the subsequent school year conditional on enrollment in a given year (Transition probability, or conditional enrollment).
4. Shock variable takes a value of one if households experience income shocks in a given year. The variable *Last* indicates whether the student will enter the last grade of an education level.
5. Each regression includes year and district fixed effects. Standard errors are clustered at household level. Controls include indicator for female, urban/rural residence and household head's education level.

Table 5: Effect of Rainfall Shocks on Probability of Enrollment

Dependent Variable: Probability of Enrollment

	All Households		Agricultural Households			
					No Savings	Has Savings
	(1)	(2)	(3)	(4)	(5)	(6)
Last	0.0288***	-0.0000	0.0569***	0.0074	0.0536***	0.0761*
	(0.0061)	(0.0087)	(0.0140)	(0.0161)	(0.0139)	(0.0430)
Shock	-0.0270	-0.0131	-0.1415*	-0.1287	-0.1846*	0.0623
	(0.0282)	(0.0449)	(0.0851)	(0.1504)	(0.0971)	(0.0619)
ShockXLast	0.0425**	0.0206	0.1492**	0.1024	0.2036**	-0.0956
	(0.0185)	(0.0394)	(0.0703)	(0.1246)	(0.0878)	(0.0764)
Constant	0.9770***	0.9754***	0.8125***	0.7798***	0.7844***	0.9660***
	(0.0391)	(0.0573)	(0.0372)	(0.0463)	(0.0434)	(0.0561)
N	6,199	3,119	1,543	802	1,279	264
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes:
1. This table tests whether households make differential enrollment decisions in response to rainfall shocks when children are entering the last grade of a given education level
2. Dependent variable is probability of enrollment in the subsequent school year conditional on enrollment in a given year (Transition probability, or conditional enrollment).
3. Columns (1) and (3) look at enrollment for secondary school sample. Columns (2) and (4) restrict the sample to grades before and after the last grade of junior high school, grades 8, 9 and 10.
4. Rainfall shock is defined to indicate rainfall falling in the first decile of historical district level rainfall. The variable *Last* indicates whether the student will enter the last grade of an education level.
5. Each regression includes year and district fixed effects. Standard errors are clustered at district level. Controls include indicator for female, urban/rural residence and household head's education level, usage of electricity, home ownership and buffer stock ownership.

Table 6: Grade Progression after Asian Financial Crisis

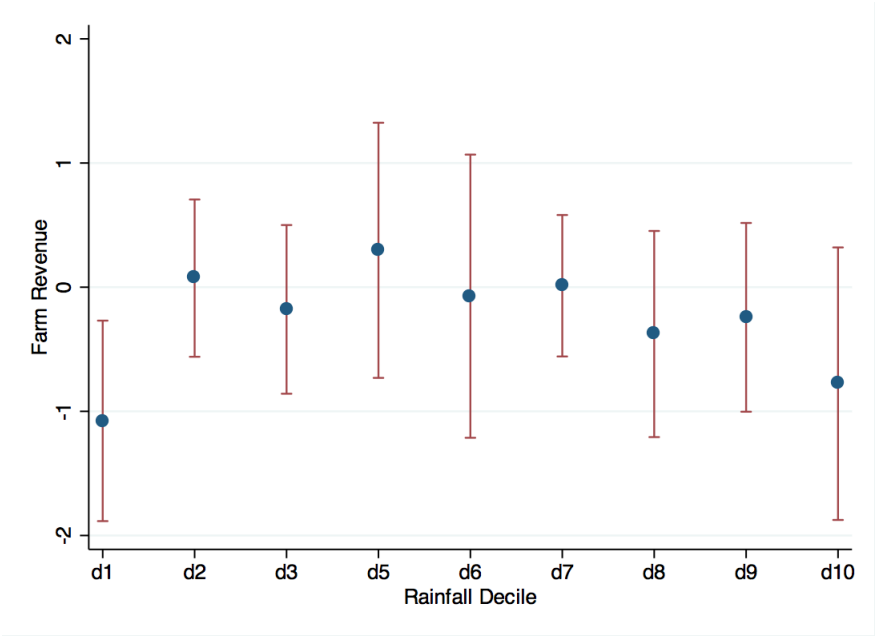
Dependent Variable: Number of grades completed

	Income Shock Percentile		
	5%	10%	25%
	(1)	(2)	(3)
Last	-0.0005	-0.0057	0.0065
	(0.0311)	(0.0316)	(0.0334)
Shock	-0.3593***	-0.1885**	-0.0437
	(0.1357)	(0.0911)	(0.0430)
ShockxLast	0.4372*	0.3608***	0.0003
	(0.2253)	(0.1304)	(0.0943)
N	1,564	1,564	1,564
District FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Notes:
1.This table tests whether households make differential grade progression decisions in response to crisis-led income shocks when children are entering the last grade of junior high school.
2. Dependent variable is number of grades progressed.
3. I define Shock to indicate households that is located are the bottom pth percentile of the income distribution in 1997 using real log per capita income as a measure of pre-crisis household income, following the findings from Thomas et el. (2004). p takes value of 5, 10 and 25 respectively for columns 1, 2 and 3.
4. Each regression includes year and district fixed effects. Standard errors are clustered at household level. Controls include indicator for female, urban/rural residence and household head's education level.

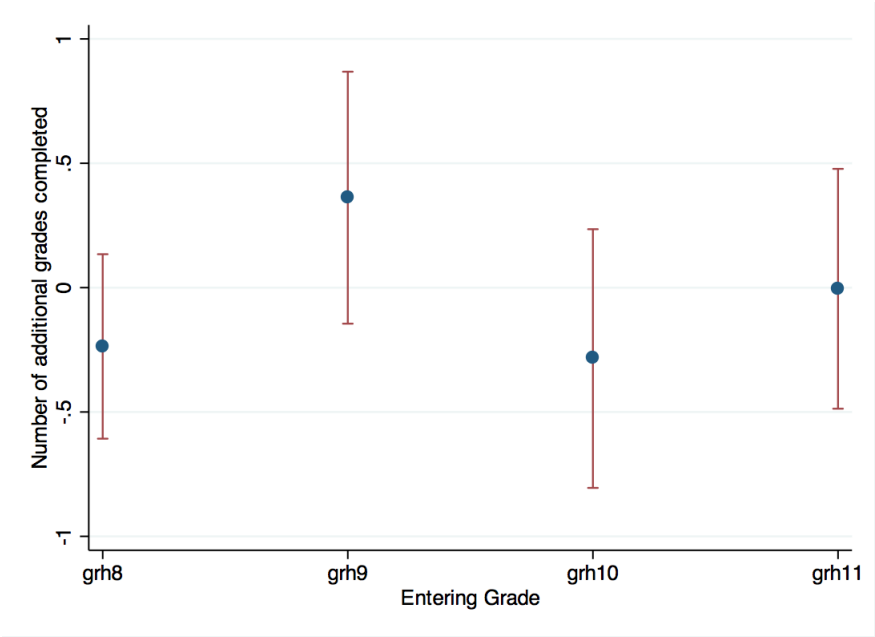
Appendix Figures and Tables

Figure A.1: Farm Revenue by Rainfall Decile



Notes:
1. This figure illustrates a non parametric relationship between post-onset rainfall decile and farm revenue for the agricultural households in the sample.
2. Dependent variable is log farm revenue, regressed on decile dummies and controls including year and district fixed effects.
3. The figure plots coefficient estimate for each decile dummy and its 95% confidence intervals. Standard errors are clustered at the district level.
4. I define rainfall shock if it falls in the first decile of the historical distribution, consistent with this figure. A regression of log farm revenue on the dummy for the first decile with controls provides a negative coefficient estimate on shock with an 10.99 F-stat value.

Figure A.2: Differential Responses to Financial Crisis Shocks by Grade

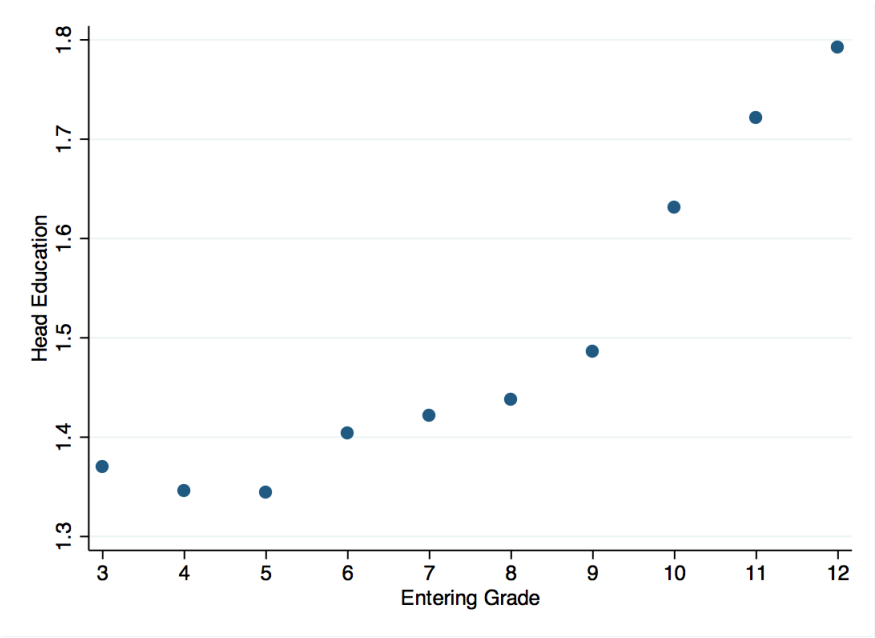


Notes:
1. This figure illustrates the differential response to crisis-led income shocks by each grade.
1. 2. Grade 9 refers to the last grade of junior and high school. The sample consists of students enrolled between grade 6 and 10 in 1997/1998 school year. Sample construction details in section 5.4.
3. Shock is defined to indicate households at the bottom 5 percentile of the pre crisis income distribution (year 1997 income distribution) who were most affected by the Asian financial crisis.
3. The Figure plots the coefficients on the interaction terms of shock and grade dummies from the following equation, δ_j, labeled as grs_j for each grade j and the corresponding 95% confidence intervals :

$$Enroll_{iht} = \alpha + \beta Shock_{ht} + \sum_{j=2}^{12} \gamma_j 1(grade_{it} = j) + \sum_{j=2}^{12} \delta_j 1(grade_{it} = j) * Shock_{ht} + X_{iht} + \epsilon_{iht}$$

4. $Enroll_{iht}$ is probability of enrollment in the subsequent school year conditional on enrollment in a given year. $1(grade_{it} = j)$ is a dummy for students entering grade j. The omitted grade category is grade 7.
5. Standard errors are clustered at the household level.

Figure A.3: Household Head's Education Level by Grade



Notes:
1.This figure displays the mean of household head's education level for the sample of students who are enrolled in a given grade.
2. Household head's completed education level is categorized to take a value of 0 for less than elementary school, 1 for elementary school, 2 for junior high school, 3 for senior high school, 4 for college or more.

Table A.1: Correlation between Students' Grade and Timing of Income Shocks

Dependent Variable: Indicator for Shock Incidence

Shock Type	Combined Shock		Unemployment		Crop Loss	
	(1)	(2)	(3)	(4)	(5)	(6)
Last	-0.0066	-0.0034	-0.0040	-0.0065	-0.0054	0.0016
	(0.0041)	(0.0076)	(0.0025)	(0.0051)	(0.0061)	(0.0155)
LastxES		-0.0057		0.0029		-0.0098
		(0.0095)		(0.0060)		(0.0173)
LastxJH		-0.0021		0.0034		-0.0058
		(0.0104)		(0.0066)		(0.0182)
Observations	12,885	12,885	12,876	12,876	6,784	6,784
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes:
1. This table tests whether the identifying assumption holds: whether the timing of household income shock is uncorrelated with whether the student is entering the last grade.
2. The dependent variable is binary variable that indicters whether household suffers a negative income shock.
3. Each regression includes year and district fixed effects and controls. Standard errors are clustered at household level.

Table A.2: Grade Progression

School Year	Grade Progression					
1997/1998	6th	7th	8th	9th	10th	11th
1998/1999	7th	8th	9th	10th	11th	12th
1999/2000	8th	9th	10th	11th	12th	college/stop school

Notes:
1.This table presents grade advancement of students enrolled in 1997/1998 school year until 1999/2000 school year if they follow normal progression path.