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The effect of weather shocks and risk on schooling and child labour in rural Indonesia

Outi Korkeala

Department of Economics

University of Sussex

O.K.Korkeala@sussex.ac.uk

Abstract: Agriculture employs 60% of workers in rural Indonesia whose crop production and incomes are threatened by variation in climatic conditions. Delayed monsoon onset related to El Niño is likely to become more frequent with climate change. Using the Indonesian Family Life Survey, IFLS, this paper examines how schooling and child labour are affected by ex post climate shock, delayed monsoon onset. A minor research question studies the impact of ex ante climate risk on school entry. The probability of continuing from primary to secondary school is reduced when a delayed onset coincides with the transition year. In other respects, monsoon onset does not affect education of rural children. However, riskier distribution of rain postpones school entry for young children. Moreover, I find that delayed onset increases child labour. Finally, I do not find any gender differences in schooling or labour supply when children exposure to delayed monsoon onset.

JEL Classification: I21, D10, J22, Q51, Q54

Key Words: Climate variability, education, drop-outs, child labour, Indonesia

1 Introduction

The objective of this chapter is to study the impact of weather shocks on schooling and child labour in rural Indonesia. The weather shock is measured as the deviation of monsoon onset, the start of the rainy season, from its historical mean date. In addition, this chapter studies whether ex-ante risk affects parents' decision to send their children to school. The weather-related risk is measured as the coefficient of variation of monsoon onset.

Weather variables have been commonly used in the literature as a means of identifying the effects of permanent and transitory components of income. However, despite the many advantages of this method, mainly the strong correlation between weather and farm income and the randomness of the weather events, the models have been based on theoretical frameworks with somewhat strong assumptions about the operation of rural labour markets, preferences and technology (Rosenzweig and Wolpin, 2000). Accordingly, some recent papers have used weather variables to study the direct relationships between income risk and income shocks and the outcome of interest using reduced form specifications (Kochar, 1999 and Rose, 2001 in Rosenzweig and Wolpin, 2000). Further, Rose (2001) argues that the direct method enables her to eliminate the possible endogeneity problem related to weather shock and production decision.[1] This study builds on this more recent body of literature and examines the effect of weather shocks and weather risk on schooling and child labour. It is noted that I am not able to distinguish the mechanism through which the effects materialise. Nevertheless, the objective of this essay is to document the impacts of past weather shocks and weather risk and therefore the mechanisms are of secondary interest.

The research questions addressed in this chapter are important from a policy perspective for a number of reasons. The expected changes in climate patterns represent a serious threat to agricultural productivity in developing countries, which undoubtedly affect livelihoods and incomes of rural population (see for example Cline, 2007; Easterling et al., 2007). Rice farming in Indonesia is greatly affected by the variation in the timing of the rainy season (monsoon) as *El Niño* events can delay rice planting by up to two months, reducing the area harvested and often

[1] For example, Walker and Ryan (1990) find that farmers commonly increase the acreage of drought-resistant crops relative to that of water intensive crops if their expectations of the rainfall conditions are poor.

driving up domestic and international rice prices (Falcon et al., 2004; Naylor et al., 2007a). Further, the current consensus predicts that the Asian monsoon will intensify in the future with climate warming, implying more and longer droughts in Indonesia (Overpeck and Cole, 2007). Agriculture continues to be an important source of livelihood while 60% of the work force in rural Indonesia engages in agriculture. Except for the well-documented relationship between monsoon onset and rice production (se, for example, Naylor et al., 2001; Naylor et al., 2007a) the socio-economic implications of climate variability in Indonesia are relatively unknown. This study seeks to fill this gap by studying the effect of climate variability on schooling and child labour.

Most of the previous literature has focused on ex post effect of a shock on education outcomes (see, for example, Kruger, 2007 and Maccini and Yang, 2009) while one of the contributions of this chapter is to enhance understanding on how schooling is used as a measure to cope with risk, that is the realization of a shock ex ante. [2] Children's schooling in risky environments might be adversely affected by households' need to build-up buffer stocks to cope with future shocks.

Schooling and other investments in human capital play an important role in escaping poverty; yet there are many factors that may interrupt schooling or prevent children from starting school. A broad body of literature has examined the interaction between exogenous shocks, such as unemployment, illness, crop loss, income loss, and investments in children (see, for example, Jacoby and Skoufias, 1997; Jensen, 2000; Thomas et al., 2004; Kruger, 2007). These questions are of particular relevance in developing countries where missing and/or imperfect credit markets may hinder investments in human capital. Along with human capital investments economists have been interested in the determinants of child labour and the impacts of exogenous shocks on child labour (see, for example, Kruger, 2007; Beegle et al., 2008; Yang, 2008).

My prior hypothesis is that early onset has either a positive or neutral impact on school attendance whereas delayed onset has a negative effect. This is based on previous research which shows that delayed onset decreases the amount of rice harvested in the following calendar year

[2] On the effect of risk on schooling, see for example Fitzsimons (2007) and Kazianga (2005).

(Falcon et al., 2004).[3] The reduced harvest affects households' farm profits, which in turn might have implications on households' investment in human capital, especially in rural settings where credit is likely to be scarce. However, both good harvest and bad harvest (delayed onset) could increase the demand for child labour because the child wage has both substitution and income effects. The increase in the child wage rate increases the demand for child labour because of the substitution effect, while the income effect has a negative sign. Therefore, the total effect depends on the relative strength of these two factors. Indeed, Kruger (2007) finds that coffee boom raises child labour in Brazil, whereas Beegle et al., (2008) argue that self-reported crop loss lead to increased hours worked by children in Tanzania.

This study contributes to the literature on households' coping mechanisms when facing an exogenous shock, with a particular emphasis on weather shocks and weather-related risk. Children's schooling is at risk when household faces a rainfall shock affecting its income. Grimm (2008) analyses the impact of food price inflation on children's schooling in Burkina Faso. The findings suggest that a loss in purchasing power had a negative effect on enrolment rates. Jensen (2000), using data on Côte d'Ivoire, finds that enrolment rates for children aged 7-15 declined by 14 and 11 percentage points among boys and girls, respectively, in areas that experienced adverse weather conditions, and actually increased at the same time in all other areas. Jacoby and Skoufias (1997), using the ICRISAT data on rural India, find that child labour and school attendance play a significant role in the self-insurance strategy for poor households. Björkman (2006) finds that negative rainfall, and thus income shocks, reduces female enrolment in primary school in Uganda. In respect to weather risk, Rose (2001) finds that ex ante risk, measured as the coefficient of variation of rainfall, increases the probability of a household participating in the labour market in rural India.[4] In addition the author finds that also unexpected bad weather increases labour force participation.

Past weather shocks have adversely affected also Indonesian households. Self-reported crop loss is associated with reduced education expenditure (Cameron and Worswick, 2001). Aggregate village-level risk, measured as past rainfall variability, was found to have reduced

[3] Also in Chapter 2 of this thesis I find that delayed onset has an adverse effect of expenditure and farm profits of the middle-income households.
[4] The dependent variable in the main analysis is a dummy variable indicating whether a member of the household participated in the labour market.

educational attainment of rural children (Fitzsimons, 2007). Finally, early-life drought between 1953 and 1973 adversely affects health, educational attainment, espousing quality, and adult socioeconomic status in rural Indonesia (Maccini and Yang, 2009).

The overall effect of child labour on individual welfare is ambiguous in theory. Child labour may itself be harmful for child's education and health, and these adverse effects might be lasting (see for example O'Donnell et al., 2005; Beegle et al., 2008). On the other hand, child might gain essential work experience that could be rewarded in the labour market (see for example Beegle et al., 2005). Nonetheless, several empirical studies have revealed negative consequences of child labour (Kruger, 2007; Beegle et al., 2008).[5] However, it is important to make a distinction between different types of child labour. Studies on India demonstrate that child labour in rural areas is often 'light' in a sense that children ought to be able to educate themselves and work, provided that schools were available. However, the story is very different for organized child labour (Basu, 1999).[6]

Using three rounds of the Indonesia Family Life Survey, IFLS data, I find that delayed monsoon onset has an increasing impact on the incidence of child labour. A one standard deviation delay in monsoon onset in the previous year increases the probability of a child working by 5.8 percentage points using data for 2000 only and 9.5 percentage points in the course of the three surveys. With respect to education, I find that delayed monsoon onset only in particular years is harmful for school attendance: delayed onset in the transition year from primary to secondary school reduces the probability of attending school in following years by 2.8 percentage points. Finally, young children aged 6-10 years are less likely to enter primary school in riskier environments.

The remainder of the chapter is structured as follows. Section 2 provides a short introduction on rice farming in Indonesia and overviews of the education system and child labour in Indonesia. Section 3 introduces the data, and section 4 describes the empirical approach. Results

[5] It is notable that Beegle et al. (2005) find that the loss in education attainment due to child labour is offset by increased earnings from wage and farm work. However, the authors argue the lasting effect of the reduced education may only realize in the long term when the return to education increase and return to work experience decrease.

[6] Basu and Van (1998) argue that in the multiple equilibrium parents choose to send their children to work when additional income is needed (bad equilibrium), but refuse to do so when adult wages are sufficiently high.

are presented and discussed in sections 5 and 6. The final section concludes, discusses some policy implications and outlines areas for future research.

2 Background

2.1 Farming and rice production in Indonesia

In Indonesia, rainfall patterns vary greatly within a year across districts as well as within districts over time. As the country is located close to the equator, the variation in temperature is very small, both within years and across them, implying that rainfall patterns are the most important dimension of the weather variation. The climate in Indonesia consists simply of one wet season (October-May) and one dry season (June-September) each year.[7] In the 20 years before 2004, a 30-day delay monsoon onset occurred nearly 18 per cent of the time in West/Central Java and 10 per cent in East Java/Bali (Naylor et al., 2007a).

Agriculture, despite its declining contribution to GDP (from 47 per cent in 1969 to around 13 per cent in 2006) employs most rural Indonesians. Agriculture currently accounts for 60 per cent of rural employment, having declined only slightly from 70 per cent in 1990. Two thirds of the households in the bottom two consumption quintiles work in agriculture (Kishore et al., 2000; World Bank, 2008).

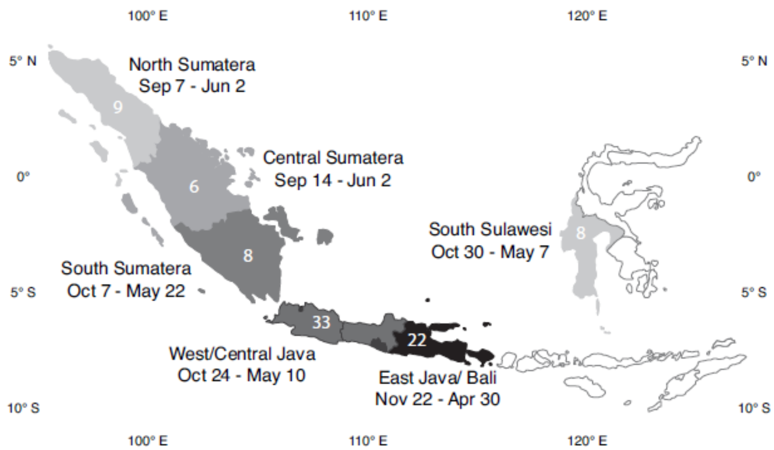
Only a minority of farm households controls irrigated rice land (*sawah*), implying that rain-fed agriculture continues to play a very important part. The distribution of *sawah* is skewed towards larger landholders: three quarters of agricultural households controlling *sawah* have less than 0.5 hectares of *sawah* each, and together they control only 38% of all *sawah* in Indonesia (McCulloch, 2008).

In Indonesia most of rice is typically planted at the beginning of the rainy season between October and December (see figure 1 for regional variations), when there is enough moisture to prepare the land for cultivation and to facilitate the early rooting. However, the main planting period occurs before the peak of the monsoon, because excessive water hampers rooting. During the 3-4 months grow-out period from planting to harvest, rice requires 600-1200 mm of water

[7] See figure 1 for local variation.

depending on the agro-ecosystem and the timing of the rainfall or irrigation. A smaller, dry season planting take then place in April and May after the wet season crop has been harvested (De Datta, 1981 in Naylor et al., 2001). Figure 1 also shows the share of rice that is produced in each of the regions.

Figure 1. The timing of the rainy season and the share of rice production out of total production in selected provinces of Indonesia.



Note: Onset date is the date past August 1 when accumulated rainfall equals 20 cm, averaged over reporting rainfall stations in the region for the years 1979–2004; termination date is the date on which 90% of that year's rainfall has accumulated. The number on each region indicates the share of region's rice production out of total production.
Source: Naylor et al., (2007a).

The timing of the onset of the monsoon is affected by the El Niño Southern Oscillation (ENSO), which causes anomalies in the sea surface temperature and sea-level pressure. *El Niño* events can delay rice planting by up to two months, reducing the area cultivated and delaying the plantings of next year's dry-season crop (Naylor et al., 2007a).[8] In addition to delays in rain, *El Niño* events are associated with reductions in the length of the rainy season (Cook et al., 2001). Monsoon timing affects the total amount of land planted for many crops, but is particularly important for rice. A sea-surface temperature index explains 60 per cent of rice planted in Java, and 40 per cent of the variation in rice production (Naylor et al., 2001). From 1983 to 2004, a

[8] During El Nino events, the warmer ocean water shifts eastward away from Indonesia causing rain to fall over the central Pacific Ocean.

30-day delay in monsoon onset caused rice output to fall, on average, by 580,000 metric tons (11.6%) in East Java/Bali and 540,000 metric tons (6%) in West/Central Java during the main rice harvest season between January and April (Naylor et al., 2007a). Also, studies on rice farming in India have found that variability in area cultivated is higher than yield variability (Walker and Ryan, 1990).

2.2 Education system in Indonesia

Indonesia has invested considerably in education in the recent decades. After achieving almost uniform enrolment in primary education, the policy focus has switched to increase the enrolment in secondary education. The secondary enrolments lagged behind, increasing slowly to just over 50 per cent in 1990. To address this problem, the Government of Indonesia extended the obligatory school-going age to 15 years in 1994, implying that the compulsory education was extended to nine years (six years of primary education and three years of secondary, junior high school).[9,10] The junior secondary enrolment rates reached 58 per cent in 1998 and were 65 per cent (net) and 82 per cent (gross) in 2004. However, there remains variation across provinces as well as within them. After completing junior secondary school the child can continue to senior secondary school, subject to, however, competitive entry. Within both junior and senior high school a distinction exists between general and vocational schools (see, for example, Pradhan, 1998, pp. 413-414; Manning, 2000, p. 26; del Granado et al., 2007).

The education expansion in Indonesia has kept up with that of most East Asian countries. However, there remain obstacles to universal education, which could also affect children's engagement in labour force. Firstly, whilst primary school enrolments rates are very high, a significant proportion of children drops out from primary school before completing grade six (nearly 20% in 1993 and 15% in 2004). Also, the continuation from primary to secondary school remains a problem, resulting in a significant loss in terms of educational attainment. As a result, approximately 30% of the primary school completers did not continue to secondary school in the

[9] It is beyond the scope of this study to assess the impact of the reform on school attendance.

[10] The current Government is planning to increase the compulsory education to 12 years by 2014. The critics argue that the Government should first finish the earlier reforms as the net attendance rate in the junior high school was only 67% in 2007 (Jakarta Post 28.6.2010, http://www.thejakartapost.com/news/2010/06/28/analysis-indonesia%E2%80%99s-12year-compulsory-education-program.html, accessed 14.1.2011).

late 1980s and the corresponding figure was 25% in the 1990s (Behrman and Deolalikar, 1991; Manning, 2000).

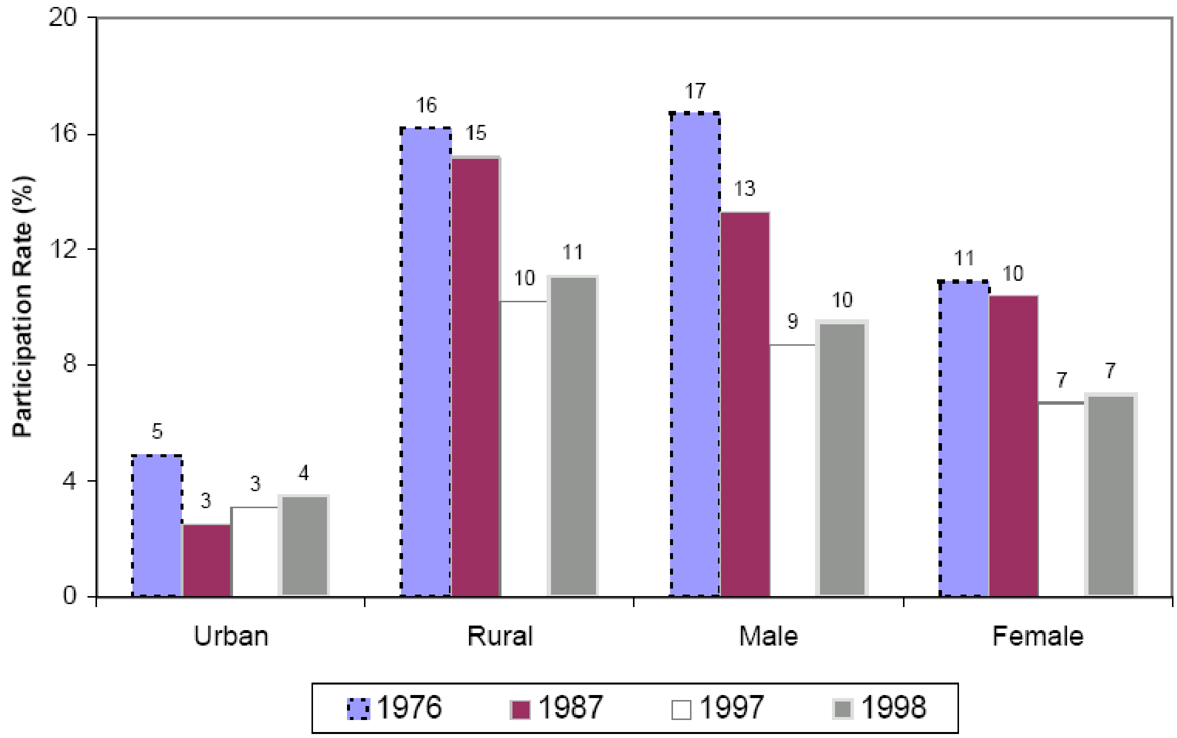
2.3 Child labour in Indonesia

There are a few, albeit descriptive, studies on the prevalence of child labour in Indonesia (see, for example, Manning 2000). Priyambada et al. (2005) compare years 1998 and 1999 in order to shed light on the question about the extent to which Asian financial crisis affected child labour and school attendance in Indonesia. However, the authors do not use any exogenous variation for identification but instead compare two subsequent years. The findings suggest that the probability of a child participating in the labour force is higher for males and for children from poor families and children living in rural areas. The probability of working is also higher in female-headed households, in households with a high dependency ratio and in households where the head of the household is working in agriculture. On the other hand, probability of working decreases with the education of the household head.

From a historical perspective, the labour force participation of children aged 10-14 years declined steeply since the mid-1970s mainly due to supply side factors, such as the increase in the supply of primary education and the improvements in living standards allowing parents to better support the education of their children. Along with the increase in education opportunities, demand side factors further contributed to the reduction; in particular, the shift from agriculture and small-scale manufacturing that had been the most significant employers of child labour (Manning, 2000). The steady decrease in child labour slightly reversed in 1998 following the Asian crisis. According to the national labour force survey, SAKERNAS, approximately eight per cent of the Indonesian children aged 10-14 were reported in the labour force. The share was higher in rural areas, 11 per cent (see figure 2).[11]

[11] Manning (2000) argue that SAKERANS understates the extent of child labour because it does not adequately take into account the economic work within the household, which is common particularly in rural areas.

Figure 2. Labour force participation of children aged 10-14 years in 1976-1998.



Source: National Labour Force Surveys in Manning (2000).

3 Data

3.1 Data sources

In this chapter the household survey employed is the Indonesia Family Life Survey, IFLS, run by RAND Corporation and the Demographic Institute of the University of Indonesia (IFLS1 and IFLS2) and the Rand Corporation and the Center for Population and Policy Studies of the University of Gadjah Mada (IFLS3). It is a panel survey covering years 1993 (IFLS1), 1997 (IFLS2) and 2000 (IFLS3) and surveyed in autumn.[12] A fourth round of the survey was conducted in 2007-2008, but this has not been used in this study, due to inability to obtain rainfall data beyond 2004. There are also some other caveats for using the IFLS4 in this study.[13]

[12] Additional information about the survey is provided in Strauss et al., (2004), Frankenberg and Thomas (2000), and Frankenberg and Karoly (1995).
[13] Firstly, IFLS4 was fielded at different time of the cropping season compared to the earlier waves. Second, as explained more in detail later in this section, information about the timing of the rainfall has been disseminated to

Moreover, panel data techniques are not used in this study in order to maximize the number of observations. There are approximately 4400 children aged 6-16 years for whom two or three rounds of data is available resulting in the total number of observations in the panel model approximately 10,000 children, that is roughly 25 per cent less than in the pooled cross section. This would be a significant reduction in the number of observations. Moreover, I would lose, for example, all children older than 12 years in the 1993 round. Other advantages of the pooled cross section are the ability to estimate marginal effects of the time-invariant characteristics and to maintain comparability of the linear probability model (LPM) and probit estimates. Fixed effect probit estimate is not available and the random effect probit estimator does not allow clustering the standard errors. On the other hand the conditional logit estimator drops all the observations for which the outcomes are only ones or zeros. Moreover, in the child labour section I also estimate a single cross section for the year 2000. Hence in order to maintain comparability of the estimates panel data techniques are not used in this study.

IFLS data is a rich data set that provides detailed data at the individual and household level on, among others, health, education, migration, employment, income and consumption. The first IFLS round sampled 311 villages, covering approximately 7,200 households in 13 provinces in Indonesia, representing approximately 83% of the Indonesian population.[14] Subsequent rounds attempted to re-contact all households interviewed in 1993, and households' attrition rates were generally below five per cent. The IFLS survey covers virtually all of the provinces highlighted in figure 1, which account for roughly 85 per cent of the national rice production. Out of the total sample approximately 52.4% of the households were located in rural areas. The exclusion of urban areas limits the total sample to 13,348 children aged 6-16 years and 6,792 children aged 6-19 years who have already completed primary school.

The rainfall data employed is from the NOAA (National Oceanic and Atmospheric Administration) Global Summary of the Day combined with additional data obtained from the Indonesian Meteorological Agency (*Badan Meteorologi dan Geofisika, BMG*). Imputed values for the missing values in the Global Summary of the Day data were provided by CEREGE,

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rural areas since 2005. And finally, the year 2007 was considered more of La Niña rather than El Niño and therefore including the 2007 would likely not increase the variation in the main independent variable.

[14] There are currently 33 provinces in Indonesia, at the time of the first survey there were 27 provinces.

Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environnement.[15] The rainfall data set contains daily rainfall data for the period 1979-2003 for 52 stations, of which 36 stations match with the IFLS data. Original IFLS households were matched with the closest weather station at the community level and households that have moved location were matched to the rainfall station closest to the geographic centre of their new district.

The start of the monsoon is defined as the number of days past August 1 when cumulative rainfall exceeds 20 cm, following Naylor et al., (2007a). The rationale for this definition is that 20 cm of cumulative rainfall is needed to moisten the ground for rice planting. For each station, I calculated the start date of the monsoon and onset was then standardized using each station's 'leave-out' mean and standard deviation across years. In other words, data from the onset year was excluded when calculating the mean and standard deviation used to standardize each year's onset. A value of O_{ijt-1} equal to zero would indicate that the nearest station's monsoon onset last year was equal to its historical average, while a value equal to one would indicate that last year's monsoon arrived one standard deviation late. The standard deviation of monsoon onset across the entire sample is 24 days. Alternative definitions of monsoon onset are also available, such as in Moron et al., (2009) that takes into account false starts, that is, dry spells occurring after the threshold has been reached. Nevertheless, Moron et al., (2009) argue that their estimations of mean onset dates for various regions in Indonesia are consistent with Naylor et al., (2007a).

3.2 Descriptive statistics

In the literature school attendance has been a widely used measure of education outcomes (see, for example, Al-Samarrai and Reilly, 2000; Lavy 1996; Kruger 2007). The relative merit of focusing on attendance in the current application is also the fairly straightforward way of linking the outcomes with the monsoon onset variables.[16] From table 1 we can see that the approximately 80 per cent of the rural children during the study period are attending school. Girls and boys aged 6-16 years are equally likely to attend school. In the school attendance specification I first focus on children aged 6-16 years who have not yet completed the compulsory education, i.e. children with less than nine years of education. Furthermore,

[15] More information on the share of imputed values in the data is presented in Appendix A, Appendix to Chapter two.
[16] Educational attainment is part of the future research.

approximately 6.4 per cent of children aged 6-16 years have never attended school, while the corresponding figure for children aged 6-10 years is 10.8 per cent.

Table 1. School attendance by gender, children aged 6-16 years who have not yet completed compulsory education (grade 9), IFLS1-IFLS3.

Currently attending school	Boys	Girls	Total
Yes	5,389 (80.4% of boys)	5,342 (80.4% of girls)	10,731 (80.4% of total)
Observations	6,706	6,642	13,348

Later I also study the effect of monsoon onset in the transition year (from primary to secondary) on the school attendance in the following years. The decreased enrolment rates after primary school in table 2 reveal that drop-outs and class repetition are a problem in rural Indonesia as only 56.3 per cent of the children aged 6-19 years who have completed primary education are still attending school.[17] Another important observation in table 2 is that girls' enrolment rate for post-primary school is slightly lower than boys' enrolment rate.

Table 2. School attendance by gender, children aged 6-19 years who have completed primary school, IFLS1-IFLS3.

Currently attending school	Boys	Girls	Total
Yes	1,945 (57.9% of boys)	1,880 (54.8% of girls)	3,825 (56.3% of total)
Observations	3,359	3,433	6,792

Information provided in the IFLS household roster give significantly lower rates for children who have worked in the past 12 months compared to the child labour figures for rural areas provided by the Sakernas survey (see figure 2). According to the national labour force survey,

[17] The corresponding figure for children aged 6-16 years is 70.4%.

approximately 11% of rural children were working in 1998, compared to the average of 4.8 per cent in the IFLS survey (see table 3 below).

Table 3. Labour force participation in the past 12 months, children aged 10-14 years, IFLS1-IFLS3.

Did the child work?	Boys	Girls	Total
Yes	176 (5.5% of boys)	130 (4.0% of girls)	306 (4.8% of total)
Observations	3,188	3,222	6,410

On the other hand, the wave 2000 has a separate section on child labour in the child book and according to this data approximately 17.1% of rural children aged 10-14 years worked either for wages or as a family worker in the past month in the year 2000 (see table 4 below).[18] The proportions of boys and girls reported to have worked seem approximately the same.

Table 4. Labour force participation in the past month, children aged 10-14 years, IFLS3.

Did the child work?	Boys	Girls	Total
Yes	199 (17.5% of boys)	183 (16.6% of girls)	382 (17.1% of total)
Observations	1,138	1,101	2,239

Comparing the data on child labour in different sources my judgement is that information presented in the child book is more accurate than the information available in the household roster. The child book contains information on both the wage work and work on family business, and moreover, the respondent is the carer of the child or the child her/himself, who likely have the best information about the work engagement. Therefore, in the child labour

[18] It is worth noting that the in the household roster the question refers to the past 12 months where as in the child book, wave three, the question refers to the past month. It is also notable that in 2000 the child book contain separate questions on work for wages and work on family business and I have combined these 2 question in order to construct an overall measure of child labour (including both family labour and wage work). In section 6.1 I present more detailed information on work for wages vs. family labour. The correlation coefficient between work definition in household roster and child book in year 2000 is 0.37 and it is statistically significant at the 1% level.

analysis I will focus on the data in wave three (2000). However, for comparison, I will also present the pooled model using information from the household roster from the waves 1993, 1997 and 2000.

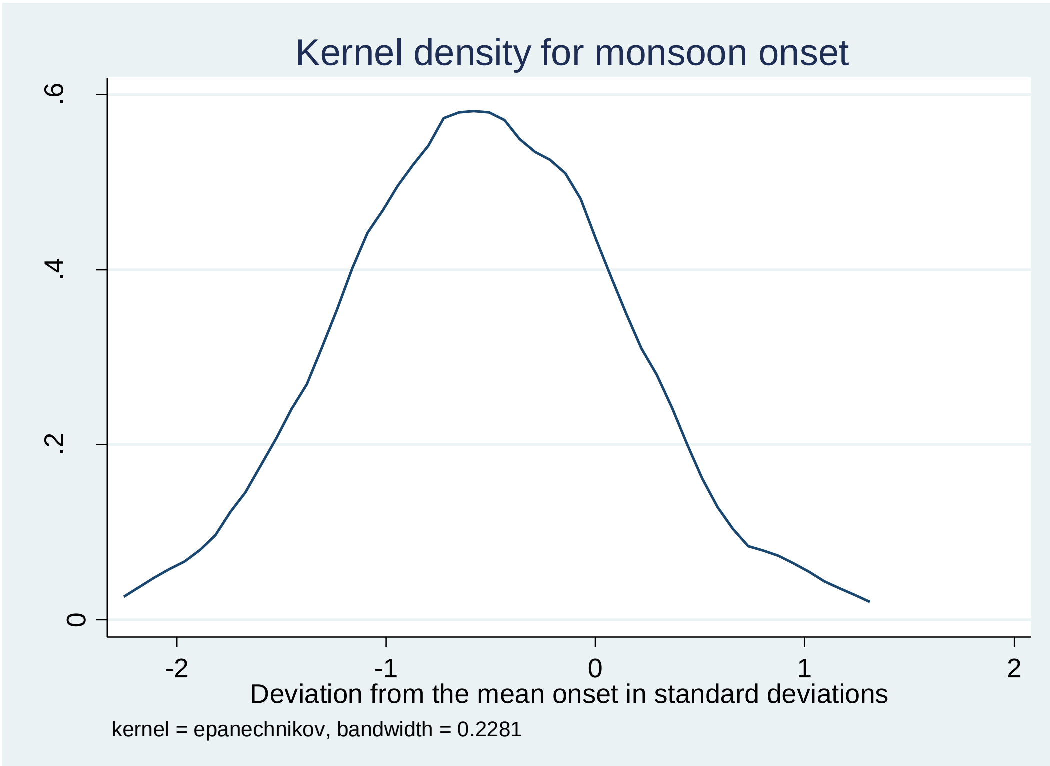
Of those children who are not attending school in 2000, approximately 38 per cent reported to have worked in the past month. The figure is smaller for children who are attending school, approximately 14 per cent. Further, 27 per cent of children who worked in the past month are not attending school and accordingly 73 per cent are attending school (see table 5).

Table 5. Working and attending school, children aged 10-14 years, IFLS3.

Working	Attending school		
	No	Yes	Total
No	174	1,680	1,854
Yes	105 (37.6% of not attending)	277 (14.2% of attending)	382
Observations	279	1,957	2,236

Regarding monsoon onset, none of the years prior to the IFLS years (i.e. 1992, 1996 and 1999) experienced a strong *El Niño* event to an extent that monsoon onset could be delayed as much as nearly four standard deviations (up to three months). Notwithstanding this, monsoon onset shows meaningful variation for the proposed analysis (see figure 3).

Figure 3. Density of the monsoon onset prior to the IFLS years.



4 Empirical approach

I now discuss the specifications that I use to study the effect of weather shocks and risk and other conventional variables, such as parental education and household wealth, on school attendance and child labour. There are several aspects that need to be taken into account when choosing the specification. These include pooled vs. panel regression model, non-linear effect of monsoon onset, treatment of standard errors and the endogeneity of the per capita expenditure, a proxy for permanent income.

The empirical approach aims to exploit the information on whether a child is currently attending school or has worked in the past month or past 12 months.[19] The probit model is the most common method in the literature to estimate demand for schooling/child labour in this

[19] Therefore the specifications in this study do not capture the intensity of schooling/working but only the extensive margins.

context. Another option is a linear probability model (LPM), i.e. ordinary least square regression. In the following I discuss the relative merits of these models for the purposes of this study.

First, a reason to prefer the probit model over the LPM is that the estimated probability lies between [0,1]. On the other hand LPM better enables the implementation of instrumental variable regression (IV-regression), which is needed to address the possible endogeneity of the household expenditure measure. Instrumenting the expenditure also enables me to reduce the potential measurement error related to the expenditure measure (see, for example, Al-Samarrai and Reilly, 2000). LPM also enables the use of fixed effects, which is part of the future research.

Finding suitable instruments for per capita expenditure is not straightforward, however.[20] A common method in the literature is to use household asset measures as instruments for household expenditure. Assets are correlated with household expenditure and therefore fulfil the criterion of relevance. However, the criterion of validity, requiring instruments to be uncorrelated with the error term, is more difficult to assess. Valid instruments start a unique causal chain; i.e. create exogenous variation in the endogenous variable that in turn changes the outcome variable. Instruments should not be directly correlated with the outcome variable, only though the endogenous variable (see, for example, Murray, 2006). Therefore the validity of the asset as an instrument could be questioned.[21] Even though assets are clearly correlated with household expenditure it could be argued that higher household expenditure enables higher assets and not vice versa. This is could be the case particularly with durable assets and housing conditions. However, the market for land is relatively narrow in rural Indonesia and the legal and institutional framework is very complex (World Bank, 1994). Therefore, I argue that the value of land is a suitable instrument for per capita expenditure.[22] An IV estimate captures the causal effect for those households whose behaviour (per capita expenditure in this case) can be manipulated by the instrument (real value of land). The effect is generally known as a local average treatment effect (LATE). The households in this group are called compliers (see, for

[20] It is notable that lagged monsoon onset does not have sufficient power as an instrument for household expenditure.
[21] Sargan test can be used to assess the validity of the instruments when the number of instruments exceeds the number of endogenous variables. However, Sargan test relies on the assumption that at least of the instruments is valid (see Murray 2006).
[22] IFLS data provide information on the value of land, judged by the household itself and not on the amount of land.

example, Angrist and Krueger, 2001). It is notable that the LATE is not informative on those households whose per capita consumption is not affected by their land holdings.

However, the linear probability model is likely to overestimate the impact of delayed monsoon onset in the pooled child labour specification. Only approximately 5 per cent of the children aged 10-14 years were reported to have worked implying that very few children engaged in labour experienced delayed monsoon onset and therefore the IV-regression in the linear probability framework may overstate the effect (see section 6.2 for further discussion). Therefore, my main specification is a pooled probit model where the share of food in the budget proxies per capita expenditure.[23] As a robustness check, I also present an IV regression in the linear probability model where the per capita expenditure is instrumented by the real value of land the household owns.[24] Endogeneity of household expenditure is ultimately not testable. However, Stata reports an endogeneity test for the IV estimation which can give some indication about the endogeneity.[25] In the current application the test statistic suggests that household expenditure is endogenous in the pooled school attendance model but exogenous in the child labour specifications.[26] This finding is not in line with my prior expectations and therefore the IV estimation is used mainly as a robustness check, and the share of food proxies wealth in my main specifications.

Another important issue is to allow a non-linear relationship between the outcomes of interest and the timing of monsoon onset. Findings of chapter two of this thesis suggest that monsoon onset has a non-linear impact on household per capita expenditure and farm profits. As in chapter two I use the linear spline function (see, for example, Gujarati, 2003) in this study. Linear splines replace the onset variable by a set of piece-wise linear segments allowing monsoon onset to exert differential effects on school attendance and child labour at different locations of the monsoon onset distribution, determined by the threshold values, knots. The key empirical issue here relates to the choice of the knots; more specifically, the location and the

[23] Correlation between share of food in the budget and per capita expenditure is -0.185, and it is statistically significant at the 1 per cent level.
[24] Per capita expenditure excludes education expenditure because household expenditure on education is used to construct the community average cost of schooling.
[25] With clustered standard errors the test is equal to inclusion of the residuals of the first stage to the model as additional regressors. If the coefficient of the residuals in this augmented regression is statistically significant then the endogenous variable is considered as endogenous.
[26] Similar results on the endogeneity are obtained using the IVPROBIT model. Importantly, IVPROBIT confirms the main results of this study.

number of knots. In this study the choice is made by experimentation and the best fit is obtained using three splines.[27, 28]

In the following equations O_{ijt-1} stands for monsoon onset and indicates the timing of monsoon onset (in standard deviations compared to the historical mean) for individual i living in province j at the nearest weather station previous year to the survey. For example, if we assume three linear splines, the form is expressed as follows:

$$f(O_i) = \phi_1 spline_1 + \phi_2 spline_2 + \phi_3 spline_3 , \qquad (1)$$

Where below the first threshold value O^{*}_{t-1}, $O_{ijt-1} \leq O^{*}_{t-1}$:

$$spline_1 = O_{ijt-1}$$
$$spline_2 = 0$$
$$spline_3 = 0.$$

Between the two threshold values O^{*}_{t-1} and O^{**}_{t-1}, $O^{*}_{t-1} < O_{ijt-1} < O^{**}_{t-1}$:

$$spline_1 = O^{*}_{t-1}$$
$$spline_2 = O_{ijt-1} - O^{*}_{t-1}$$
$$spline_3 = 0.$$

And above the second threshold value, O^{**}_{t-1}, $O_{ijt-1} \geq O^{**}_{t-1}$:

[27] The use of splines allows the early onset to exert a different (in absolute terms) effect compared to late onset. This might be of interest especially in the child labour specification because the coefficients of the first and third splines are evidence of the relative strengths of the underlying income and substitution effects.

[28] In chapter two of this thesis I use two lags of monsoon onset. However, the second lag proved to be unnecessary in the current application. I checked that the results presented in this chapter are robust to including the second lag but because the estimates of the second lag are close to zero and statistically insignificant I dropped the variable.

$$spline_1 = O^{*}_{t-1}$$
$$spline_2 = O^{**}_{t-1} - O^{*}_{t-1}$$
$$spline_3 = O_{ijt-1} - O^{**}_{t-1}.$$

In the equations above O^{*} and O^{**} are threshold values, knots, determined in advance. The final specifications have two knots and they are located at -0.5 and 0.5 standard deviations. The estimated effect for ϕ_1 provides the average effect, *ceteris paribus*, of monsoon onset on attendance/child labour if the onset falls within the first linear segment, i.e. if monsoon onset is less than the value $O*$. Respectively, the estimated effect for ϕ_2 provides the average effect for a monsoon onset that falls between the two knots and, finally, the estimated effect for ϕ_3 provides the average effect for an onset that falls within the third segment, i.e. an onset greater than the value $O**$.

My main specification could be expressed as follows:

$$PR(S_{ijt} / L_{ijt} = 1) = \alpha + \phi_1 spline_{1,t-1} + \phi_2 spline_{2,t-1} + \phi_3 spline_{3,t-1} + X'_{ijt}\beta_1 + \gamma_j + T_t + \varepsilon_{ijt}, \quad (2)$$

where S_{ijt} is a binary variable, taking the value one if the child i, living in province j is enrolled in school in year t and L_{ijt} is a binary variable taking value of one if child has worked in the past 12 months either for wages or as a family worker. X'_{ijt} is a vector of individual and household characteristics, including age and age squared of the child, gender of the child, parental education, dummies for maternal and paternal orphans, religion, gender and age of the head of the household, share of food in the budget as a proxy for permanent income, community average travel time to school, community average cost of schooling[29] and household demographic structure defined as number of below school age children, number of school age

[29] I constructed household average cost of schooling (tuition fees and other costs, including supplies, uniforms, registration fees) per household member attending school and then calculated the community average of this cost measure.

children, number of adults and number of old people in the household. Also dummies indicating households' farm ownership or engagement in non-farm business are included in the characteristics. γ_j is a vector of province dummies and T_t is a vector of year dummies. ε_{ijt} is a stochastic error term, which is robust to heteroscedasticity and clustered on rain stations.[30]

Wave three in the year 2000 has more detailed and accurate information on child labour. To take advantage of this information I estimate a probit specification for the year 2000 where the monsoon onset variable appears in linear form because linear splines may overestimate the effect of delayed onset due to the decrease in sample size.[31] The estimated equation is:

$$PR(L2_{ij}=1)=\alpha+\delta_1 O_{ijt-1}+X'_{ij}\beta_3+\gamma_j+\varepsilon_{ij}, \qquad (3)$$

where $L2_{ij}$ is a binary variable, taking the value of one if the child worked for wages or as a family worker during the past month. O_{ijt-1} stands for standardized monsoon onset in the previous year, X_{ij} is a vector of individual and household characteristics as described earlier.

Primary school participation is almost uniform in Indonesia. However, drop-outs appear to be a major problem in later stages. In this context delayed monsoon onset might have a more significant role to play during the transition year from primary to secondary school. To test this hypothesis I estimate the following specification for children aged 6-19 years who have completed primary school:

$$PR(S_{ijt}=1)=\delta_2 OT_{ij}+X'_{ijt}\beta_5+\gamma_j+\lambda_{bc}+T_t+\varepsilon_{ijt}, \qquad (4)$$

[30] Climate shock might also suffer from spatial autocorrelation, that is, shocks in two regions are likely to be correlated if the regions are in close proximity. However, no attempt is made to correct the standard errors for spatial autocorrelation in this study.

[31] When placing the knots at -0.5 and 0.5 standard deviations delayed monsoon onset increases the probability of child aged 10-14 years working by over 40 percentage points in the IV regression and over 30 percentage points in the pooled probit model.

where S_{ijt} is a binary variable, taking the value of one if the child is attending school at the time of the survey. In this specification, OT_{ij} is the standardized monsoon onset, in linear form, in the transition year, i.e. in the year when the child was supposed to transfer from primary to secondary school and λ_{bc} represents birth cohort fixed effects. In Indonesia children normally start school at the age of six, implying that children who are born in August-December start school in the year they turn to seven. Using this information I construct the year each birth cohort started primary school. I further assume that the transition year is six years after starting the primary school.[32] It is notable that in this case the timing of the IFLS surveys does not restrict the analysis and therefore we can use the monsoon onset in the transition year instead of the first lag.

Finally, I study whether the riskiness of the weather affects parents' decision to send their children to school. The riskiness of weather is measured as the coefficient of variation of monsoon onset (see for example Rose, 2001).[33] By definition, the coefficient of variation is time-invariant. Therefore, in my view, the most relevant research question is whether the child has ever attended school. The estimated equation is:

$$PR(SE_{ijt} = 1) = \alpha + \theta_1 COEF + X'_{ijt}\beta_7 + \gamma_j + T_t + \varepsilon_{ijt}, \tag{5}$$

where the variable SE indicates whether the child has ever attended school and the variable COEF is the coefficient of variation of monsoon onset.

The empirical approach is based on the assumption that monsoon onset, as any rainfall variable, is exogenous. Therefore we can interpret the changes in schooling and child labour as causal effects due to the timing of monsoon onset, and any omitted variables of the model should not bias the estimate of monsoon onset. Several previous studies have assumed that rainfall is exogenous with respect to household behaviour (see, for example, Paxon, 1992; Rose, 2001;

[32] IFLS survey also includes a question on the year/age child completed primary school. Because of the high proportion of missing values in this question (approximately 50 percent) I decided to construct the transition year assuming that it occurred six years after the starting of the primary school. Because of the class repetition this measure is undoubtedly measured with error to some extent.

[33] Coefficient of variation is the standard deviation over the mean.

Munshi, 2003; Newhouse. 2005; Jayachandran, 2006; the literature is surveyed in Rosenzweig and Wolpin, 2000). However, some caution should be exercised. In the past decade the *El Niño* phenomenon has been extensively modelled and relatively accurate predictions about the occurrence of *El Niño/La Niña* are available. As a result, it could be argued that monsoon onset cannot be treated as purely exogenous. Put differently, rainfall itself is exogenous but forecasts alter farmers' behaviour. However, I argue that this is unlikely a problem in the current application. Firstly, even if strong *El Niño/La Niña* years are possible to predict, at least to some extent, my data does not cover these 'big' events and there remains local variation in the timing of the monsoon that is not covered in the national aggregate forecasts. Moreover, the systematic dissemination of the available information and forecasts to rural areas started only as a pilot project in 2005.[34] Therefore, as far as I could judge, these farmers did not possess accurate forecasts on monsoon onset.[35]

In the rest of the study I focus on the effects of early and late onset. I define early onset as a monsoon onset that arrives one standard deviation before the historical mean, and late onset as a monsoon onset that arrives one standard deviation after the historical mean. The multiplication of the coefficient of the first linear spline/coefficient of linear monsoon onset by the negative one gives us the effect of the early onset and correspondingly, the multiplication of the coefficient of the third linear spline/coefficient of linear monsoon onset by one gives the effect of the delayed onset.

5 Empirical results schooling

5.1 The effect of weather shocks on school attendance

Equation (1) is estimated for children aged 6-16 years, who have not yet completed the compulsory education. I also divide sample into young children aged 6-10 years and older children aged 11-16 years in order to examine whether the impact of timing of monsoon onset on

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[34] Information has been disseminated via Climate Change Field Schools organized for farmers. For further information see: http://www.agrometeorology.org/topics/accounts-of-operational-agrometeorology/climate-field-schools-in-indonesia-coping-with-climate-change-and-beyond. Accessed 10th October 2009.

[35] Field study surveyed in the main rice production kabupatens in West and East Java in late 2000s decade indicated that formal climatic data were used in the timing of the farming activities (Natawidjaja et al., 2009).

school attendance is constant across the age groups. The division of the analysis into two age groups is supported by the finding that younger children were at a disadvantageous position to elder children in terms of school attendance during the economic crisis in late 1990s. Thomas et al. (2004) argue that given the higher rates of return to secondary education in Indonesia, protecting the education of elder children is a prudent choice in resource-scarce households. Accordingly, the authors' results suggest that older children, males aged 16-19 years and females aged 14-19 years were more likely to be enrolled in school in 1998 relative to 1997.

5.1.1 All children aged 6-16 years

Estimates for rural children aged 6-16 years are presented in table B1 in Appendix B, for a brief summary see table 6. As robustness check I also present results from the IV regression in the linear probability model where the per capita expenditure has been instrumented with the real value of household's land.

Overall, variation in monsoon onset does not have a significant impact for school attendance. For all children aged 6-16, monsoon onset arriving 0.5 standard deviation early has no impact on the probability of a child attending school. The impact of monsoon onset on school attendance is increasing in the interval between -0.5 and 0.5 standard deviations, but the estimated effect does not gain statistical significance. Monsoon onset arriving 0.5 standard deviations or later compared to the historical average has a decreasing impact on school attendance, but the effect is again not statistically significant at the conventional levels.[36] Separate regressions for boys and girls do not change this overall finding (results not reported here).

As expected, the probability of attending primary school is increasing with age but at a decreasing rate: according to the estimates for age and age squared the turning point is 10.34 years. The estimated turning point could be an indicator of both delayed enrolment and the problem of drop-outs. The marginal effects for the gender of the child and the gender of the household head are not well determined. Children living in Christian households are 5.4 percentage points more likely to attend school compared to children living in Muslim households, but the effect is only marginally significant at the 10% level.

[36] The coefficient for monsoon onset in linear form is close to zero and statistically insignificant at the conventional levels.

In line with previous studies parental education is an important determinant of children's education (see, for example, Lavy, 1996; Al-Samarrai and Reilly, 2000)[37]. For instance, if the mother has some primary education or has completed primary education, this increases the probability of a child attending school by 4.9 or 9.4 percentage points respectively, compared to children whose mother has no formal education. Children whose father have completed primary education or some secondary education are 5.2 or 7.1 percentage points more likely to be attending school compared to ones whose father has no formal education. However, it is notable that the highest categories of parental education are not well determined in the IV specification even though they are highly significant in the pooled probit regression.[38] One possible explanation is that the fitted values of per capita expenditure absorb the effect of high parental education. The important role of parents in children's education is also captured by the orphans in the sample. Children who have lost their mother or father are 3.7 or 5.9 percentage points less likely to attend school compared to children whose parents are still alive.

The marginal effect of the share of food in the budget, a proxy for household wealth in the pooled probit regression, indicates that one percentage point increase in the share of food in the budget decreases the probability of attending school by 0.00271 of a percentage point. The estimated elasticity is -0.212.[39] As anticipated, the distance to school is an important determinant of school attendance in rural Indonesia. Increasing the distance to school (measured as one-way travelling time) by 10 minutes decreases the probability of attending school by 0.02 of a percentage point. The corresponding elasticity, -0.04, is very low, though. The estimates for the standard demand variable, logged household per capita expenditure is explored as follows. The IV regression suggest that a 10% increase in per capita expenditure increases the probability of attending school by 3.35 percentage points, and the corresponding elasticity is 0.42, which is reasonable.[40,41]

Generally the estimates from the pooled probit are rather consistent with the IV specification. However, there are some notable differences. Firstly, as already discussed earlier, per capita

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[37] In this specification only the marginal effect for father having some primary education is not statistically significant at the conventional levels.

[38] In the LPM the marginal effects of parental education are similar to the pooled probit model.

[39] The elasticity is computed using the formula: marginal effect*(mean share of food/sample proportion).

[40] The elasticity is computed using the formula: marginal effect/sample proportion.

[41] On estimations of income/expenditure elasticities on education in developing countries, see for example Behrman and Knowles (1999).

expenditure is likely absorbing the effect of parental education reducing the magnitude and/or statistical significance of the effects of parental education in the IV specification.

Second, the effects of household demographic characteristics differ. The effect of the number of children below school age is negative and statistically significant in the pooled probit model but positive and statistically significant in the IV-regression. The effect in the IV regression seems rather counterintuitive given that young children need care which commonly is the task of the siblings. The marginal effect of the number of school age children in the family is negative and statistically significant in my main specification but positive in the IV model. The result from the pooled probit suggests that there is some evidence that parents are trading ´quality´ for ´quantity´ (see for example Montgomery et al. 1995). The marginal effects of number of adults and number of old persons in the households are positive in both specifications, but statistically significant only in the IV-specification. This finding suggests that children and adults do not compete for the same resources. Finally, the marginal effect for children living in households that own a non-farm business is only statistically significant in the IV-specification: these children are 7.0 percentage points less likely to attend school compared to children in households not owning a non-farm business.

5.1.2 Young children aged 6-10 years

Estimation results for young children aged 6-10 years are presented in table B2, columns 1 and 2, and they look fairly similar to those of all children. The timing of monsoon onset does not have a significant impact of the school attendance of young children. Monsoon onset arriving earlier than 0.5 standard deviation compared to the historical mean has virtually zero effect, whereas monsoon onset arriving later than 0.5 standard deviations decreases the probability of attending school. The estimated effect of monsoon arriving one standard deviation late is -4.5 percentage points but again, the effect does not gain statistical significance at the conventional levels.

Among young children, girls are more likely to attend school. The estimated impact effect indicates that girls are 1.6 percentage points more likely to attend school than boys. Travel time to school is an important factor determining young children's attendance but the estimated effect is of the same magnitude as for all children. Younger children's attendance is increasing with parental education but there seems to be no notable difference between mother's and father's education. The estimated marginal effects of the share of food in the budget, -0.087, and per capita expenditure, 0.191, are also smaller for young children compared to -0.271 and 0.326 for all rural children. Both the number of below school age children and school age children in the family exert a negative impact on younger children's school attendance.

5.1.3 Older children aged 11-16 years

The estimation results for children aged 11-16 years are presented in table B2, columns 3 and 4. Estimation results show that the lagged monsoon onset has a stronger impact on older children. The second spline is positive and marginally statistically significant at the 10% level, implying that between the interval of -0.5 and 0 standard deviations, attendance of older children is decreasing and increasing between 0 and 0.5 standard deviations.[42] The coefficient of the third spline is negative but not statistically significant at the conventional levels.

Generally the impact effects for maternal education are positive and also higher than for all children.[43] For example, mother having some primary or completed primary increases the probability of attending school for older children by 6.0 or 14.4 percentage points, compared to 4.9 or 9.4 for all rural children, respectively. Also the impact effects of parental education for completed primary education and above are large and significant. However, impact effects for paternal education are not well determined in the IV specification, likely undermined by the expenditure absorbing some of the effects as explained earlier. The estimate for maternal and paternal orphans are marginally statistically significant, impact effects being -0.051 and -0.064, respectively. The number of school age children exerts a negative impact and the number of adults and old people in the household exert a positive impact on school attendance for older children. Older children living in Christian households are 10.6 percentage points more likely to attend school compared to Muslim households and the impact effect is statistically significant at the 1% level. Furthermore, the marginal effect of the share of food in the budget and per capita expenditure are high and also highly statistically significant: a one percentage point decrease in the share of food in the budget increases the probability of attending by 0.0045 of a percentage

[42] The significance of the second spline might indicate that monsoon onset in linear form could fit the data better. The estimate of the pooled probit with monsoon onset in linear form suggests that one standard deviation delay in monsoon onset increases the school attendance of the older children by 2.6% and it is statistically significant at the 5% level. However, the estimate of the linear monsoon onset is not statistically significant in the IV-model. Together this gives weak evidence that parents may protect the education of their older children when facing delayed onset, similar to the finding of the education outcomes during the financial crisis (Thomas et al., 2004).

[43] Somewhat surprisingly the impact effect for mother having university education is negative and statistically significant in the IV specification. However, only 110 mothers of children above 10 years have university education.

point, and correspondingly, a 10% increase in the per capita expenditure increases the probability of attending school by 5.24 percentage points.

5.2 Transition from primary to secondary school

In the earlier sections I have provided evidence that monsoon onset plays limited role in the participation in compulsory education in rural Indonesia. However, monsoon onset could have a larger effect during the years when children are more vulnerable to drop out. The transition from primary to secondary school has been identified as a crucial turning point in school progress in Indonesia (see, for example, World Bank, 2006b, p. 69). To test this hypothesis, I estimate equation (4) for children aged 6-19 years who have completed primary education, the results are presented in table 6 (for further details, see table B3 in the Appendix B, columns 1, 2 and 3). I assume that the transition year is six years after starting the primary school.

I find that monsoon onset in the transition year indeed has a decreasing impact on school attendance in the following years and the estimated effect is statistically significant at the 1% level. Monsoon onset arriving one standard deviation late in the transition year reduces the school attendance in the following years by 2.8 percentage points, and respectively, monsoon onset arriving one standard deviation early increases the school attendance by 2.8 percentage points.[44] The result is robust to the IV regression, although in the IV specification the effect is slightly smaller (-2.1 percentage points) but also statistically significant at the 1% level. The result is also robust to inclusion of children aged 6-16 years only and fitting a spline function rather than monsoon onset in linear form.[45]

Other variables determining the continuation from primary to secondary education are wealth (permanent income, proxied by the share of food in the budget), parental education, and gender, among others. Girls are 7.7 percentage points less likely to attend school after primary education compared to boys. Controversially, the community cost of schooling exerts a positive impact on

[44] I have included observations regardless of whether they are present in more than one wave after the transition year. For example, persons who transferred to secondary school in 1992 might be present both in 1993 and 1997 waves. This enables capturing the lasting effects of the monsoon onset in transition year, i.e. I am able to control whether they return to school later even if dropping from school for some period of time. However, this does not change the results. After eliminating the duplicate observations the number of observations decreases from 6786 to 4810 children but the estimated effect is the same and statistically significant at the 1% level.

[45] For the children aged 6-16 years the estimated effect is -0.026 and it is statistically significant at the 1% level. When using the splines the estimated effect for the early onset is 0.064 (statistically significant at the 5%) and the estimated effect for the delayed onset is -0.031 (statistically significant at the 10% level).

continuation from primary to secondary. However, as the cost measure is constructed by using the community average household expenditure on education, the measure likely captures also wealth of the community, as the coefficient is not statistically significant in the IV specification.

The results presented above are grounded on the assumption that the birth cohort correctly represents the school starting age. However, due to delayed enrolments the school starting age, and therefore the transition year is likely to be, at least to some extent, measured with error. As an additional robustness check I re-estimate equation (4) using information on school starting year based on parents' recall on the age/year their children started primary school.[46,47] Generally I consider the variable representing children's age more reliable than parents' recall on the year their children started school, and therefore the birth cohort approach is my main specification.[48] Again, I assume that transition year follows six years after the year children started primary school. The results are presented in table B3 in the Appendix, columns 4, 5 and 6.

Monsoon onset arriving one standard deviation late compared to the historical average in the transition year reduces the probability of attending school in the following years by 1.9 percentage points, and the estimated effect is statistically significant at the 1% level. The effect is slightly smaller in the IV specification, -1.0 percentage points, and marginally statistically significant at the 10% level. Together these results suggest that timing of monsoon onset, which is a crucial factor in rice planting and production, play an important role determining children's continuation from primary to secondary school.

5.3 The impact of weather risk on school entry

In this section I present results derived from equation (5). The dependent variable is a dummy variable indicating whether a child has ever attended school. The main independent variable is the coefficient of variation of monsoon onset, representing the riskiness of the environment. The estimation results are presented in table B4 in the Appendix.

The estimation results suggest that the riskiness of the weather does not play a significant role in determining entry of all children age 6-16. However, risk is an important factor affecting entry

[46] Persons aged 15 and above personally answered this question.
[47] In this specification I do not control for birth cohort fixed effects.
[48] The birth cohort approach is also robust to age group of 6-16 years and fitting the splines instead of the monsoon onset in linear form.

into school for young children aged 6-10 years. A 10% increase in the coefficient of variation decreases the probability of a child entering school by 0.3 of a percentage point, ceteris paribus.[49] This is an important finding as delayed enrolment could adversely affect the education attainment or deter the entry completely. Accordingly, Fitzsimons (2007) find that village risk inversely affected years of schooling in rural Indonesia.

Other important factors determining entry into school are wealth measures, parental education, ownership of non-farm business, and gender; factors that decrease the probability of entering include distance to school, number of below school age and number of school age children in the household.

5.4 Discussion

In Indonesia, the transition year from primary to secondary school particularly has been identified as an important year affecting future education outcomes. The findings of this study suggest that timing of monsoon onset is a major factor determining children's continuation from primary to secondary school. I construct the variable indicating monsoon onset in the transition year and find that delayed monsoon onset in this particular year reduces the probability of attending school in the following years by 2.8 percentage points. The size of the effect is notable and it is robust to various specifications.

The object of this paper is also to examine the relative importance of weather risk, measured as the coefficient of variation of monsoon onset in school progress. The results suggest that parents delay the entry into school of young children in riskier environments. Therefore, to conclude, both ex post weather shock, i.e. delayed monsoon onset during the transition year and ex ante weather risk, play an important role in education outcomes in rural Indonesia. In other respects, monsoon onset in previous year has little impact on compulsory school attendance for all rural children. However, it is notable that I am only measuring school attendance, while monsoon onset could also affect the intensity children are attending school (hours spent in school, among others) and education attainment. Moreover, there seems to be some notable differences between the factors determining the school attendance for young and old children.

[49] The result is obtained using the formula: 0.1*mean coefficient of variation*marginal effect, the mean coefficient of variation being 0.322.

Family characteristics, such as share of food in the budget as a proxy for wealth, parental educational attainment and religion have stronger impact on older children than for younger ones. This evidence suggests that enrolment in primary school is almost universal in Indonesia, but drop-outs are a serious problem at later stages. Weather shocks, as well as family resources and characteristics, play an important role in the continuation and completion of schooling in rural Indonesia.

6 Empirical results on child labour

To study the effect of monsoon onset on child labour I first estimate equation (3) with a single cross section data using information only from the year 2000. As explained earlier in section 3, there are two sources of information on child labour in the IFLS data, and I will start with the definition that is most consistent and least problematic. Wave three in 2000 has a separate section on child's work history in the child book, including children aged 6-14 years. The section contains separate questions on whether child worked for wages or in family business in the past month. The respondent of the child file is the carer of the child or the child her/himself, who are likely have the best information about the work engagement. I estimate a probit model where the share of food in the budget proxies household wealth. As a robustness check, I also present results from an IV specification in the linear probability framework.

In addition, I present a pooled probit specification for all years 1993, 1997 and 2000 where the dependent variable is a dummy variable indicating whether child worked (the variable is meant to cover both the work for wages and the work in the family business) in the past 12 months. The variable is defined for children aged 10-14 years. Unfortunately, this variable has a large share (16.7%) of missing values in 1993. Therefore, I also present results restricting the sample to years 1997 and 2000 only.

6.1 Monsoon onset, work in family business and wage work

Table B5 in the Appendix presents estimation results for the cross section specification, using only information provided in wave three (summary of the main results are presented in table 6 below). Table B5 presents marginal and impact effects from pooled probit specification, LPM and IV specification for all children aged 6-14 years, and old children aged 10-14 years. Linear splines do not fit the data well and might overestimate the effect of delayed onset.[50] Therefore, I use monsoon in the linear form and focus on specifications for all children and old children aged 10-14 years. Only 2% of children below 10 years reported to have worked in the past month which constrains a meaningful estimation for this age group. The corresponding figure for children aged 10-14 years is 17 per cent. Working on family farm or family business is much more common compared to wage work: almost 14 per cent of the children aged 10-14 years reported to have worked in the family business in the past month, compared to 4 per cent for wage work.

For children aged 10-14 years, a one standard deviation delay in monsoon onset increases the probability of a child working by 5.8 percentage points. The finding is statistically significant at the 5% level, and the estimate is similar in the IV specification. This finding suggests that monsoon onset arriving later than historical average is associated with increased child labour. Delayed onset could cause crop loss due to reduced area harvested and which, in turn, could increase the price of rice. In chapter two of this thesis I find that one standard deviation delay in monsoon onset increases the local market price of rice by 6.2 per cent. Increased child labour may have an economic underpinning both in the event of either crop loss or an increase in rice prices, depending, for example, on the net producer status of the household.

Interestingly, the share of food in the budget as well as the per capita expenditure in the IV specification are statistically insignificant, suggesting that child labour in rural Indonesia might not be a result of poverty. This finding contrasts the findings in previous studies (see for example Manning, 2000 and Priyambada et al., 2005).

In respect to parental education, higher parental education is associated with smaller probabilities of child labour. For example, mother or father having some or completed senior high school decreases the probability of a child working by 7.4 or 6.6 percentage points, respectively. As anticipated, the ownership of a farm and non-farm business is an important determinant of children's engagement in work. The fact of the household having farm business

[50] Restricting the sample to the year 2000 only significantly reduces the number of observations (the number of children aged 10-14 is reduced from 6321 to 2240). For example, in the probit model for children aged 10-14 years the estimate for the third spline, i.e. delayed monsoon onset is 0.336

or non-farm business increases the probability of child labour by 6.4 or 8.0 percentage points, respectively.

Further disaggregation reveals that both family work and wage work are increased by delayed onset, but the increase in wage work is slightly better determined (see table B6). One standard deviation delay in monsoon onset increases the probability of a child working on family business by 3.6 percentage points and for wages by 3.2 percentage points. It is notable that neither the share of food in the budget nor the per capita expenditure has a statistically significant effect; this holds both with the wage and family work specifications. As expected, the ownership of farm and non-farm business only increases the probability of a child engaging in family work. Children living in female headed households are more likely to engage in wage work but this relationship does not hold for work on family business.[51] An interaction term between gender and lagged monsoon does not gain statistical significance implying that there are no gender differences in labour supply when children are exposed to delayed onset (see table B7).

Finally, I do not find any evidence that riskiness of weather, measured as the coefficient of variation of monsoon onset, would affect the probability of a child working (results not reported here).

6.2 Monsoon onset and child labour, pooled model

Estimation results for pooled cross section for years 1993, 1997 and 2000 are presented in table B8, in columns 1, 2 and 3. Estimation results confirm the earlier finding that delayed monsoon onset increases the probability of a child working; specifically, monsoon onset arriving one standard deviation late increases the probability of child labour by 9.5 percentage points.[52] The estimated effect is higher (0.186) in the IV specification. However, a word of caution is appropriate. Only approximately 5 per cent of the children aged 10-14 years were reported to have worked implying that very few children engaged in labour experienced delayed monsoon

[51] Average per capita expenditure of female headed households is slightly smaller than of male-headed households.
[52] Placing the monsoon onset in linear form in the pooled probit specification suggest that delay in monsoon onset decreases child labour. However, the coefficient is close to zero (-0.005) and only marginally statistically significant. Further, the result is not robust to IV specification or excluding the year 1993.

onset and therefore the IV regression in the linear probability framework may overstate the effect to some extent.[53]

Interestingly, early onset also increases the probability of a child working, although by a much smaller rate: the marginal effect for the first spline is -0.005. However, it is worth re-emphasizing that monsoon onset in this segment takes only negative values and therefore the estimation result implies that monsoon onset arriving one standard deviation early compared to the historical mean increases the probability of a child working by 0.5 percentage points. Assuming that the early monsoon onset is associated with an increase in the rice harvest and household incomes, this result is consistent with a strong substitution effect.[54]

The marginal effect of the share of food in the budget is positive and statistically significant implying the children living in poor households are more likely to work. However, the estimate of the per capita expenditure in the IV regression is not statistically significant. The share of food in the budget is likely an imperfect proxy for income and therefore I cannot conclude that children living in poorer households are more likely to engage in child labour in the pooled model.

Parental education has a negative impact on the probability of a child working, as expected, and the estimated effects are highly significant. Only the highest categories lack statistical significance, likely due to the small number of mothers/fathers who have completed higher degrees. Reflecting the findings in the schooling specification, the fitted value of per capita expenditure is likely to absorb the effect of high parental education in the IV specification. The variables for distance to school and community average schooling costs do not have explanatory power in the demand for child labour.

In the pooled model for 1993-2000 the dummies indicating the ownership of farm and non-farm business are not well determined, confirming the argument that the work variable in the pooled model does not capture work on family business adequately.

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[53] The coefficient of the third spline in the standard OLS regression is 0.173. Therefore the higher IV-estimate compared to the pooled probit is likely due to the linear probability model than to the IV regression per se.

[54] This assumption is not entirely plausible, however, as I did not find robust evidence for the positive effect of early onset on farm profits and household expenditure (see Korkeala et al. 2009).

Estimation results for pooled cross section for years 1997 and 2000 are presented in table B8 in the Appendix in columns 4, 5 and 6. Restricting the sample to the years 1997 and 2000 only reduces the statistical significance of the first spline, while the third spline remains highly significant. The estimate for the third spline suggest that monsoon onset arriving one standard deviation late increases the probability of a child working by 11.6 percentage points. Again, the estimate for the third spline is much higher in the IV specification (0.267). Nevertheless, the estimation results enable us to conclude that delayed monsoon onset is associated with an increase in child labour.

Table 6. Summary results for early and delayed monsoon onset on school attendance and child labour.

	School attendance, children aged 6-16 years	School attendance, monsoon onset in the transition year	Child Labour in 2000, children aged 10-14 years	Child Labour in 1993-2000, children aged 10-14 years
Early monsoon onset	-0.003	0.028***	-0.058**	0.005*
Delayed monsoon onset	-0.063	-0.028***	0.058***	0.095***

Notes: Early monsoon onset refers to an onset that arrived one standard deviation earlier than historical average, and delayed monsoons onset to a one standard deviation delay.

6.3 Discussion

The analysis presented above suggests that delayed monsoon onset increases the incidence of child labour. This is confirmed using both the more detailed information on child labour in wave 2000 and in the pooled cross section. The data for 2000 reveals that both work on the family business as well as wage work increases as a result of delayed onset. Further, the results cast doubt whether child labour is a result of poverty as the estimates on share of food in the budget and per capita expenditures in the IV specifications fail to gain statistical significance in the specification using data on the year 2000. In the pooled probit model for 1993-2000 and 1997-2000, the estimate on the share of food in the budget suggests that children living in poorer households are more likely to work but this cannot be taken as robust evidence because the share of food is likely an imperfect proxy for income: the estimate on per capita expenditure in the pooled IV specification is statistically insignificant. The results using data on 2000 suggest that children living in households owning a non-farm business are more likely to work. It seems that these households are wealthier than average households which could, at least partly, explain the result that households' wealth is not necessarily inversely related to child labour.[55]

7 Conclusion

The major thrust of this study was to document the effects of delayed monsoon onset on schooling and child labour in rural Indonesia, in an environment of incomplete insurance and capital markets. Previous studies have found that parents might withdraw children from school as a coping mechanism to an exogenous shock to household incomes. The prior assumption about the effect of monsoon onset on child labour is less clear cut. The conventional perception has been that negative income shocks increase child labour. However, recent studies have emphasised the positive relationship between economic upturns and child labour. In this context the key question is whether parents see the shock as a temporary one that could be exploited by increasing the labour supply of their children. Furthermore, this study has also examined the effect of risk on education outcomes.

I find that delayed onset is associated with an increase in child labour. The estimates using data on 2000 suggest that one standard deviation delay in onset increases the probability of a child working by 5.8 percentage points. Further disaggregation reveals that both family work and wage work are increased by delayed onset. The spline functions in the pooled cross section suggest that monsoon onset arriving one standard deviation late compared to historical average increases the probability of a child working by 9.5 percentage points in the course of the surveys. Finally, I do not find any gender differences in labour supply when studying children's exposure to delayed onset.

[55] Using the data for 2000 the interaction term between the indicator variable for non-farm business and share of food in the budget is negative and statistically significant at the 5% for all children aged 6-14 years implying that wealth is not inversely related to child labour in households that owns a non-farm business.

Previous studies have argued that children might be particularly vulnerable to drop-out from school in specific years. Accordingly, I study the effect monsoon onset in the transition year from primary to secondary school on the probability of attending school in the following years. Indeed, delayed monsoon onset coinciding with the transition year reduces the probability of attending by 2.8 percentage points. The estimated effect is notable and robust to various specifications. On that account, monsoon onset is one factor, among many, explaining drop-out and continuation from primary to secondary school.

In other respects, I find that monsoon onset in the previous year does not affect the compulsory school attendance of children aged 6-16 years. However, the riskiness of the environment, measured as the coefficient of variation of monsoon onset, plays a role in parents' decision to send their children to school. The findings of this study suggest that an increase in the weather-related risk reduces the probability of ever attending school for children aged 6-10 years. Thus, uncertainty about weather, and hence production, is associated with delayed enrolments in rural Indonesia. This finding may suffer from omitted variable problem. For example, due to data availability, I am not able to control for the quality of household's landholdings or access to irrigation. To the extent that the land quality is negatively correlated with riskiness of the weather, the estimate of the education response to weather risk is downward biased. Therefore, if anything, the results presented here underestimates the effect of weather risk. To conclude, both ex ante weather risk and ex post weather shock on a specific year adversely affect school progress and education outcomes in rural Indonesia.

One limitation of this study is that the reduced form specification does not allow me to examine the mechanisms through which late monsoon onset affects households and lead to an increase in child labour. Another limitation is the amount and quality of the rainfall data. Only 36 rain stations can be matched to the IFLS data and none of the years captured by the IFLS follow a strong *El Niño* year. Further, the measure of late onset is based on daily rainfall data, which is measured with a degree of error. Since measurement error in rainfall is independent of household characteristics, the true effect of delayed onset, both positive and negative, is greater than the estimates presented here.

Despite the aforementioned limitations, this study makes an important contribution to the understanding of the nature of child labour in rural Indonesia, and particularly its response to changes in agricultural conditions. The study has also identified two important factors that threaten school enrolment and progress in rural Indonesia: delayed monsoon onset in transition year and weather risk. An important policy conclusion that emerges is that better insurance policies and/or credit opportunities might help households to cope with the delay in the rainy season. Further, the study provides evidence suggesting that enhancing the weather forecasting systems and the distribution of weather-related information potentially help rural households to cope with weather shocks. Finally, further research on the intensity of schooling and education attainment is needed to complete the analysis on the impact of monsoon onset on education outcomes and to assess the interaction between child labour and schooling.

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Appendix A

Table A1. Variable descriptions.

Variable	Variable description
Attend	Indicator variable, 1 if child is attending school
Ever attend	Indicator variable, 1 if child has ever attended school
Work2	Indicator variable, 1 if child worked during past 12 months
Work3[c]	Indicator variable, 1 if child worked during past 4 weeks, only year 2000
Wage work	Indicator variable, 1 if child worked for wages during past 4 weeks, only year 2000
Family work	Indicator variable, 1 if child worked on family business during past 4 weeks, only year 2000
Spline1	Lagged monsoon onset < -0.5 standard deviations
Spline2	-0.5 < Lagged monsoon onset < 0.5 standard deviations
Spline3	Lagged monsoon onset > 0.5 standard deviations
Lagged monsoon onset	Monsoon onset previous year to the IFLS survey, in linear from (deviation from the mean)
Monsoon onset in transition year	Monsoon onset in transition year from primary to secondary (deviation from the mean)
Weather risk	The coefficient of variation of the monsoon onset
PCE	The log of household per capita expenditure, excluding the education expenditure
Value of land	Real value of household's land (in logs)
Share of food	Share of food in the household budget
Age	Age of the child
Age2	Age of the child squared

Variable	Variable description
Female	1 if child female
Head female	1 if household has female head
Religion of the head	Set of dummy variables, reference category is Muslim
Muslim[a]	1 if Muslim
Chrstian	1 if Christian
Hindu	1 if Hindu
Other religion	1 if other religion
Age of the head	Set of dummy variables, reference category
Head 15-24 years	1 if head below 25 years
Head 25-34	1 if head 25-34 years
Head 35-49	1 if head 35-49 years
Head 50-64	1 if head 50-64 years
Head 65+	1 if head over 65 years
Education of the mother	Set of dummy variables, reference category no education
Mother no education[a]	1 if no formal education
Mother some primary	1 if some primary
Mother primary	1 if completed primary
Mother some Jr	1 if some junior high school
Mother Jr high	1 if completed junior high school
Mother Sr high	1 if some or completed senior high school
Mother university	1 if some university education
Mother edu missing	1 if informal or education information missing
Education of the farther	Set of dummy variables, reference category no education
Father no education[a]	1 if no formal education
Father some primary	1 if some primary
Father primary	1 if completed primary
Father some Jr	1 if some junior high school

Variable	Variable description
Father Jr high	1 if completed junior high school
Father Sr high	1 if some or completed senior high school
Father university	1 if some university education
Father edu missing	1 if informal or education information missing
Maternal orphan	1 if mother has died
Paternal orphan	1 if father has died
Time	Community averaged travel time to school in minutes
Education cost	The log of community average cost of schooling
#Young	Number of children below 6 years in the household
#Schoolage	Number of children 6-16 years in the household
#Adult	Number of adults in the household
#Old	Number of old people in the household
HH farm	1 if household owns a farm business
HH nonfarm biz	1 if household owns a non-farm business
Province	Set of dummy variables, reference category North Sumatra
North Sumatra[a]	North Sumatra
West Sumatra	West Sumatra
South Sumatra	South Sumatra
Lampung	Lampung
Jakarta	Jakarta
West Java	West Java
Central Java	Central Java
Yogya	Yogya
East Java	East Java
Bali	Bali
West Nusa Tenggara	West Nusa Tenggara

Variable	Variable description
South Kalimantan	South Kalimantan
South Sulawesi	South Sulawesi
1993[a]	Year 1993
1997	Year 1997
2000	Year 2000

NA signifies not applicable.

[a]The reference category, which is not included in the regression analysis

[c] Only year 2000

Table A2. Sample Descriptive Statistics. School attendance specification for children aged 6-16 years who have not yet completed grade 9 unless stated otherwise.

	Mean	sd	min	max
Attend	0.8037818	0.3971504	0	1
Ever attend	0.9370979	0.2427976	0	1
Work2[b]	0.0440044	0.205121	0	1
Spline1	-0.7653727	0.3915798	-1.983609	-0.5
Spline2	0.2166674	0.3065688	0	1
Spline3	0.013746	0.0694708	0	0.5829886
Monsoon onset in transition year[c]	0.0643102	1.111159	-2.866436	3.799383
Weather risk	0.3257536	0.15782	0.1217305	0.7442609
Share of food	0.6277523	0.1558563	0.0666682	0.9028614
Pce	11.8621	0.6913849	9.277908	16.10229
Value of land	5.820885	10.70796	-4.60517	20.74421

	Mean	sd	min	max
(logs)				
Age	10.65334	2.967613	6	16
Age2	122.2996	64.26946	36	256
Female	0.4977114	0.5000135	0	1
Head female	0.1154799	0.3196121	0	1
Muslim[a]	0.8932243	0.3088395	0	1
Christian	0.0556764	0.2293044	0	1
Hindu	0.0455466	0.2085076	0	1
Other religion	.0055526	.0743116	0	1
Head 15-25[a]	0.0165829	0.1277071	0	1
Head 25-35	0.1968935	0.3976661	0	1
Head 35-50	0.5175959	0.499709	0	1
Head 51-65	0.2124259	0.40904	0	1
Head 65+	0.0565018	0.2308969	0	1
Mother no education[a]	0.1654536	0.3716034	0	1
Mother some primary	0.3487657	0.4765975	0	1
Mother primary	0.2959406	0.4564815	0	1
Mother some Jr	0.0204097	0.1414024	0	1
Mother Jr High	0.0640054	0.2447717	0	1

	Mean	sd	min	max
Mother Senior High	0.0535754	0.2251864	0	1
Mother university	0.0165829	0.1277071	0	1
Mother edu missing	0.0352668	0.1844602	0	1
Father no education[a]	0.1130037	0.3166092	0	1
Father some primary	0.290613	0.4540623	0	1
Father primary	0.3024687	0.4593443	0	1
Father some Jr	0.0305395	0.1720729	0	1
Father Jr High	0.0830645	0.27599	0	1
Father Senior High	0.0927441	0.2900843	0	1
Father university	0.0321903	0.1765118	0	1
Father edu missing	.0553763	0.2287219	0	1
Maternal orphan	0.029564	0.1693876	0	1
Paternal orphan	0.0492234	0.2163422	0	1
Time	15.27924	7.422775	1	76.33334
Education cost	10.43239	.5799066	7.36781	12.93227
#Young	0.6478577	0.7913116	0	5
#School age	2.355369	1.141398	1	11
#Adult	2.451414	1.124686	0	12

	Mean	sd	min	max
#Old	0.2658513	0.5280009	0	3
HH farm	0.610565	0.4876405	0	1
HH nonfarm biz	0.3685751	0.4824365	0	1
North Sumatra[a]	0.0664816	0.2491314	0	1
West Sumatra	0.0645307	0.2457051	0	1
South Sumatra	.0696331	0.2545372	0	1
Lampung	0.0709837	0.2568073	0	1
West Java	0.1687552	0.3745496	0	1
Central Java	0.1307121	0.3370979	0	1
Yogya	0.0312148	0.1739044	0	1
East Java	0.1374653	0.3443508	0	1
Bali	0.0435957	0.2042015	0	1
West Nusa Tenggara	0.1096271	0.3124361	0	1
South Kalimantan	0.0460719	0.2096487	0	1
South Sulawesi	0.0592031	0.2360133	0	1
1993[a]	0.3201771	0.4665619	0	1
1997	0.3271554	0.4691921	0	1
2000	0.3526675	0.4778182	0	1
N	13327			

[a] The reference category, which is not included in the regression analysis

[b] Only children aged 10-14 years

[c] Only children aged 6-19 years who have completed primary school

Table A3. Sample descriptive statistics. Child labour specification, year 2000.

	Mean	sd	min	max
Work3	0.1706119	0.3762535	0	1
Wage work	0.0397499	0.1954147	0	1
Family work	0.1424743	0.349614	0	1
Lagged monsoon onset	-0.2116888	0.5732069	-1.756325	1.082989
Share of food	0.6329645	0.1476538	.1274308	.8925965
Pce	11.9879	0.6463436	10.10725	15.14419
Value of land	5.70234	10.44994	-4.60517	20.02765
Age	11.99285	1.419242	10	14
Age2	145.8419	34.10594	100	196
Female	0.4917374	0.5000434	0	1
Head female	0.1281822	0.3343673	0	1
Muslim	0.9030817	0.2959125	0	1
Christian	0.0518088	0.2216904	0	1
Hindu	0.0446628	0.2066086	0	1
Other religion	0.0004466	0.0211336	0	1
Head 15-25	0.0107191	0.1029996	0	1

Head 25-35	0.1406878	0.3477769	0	1
Head 35-50	0.5815096	0.4934216	0	1
Head 51-65	0.1983028	0.3988105	0	1
Head 65+	0.0687807	0.2531374	0	1
Mother no education	0.1549799	0.3619664	0	1
Mother some primary	0.3479232	0.4764179	0	1
Mother primary	0.2979008	0.4574379	0	1
Mother some Jr	0.026351	0.1602128	0	1
Mother Jr Hig	0.073247	0.2605997	0	1
Mother Senior High	0.0602948	0.2380853	0	1
Mother university	0.0200983	0.1403678	0	1
Mother edu missing	0.019205	0.1372756	0	1
Father no education	0.1089772	0.3116802	0	1
Father some primary	0.3010272	0.458807	0	1
Father primary	0.2974542	0.4572402	0	1
Father some Jr	0.0317106	0.1752676	0	1
Father Jr High	0.0884323	0.2839861	0	1
Father Senior High	0.1067441	0.3088566	0	1

Father university	0.0299241	0.1704159	0	1
Father edu missing	0.0357302	0.1856582	0	1
Maternal orphan	0.0276909	0.1641224	0	1
Paternal orphan	0.041983	0.2005952	0	1
Time	16.07606	6.947539	1	50
Education cost	10.38079	0.505855	7.469246	12.52205
#Young	0.5355069	0.6865643	0	5
#School age	2.317552	1.087179	1	7
#Adult	2.376061	1.072309	0	8
#Old	0.2764627	0.542999	0	3
HH farm	0.6150067	0.4867024	0	1
HH nonfarm biz	0.430996	0.4953262	0	1
West Sumatra	0.0625279	0.242166	0	1
South Sumatra	0.0781599	0.268483	0	1
Lampung	0.0710138	0.2569053	0	1
West Java	0.1710585	0.3766442	0	1
Central Java	0.1255025	0.3313618	0	1
Yogya	0.031264	0.1740691	0	1
East Java	0.1357749	0.3426259	0	1
Bali	0.0473426	0.212418	0	1
West Nusa Tenggara	0.1170165	0.3215118	0	1

South Kalimantan	0.0451094	0.2075905	0	1
South Sulawesi	0.0468959	0.2114632	0	1
N	2239			

Appendix B

Table B1. School attendance for all children aged 6-16 years. For probit specification marginal and impact effects reported.

Dependent variable	School attendance		
	Pooled probit	LPM	IVREG; LPM
Spline1	0.003	-0.004	0.000
	(0.017)	(0.016)	(0.022)
Spline2	0.029	0.039	0.054
	(0.028)	(0.026)	(0.036)
Spline3	-0.063	-0.105	-0.120
	(0.140)	(0.109)	(0.096)
Pce		0.034***	0.335**
		(0.009)	(0.138)
Share of food	-0.271***		
	(0.024)		
Age	0.331***	0.385***	0.378***
	(0.013)	(0.016)	(0.017)
Age2	-0.016***	-0.019***	-0.019***
	(0.001)	(0.001)	(0.001)
Female	-0.001	-0.002	-0.006
	(0.008)	(0.007)	(0.007)
Head female	-0.013	-0.004	0.028
	(0.019)	(0.018)	(0.022)
Christian	0.054*	0.056	0.078*
	(0.028)	(0.035)	(0.043)
Hindu	-0.030	-0.016	-0.049
	(0.041)	(0.039)	(0.042)
Other religion	-0.147*	-0.141**	-0.190***
	(0.085)	(0.066)	(0.064)
Head 25-35	-0.003	0.008	0.008
	(0.026)	(0.032)	(0.040)
Head 35-50	0.018	0.026	0.035
	(0.029)	(0.035)	(0.042)
Head 51-65	0.008	0.020	0.044
	(0.028)	(0.034)	(0.041)
Head 65+	-0.036	-0.023	0.005

Dependent variable	School attendance		
	Pooled probit	LPM	IVREG; LPM
	(0.045)	(0.044)	(0.051)
Mother some primary	0.049***	0.073***	0.052***
	(0.010)	(0.013)	(0.019)
Mother primary	0.094***	0.123***	0.095***
	(0.010)	(0.014)	(0.022)
Mother some Jr	0.079***	0.115***	0.045
	(0.019)	(0.024)	(0.041)
Mother Jr high	0.096***	0.127***	0.070**
	(0.012)	(0.017)	(0.028)
Mother Sr high	0.074***	0.094***	-0.014
	(0.014)	(0.014)	(0.046)
Mother university	0.083***	0.096***	-0.075
	(0.030)	(0.017)	(0.073)
Mother edu missing	0.009	0.023	-0.008
	(0.019)	(0.025)	(0.029)
Father some primary	0.018	0.034	0.035*
	(0.016)	(0.021)	(0.020)
Father primary	0.052***	0.070***	0.045*
	(0.014)	(0.018)	(0.026)
Father some Jr	0.071***	0.090***	0.040
	(0.015)	(0.023)	(0.040)
Father Jr high	0.077***	0.095***	0.038
	(0.011)	(0.019)	(0.041)
Father Sr high	0.115***	0.130***	0.057
	(0.009)	(0.016)	(0.047)
Father university	0.088***	0.109***	-0.030
	(0.024)	(0.023)	(0.081)
Father edu missing	0.038**	0.059**	0.036
	(0.018)	(0.028)	(0.039)
Maternal orphan	-0.037*	-0.032	-0.033
	(0.021)	(0.022)	(0.025)
Paternal orphan	-0.059**	-0.064**	-0.052**
	(0.026)	(0.024)	(0.025)
Time	-0.002***	-0.003**	-0.002**
	(0.001)	(0.001)	(0.001)
Education cost	0.020	0.024	-0.026
	(0.015)	(0.014)	(0.036)
#Young	-0.008**	-0.009*	0.037*
	(0.004)	(0.005)	(0.020)
#Schoolage	-0.016***	-0.011**	0.017
	(0.004)	(0.004)	(0.014)
#Adult	0.004	0.007	0.021***
	(0.004)	(0.004)	(0.007)
#Old	0.014	0.016	0.043***
	(0.013)	(0.013)	(0.011)
HH farm	0.005	0.004	-0.006
	(0.012)	(0.011)	(0.014)
HH nonfarm biz	0.008	-0.000	-0.070**

Dependent variable	School attendance		
	Pooled probit	LPM	IVREG; LPM
	(0.009)	(0.007)	(0.031)
Observations	13327	13327	13322
F-test 1stage			39.72***

Robust standard errors in parenthesis
* p<0.1, ** p<0.05, *** p<0.01

Specifications also includes province and year fixed effects. The probit estimates are transformed into marginal effects for continuous variables and impact effects for binary variables, both evaluated at the mean of the explanatory variables. Observations are weighted according to their sampling weights. Standard errors clustered on rain stations.

Table B2. School attendance for young children aged 6-10 years and old children aged 11-16 years. Spline function, knots at -0.5 and 0.5. For probit specification marginal and impact effects reported.

Dependent variable	School attendance			
	Young children aged 6-10 years		Old children aged 11-16 years	
	Pooled probit	IVREG; LPM	Pooled probit	IVREG; LPM
Spline1	0.001	-0.004	0.005	0.009
	(0.017)	(0.015)	(0.022)	(0.043)
Spline2	-0.006	-0.000	0.068*	0.106*
	(0.023)	(0.029)	(0.041)	(0.056)
Spline3	-0.045	-0.077	-0.033	-0.109
	(0.119)	(0.114)	(0.151)	(0.139)
Pce		0.143		0.524***
		(0.107)		(0.198)
Share of food	-0.087***		-0.445***	
	(0.029)		(0.043)	
Age	0.483***	0.820***	-0.058	0.135
	(0.031)	(0.050)	(0.089)	(0.112)
Age2	-0.027***	-0.046***	-0.002	-0.009**
	(0.002)	(0.003)	(0.003)	(0.004)
Female	0.016**	0.016**	-0.020	-0.028*
	(0.007)	(0.008)	(0.013)	(0.015)
Head female	-0.011	0.009	-0.001	0.045*
	(0.017)	(0.022)	(0.023)	(0.024)
Christian	0.016	0.030	0.106***	0.137***
	(0.027)	(0.041)	(0.026)	(0.045)
Hindu	-0.102	-0.090	0.009	0.011
	(0.078)	(0.060)	(0.049)	(0.091)
Other religion	0.029	0.001	-0.287***	-0.284***
	(0.069)	(0.092)	(0.085)	(0.060)
Head 25-35	-0.015	-0.025	-0.013	0.004
	(0.030)	(0.041)	(0.048)	(0.072)
Head 35-50	0.006	-0.003	0.021	0.059

Dependent variable	School attendance			
	Young children aged 6-10 years		Old children aged 11-16 years	
	Pooled probit	IVREG; LPM	Pooled probit	IVREG; LPM
	(0.032)	(0.047)	(0.055)	(0.072)
Head 51-65	-0.035	-0.039	0.030	0.093
	(0.039)	(0.047)	(0.052)	(0.073)
Head 65+	-0.011	-0.013	-0.069	0.008
	(0.034)	(0.042)	(0.080)	(0.088)
Mother some primary	0.027***	0.042**	0.060***	0.047
	(0.010)	(0.020)	(0.015)	(0.029)
Mother primary	0.044***	0.058***	0.144***	0.124***
	(0.007)	(0.018)	(0.017)	(0.036)
Mother some Jr	0.028	0.029	0.144***	0.068
	(0.018)	(0.033)	(0.023)	(0.062)
Mother Jr high	0.056***	0.077***	0.126***	0.064
	(0.007)	(0.023)	(0.026)	(0.047)
Mother Sr high	0.047***	0.042	0.118***	-0.094
	(0.010)	(0.038)	(0.031)	(0.090)
Mother university	0.052***	0.012	0.099	-0.170
	(0.011)	(0.067)	(0.092)	(0.106)
Mother edu missing	-0.003	-0.005	0.027	-0.001
	(0.023)	(0.034)	(0.024)	(0.037)
Father some primary	0.022	0.041*	0.007	0.037*
	(0.013)	(0.025)	(0.023)	(0.022)
Father primary	0.036**	0.049*	0.058***	0.043
	(0.015)	(0.027)	(0.021)	(0.035)
Father some Jr	0.041***	0.047	0.105***	0.057
	(0.008)	(0.031)	(0.031)	(0.057)
Father Jr high	0.040***	0.047	0.126***	0.039
	(0.012)	(0.036)	(0.018)	(0.058)
Father Sr high	0.066***	0.077**	0.159***	0.052
	(0.007)	(0.034)	(0.015)	(0.063)
Father university	0.043***	0.017	0.158***	-0.050
	(0.016)	(0.058)	(0.025)	(0.118)
Father edu missing	0.041***	0.090**	0.034	-0.018
	(0.015)	(0.044)	(0.023)	(0.054)
Maternal orphan	-0.030	-0.021	-0.051**	-0.056
	(0.032)	(0.026)	(0.024)	(0.036)
Paternal orphan	-0.060*	-0.066**	-0.064*	-0.022
	(0.032)	(0.030)	(0.034)	(0.033)
Time	-0.002***	-0.003***	-0.002*	-0.000
	(0.000)	(0.001)	(0.001)	(0.001)
Education cost	0.007	-0.008	0.028	-0.047
	(0.008)	(0.024)	(0.025)	(0.058)
#Young	-0.013***	0.002	-0.004	0.070**

Dependent variable	School attendance			
	Young children aged 6-10 years		Old children aged 11-16 years	
	Pooled probit	IVREG; LPM	Pooled probit	IVREG; LPM
	(0.004)	(0.016)	(0.007)	(0.030)
#Schoolage	-0.016***	-0.007	-0.010*	0.044**
	(0.004)	(0.013)	(0.006)	(0.020)
#Adult	-0.000	0.007	0.011**	0.034***
	(0.004)	(0.007)	(0.005)	(0.008)
#Old	0.002	0.012	0.031*	0.080***
	(0.012)	(0.013)	(0.017)	(0.020)
HH farm	-0.008	-0.009	0.031	0.002
	(0.006)	(0.008)	(0.024)	(0.021)
HH nonfarm biz	0.011	-0.023	0.008	-0.117***
	(0.007)	(0.025)	(0.016)	(0.043)
Observations	6520	6519	6807	6803
F-test 1st stage		24.79***		40.49***

Robust standard errors in parenthesis
* p<0.1, ** p<0.05, *** p<0.01

Specifications also includes province and year fixed effects. The probit estimates are transformed into marginal effects for continuous variables and impact effects for binary variables, both evaluated at the mean of the explanatory variables. Observations are weighted according to their sampling weights. Standard errors are clustered on rain stations.

Table B3. School attendance for children age 6-19 years who have completed primary school, conditioning on the monsoon onset in the transition year from primary to secondary school.

Dependent variable	School attendance after completion of primary school					
	Start year based on reported school starting age			Start year based on birth cohort		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LPM
Monsoon onset in transition year	-0.019***	-0.013**	-0.010*	-0.028***	-0.023***	-0.021***
	(0.007)	(0.005)	(0.006)	(0.010)	(0.007)	(0.006)
Pce		0.042***	0.325*		0.037**	0.291
		(0.014)	(0.195)		(0.014)	(0.183)
Share of food	-0.679***			-0.649***		
	(0.065)			(0.077)		
Age	0.125*	0.113**	0.131***	0.151**	0.150***	0.176***
	(0.074)	(0.049)	(0.050)	(0.069)	(0.054)	(0.053)
Age2	-0.008***	-0.007***	-0.007***	-0.007***	-0.006***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)

Dependent variable	School attendance after completion of primary school					
	Start year based on reported school starting age			Start year based on birth cohort		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LPM
Female	-0.072***	-0.045***	-0.050***	-0.077***	-0.050***	-0.053***
	(0.018)	(0.014)	(0.014)	(0.021)	(0.016)	(0.017)
Head female	0.018	0.018	0.032	-0.010	0.005	0.023
	(0.026)	(0.016)	(0.024)	(0.026)	(0.017)	(0.027)
Christian	0.151**	0.100*	0.146**	0.102	0.073	0.100*
	(0.069)	(0.051)	(0.064)	(0.076)	(0.050)	(0.058)
Hindu	-0.021	-0.009	-0.031	-0.071	-0.039	-0.044
	(0.052)	(0.048)	(0.058)	(0.050)	(0.041)	(0.050)
Other religion	-0.244*	-0.181*	-0.210***	-0.241*	-0.183*	-0.209***
	(0.144)	(0.098)	(0.070)	(0.145)	(0.094)	(0.066)
Head 25-35	0.003	-0.003	-0.022	-0.054	-0.040	-0.069*
	(0.039)	(0.027)	(0.039)	(0.037)	(0.027)	(0.040)
Head 35-50	0.078**	0.051**	0.056*	0.016	0.012	0.014
	(0.037)	(0.023)	(0.029)	(0.034)	(0.023)	(0.031)
Head 51-65	0.076	0.050	0.054	0.022	0.014	0.018
	(0.052)	(0.035)	(0.040)	(0.043)	(0.030)	(0.036)
Head 65+	0.021	0.005	0.024	-0.042	-0.035	-0.025
	(0.059)	(0.038)	(0.044)	(0.055)	(0.035)	(0.042)
Mother some primary	0.138***	0.113***	0.085***	0.109***	0.095***	0.075***
	(0.025)	(0.019)	(0.026)	(0.024)	(0.019)	(0.024)
Mother primary	0.227***	0.189***	0.148***	0.219***	0.187***	0.156***
	(0.031)	(0.023)	(0.031)	(0.029)	(0.022)	(0.027)
Mother some Jr	0.344***	0.292***	0.207***	0.323***	0.277***	0.214***
	(0.050)	(0.039)	(0.066)	(0.056)	(0.047)	(0.062)
Mother Jr high	0.299***	0.248***	0.180***	0.266***	0.227***	0.173***
	(0.030)	(0.029)	(0.049)	(0.033)	(0.030)	(0.043)
Mother Sr high	0.171***	0.144***	0.025	0.190***	0.160***	0.051
	(0.049)	(0.035)	(0.062)	(0.040)	(0.030)	(0.062)
Mother university	0.282***	0.238***	0.099	0.324***	0.243***	0.139
	(0.072)	(0.050)	(0.097)	(0.044)	(0.047)	(0.086)
Mother edu missing	0.126**	0.113**	0.081	0.110***	0.103***	0.074*
	(0.054)	(0.046)	(0.066)	(0.040)	(0.033)	(0.045)
Father some primary	0.032	0.031	0.038	0.040	0.038	0.043
	(0.041)	(0.030)	(0.030)	(0.038)	(0.028)	(0.027)

Dependent variable	School attendance after completion of primary school					
	Start year based on reported school starting age			Start year based on birth cohort		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LPM
Father primary	0.092*	0.081**	0.063	0.101**	0.089**	0.071*
	(0.047)	(0.037)	(0.044)	(0.049)	(0.038)	(0.043)
Father some Jr	0.152**	0.141***	0.087	0.169***	0.152***	0.109**
	(0.062)	(0.044)	(0.061)	(0.057)	(0.044)	(0.049)
Father Jr high	0.209***	0.176***	0.139**	0.219***	0.186***	0.141**
	(0.039)	(0.035)	(0.059)	(0.037)	(0.035)	(0.062)
Father Sr high	0.306***	0.245***	0.179***	0.301***	0.252***	0.192***
	(0.031)	(0.033)	(0.068)	(0.031)	(0.032)	(0.063)
Father university	0.293***	0.233***	0.106	0.316***	0.257***	0.142
	(0.050)	(0.050)	(0.129)	(0.043)	(0.048)	(0.116)
Father edu missing	0.083	0.066	0.018	0.121**	0.105**	0.069
	(0.055)	(0.045)	(0.063)	(0.052)	(0.041)	(0.050)
Maternal orphan	-0.068	-0.036	-0.025	-0.078**	-0.046*	-0.048*
	(0.044)	(0.029)	(0.032)	(0.038)	(0.026)	(0.027)
Paternal orphan	-0.015	-0.013	-0.001	-0.010	-0.013	-0.001
	(0.036)	(0.022)	(0.021)	(0.032)	(0.019)	(0.018)
Time	-0.002	-0.000	-0.001	-0.003**	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Education cost	0.091**	0.078***	0.031	0.085***	0.076***	0.030
	(0.039)	(0.027)	(0.051)	(0.030)	(0.023)	(0.048)
#Young	-0.012	-0.013	0.032	-0.007	-0.011	0.028
	(0.013)	(0.011)	(0.036)	(0.014)	(0.011)	(0.032)
#Schoolage	0.001	0.008	0.035*	0.004	0.009	0.033*
	(0.008)	(0.006)	(0.020)	(0.007)	(0.006)	(0.019)
#Adult	0.014	0.011	0.028**	0.010	0.008	0.020**
	(0.009)	(0.007)	(0.012)	(0.008)	(0.006)	(0.010)
#Old	0.013	0.013	0.039**	0.012	0.013	0.039*
	(0.016)	(0.012)	(0.015)	(0.019)	(0.013)	(0.021)
HH farm	0.035	0.016	0.008	0.035	0.019	0.012
	(0.025)	(0.016)	(0.016)	(0.023)	(0.015)	(0.016)
HH nonfarm biz	-0.002	0.001	-0.056*	-0.006	-0.001	-0.055
	(0.018)	(0.012)	(0.034)	(0.014)	(0.009)	(0.035)
Observations	6181	6181	6177	6786	6786	6782
F-test 1st			31.46***			29.52***

Dependent variable	School attendance after completion of primary school					
	Start year based on reported school starting age			Start year based on birth cohort		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LPM
stage						

Robust standard errors in parenthesis
* p<0.1, ** p<0.05, *** p<0.01

Specification also includes province and year fixed effects and the last two regressions also birth cohort fixed effects. The probit estimates are transformed into marginal effects for continuous variables and impact effects for binary variables, both evaluated at the mean of the explanatory variables. Observations are weighted according to their sampling weights. Standard errors clustered on rain stations.

Table B4. The impact of weather risk (coefficient of variation of the monsoon onset for the period 1979-2003) on the probability of child ever attending school.

Dependent variable	Ever attended school					
	All children aged 6-16 years			Young children aged 6-10 years		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LPM
Weather risk	-0.022	-0.060	-0.062	-0.092**	-0.140**	-0.138**
	(0.019)	(0.042)	(0.042)	(0.038)	(0.068)	(0.067)
Pce		0.017***	0.052		0.027***	0.116
		(0.005)	(0.069)		(0.006)	(0.115)
Share of food	-0.038***			-0.083***		
	(0.011)			(0.024)		
Age	0.062***	0.173***	0.173***	0.315***	0.697***	0.699***
	(0.004)	(0.016)	(0.016)	(0.024)	(0.062)	(0.063)
Age2	-0.003***	-0.007***	-0.007***	-0.017***	-0.039***	-0.039***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.003)	(0.004)
Female	0.004	0.007	0.007	0.014**	0.017*	0.017*
	(0.004)	(0.006)	(0.006)	(0.007)	(0.009)	(0.009)
Head female	-0.000	0.001	0.005	0.003	0.008	0.020
	(0.005)	(0.009)	(0.011)	(0.011)	(0.014)	(0.024)
Christian	0.010	0.018	0.019	0.020	0.025	0.030
	(0.006)	(0.020)	(0.021)	(0.016)	(0.030)	(0.033)
Hindu	0.008	0.027	0.025	0.020	0.027	0.017
	(0.006)	(0.021)	(0.021)	(0.022)	(0.031)	(0.034)
Other religion	-0.013	-0.010	-0.015	-0.016	-0.006	-0.041
	(0.034)	(0.040)	(0.032)	(0.094)	(0.076)	(0.072)
Head 25-35	0.008***	0.034***	0.034***	0.007	0.042	0.039
	(0.003)	(0.011)	(0.011)	(0.026)	(0.052)	(0.048)
Head 35-50	0.018***	0.043***	0.045***	0.026	0.062	0.059

Dependent variable	Ever attended school					
	All children aged 6-16 years			Young children aged 6-10 years		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LPM
	(0.006)	(0.015)	(0.014)	(0.027)	(0.054)	(0.052)
Head 51-65	0.009**	0.032**	0.034**	0.003	0.032	0.032
	(0.004)	(0.014)	(0.014)	(0.023)	(0.047)	(0.043)
Head 65+	0.007	0.027	0.030	-0.005	0.027	0.034
	(0.005)	(0.018)	(0.019)	(0.027)	(0.047)	(0.043)
Mother some primary	0.008***	0.026***	0.024**	0.016*	0.041**	0.034
	(0.003)	(0.009)	(0.012)	(0.008)	(0.016)	(0.022)
Mother primary	0.017***	0.043***	0.040***	0.033***	0.067***	0.060***
	(0.003)	(0.009)	(0.012)	(0.006)	(0.014)	(0.018)
Mother some Jr	0.008	0.030*	0.022	0.020	0.059*	0.039
	(0.007)	(0.017)	(0.021)	(0.015)	(0.032)	(0.040)
Mother Jr high	0.015***	0.051***	0.044***	0.039***	0.095***	0.078***
	(0.003)	(0.010)	(0.017)	(0.006)	(0.015)	(0.025)
Mother Sr high	0.016***	0.053***	0.042*	0.040***	0.096***	0.070*
	(0.003)	(0.010)	(0.024)	(0.007)	(0.019)	(0.037)
Mother university	0.016***	0.042***	0.023	0.036***	0.076***	0.024
	(0.003)	(0.008)	(0.038)	(0.008)	(0.018)	(0.071)
Mother edu missing	-0.010	-0.018	-0.021	-0.032	-0.032	-0.040
	(0.012)	(0.021)	(0.018)	(0.027)	(0.038)	(0.037)
Father some primary	0.005	0.021	0.020	0.009	0.026	0.022
	(0.005)	(0.018)	(0.018)	(0.011)	(0.027)	(0.026)
Father primary	0.009**	0.029*	0.025	0.019	0.039	0.026
	(0.004)	(0.016)	(0.019)	(0.012)	(0.027)	(0.031)
Father some Jr	0.012***	0.039*	0.033	0.025***	0.051	0.033
	(0.003)	(0.022)	(0.028)	(0.009)	(0.033)	(0.043)
Father Jr high	0.012***	0.037*	0.030	0.025**	0.052	0.032
	(0.004)	(0.018)	(0.026)	(0.011)	(0.033)	(0.043)
Father Sr high	0.017***	0.048***	0.039	0.036***	0.064**	0.036
	(0.002)	(0.014)	(0.029)	(0.007)	(0.024)	(0.048)
Father university	0.011**	0.037**	0.019	0.018	0.039	-0.008
	(0.005)	(0.017)	(0.044)	(0.016)	(0.029)	(0.070)

Dependent variable	Ever attended school					
	All children aged 6-16 years			Young children aged 6-10 years		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LPM
Father edu missing	0.013***	0.056**	0.054**	0.035***	0.097**	0.094**
	(0.003)	(0.024)	(0.026)	(0.007)	(0.043)	(0.045)
Maternal orphan	-0.005	-0.010	-0.009	-0.021	-0.031	-0.023
	(0.007)	(0.010)	(0.009)	(0.025)	(0.030)	(0.026)
Paternal orphan	-0.023**	-0.031*	-0.028*	-0.037	-0.043	-0.039
	(0.012)	(0.016)	(0.017)	(0.031)	(0.034)	(0.032)
Time	-0.000***	-0.002***	-0.001***	-0.001***	-0.002***	-0.002***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Education cost	0.011***	0.021**	0.016	0.017*	0.025*	0.011
	(0.004)	(0.009)	(0.019)	(0.010)	(0.014)	(0.029)
#Young	-0.003**	-0.004	0.002	-0.009***	-0.012**	0.002
	(0.002)	(0.003)	(0.014)	(0.003)	(0.005)	(0.020)
#Schoolage	-0.005***	-0.011**	-0.007	-0.014***	-0.019***	-0.011
	(0.002)	(0.004)	(0.010)	(0.003)	(0.006)	(0.014)
#Adult	0.000	0.001	0.003	0.001	0.004	0.009
	(0.002)	(0.003)	(0.005)	(0.003)	(0.004)	(0.009)
#Old	0.004	0.007	0.011*	0.004	0.007	0.015
	(0.004)	(0.007)	(0.006)	(0.010)	(0.014)	(0.011)
HH farm	-0.002	-0.002	-0.003	-0.004	-0.001	-0.003
	(0.003)	(0.006)	(0.006)	(0.007)	(0.010)	(0.010)
HH nonfarm biz	0.005*	0.002	-0.005	0.013**	0.008	-0.011
	(0.003)	(0.006)	(0.014)	(0.005)	(0.007)	(0.025)
Observations	11899	11895	11890	5684	5684	5683
F-test 1st stage			59.36***			38.81***

Robust standard errors in parenthesis
* p<0.1, ** p<0.05, *** p<0.01

Specification also includes province and year fixed effects. The probit estimates are transformed into marginal effects for continuous variables and impact effects for binary variables, both evaluated at the mean of the explanatory variables. Observations are weighted according to their sampling weights. Standard errors clustered on rain stations.

Table B5. Labour participation (if child worked in the past month), only survey year 2000. Lagged monsoon onset in linear form.

Dependent variable	Child labour (only year 2000)					
	All children aged 6-14 year			Old children aged 10-14 years		
	Pooled probit	LPM	IVREG; LMP	Pooled probit	LPM	IVREG; LPM
Lagged monsoon onset	0.021**	0.027*	0.027**	0.058**	0.051*	0.050**
	(0.011)	(0.014)	(0.014)	(0.027)	(0.026)	(0.025)
Pce		0.023*	0.058		0.036*	0.001
		(0.012)	(0.118)		(0.019)	(0.178)
Share of food	-0.020			0.005		
	(0.022)			(0.049)		
Age	0.049***	-0.050**	-0.048**	-0.038	-0.151	-0.161
	(0.018)	(0.019)	(0.022)	(0.144)	(0.143)	(0.152)
Age2	-0.001	0.004***	0.004***	0.003	0.008	0.009
	(0.001)	(0.001)	(0.001)	(0.006)	(0.006)	(0.006)
Female	-0.004	-0.006	-0.007	-0.012	-0.014	-0.012
	(0.006)	(0.010)	(0.012)	(0.016)	(0.018)	(0.022)
Head female	0.031**	0.042**	0.045***	0.065**	0.067**	0.065**
	(0.015)	(0.019)	(0.016)	(0.032)	(0.029)	(0.027)
Christian	0.022	0.034	0.034	0.063	0.067	0.070
	(0.032)	(0.043)	(0.042)	(0.072)	(0.069)	(0.069)
Hindu	0.014	0.002	-0.002	0.029	0.004	0.007
	(0.073)	(0.094)	(0.094)	(0.157)	(0.150)	(0.145)
Other religion		-0.060	-0.080		-0.260***	-0.259***
		(0.065)	(0.064)		(0.087)	(0.083)
Head 25-35	0.042	0.064	0.064	0.055	0.067	0.065
	(0.045)	(0.040)	(0.040)	(0.081)	(0.062)	(0.057)
Head 35-50	0.024	0.049	0.050	0.042	0.057	0.054
	(0.031)	(0.041)	(0.039)	(0.062)	(0.056)	(0.050)
Head 51-65	0.022	0.042	0.043	0.025	0.041	0.037
	(0.045)	(0.048)	(0.046)	(0.082)	(0.072)	(0.062)
Head 65+	0.061	0.084	0.087*	0.079	0.098	0.093
	(0.071)	(0.059)	(0.051)	(0.108)	(0.093)	(0.074)
Mother some primary	-0.001	0.000	0.000	-0.008	-0.008	-0.007
	(0.014)	(0.023)	(0.022)	(0.030)	(0.034)	(0.033)
Mother primary	-0.023*	-0.027	-0.027	-0.048*	-0.047	-0.046
	(0.013)	(0.022)	(0.022)	(0.028)	(0.033)	(0.032)
Mother some Jr	-0.016	-0.028	-0.027	-0.018	-0.024	-0.016
	(0.025)	(0.045)	(0.044)	(0.071)	(0.079)	(0.076)
Mother Jr	-0.012	-0.019	-0.024	-0.019	-0.020	-0.014

Dependent variable	Child labour (only year 2000)					
	All children aged 6-14 year			Old children aged 10-14 years		
	Pooled probit	LPM	IVREG; LMP	Pooled probit	LPM	IVREG; LPM
high						
	(0.012)	(0.022)	(0.027)	(0.027)	(0.033)	(0.042)
Mother Sr high	-0.026**	-0.046*	-0.052	-0.074***	-0.096***	-0.086
	(0.012)	(0.025)	(0.032)	(0.022)	(0.034)	(0.056)
Mother university	-0.043***	-0.071*	-0.084	-0.099***	-0.096	-0.083
	(0.011)	(0.035)	(0.059)	(0.037)	(0.064)	(0.094)
Mother edu missing	-0.044***	-0.077**	-0.078**	-0.110***	-0.137***	-0.134***
	(0.010)	(0.032)	(0.031)	(0.028)	(0.049)	(0.042)
Father some primary	-0.024***	-0.043***	-0.043***	-0.044**	-0.053**	-0.055**
	(0.007)	(0.012)	(0.012)	(0.019)	(0.024)	(0.027)
Father primary	-0.013	-0.031	-0.033	-0.024	-0.037	-0.037
	(0.009)	(0.018)	(0.021)	(0.025)	(0.032)	(0.032)
Father some Jr	-0.043***	-0.081***	-0.083***	-0.092***	-0.125***	-0.117***
	(0.007)	(0.020)	(0.021)	(0.022)	(0.044)	(0.042)
Father Jr high	-0.014	-0.032	-0.036	-0.033	-0.043	-0.040
	(0.010)	(0.020)	(0.029)	(0.026)	(0.036)	(0.045)
Father Sr high	-0.031***	-0.057**	-0.065**	-0.066**	-0.077*	-0.074**
	(0.010)	(0.023)	(0.030)	(0.027)	(0.041)	(0.037)
Father university	-0.002	-0.023	-0.043	-0.014	-0.047	-0.026
	(0.021)	(0.028)	(0.066)	(0.040)	(0.057)	(0.105)
Father edu missing	-0.015	-0.039	-0.039	-0.007	-0.028	-0.027
	(0.014)	(0.024)	(0.025)	(0.046)	(0.054)	(0.051)
Maternal orphan	-0.002	-0.018	-0.017	-0.014	-0.014	-0.015
	(0.026)	(0.039)	(0.038)	(0.051)	(0.046)	(0.044)
Paternal orphan	-0.004	-0.000	0.001	-0.008	-0.004	-0.007
	(0.020)	(0.037)	(0.038)	(0.048)	(0.055)	(0.058)
Time	0.001	0.001	0.001	0.002	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Education cost	-0.005	-0.012	-0.019	-0.014	-0.023	-0.015
	(0.013)	(0.016)	(0.032)	(0.033)	(0.031)	(0.062)
#Young	-0.001	0.002	0.007	0.000	0.007	0.001
	(0.005)	(0.006)	(0.019)	(0.010)	(0.009)	(0.028)

Dependent variable	Child labour (only year 2000)					
	All children aged 6-14 year			Old children aged 10-14 years		
	Pooled probit	LPM	IVREG; LMP	Pooled probit	LPM	IVREG; LPM
#Schoolage	0.007	0.010	0.013	0.016*	0.020*	0.017
	(0.004)	(0.007)	(0.011)	(0.009)	(0.011)	(0.016)
#Adult	-0.003	-0.003	0.000	-0.005	-0.002	-0.005
	(0.004)	(0.005)	(0.009)	(0.010)	(0.009)	(0.012)
#Old	0.002	0.003	0.005	0.016	0.019	0.016
	(0.009)	(0.014)	(0.021)	(0.019)	(0.023)	(0.033)
HH farm	0.029***	0.036**	0.035**	0.064***	0.060**	0.062***
	(0.010)	(0.016)	(0.014)	(0.022)	(0.025)	(0.021)
HH nonfarm biz	0.038***	0.043***	0.036	0.080***	0.067***	0.075
	(0.010)	(0.012)	(0.032)	(0.021)	(0.021)	(0.054)
Observations	3949	3951	3948	2240	2239	2237
F-test 1st stage			16.02***			33.80***

Robust standard errors in parenthesis
* p<0.1, ** p<0.05, *** p<0.01

Specifications also includes province fixed effects. The probit estimates are transformed into marginal effects for continuous variables and impact effects for binary variables, both evaluated at the mean of the explanatory variables. Observations are weighted according to their sampling weights. Standard errors clustered on rain stations.

Table B6. Work disaggregated into family work and wage work, year 2000, children aged 10-14 years. Monsoon onset in linear form.

Dependent variable	Child labour (family work or wage work)					
	Family Work			Wage Work		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LMP
Lagged monsoon onset	0.036**	0.030*	0.029*	0.032***	0.034**	0.034**
	(0.018)	(0.017)	(0.017)	(0.011)	(0.016)	(0.015)
Pce		0.037**	0.089		0.004	-0.077
		(0.014)	(0.164)		(0.013)	(0.078)
Share of food	-0.020			0.016		
	(0.041)			(0.023)		
Age	0.111	0.033	0.041	-0.119***	-0.214***	-0.230***
	(0.138)	(0.151)	(0.153)	(0.042)	(0.059)	(0.065)
Age2	-0.003	-0.000	-0.000	0.005***	0.010***	0.010***
	(0.006)	(0.006)	(0.006)	(0.002)	(0.003)	(0.003)
Female	-0.013	-0.016	-0.017	0.000	0.000	0.003

Dependent variable	Child labour (family work or wage work)					
	Family Work			Wage Work		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LMP
	(0.012)	(0.013)	(0.016)	(0.007)	(0.010)	(0.011)
Head female	0.021	0.025	0.028	0.045***	0.053***	0.048***
	(0.032)	(0.032)	(0.025)	(0.015)	(0.017)	(0.014)
Christian	0.085	0.092	0.094	-0.015	-0.014	-0.014
	(0.068)	(0.062)	(0.060)	(0.010)	(0.024)	(0.025)
Hindu	0.056	0.026	0.022	-0.009	-0.015	-0.009
	(0.171)	(0.152)	(0.148)	(0.006)	(0.016)	(0.023)
Other religion		-0.139**	-0.139**		-0.123**	-0.121**
		(0.064)	(0.063)		(0.046)	(0.048)
Head 25-35	0.045	0.049	0.051	0.028	0.042	0.039
	(0.097)	(0.075)	(0.072)	(0.044)	(0.041)	(0.040)
Head 35-50	0.024	0.031	0.036	0.027	0.050	0.043
	(0.071)	(0.062)	(0.056)	(0.026)	(0.043)	(0.044)
Head 51-65	0.005	0.010	0.014	0.042	0.056	0.049
	(0.091)	(0.084)	(0.076)	(0.046)	(0.042)	(0.042)
Head 65+	0.037	0.049	0.056	0.042	0.048	0.037
	(0.113)	(0.102)	(0.087)	(0.054)	(0.043)	(0.043)
Mother some primary	-0.011	-0.014	-0.014	0.005	0.010	0.010
	(0.028)	(0.034)	(0.032)	(0.008)	(0.010)	(0.011)
Mother primary	-0.036	-0.035	-0.035	-0.003	-0.003	-0.002
	(0.028)	(0.036)	(0.035)	(0.006)	(0.010)	(0.011)
Mother some Jr	0.005	0.002	0.005		-0.028**	-0.025*
	(0.071)	(0.079)	(0.081)		(0.011)	(0.013)
Mother Jr high	-0.011	-0.005	-0.012	-0.009	-0.014	-0.002
	(0.027)	(0.035)	(0.042)	(0.007)	(0.011)	(0.017)
Mother Sr high	-0.080***	-0.115***	-0.130***	0.020	0.025	0.049
	(0.018)	(0.037)	(0.048)	(0.032)	(0.026)	(0.042)
Mother university	-0.082***	-0.087	-0.107		-0.009	0.022
	(0.029)	(0.062)	(0.086)		(0.018)	(0.038)
Mother edu missing	-0.086***	-0.109**	-0.114***	-0.021***	-0.031	-0.025
	(0.026)	(0.047)	(0.042)	(0.006)	(0.022)	(0.023)
Father some primary	-0.048**	-0.062**	-0.059*	-0.002	-0.000	-0.004
	(0.020)	(0.028)	(0.030)	(0.007)	(0.013)	(0.014)
Father primary	-0.021	-0.035	-0.037	-0.008	-0.013	-0.010

Dependent variable	Child labour (family work or wage work)					
	Family Work			Wage Work		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LMP
	(0.027)	(0.036)	(0.037)	(0.008)	(0.017)	(0.015)
Father some Jr	-0.096***	-0.153***	-0.155***	0.001	0.002	0.011
	(0.017)	(0.045)	(0.043)	(0.014)	(0.023)	(0.026)
Father Jr high	-0.026	-0.042	-0.048	-0.007	-0.009	-0.001
	(0.028)	(0.041)	(0.049)	(0.010)	(0.019)	(0.021)
Father Sr high	-0.050*	-0.065	-0.070	-0.017**	-0.030	-0.022
	(0.029)	(0.046)	(0.044)	(0.008)	(0.021)	(0.018)
Father university	0.008	-0.028	-0.060		-0.043	0.006
	(0.040)	(0.052)	(0.107)		(0.028)	(0.040)
Father edu missing	-0.029	-0.058	-0.059	0.010	0.012	0.014
	(0.038)	(0.050)	(0.048)	(0.026)	(0.037)	(0.035)
Maternal orphan	-0.030	-0.026	-0.026	0.009	0.008	0.007
	(0.045)	(0.036)	(0.035)	(0.025)	(0.029)	(0.029)
Paternal orphan	-0.005	-0.002	0.002	-0.011	-0.022	-0.028
	(0.048)	(0.056)	(0.055)	(0.010)	(0.029)	(0.029)
Time	0.002*	0.002	0.002	-0.000	-0.000	-0.001
	(0.001)	(0.001)	(0.002)	(0.000)	(0.001)	(0.001)
Education cost	-0.027	-0.035	-0.049	0.011	0.012	0.032
	(0.029)	(0.028)	(0.056)	(0.008)	(0.012)	(0.027)
#Young	-0.004	0.001	0.009	0.004	0.007	-0.006
	(0.011)	(0.010)	(0.028)	(0.003)	(0.006)	(0.010)
#Schoolage	0.004	0.009	0.014	0.010***	0.014**	0.007
	(0.008)	(0.010)	(0.016)	(0.003)	(0.006)	(0.010)
#Adult	-0.003	-0.000	0.004	-0.006*	-0.008*	-0.015**
	(0.009)	(0.009)	(0.013)	(0.003)	(0.005)	(0.007)
#Old	0.018	0.022	0.027	0.002	0.004	-0.003
	(0.017)	(0.021)	(0.033)	(0.008)	(0.015)	(0.018)
HH farm	0.077***	0.076***	0.073***	-0.005	-0.006	-0.002
	(0.021)	(0.024)	(0.021)	(0.007)	(0.009)	(0.009)
HH nonfarm biz	0.083***	0.073***	0.062	0.000	-0.001	0.016
	(0.022)	(0.024)	(0.052)	(0.005)	(0.008)	(0.020)
Observations	2240	2239	2237	2096	2239	2237
F-test 1st stage			33.80***			33.80***

Robust standard errors in parenthesis
* p<0.1, ** p<0.05, *** p<0.01

Specification also includes province fixed effects. The probit estimates are transformed into marginal effects for continuous variables and impact effects for binary variables, both evaluated at the mean of the explanatory variables. Observations are weighted according to their sampling weights. Standard errors clustered on rain stations.

Table B7. Labour participation, lagged monsoon onset interacted with female dummy. Only survey year 2000. Pooled probit regression.

	Both family and wage	Family Work	Wage work
Lagged monsoon onset	0.051**	0.027	0.035***
	(0.026)	(0.018)	(0.011)
Lagged monsoon*female	0.016	0.023	-0.007
	(0.025)	(0.024)	(0.009)
Share of food	0.005	-0.020	0.016
	(0.050)	(0.041)	(0.023)
Observations	2240	2240	2096

Robust standard errors in parenthesis
* p<0.1, ** p<0.05, *** p<0.01

Specification also includes same individual, household and community characteristics as in previous tables. Also province fixed effects included. Observations are weighted according to their sampling weights. Standard errors clustered on rain stations.

Table B8. Labour participation, children aged 10-14 years (if worked in the past 12 months). Spline function, knots at -0.5, and 0.5. For probit regression marginal and impact effects reported.

Dependent variable	Child labour					
	Survey years 1993, 1997 and 2000			Survey years 1997 and 2000		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LPM
Spline1	-0.005*	-0.009	-0.008	0.009	0.019	0.017
	(0.003)	(0.007)	(0.008)	(0.008)	(0.015)	(0.017)
Spline2	-0.015*	-0.027*	-0.037*	-0.024**	-0.047**	-0.061**
	(0.009)	(0.014)	(0.019)	(0.011)	(0.020)	(0.025)
Spline3	0.095***	0.173***	0.186***	0.116***	0.233***	0.267***
	(0.036)	(0.054)	(0.065)	(0.028)	(0.043)	(0.058)
Pce		0.009	-0.093		0.020*	-0.119
		(0.010)	(0.069)		(0.010)	(0.087)
Share of food	0.033***			0.036***		
	(0.009)			(0.009)		
Age	0.009	-0.127*	-0.137*	-0.007	-0.159***	-0.168***
	(0.037)	(0.073)	(0.071)	(0.021)	(0.050)	(0.050)
Age2	0.000	0.006*	0.007**	0.001	0.007***	0.008***

Dependent variable	Child labour					
	Survey years 1993, 1997 and 2000			Survey years 1997 and 2000		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LPM
	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)	(0.002)
Female	-0.005	-0.010	-0.006	-0.004	-0.009	-0.002
	(0.005)	(0.007)	(0.007)	(0.004)	(0.006)	(0.007)
Head female	0.015*	0.025*	0.018	0.013	0.025	0.013
	(0.008)	(0.012)	(0.015)	(0.009)	(0.016)	(0.022)
Christian	0.009	0.015	0.006	0.018	0.033	0.024
	(0.016)	(0.021)	(0.025)	(0.023)	(0.028)	(0.032)
Hindu	-0.015**	-0.030	-0.018	-0.003	-0.008	-0.015
	(0.006)	(0.024)	(0.017)	(0.014)	(0.025)	(0.031)
Other religion	0.174**	0.251***	0.248***		-0.042*	-0.006
	(0.087)	(0.089)	(0.084)		(0.024)	(0.033)
Head 25-35	0.007	0.015	0.021	0.007	0.014	0.019
	(0.018)	(0.026)	(0.028)	(0.014)	(0.029)	(0.032)
Head 35-50	0.002	0.007	0.008	-0.001	0.002	-0.001
	(0.013)	(0.023)	(0.026)	(0.011)	(0.027)	(0.030)
Head 51-65	0.004	0.010	0.006	0.006	0.013	0.009
	(0.015)	(0.023)	(0.024)	(0.012)	(0.026)	(0.026)
Head 65+	0.021	0.034	0.030	0.015	0.028	0.024
	(0.022)	(0.021)	(0.022)	(0.019)	(0.030)	(0.029)
Mother some primary	-0.006*	-0.015*	-0.005	-0.012***	-0.034***	-0.022
	(0.004)	(0.009)	(0.011)	(0.004)	(0.011)	(0.015)
Mother primary	-0.011***	-0.025***	-0.012	-0.011***	-0.034***	-0.019
	(0.003)	(0.007)	(0.013)	(0.003)	(0.010)	(0.017)
Mother some Jr	-0.020***	-0.055***	-0.030		-0.063***	-0.040**
	(0.002)	(0.010)	(0.021)		(0.009)	(0.019)
Mother Jr high	-0.012**	-0.022*	-0.002	-0.010**	-0.033**	-0.006
	(0.005)	(0.011)	(0.020)	(0.005)	(0.015)	(0.028)
Mother Sr high	-0.008	-0.025*	0.014	-0.011***	-0.046***	0.004
	(0.007)	(0.013)	(0.028)	(0.004)	(0.014)	(0.037)
Mother university		-0.039***	0.018		-0.047***	0.028
		(0.013)	(0.041)		(0.012)	(0.052)
Mother edu missing	0.009	0.017	0.035	0.003	0.004	0.034
	(0.014)	(0.026)	(0.024)	(0.012)	(0.031)	(0.029)
Father some primary	0.000	-0.005	-0.007	0.005	0.009	0.003
	(0.003)	(0.007)	(0.006)	(0.004)	(0.009)	(0.010)

Dependent variable	Child labour					
	Survey years 1993, 1997 and 2000			Survey years 1997 and 2000		
	Pooled Probit	LPM	IVREG; LPM	Pooled Probit	LPM	IVREG; LPM
Father primary	-0.014***	-0.029***	-0.023*	-0.009***	-0.019*	-0.014
	(0.004)	(0.010)	(0.013)	(0.003)	(0.010)	(0.012)
Father some Jr	-0.012*	-0.032*	-0.013	-0.012***	-0.032**	-0.015
	(0.007)	(0.017)	(0.020)	(0.004)	(0.013)	(0.015)
Father Jr high	-0.011**	-0.030*	-0.013	-0.007*	-0.016	0.002
	(0.005)	(0.015)	(0.019)	(0.004)	(0.012)	(0.019)
Father Sr high	-0.018***	-0.040**	-0.017	-0.010**	-0.023	-0.003
	(0.005)	(0.015)	(0.022)	(0.005)	(0.014)	(0.019)
Father university	-0.001	-0.024*	0.031	-0.012***	-0.036**	0.034
	(0.012)	(0.013)	(0.037)	(0.004)	(0.015)	(0.044)
Father edu missing	-0.011**	-0.031*	-0.024	-0.005	-0.009	-0.006
	(0.005)	(0.016)	(0.020)	(0.006)	(0.018)	(0.020)
Maternal orphan	0.018	0.028	0.031	0.016*	0.030	0.033
	(0.012)	(0.019)	(0.020)	(0.010)	(0.020)	(0.023)
Paternal orphan	0.016	0.032	0.026	0.005	0.009	0.001
	(0.011)	(0.020)	(0.021)	(0.011)	(0.025)	(0.026)
Time	0.000	0.000	0.000	-0.000	-0.000	-0.001
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Education cost	-0.000	-0.005	0.014	-0.000	-0.010	0.025
	(0.004)	(0.008)	(0.016)	(0.005)	(0.008)	(0.024)
#Young	-0.003	-0.002	-0.018	-0.002	0.001	-0.021
	(0.003)	(0.003)	(0.011)	(0.002)	(0.004)	(0.014)
#Schoolage	0.004	0.007	-0.003	0.005***	0.012*	0.000
	(0.002)	(0.006)	(0.009)	(0.002)	(0.006)	(0.011)
#Adult	-0.000	0.001	-0.003	-0.000	0.002	-0.005
	(0.002)	(0.004)	(0.006)	(0.002)	(0.004)	(0.006)
#Old	-0.000	0.000	-0.010	-0.005*	-0.006	-0.023*
	(0.003)	(0.005)	(0.008)	(0.003)	(0.005)	(0.012)
HH farm	0.004	0.006	0.007	0.003	0.005	0.006
	(0.004)	(0.008)	(0.009)	(0.004)	(0.009)	(0.010)
HH nonfarm biz	0.002	0.002	0.026	-0.000	-0.003	0.028
	(0.004)	(0.006)	(0.017)	(0.003)	(0.006)	(0.021)
Observations	6321	6406	6404	4455	4652	4650
F-test 1st stage			22.47***			15.87***

Robust standard errors in parenthesis
* p<0.1, ** p<0.05, *** p<0.01

Specification also includes province and year fixed effects. The probit estimates are transformed into marginal effects for continuous variables and impact effects for binary variables, both evaluated at the mean of the explanatory variables. Observations are weighted according to their sampling weights. Standard errors clustered on rain stations.