

The effects of economic shocks to households on children development: An evidence from China

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Abstract

Using data from the Institute of Social Science Survey (ISSS) of Peking University conducted in China, this article examines the impact of economic shock to households on changes in school attendance levels and education expenditure. Firstly, ordered logit model is utilized to estimate the effect of adverse income shock on additional overage of children. The results suggest that the overage of children tends to be greater if income per capita decreases by less than 40%, while adverse income shock defined by income per capita falls by more than 40% have no effect on overage. Secondly, using OLS model, this study also indicates that households are likely to reduce education expenditure to cope with income shocks.

Keywords: economic shock, human capital, overage, education expenditure, China

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1 Introduction

Economic volatility is an issue of broad interest to the general public, the poor and the non-poor alike. While there are some studies about the causes of volatility, there are researches on its effects. During a crisis, health, educational, and nutritional indicators deteriorate while inequality and poverty increase, especially among the poor.

However, whether economic volatility have negative influence on children? The answer of the given question is enormously important due to the fact that this issue is highly correlated to poverty of a country. If shocks entail reductions in investment in children, this phenomenon might have serious effects on poverty in the long term. As stated by Brauw and Giles (2006), improving quality of education and raising education attainment are two priority tasks of policy makers. Indeed, human capital accumulaiton benefits economic growth in the long term, in which, education attainment contributes to higher wages and improve human development

Duryea (1998) analyzes the impacts of transitory economic shocks on children's progress through schooling in Brazil by using a panel data set conducted by the Brazilian census bureau namely the Pesquisa Mensal de Emprego (PME). She finds that if the father of a household become unemployed, the probability that children aged 10-15 finish school year will decrease by 4 percent. This impact is negatively significant for both girls and boys. The results show that the ways in which households are protected from transitory income shocks thanks to children's time are consistent with models of education including assumptions of imperfect credit markets.

In addition, employing a data set of surveys to investigate household reactions against adverse income shocks in seven Latin American countries, Gaviria (2001) finds that households increase their labor force participation, sell physical assets and disinvest in human capital to deal with income shocks.

Besides, Duryea, Lam and Leviso (2007) study the effect of economic shocks of households on children's employment and schooling in urban Brazil. The outcomes of probit regressions state that unemployment shock of male household head rises the likelihood that a child participates in labor force, quits school, and is unable to complete the school year. However, there is no significant impact of shocks taking place after the school year, revealing that these outcomes are not because of unobservable characteristic.

China, which is located in East Asia, has the largest population in the world with more than 1.378 billion as of 2016. Although China has been one of the fastest-growing major economies in the world thanks to economic reforms introduced in 1978, the most significant feature of the development in China's economy is a wide fluctuation which cause contradictions and conflicts in Chinese society. Angang (1996) demonstrates that China's fluctuation coefficient is significantly higher than those in the Western countries, and much more higher than the world average. During the period from 1960 to 1989, the fluctuation coefficient of China's economy was 1.8 times those of Yugoslavia, Britain, and India; 2.6 times that of Japan; 2.2 times that of the United States; 3.4 times that of the former Soviet Union; 3.0 times that of South Korea; and 4.3 times the world average.

The above-mentioned phenomenon leads to considerable consequences. For instance, Autor, Dorn and Hanson (2016) studies the impact of trade shocks on labor markets. They find out that due to a provided trade shock, employees' annual and lifetime earnings are reduced and their tendency to exit the labor market is increased. In addition, Jalan and Ravallion (2001) examine the impacts of idiosyncratic risk to households on portfolio and other behaviors in rural China.

They estimate that the percentage of liquid wealth held by individuals would decreased by less than one percent owing to the elimination of income risk. Moreover, Jalan and Ravallion (1999) analyses the influence of income risk on consumption by using a panel data of households in rural China. The outcomes show that the response to income risk of the poor is markedly different from the rich. Particularly, the poorer experience a larger effect of income risk on consumption. However, regarding to the effect of economic shocks and investment in human capital and child labor in China, the evidence is unclear and scarce. Jalan and Ravallion (1999) find no evidence that income risk decreases school enrollment in rural China.

This study makes a significant contribution to literature by examining the impact of short-run economic shocks on education expenditure, additional overage and child labor in the context of China, in which, education expenditure used to estimate changes in quality of education and additional overage is defined as a quantity effect of education.

In order to examine the impact of given shock on human capital, most previous studies have concentrated on analyzing quantity variables such as school enrollment, drop- out rate, repetition.

However, child's school attendance may not decline immediately if households face smaller shocks. For example, the household might make a reduction of time spent on education of children instead of taking children away from school. In addition, they may make a decision of cutting education expenditure by moving their children to a cheaper school or/and cutting expenses of purchasing school inputs. Escobal, Saavedra and Suarez (2007) find out that in Peru, short-run economic shocks have an effect on 'quality' rather than 'quantity' of investment in education.

The remainder of this study is arranged into six sections. Section 2 captures a summary of literature review of the impact of short-term economic shock on children. Section 3 shows the data of this study. Section 4 mentions this study's research methodology. Section 6 analyzes the regression results. Lastly, Section 7 gives the conclusions with some main findings some policy implications.

2 Empirical review

A large amount of researches examine household adjustment mechanisms affected by economic shocks. The accumulation of human capital is affected by a few researches of such mechanisms. Upon studying the household responses to a variety of economic shocks, Gaviria (2001) and Faloon and Lucas (2002) find out that one of strategies opted by the families is adjustment in investment in human capital. Significant literature investment is undertaken in an attempt to evaluate the impacts of economic shocks on education variables. A few researchers study the effect of aggregate shocks on the accumulation of human capital and others study the idiosyncratic shocks. For Costa Rica, Funkhouser (1999) calculates a reduced form for the decision of sending children to school thanks to the use of a pseudo-panel of households and estimates the economic cycle owing to the utilization of dummy variables of yearly impacts for every single year of the survey. He finds that the impact of aggregate shocks on secondary school attendance is considerable, especially in rural places. For Pakistan, Sawada and Lokshin (2000) realize that negative income shocks lead to the increase in secondary drop out and the decrease in primary drop out.

Neri and Thomas (2000) study the impact of household's economic changes on repetition and drop-out by analyzing both aggregate shocks and idiosyncratic shocks. They find that a transition from formal to informal sector of the head of household might increase the likelihood of the child repetition

in that year's school in the period of recessions. However, either income shock or unemployment shock do not have educational effect.

Duryea (1998) finds that if the father of a household become unemployed, the probability that children aged 10-15 finish school year will decrease by 4 percent. This impact is negatively significant for both girls and boys. The results of this paper also show that the ways in which households are protected from transitory income shocks thanks to children's time are consistent with models of education including assumptions of imperfect credit markets. As stated by Jacoby and Skoufias (1997), there is no strong evidence found to prove that either aggregate shocks or idiosyncratic shocks have an effect on school attendance.

Besides, the factors that make contributions to the effects of economic shock on the human capital accumulation are the nature of the shock, the structure of the credit market, and access to the credit market. Jacoby and skoufias (1997) investigate the connection between incomplete financial market and human capital accumulation. They study the response of school attendance of children to the income of farming households fluctuate seasonally with various levels of access to credit. They find out that the impact of idiosyncratic shock on school attendance is smallest in the village with the most developed financial market.

Acemoglu and Pischke (2001) suggest models of the link between income changes and investment in school in a context of credit constraints. Barham et al (1995) suggest a theoretical model that demonstrates the effects of family wealth on the possibility of a child receiving an education and the investment in education which is lower than optimum due to liquidity restrictions, as the child's ability is provided. Similarly, Jacoby (1994) find the evidence to show that borrowing restrictions affect school attendance in Peru. The result shows that borrowing restrictions can be a mechanism to transmit poverty from one generation to the next. They also find that if children are born in households with lower incomes, they will start to leave school earlier.

Another factor that influences the correlation between economic shock and human capital accumulation is the child labour market. Theoretically, given the fact there is a trade-off between children's work and school attendance, households decide on children's work and school attendance at the same time. The specific individual and household characteristics and the state of the labour market are

two factors which affect opportunity cost of school attendance. In reality, instead of going to school, children have to start joining the labour market, or to take over household activities from an adult in the household if that person makes decision of going out to work. Duryea and Arends-Kuenning (2003) examine that in Brazil, decrease in household income due to aggregate shocks does not increase child labour or make school attendance less as they appear to be offset by declining cost of opportunity for children in the labour market. Neri and Thomas (2000) document that a transition from formal sector to informal sector of the head of household may increase the probability that their children join the labor market during the period of growth. Besides, Neri et al (2000) examine how idiosyncratic shocks to income of father affect human capital accumulation of children which are dropout rate of school, repetition, non-domestic labor and domestic labor. They find that income of father is positively correlated with the likelihood that children drop out of school and the likelihood that children repeat at school. Their findings suggest that there is no correlation between a father becoming unemployed and the likelihood that children enter non-domestic labor market. In contrast, the outcomes illustrate that father becoming unemployed is positively correlated with child which start to work in domestic labor.

Also, an unemployed father is positively correlated to children who drop out and repeat a grade. Jacoby and Skoufias (1997) find that in rural India, salary of children have negative relationship with children school attendance. Shady (2002) studies the impact of macroeconomic crisis on school attendance and children employment in urban Peru in 1988-1992. He find out that the macroeconomic crisis does not have an effect on school attendance. However, the percentage of children working and going to school declines during the crisis. He also figures out that children who expose to the crisis have more years of schooling that those who unexposed to the crisis. In Mexico, Binder (1999) states that in the periods of economic contraction, decrease in cost of opportunity leads to improve school attendance indicators while a reduction in income is likely to worsen them. As a result, the total impact of two opposing impacts is worsening school attendance in the periods of recession given the fact that the negative impact of income reduction outweighs the positive impact of becoming lower in opportunity costs.

Specially, while the outcome of most studies is that economic shocks have negative impact on

education and child labor, Schady (2002) finds an opposing result. He examines the influence of economic crisis on school attendance in Peru. He figures out that the number of children who are employed as well as children who are in school declines significantly during the crisis. He also points out that children who are exposed to economic crisis have higher education attainment than those who are not exposed. This results can be interpreted that economic crisis have positive impact on schooling and employment of children.

For China, wide range of economic fluctuations is the most significant feature of the development. However, regarding to the effect of economic shocks and investment in human capital and child labor in China, the evidence is unclear and scarce. Jalan and Ravallion (1998) find no evidence that income risk decreases school enrollment in rural China.

3 Data

China Family Panel Studies (CFPS), which is carried out by the Institute of Social Science Survey (ISSS) of Peking University, China in the year 2010, is a nationally representative, annual individual, family, and community-level longitudinal survey of communities, families, and individuals in contemporary China. Collecting the longitudinal data of Chinese communities, families, and individuals is the purpose of the CFPS.

Probability-Proportional-to-Size Sampling (PPS) takes place with implicit stratification in CFPS. The major stratification variables are administrative units and socioeconomic status (SES). The ordering index for SES is local GDP per capita within the administrative unit. In the event of the GDP per capita in the administrative unit not available, the alternative is the percentage of nonagricultural population or population density.

The target sample consists of 16,000 households. 8,000 samples are created due to oversampling with five independent sampling frames (called “large provinces”) of Shanghai, Liaoning, Henan, Gansu, and Guangdong. 1,600 households is the number of each sub-sample. An independent sampling frame formed from 20 provinces (called “small provinces”) provides the data of the remaining 8,000 households.

The sampling frame representative of the regional population is the “large provinces”, which could

make a contribution to comparisons between provincial population inferences and cross-region. With a second-stage sampling, the overall representative at the national level composes of the five “large provinces” and “small provinces”.

The sub-sampling frames of CFPS are achieved through three different stages, namely the Primary Sampling Unit (PSU) which is administrative districts/counties, the Second-stage 18 Sampling Unit (SSU) which is administrative villages/neighborhood communities, and the third-stage (Ultimate) Sampling Unit (TSU) which is households. The first and second stages employ official administrative divisions for the purpose of the sample selection. In the third stage, the sample consists of housing units opted systematically from street listing with random starting point along with equal probability method.

The sample size is at the level of 16,000 households in 25 various provinces/ municipalities/ autonomous regions in China (excluding Hong Kong, Macao, Taiwan, Inner Mongolia, Qinghai, Ningxia, Tibet, Xinjiang, and Hainan), a representative of 95% of the population in China. The subjects of survey data collection are all eligible households and household members. The former is defined as an independent economic unit that resides in a residential community and at least one family member is Chinese. The latter refers to financially dependent immediate relatives, or non-immediate blood/marital/adoptive relatives who have resided with the sampled household for over three consecutive months and financially related to such household. The subjects of the interview are all household individuals aged over 9 in an eligible household. These members are considered as core members of the CFPS and children also constitute core members of the CFPS. All core members of the CFPS is monitored annually. Comparisons at the regional level can be done thanks to oversampling from five different provinces selected with each sub-sample consisting of 1600 households. The remaining 8000 households are opted from the other provinces in order to make the overall CFPS sample represent China through weighting except distant areas.

CFPS data is published on <http://www.iss.edu.cn> which is the official website of the Institute of Social Science Survey. Currently, the data is available for three years 2010, 2012, 2014. In order to investigate the impact of economic shock on overage and education expenditure, a panel data from 2010 to 2014 is supposed to be used. However, some queries in the questionnaire in 2014 related to the

identification of household's head have not been released yet. Besides, the content of the questionnaire in 2014 is different from those in 2010 and 2012, such as lack of question about total assets of household which is one of the crucial variables in the model. Thus, a cross sectional data which is created by the data in 2010 and 2012 is employed for this study.

4 Methodology

During economic shocks, the indicators which are utilized to measure changes in investment education investment are additional overage and changes in education expenditure. The former is used to capture the 'quantity' effect and the latter is used to measure the 'quality' effect.

The basic models are proposed by Escobal, Saavedra and Suarez (2005) which are adapted from Cameron and Heckman (1998). Each family has j alternative choice of additional overage AA_j with $j = [1 \dots j]$. It will make decision of choosing the additional overage AA which it want to get. We can observe actual additional overage AA of the child at any given point, but we cannot observe the desired AA^* . The additional overage level chosen by a household is the point maximizing household's perceived utility, provided some restrictions. Provided a set of child, household and contextual characteristics X , the observed utility of the additional overage alternative AA is described as the disparity between expected returns and expected costs. The ordered logit model are utilized in this case to estimate the impact of economic shocks on additional overage.

The dormant demand for the level of additional overage which household want to get AA^* is defined as follows:

$$AA^* = \beta'X + \mu \quad (1)$$

Whereas μ is an independently distributed disturbance term and β is the coefficients to be calculated. In which, additional overage of the children AA takes three value; AA equals 0 if the child observed has no additional overage; AA equals 1 if the additional overage of the child is of one year ; and AA takes the value of 2 if the child observed has two years or three years of additional overage. The model with actual additional overage AA is given by:

$$AA = F(N_{t-1}, H_{t-1}, R_{t-1}, D_{t-1}, E_{t-1}, S). \quad (2)$$

Whereas

N_{t-1} : Child's characteristics in t

H_{t-1} : Household's characteristics and the head of the household's characteristic

R_{t-1} : Variables of the economic situation the child's household

D_{t-1} : Variables of the child's place of residence

E_{t-1} : Characteristics of the education system in the locality

S : Economic shock between t and $t - 1$

The likelihood that child has additional overage AA and the level of AA can be influenced by the child's characteristics and the household's characteristic in the year t . Sex, health status, level of education and whether the child enters labour force are some of typical characteristics of the child. Some characteristics of the household are size, the household income, the age, sex and education of the household head, number of members in the household, the education level of each member in the family. In addition, the probability of additional overage can be determined by the total value of household assets which express the level of credit restrictions faced by the household and the level of household wealth. One way to estimate the impact of labour market on the likelihood of additional overage is to observe the potential income of the adult woman who have the lowest level of education in the family. The mechanism is that high potential income rise the opportunity cost of the woman and then increase the likelihood that a child has to replace to do her household jobs. This result implies that the probability of overage is higher.

Besides, if there are under-five-year-old children in the family, the child, especially the girl, might opt to take care of their younger siblings. In this circumstance, the probability of overage increase. Finally, the probability of overage may be influenced by economic shocks which are defined by changes in income, changes in expenditure, changes in labor status of the head of the household, including moving from formal sector to informal sector or becoming unemployment. The likelihood of overage can be influenced by other variables which are associated with the local system of education.

In order to estimate the effect of short-term economic shocks on education expenditure, the following equation is employed.

$$\Delta G = G(N_{t-1}, H_{t-1}, R_{t-1}, D_{t-1}, E_{t-1}, S). \quad (3)$$

Whereas, ΔG is changes in expenditure of education. Other explanatory variables such as N_{t-1} , H_{t-1} , R_{t-1} , D_{t-1} , E_{t-1} and S are similar to the equation (2), but the variables which is related to the labour market is not included in equation (3).

5 Summary statistics

The summary statistics of the dependent variables and explanatory variables are shown in Table 3. For the dependent variables, table 3 shows that the average overage year is about 0.49. However, the variation of overage is large. Particularly, the minimum and maximum overage are -1 and 8 respectively. The latter which is less than zero means that the child goes to school one year earlier. Besides, the minimum and maximum additional overage are 0 and 2 respectively. The second dependent variable is change in education expenditure between 2012 and 2010, which is calculated by logarithm of education expenditure in 2012 minus logarithm of education expenditure in 2010.

With regard to some of the explanatory variables, the last grade completed which is calculated by grade child is attending minus 1 has the value from 0 to 5, and the average is approximately 1.64 (SD = 1.16). However, there are only 1,571 individuals responding to this information while most of other variables have 2,696 observations. The number of boys and girls taking part in the survey is not really different since the average of child's sex, which is recorded as 0 for male and 1 for female, is nearly 0.52 (SD = 0.50). Although the amount of times that Chinese children are hospitalized ranges from 0 to 44 in 2010, the average number of hospitalization is only 0.89, which could mean the values vary remarkably (SD = 2.99). When it comes to household variables, there are averagely over 5 members living together within each household, it is also worth-noticed that there are even some families having 17 members, it undoubtedly accounts for the maximum value of this variable. Most household's head seems to be a man, because with the values recorded as 1 for male and 0 for female, the average of this variable is 0.80 (SD = 0.40). Moreover, the household's head

is more likely to be middle-aged as the average age for them is slightly over 45, taking into account that the $SD = 12.3$ and the ages range from 17 to 80. Regarding the highest education of members, the variable is recorded from 1 to 8 for illiterate/semi-literate/primary school, junior high school, senior high, school/secondary, school/technical school/vocational senior school, 3-year college, year college/bachelor's degree, master's degree and doctoral degree alternately. With the average number calculated as 3.04 (1.19), most people seem not to take part in senior high. Additionally, the maximum number of this variable is 7, which means there is no one of those 2,696 individuals having a doctoral degree. Among all of the variables chosen in this study, the log of total asset is the variable that varies most with $SD = 5076.431$ and the average log of total asset is merely over 2649. The average potential income of household's female adult with fewest year of education, which is measured based on median income of adult female located in the province that have the similarity in education level and age, is 11.90 ($SD = 1.19$).

Table 3

6 Empirical analysis

Tables 4 shows the estimation of additional overage models using the panel of 6 to 12-year-olds with economic shock defined by income shock. Employing OLS regression, column 1 of the given table illustrates factors affecting overage. In particular, the outcomes show that overage will be greater when the frequency that the child goes to the hospital due to illness increases. The overage of female is lower as compared to that of male. Similarly, the overage of child living in highland regions is lower than the one of child residing in coastal regions.

Using ordered logit model, column 2 indicates the outcomes of the specifications for additional overage; in which economic shock to household is defined by adverse income shock 1 which means income per capita falls by less than 40%. The positively significant coefficient of adverse income shock 1 implies that the probability of overage will increase if income per capita decreases by less than 40%. The outcomes also show that the more the children are being admitted to the hospital, the more overage they have. Besides, the larger the family size is, the more overage the child has. Likewise, the more overage takes place in household located in rural areas. On the other hand, the overage is likely

to be reduced thanks to the education that household adult members have.

In column 3, instead of using adverse income shock 1, adverse income shock 2 is used as an alternative short-term shock variable. Column 3 demonstrates similar results to column 2, except adverse income shock 2 which means that income per capita decreases by more than 40%. The insignificant coefficient of adverse income shock 2 can be interpreted that there is no effect of adverse income shock 2 on additional overage

Table 4

Table 5 indicates the outcomes of regression by adding groups of variables including N, H, R, D, and E with economic shock defined by adverse income shock 1. Due to the lack of important variables, there is no evidence to show that adverse income shock 1 has impact on additional overage in column 1 and 2. On the contrary, the results of columns 3 and 4 which add more groups of variables shows that adverse income shock 1 increases overage of the child

Similarly, Table 6 also indicates the outcomes of regression by adding groups of variables including N, H, R, D, and E with economic shock defined by adverse income shock 2. The results find out that adverse income shock 2 have no impact on additional overage in all 4 cases.

Table 5

Table 6

Table 7 shows the estimation of additional overage models using the panel of 6 to 12-year-olds with economic shock variable as above-mentioned employment shock. Using ordered logit model, column 1 to 4 shows the results of regression by adding groups of variables including characteristics of the child in 2010 (N), household's characteristics and the head of the household's characteristic (H), variables of the economic situation the child's household (R), and combination of variables of the child's place of residence (D) and characteristics of the education system in the locality (E) to these columns respectively. The insignificant coefficient of employment shock in column 5 when all groups of variables included shows that employment shock has no impact on overage. The reason is that due to the low income of household's head as they are employed in 2010, their unemployment in 2012 may have no effect on additional overage of children.

Table 7

The results of the estimations with education expenditure as a dependent variable are shown in Table 9. The first column in the table illustrates the determinants of education expenditure. The expenditure per child is likely to be larger in families that have higher income, more assets, and members gaining more education. In addition, there is positive relationship between age of the household's head and education expenditure. This result can be interpreted that a family with older household's head tends to invest more in education for children. In contrast, the larger families are, the less education investment the child has. Moreover, the education expenditure is smaller on the child living in highland regions, and is greater in urban areas.

The estimation outcomes for the change in education expenditure are shown in columns 2 to 5. Column 5 shows the outcomes when all groups of explanatory variables are included. In particular, the income per capita shock is positively related to change in education expenditure. This result means that when the income per capita decreases, education expenditure reduces as well. Moreover, children in higher grades and those who are three or more years of overage receive more education investment. Besides, education expenditure tends to increase in families with higher income, more assets, more income per capita and where the household's head is a woman. Similarly, the older the household's head is, the more education expenditure the child has.

Other variables that impact the change in education expenditure are related to where the child lives. Particularly, the change in education expenditure for the children living in highland regions is bigger than those living in coastal regions

Table 9

Table 10 and 11 indicate the outcomes of the estimations with economic shock defined by employment shock and expenditure shock respectively. Using OLS model, the result is that neither employment shock nor expenditure shock have impact on change in education expenditure. For other variables, the results are similar to Table 9.

Table 10

Table 11

7 Conclusion

The results of the estimations show that economic shocks defined by income per capita of household fall by less than 40% have negative impact on overage of children which is a quantity variable of education. This finding is consistent with the results of Sawada and Lokshin finding for Pakistan that negative income shocks raise secondary drop-out. However, unexpectedly, there is no evidence to state that economic shocks indicated by income per capita of household falling by more than 40% have impact on additional overage of children.

In addition, adjustment on education investment is another strategy which households adopt to cope with income shock. There is evidence to prove that families tend to reduce education expenditure when income of households falls. Households might reduce education expenditure by moving the child to a cheaper school, cutting education cost or purchasing fewer school materials. They are coping strategies which can have a long-term impact on their children's human capital.

Our results also suggest that schooling effects are only related to income shock but not related to expenditure shock and employment shock. This result implies that income reduction of households should become an issue which authorities should pay attention to. Besides, we should investigate more about the mechanisms which income shock affect schooling of children in China for the future research.

This article has two major policy implications. First, authorities should have policies like making loan, granting subsidy, offering education and social program to reduce the effects of income shock on overage which might be due to temporary drop-out or repetition. Second, policy makers should take consideration into maintaining mechanisms that guarantee that there is no reduction in families' education investment.

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Table 1: List of explanatory variables

Name of variables	Group	Meaning	Value
Last grade completed	(N) The child's characteristics in 2010	The grade which the child completed in 2010	The grade child is attending minus 1.
Child's sex		Sex of the child in 2010	Equals 1 if child is girl; otherwise equals 0
The number of hospitalization			
Child overage (1 year) in 2010		Whether the child has 1 overage year or not in 2010	Equals 1 if the child has 1 overage year of schooling; otherwise equals 0
Child overage (2 years) in 2010		Whether the child has 2 overage year or not in 2010	Equals 1 if the child has 2 overage year of schooling; otherwise equals 0
Child overage (3 or more years) in 2010		Whether the child has 3 or more overage year or not in 2010	Equals 1 if the child has 3 or more overage year of schooling; otherwise equals 0
Number of household members	(H) Household's characteristics and head of the household's characteristics in 2010	Number of household members in 2010	
Sex of household head		Sex of household head in 2010	Equals 1 if household head is male; otherwise equals 0
Age of household head		Age of household head in 2010	
Highest education of members		Highest education of the most educated member in the family in 2010	1. Illiterate/Semi-literate/Primary school 2. Junior high school 3. Senior high school/secondary 4. School/technical school/vocational senior school 5. 3-year college 6. Year college/Bachelor's degree 7. Master's degree 8. Doctoral degree
Potential income of household's female adult with fewest year of education	(R) Economic situation of the child's household in 2010	Potential income of household's female adult with fewest year of education in 2010	Measured based on median income of adult female located in the province that have the similarity in education level and age. Hence, two education levels and three age ranges for each of 15 provinces and two areas (urban and rural) in each province are included, making total of 180 distinct values
Log of total asset			Log of total asset of the household in 2010

Table 1: List of explanatory variables

Name of variables	Group	Meaning	Value
Household with under 5 (yes=1) x child's sex (girl=1)		Interaction variable	Equals 1 if household with kid under 5 years old and the child researched is female; otherwise equals 0
Log income per capital of household			Log income per capital of household in 2010
Highland	(D) Variables of the region child lives in 2010	Whether the child live in highland region or not	Equals 1 if the child lives in highland region schooling; equals 0 if the child lives in coastal region.
Urban		Whether the child live in urban or not	Equals 1 if the child lives in urban schooling; equals 0 if the child lives in rural.
Adverage overage in the county which child lives	Local education situation	Adverage overage in the county which child lives	
Adverse income shock 1	(S) Economic shock between 2012 and 2010	Decrease less than 40%	Equals 1 if income per capita decrease less than 40% ; otherwise equals 0
Adverse income shock 2		Decrease more than 40%	Equals 1 if income per capita decrease more than 40% ; otherwise equals 0
Per capita income shock			Logarit of income per capita in 2012 minus logarit of income per capita in 2010
Expenditure shock			Logarit of total expenditure 2012 minus logarit of total expenditure 2010
Employment shock			Equals 1 if the household head change from employment in 2010 to unemployment in 2012; otherwise equals 0.

Table 2: List of dependent variables

Name of variables	Meaning	Value
Additional overage	The different between overage in 2012 and 2010	Calculated by overage of 2012 minus overage 2010. Equals 0 if the child have no more years of overage Equals 1 if the child have one more years of overage Equals 2 if the child have two more years of overage.
Change in education expenditure	Change in education expenditure of the household between in 2012 and 2010	Calculated by logarithm of education expenditure in 2012 minus logarithm of education expenditure in 2010

Table 3: Summary statistics

Variables	Obs	Mean	.Dev	Min	Max
Overage	2,696	.495549	1.722485	-1	8
Overage additional	2,696	.208457	.4791951	0	2
Last grade completed	1,571	1.264799	1.157045	0	5
Child's sex (female=1)	2,696	.5281899	.4992973	0	1
The number of hospitalization	2,696	.977745	2.990316	0	44
Child overage (1 year) in 2010	2,696	.1828635	.3866263	0	1
Child overage (2 years) in 2010	2,696	0.0400593	.1961348	0	1
Child overage (3 or more years) in 2010	2,696	.4870178	.4999242	0	1
Number of household members	2,696	5.126484	1.816832	2	17
Sex of household head	2,696	.7974777	.4019539	0	1
Age of household head	2,696	45.09458	12.30058	17	80
Highest education of members	2,696	3.039688	1.186935	1	7
Potential income of household's	1,825	2649.003	5076.431	0	27000
Female with fewest year of education	2,583	11.90195	1.194352	5.303305	17.34436
Household with kid under 5 (yes=1) x child's sex (girl=1)	2,696	.2088279	.4065466	0	1
Log income per capital	2,501	8.209826	1.202753	0	12.73711
Highland	2,696	.6772997	.4675959	0	1
Urban	2,696	.3568249	.4791514	0	1
Average overage in the county	2,696	1.093989	.4047289	.09375	2.375
Income shock	2,441	.44548	1.373469	-9.3926	11.759
Adverse income shock 1	2,696	.1353858	0.3421986	0	1
Adverse income shock 2	2,696	0.1988131	.3991811	0	1
Employment shock	2,696	.1639466	0.3702958	0	1
Expenditure shock	2,117	.3796586	0.8352438	-2.564755	4.207803

Table 4: Ordered logit estimation of additional overage with economic shock defined by income shock (0 = no overage, 1 = one year overage, 2 = two year overage)

	Overage (years) in 2010 - OLS	Overage additional	Overage additional
Last grade completed	-0.421*** (0.0592)	0.306*** (0.0925)	0.301*** (0.0923)
Child's sex (female=1)	-0.342** (0.148)	0.0694 (0.209)	0.0371 (0.208)
The number of hospitalization	0.0752*** (0.0238)	0.0960* (0.0500)	0.101** (0.0505)
Child overage (1 year) in 2010		-0.800*** (0.243)	-0.818*** (0.242)
Child overage (2 years) in 2010		-1.129** (0.501)	-1.122** (0.489)
Child overage (3 or more years) in 2010		2.203*** (0.287)	2.139*** (0.282)
Number of household members	-0.0333 (0.0494)	0.211*** (0.0565)	0.201*** (0.0557)
Sex of household head	0.190 (0.179)	-0.0183 (0.219)	-0.0137 (0.219)
Age of household head	0.00584 (0.00592)	-0.00337 (0.00909)	-0.00309 (0.00917)
Highest education of members	-0.0771 (0.0627)	-0.202** (0.103)	-0.208** (0.103)
Log of total asset	0.0798 (0.0510)	0.0166 (0.0716)	0.0224 (0.0729)
Potential income of household's female adult with fewest year of education	1.76e-05 (2.00e-05)	1.92e-05 (2.47e-05)	1.84e-05 (2.57e-05)
Household with under 5 (yes=1) x child's sex (girl=1)	-0.102 (0.249)	-0.130 (0.332)	-0.119 (0.333)
Income per capital of household	-0.0454 (0.0716)	-0.0607 (0.113)	-0.000824 (0.121)
Child lives in highland region	-0.331** (0.159)	-0.146 (0.230)	-0.100 (0.228)
Urban	0.0308 (0.175)	-0.550** (0.233)	-0.545** (0.233)
Average overage in the county which child lives		-0.641*** (0.229)	-0.619*** (0.231)
Adverse income shock 1 (less than 40%)		0.549** (0.245)	
Adverse income shock 2 (more than 40%)			-0.219 (0.249)
Constant cut1		0.997 (1.169)	1.379 (1.192)
Constant cut2		2.910** (1.180)	3.283*** (1.203)
Constant	1.339* (0.777)		
Observations	936	936	936
R-squared	0.079		

Standard error in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Ordered logit estimation of additional overage with economic shock defined by expenditure shock (0 = no overage, 1 = one year overage, 2 = two year overage)

	(1) Overage additional	(2) Overage additional	(3) Overage additional	(4) Overage additional
Last grade completed	0.273*** (0.0696)	0.284*** (0.0704)	0.312*** (0.0912)	0.306*** (0.0925)
Child's sex (female=1)	0.105 (0.139)	0.157 (0.142)	0.0370 (0.208)	0.0694 (0.209)
The number of hospitalization	0.0441 (0.0357)	0.0474 (0.0366)	0.0868* (0.0482)	0.0960* (0.0500)
Child overage (1 year) in 2010	-0.766*** (0.175)	-0.861*** (0.176)	-0.838*** (0.237)	-0.800*** (0.243)
Child overage (2 years) in 2010	-1.333*** (0.404)	-1.536*** (0.402)	-1.139** (0.484)	-1.129** (0.501)
Child overage (3 or more years) in 2010	1.728*** (0.206)	1.829*** (0.216)	2.083*** (0.284)	2.203*** (0.287)
Number of household members		0.180*** (0.0352)	0.220*** (0.0550)	0.211*** (0.0565)
Sex of household head		-0.0943 (0.170)	-0.0275 (0.218)	-0.0183 (0.219)
Age of household head		-0.00191 (0.00625)	-0.00376 (0.00887)	-0.00337 (0.00909)
Highest education of members		-0.151** (0.0618)	-0.242** (0.0995)	-0.202** (0.103)
Log of total asset			0.0286 (0.0690)	0.0166 (0.0716)
Potential income of household's female adult with fewest year of education			2.34e-06 (2.37e-05)	1.92e-05 (2.47e-05)
Household with under 5 (yes=1) x child's sex (girl=1)			-0.123 (0.329)	-0.130 (0.332)
Income per capital of household			-0.0695 (0.109)	-0.0607 (0.113)
Child lives in highland region				-0.146 (0.230)
Urban				-0.550** (0.233)
Average overage in the county which child lives				-0.641*** (0.229)
Adverse income shock 1 (less than 40%)	0.166 (0.186)	0.292 (0.190)	0.519** (0.249)	0.549** (0.245)
Constant cut1	1.882*** (0.176)	2.222*** (0.405)	1.932* (1.034)	0.997 (1.169)
Constant cut2	3.661*** (0.204)	4.031*** (0.429)	3.827*** (1.047)	2.910** (1.180)
Observations	1,571	1,571	936	936

Standard error in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Ordered logit estimation of additional overage - (0 = no overage, 1 = one year overage, 2 = two year overage)

	(1)	(2)	(3)	(4)
	Overage additional	Overage additional	Overage additional	Overage additional
Last grade completed	0.273*** (0.0692)	0.282*** (0.0701)	0.309*** (0.0913)	0.301*** (0.0923)
Child's sex (female=1)	0.0976 (0.139)	0.147 (0.142)	0.00346 (0.207)	0.0371 (0.208)
The number of hospitalization	0.0466 (0.0360)	0.0503 (0.0371)	0.0930* (0.0489)	0.101** (0.0505)
Child overage (1 year) in 2010	-0.762*** (0.175)	-0.858*** (0.176)	-0.854*** (0.236)	-0.818*** (0.242)
Child overage (2 years) in 2010	-1.344*** (0.404)	-1.541*** (0.402)	-1.141** (0.476)	-1.122** (0.489)
Child overage (3 or more years) in 2010	1.714*** (0.204)	1.808*** (0.214)	2.023*** (0.277)	2.139*** (0.282)
Number of household members		0.172*** (0.0348)	0.209*** (0.0543)	0.201*** (0.0557)
Sex of household head		-0.103 (0.170)	-0.0184 (0.217)	-0.0137 (0.219)
Age of household head		-0.00193 (0.00624)	-0.00356 (0.00892)	-0.00309 (0.00917)
Highest education of members		-0.146** (0.0616)	-0.249** (0.0997)	-0.208** (0.103)
Log of total asset			0.0345 (0.0699)	0.0224 (0.0729)
Potential income of household's female adult with fewest year of education			8.16e-07 (2.42e-05)	1.84e-05 (2.57e-05)
Household with under 5 (yes=1) x child's sex (girl=1)			-0.106 (0.330)	-0.119 (0.333)
Income per capital of household			-0.0142 (0.117)	-0.000824 (0.121)
Child lives in highland region				-0.100 (0.228)
Urban				-0.545** (0.233)
Average overage in the county which child lives				-0.619*** (0.231)
Adverse income shock 2 (more than 40%)	-0.231 (0.195)	-0.173 (0.197)	-0.233 (0.254)	-0.219 (0.249)
Constant cut1	1.806*** (0.177)	2.099*** (0.401)	2.224** (1.048)	1.379 (1.192)
Constant cut2	3.587*** (0.200)	3.907*** (0.421)	4.110*** (1.062)	3.283*** (1.203)
Observations	1,571	1,571	936	936

Standard error in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Ordered logit estimation of additional overage with economic shock defined by employment shock (0 = no overage, 1 = one year overage, 2 = two year overage)

	(1)	(2)	(3)	(4)
	Overage additional	Overage additional	Overage additional	Overage additional
Last grade completed	0.274*** (0.0697)	0.282*** (0.0705)	0.308*** (0.0917)	0.300*** (0.0926)
Child's sex (female=1)	0.0986 (0.140)	0.146 (0.142)	0.0138 (0.206)	0.0443 (0.207)
The number of hospitalization	-0.0434 (0.0359)	-0.0475 (0.0370)	-0.0939 (0.0491)	-0.101 (0.0505)
Child overage (1 year) in 2010	-0.774*** (0.175)	-0.862*** (0.176)	-0.875*** (0.236)	-0.836*** (0.242)
Child overage (2 years) in 2010	-1.388*** (0.402)	-1.567*** (0.399)	-1.160** (0.479)	-1.137** (0.492)
Child overage (3 or more years) in 2010	1.721*** (0.206)	1.809*** (0.215)	2.031*** (0.278)	2.144*** (0.282)
Number of household members		0.171*** (0.0352)	0.209*** (0.0545)	0.200*** (0.0561)
Sex of household head		-0.112 (0.170)	-0.0226 (0.218)	-0.0168 (0.219)
Age of household head		-0.00148 (0.00629)	-0.00251 (0.00892)	-0.00207 (0.00920)
Highest education of members		-0.135** (0.0631)	-0.236** (0.100)	-0.197* (0.103)
Log of total asset			0.0351 (0.0709)	0.0234 (0.0740)
Potential income of household's female adult with fewest year of education			2.08e-06 (2.44e-05)	1.99e-05 (2.58e-05)
Household with under 5 (yes=1) x child's sex (girl=1)			-0.117 (0.328)	-0.129 (0.331)
Income per capital of household			-0.0419 (0.111)	-0.0266 (0.115)
Child lives in highland region				-0.0974 (0.228)
Urban				-0.547** (0.234)
Average overage in the county which child lives				-0.611*** (0.231)
Employment shock	0.487*** (0.177)	0.417** (0.181)	0.179 (0.261)	0.137 (0.268)
Constant cut1	1.938*** (0.177)	2.250*** (0.409)	2.156** (1.044)	1.332 (1.195)
Constant cut 2	3.724*** (0.203)	4.063*** (0.431)	4.040*** (1.057)	3.235*** (1.205)
Observations	1,571	1,571	936	936

Standard error in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Ordered logit estimation of additional overage (0 = no overage, 1 = one year overage, 2 = two year overage)

	(1)	(2)	(3)	(4)
	Overage additional	Overage additional	Overage additional	Overage additional
Last grade completed	0.273*** (0.0787)	0.283*** (0.0790)	0.298*** (0.106)	0.294*** (0.107)
Child's sex (female=1)	0.104 (0.157)	0.125 (0.159)	-0.0620 (0.227)	-0.0324 (0.228)
The number of hospitalization	-0.0444 (0.0437)	-0.0477 (0.0449)	-0.0907 (0.0556)	-0.0987 (0.0575)
Child overage (1 year) in 2010	-0.752*** (0.197)	-0.882*** (0.201)	-0.826*** (0.270)	-0.801*** (0.276)
Child overage (2 years) in 2010	-1.086*** (0.410)	-1.328*** (0.407)	-1.000** (0.497)	-0.974* (0.505)
Child overage (3 or more years) in 2010	1.712*** (0.231)	1.814*** (0.241)	2.058*** (0.297)	2.164*** (0.301)
Number of household members		0.173*** (0.0463)	0.191*** (0.0614)	0.182*** (0.0641)
Sex of household head		-0.0448 (0.198)	0.00118 (0.245)	0.00569 (0.247)
Age of household head		-0.00595 (0.00758)	-0.00901 (0.0104)	-0.00920 (0.0108)
Highest education of members		-0.170** (0.0696)	-0.216** (0.108)	-0.180 (0.110)
Log of total asset			0.0734 (0.0822)	0.0530 (0.0838)
Potential income of household's female adult with fewest year of education			-4.06e-07 (2.68e-05)	1.12e-05 (2.85e-05)
Household with under 5 (yes=1) x child's sex (girl=1)			0.0182 (0.370)	0.0149 (0.372)
Income per capital of household			-0.126 (0.125)	-0.120 (0.128)
Child lives in highland region				-0.147 (0.249)
Urban				-0.445* (0.262)
Average overage in the county which child lives				-0.611** (0.251)
Expenditure shock	-0.0234 (0.0955)	-0.00831 (0.0950)	-0.0452 (0.125)	-0.0446 (0.123)
Constant cut1	1.869*** (0.200)	1.917*** (0.463)	1.536 (1.193)	0.489 (1.379)
Constant cut 2	3.697*** (0.228)	3.767*** (0.484)	3.506*** (1.207)	2.477* (1.384)
Observations	1,247	1,247	770	770

Standard error in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 9: Regression for education expenditure with economic shock defined by income shock

	(1)	(2)	(3)	(4)	(5)
	Log education expenditure 2010	Change in education expenditure			
Log educationexpenditure 2010		-0.590*** (0.0198)	-0.628*** (0.0204)	-0.650*** (0.0212)	-0.656*** (0.0214)
Last grade completed	0.00955 (0.0164)	0.197*** (0.0166)	0.190*** (0.0164)	0.183*** (0.0167)	0.182*** (0.0167)
Child's sex (female=1)	0.00583 (0.0532)	-0.0521 (0.0532)	-0.0582 (0.0528)	-0.0912* (0.0538)	-0.0853 (0.0536)
The number of hospitalization	0.0148 (0.0108)	0.000623 (0.0107)	0.00108 (0.0106)	0.00166 (0.0108)	0.00269 (0.0108)
Child overage (1 year) in 2010	-0.307*** (0.0613)	-0.134** (0.0600)	-0.0530 (0.0603)	-0.0638 (0.0615)	-0.0829 (0.0615)
Child overage (2 years) in 2010	-0.459*** (0.108)	-0.312*** (0.105)	-0.176* (0.105)	-0.142 (0.106)	-0.128 (0.106)
Child overage (3 or more years) in 2010	0.115 (0.102)	0.811*** (0.100)	0.814*** (0.0992)	0.773*** (0.101)	0.765*** (0.100)
Number of household members	-0.139*** (0.0178)		-0.0508*** (0.0176)	-0.0436** (0.0181)	-0.0445** (0.0183)
Sex of household head	-0.0924 (0.0662)		-0.174*** (0.0653)	-0.165** (0.0669)	-0.182*** (0.0669)
Age of household head	0.0129*** (0.00255)		0.00588** (0.00255)	0.00574** (0.00260)	0.00529** (0.00260)
Highest education of members	0.0824*** (0.0267)		0.136*** (0.0240)	0.0926*** (0.0264)	0.109*** (0.0271)
Log of total asset	0.101*** (0.0224)			0.0880*** (0.0224)	0.0849*** (0.0224)
Log of incomeper capita	0.174*** (0.0263)			0.0825** (0.0332)	0.0692** (0.0335)
Child lives in highland region	-0.325*** (0.0581)				-0.235*** (0.0588)
Urban	0.288*** (0.0610)				-0.0984 (0.0614)
Income shock	0.0286	0.0321 (0.0199)	0.0752*** (0.0197)	0.0751*** (0.0248)	
Constant	3.621*** (0.318)	4.222*** (0.137)	4.143*** (0.195)	2.691*** (0.338)	3.060*** (0.356)
Observations	2,297	2,021	2,021	1,934	1,934
R-squared	0.200	0.338	0.356	0.362	0.368

Standard error in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10: Regression for education expenditure with economic shock defined by employment shock

	(1)	(2)	(3)	(4)
	Dependent variable: Change in education expenditure between 2010 and 2012			
Log education expenditure 2010	-0.591*** (0.0188)	-0.629*** (0.0192)	-0.653*** (0.0209)	-0.661*** (0.0209)
Last grade completed	0.197*** (0.0158)	0.189*** (0.0156)	0.183*** (0.0165)	0.182*** (0.0164)
Child's sex (female=1)	-0.0380 (0.0507)	-0.0438 (0.0503)	-0.0720 (0.0530)	-0.0672 (0.0528)
The number of hospitalization	0.00780 (0.0102)	0.00812 (0.0100)	0.00563 (0.0106)	0.00694 (0.0105)
Child overage (1 year) in 2010	-0.146** (0.0570)	-0.0717 (0.0573)	-0.0960 (0.0605)	-0.108* (0.0604)
Child overage (2 years) in 2010	-0.328*** (0.0991)	-0.197** (0.0995)	-0.129 (0.104)	-0.112 (0.104)
Child overage (3 or more years) in 2010	0.797*** (0.0955)	0.792*** (0.0945)	0.781*** (0.0996)	0.773*** (0.0993)
Number of household members		-0.0707*** (0.0164)	-0.0601*** (0.0174)	-0.0604*** (0.0176)
Sex of household head		-0.139** (0.0623)	-0.170*** (0.0659)	-0.183*** (0.0658)
Age of household head		0.00763*** (0.00237)	0.00637** (0.00255)	0.00584** (0.00255)
Highest education of members		0.127*** (0.0229)	0.100*** (0.0257)	0.112*** (0.0260)
Log of total asset			0.0923*** (0.0220)	0.0886*** (0.0220)
Log of incomeper capita			0.0217 (0.0261)	0.00794 (0.0264)
Child lives in highland region				-0.216*** (0.0577)
Urban				-0.0554 (0.0376)
Employment shock	0.0219 (0.0694)	0.0666 (0.0689)	0.0335 (0.0730)	0.0327 (0.0727)
Constant	4.232*** (0.129)	4.168*** (0.181)	3.220*** (0.301)	3.583*** (0.318)
Observations	2,256	2,256	2,012	2,012
R-squared	0.335	0.353	0.361	0.366

Standard error in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11: Regression for education expenditure with economic shock defined by expenditure shock

	(1)	(2)	(3)	(4)
	Dependent variable: Change in education expenditure between 2010 and 2012			
Log education expenditure 2010	-0.588*** (0.0208)	-0.629*** (0.0213)	-0.655*** (0.0232)	-0.666*** (0.0232)
Last grade completed	0.200*** (0.0176)	0.190*** (0.0175)	0.181*** (0.0184)	0.181*** (0.0183)
Child's sex (female=1)	-0.0505 (0.0565)	-0.0581 (0.0559)	-0.0722 (0.0586)	-0.0724 (0.0583)
The number of hospitalization	0.00551 (0.0113)	0.00549 (0.0112)	0.00365 (0.0118)	0.00599 (0.0118)
Child overage (1 year) in 2010	-0.115* (0.0638)	-0.0303 (0.0642)	-0.0505 (0.0675)	-0.0654 (0.0673)
Child overage (2 years) in 2010	-0.355*** (0.109)	-0.211* (0.110)	-0.166 (0.115)	-0.151 (0.114)
Child overage (3 or more years) in 2010	0.819*** (0.106)	0.806*** (0.105)	0.805*** (0.109)	0.791*** (0.109)
Number of household members		-0.0790*** (0.0194)	-0.0703*** (0.0206)	-0.0670*** (0.0210)
Sex of household head		-0.159** (0.0707)	-0.206*** (0.0744)	-0.221*** (0.0742)
Age of household head		0.00802*** (0.00272)	0.00751*** (0.00289)	0.00685** (0.00289)
Highest education of members		0.128*** (0.0258)	0.116*** (0.0287)	0.127*** (0.0290)
Log of total asset			0.0670*** (0.0247)	0.0600** (0.0247)
Log of income per capita			0.0105 (0.0320)	-0.00878 (0.0322)
Child lives in highland region				-0.266*** (0.0643)
Urban				-0.0351 (0.0436)
Expenditure shock	0.000151 (9.36e-05)	0.000145 (9.24e-05)	0.000125 (9.47e-05)	0.000134 (9.42e-05)
Constant	4.203*** (0.144)	4.198*** (0.206)	3.593*** (0.360)	4.075*** (0.377)
Observations	1,776	1,776	1,634	1,634
R-squared	0.344	0.363	0.369	0.376

Standard error in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$