Economic Shocks and Changes in School Attendance Levels and Education Expenditure in Peru

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Abstract

This paper studies the effect of economic shocks on household human capital investment patterns using a sample of 6 to 14-year-old children going through the Peruvian education system. While other studies have analysed the impact of shocks on the accumulation of human capital, based chiefly on an analysis of school attendance, this study employs a more comprehensive analysis of the various mechanisms through which spending on education can be affected by short-term economic shocks. We have found evidence that is consistent with the hypothesis that shocks have an impact on the quality rather than the quantity of education. We have not found evidence that negative shock policies entail further overage (ie, children at least one year older than the age expected for their grade) and hence there may be no effect on the school drop-out rate either. However, even when a negative shock does not produce a change in the time spent on education, we find that it does reduce the effective accumulation of human capital through cuts in spending on education, in both urban and rural areas. Results are significant both when a short-term shock is brought about by changes in household income or expenses and when it is brought about by changes in employment status.

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Preface

This paper is one of a series of working papers published by the Young Lives Project, an innovative longitudinal study of childhood poverty in Ethiopia, India (Andhra Pradesh State), Peru and Vietnam. Between 2002 and 2015, some 2000 children in each country are being tracked and surveyed at 3-4 year intervals from when they are 1 until 14 years of age. Also, 1000 older children in each country are being followed from when they are aged 8 years.

Young Lives is a joint research and policy initiative co-ordinated by an academic consortium (composed of the University of Reading, the London School of Hygiene and Tropical Medicine, London South Bank University and the South African Medical Research Council) and Save the Children UK, incorporating both inter-disciplinary and North-South collaboration.

Young Lives seeks to:

- Produce long-term data on children and poverty in the four research countries
- Draw on this data to develop a nuanced and comparative understanding of childhood poverty dynamics to inform national policy agendas
- Trace associations between key macro policy trends and child outcomes and use these findings as a basis to advocate for policy choices at macro and meso levels that facilitate the reduction of childhood poverty
- Actively engage with ongoing work on poverty alleviation and reduction, involving stakeholders who may use or be impacted by the research throughout the research design, data collection and analyses, and dissemination stages
- Foster public concern about, and encourage political motivation to act on, childhood poverty issues through its advocacy and media work at both national and international levels

The project received financial support from the UK Department for International Development and this is gratefully acknowledged.

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Introduction

Despite improvements in enrolment rates in recent decades, the Peruvian school system still has serious shortcomings. While the enrolment rate has reached 99 per cent at primary level, at secondary level it hardly reaches 55 per cent. To a great extent the drop-out rate is linked to weaknesses in the system, which does not provide adequate support for students who fall behind, for those who cannot afford to go to school for socio-economic reasons, or for those for whom the job market presents greater opportunities than schooling.

This problem becomes particularly serious when households have to face economic shocks that force them to reassign time and money in order to reduce the impact on their consumption. Under incomplete credit markets and without other consumption-smoothing mechanisms, falls in levels of activity resulting from inappropriate macroeconomic policies, banking crises or external shocks can have a correlation at microeconomic level.

The potential reallocation of intra-family resources as a result of a shock entails potential reductions in the resources allocated to investment in human capital. Since some families cannot obtain loans in order to invest in basic education, the need to lower consumption in the face of fluctuating income may lead them to withdraw their children from school. In other words, children's opportunity cost may increase if there is a chance of their taking over domestic chores from an adult who will have to reassign time spent working at household level to the job market.

Most studies that have tried to determine the effect of macroeconomic shocks on human capital have been based on an analysis of changes in school enrolment. Such is the case with studies that evaluate how, in the face of a negative shock, households can use children's work as a risk-reduction mechanism, affecting the pace of the child's educational progress and consequently reducing any future productivity (Jacoby and Skoufias, 1997). However, the family's decision, which often involves lowering investment in human capital, is more complex. For instance, the family may decide not to take the child away from school but to reduce the time the child spends learning, replacing study time at home with work, or cutting back the time spent by other family members on helping the child with their homework. The family may decide to cut its education expenses by sending the child to a cheaper school – with the corresponding possible drop in quality – or by simply cutting expenses and buying fewer school inputs. Thus, even when at the time of a negative shock or afterwards there is no evidence of children dropping out, these other mechanisms can have an effect on the accumulation of human capital by reducing education quality.

These adjustments can affect the child's performance and learning capacity. They can manifest themselves over time in a higher likelihood of repetition, which in turn leads to overage and an increase in the likelihood of dropping out.

This paper studies the effects of short-term economic shocks on households' investment in human capital and suggests a more comprehensive analysis of the possible mechanisms through which investment in education can be affected. It begins by analysing how the 6 to 14-year-old's progress in the Peruvian school system is altered by a shock. A child's progress in the system may move away from the norm if the child repeats the year, or drops out – temporarily or not. Dropping out, however, is a decision that can be conditioned to shocks of a certain size. Smaller shocks may not

cause any immediate change in the child's school attendance; however, they can have an effect on the accumulation of human capital if they generate small reallocations of time or expenses as mentioned above. These adjustments, which are also studied here, have an effect on education quality and hence on the process of human capital accumulation. This study analyses two mechanisms that can lead to adjustments in quality: moving from private to public schools, and changes in education spending on each child in the household.

Economic shocks faced by households are defined here as changes in aggregates in consumption and income, and changes in the employment status of the head of the household, either moving into unemployment or moving from formal to informal sector employment.

Results show that, in general, short-term economic shocks have no impact on the accumulation of human capital through variables related to education 'quantity', in that they have no effect on overage. There is evidence, however, that households can cut spending on education, by changing the child from a private to a public school, since it is cheaper – and possibly of lower quality – or simply by reducing spending by buying fewer school materials. There is robust evidence that negative shocks in per capita expenditure or income, after correcting for endogeneity problems, have a negative effect on education spending. In urban areas, the exogenous income shock, the instrumentalised income shock and the extreme negative per capita expenditure shock affect changes in education spending. Redundancy also has a negative effect on education spending. In rural areas, per capita expenditure and extreme negative shocks in expenses have a significant impact on education spending.

The paper's second section includes a brief literature review and presents the study's conceptual framework. The following section describes the data and the main analysis variables. The fourth section presents the methodological approach used for estimating the equations of interest. The fifth section describes the results of the estimates of the equations of additional overage and change in spending on education. Finally, the sixth section discusses the study's main results.

1. Literature review and conceptual framework

A number of studies analyse household adjustment mechanisms in the face of economic shocks. Some of these mechanisms affect the accumulation of human capital. Gaviria (2001) and Fallon and Lucas (2002) analyse the response of households to various economic shocks and recognise that adjustment in investment in human capital is one of the strategies families adopt. There is considerable literature that attempts to approximate the effects of economic shocks on education variables. Some researchers analyse the impact of aggregate shocks on the accumulation of human capital and some analyse the impact of idiosyncratic shocks.[1] For Costa Rica, Funkhouser (1999) uses a pseudo-panel of households and estimates a reduced form for the decision of sending children to school, approximating the economic cycle using dummy variables of 'annual effects' for each year of the survey. He found that aggregate shocks have a significant impact on secondary school attendance, especially in rural areas. Sawada and Lokshin (2000) find that in Pakistan negative income shocks increase secondary drop-out and to a lesser extent primary drop-out.

Neri and Thomas (2000) combine the analysis of aggregate and idiosyncratic shocks. They analyse the effect of different economic changes in the household on drop-out and repetition. They find that neither the loss of precarious employment nor income shocks have an effect on drop-out, unlike changes from jobs in the formal sector to jobs in the informal sector. However, they only find this effect in periods of economic contraction. Duryea (1998) finds that in Brazil, if the head of the household is unemployed this will reduce the likelihood of the child finishing the school year. Jacoby and Skoufias (1997) do not find strong evidence that aggregate or idiosyncratic shocks have an impact on school attendance.

In addition, the way an economic shock can affect the accumulation of human capital is conditioned by the nature of the shock and by the structure of, and access to, the credit market. Jacoby and Skoufias (1997) show the link between underdeveloped financial markets and the accumulation of human capital, and examine how children's school attendance responds to seasonal fluctuations in the income of farming households, given different levels of access to credit. They find that restrictions on the credit markets in the smallest communities affect household decisions about investment in human capital. They contend that given certain characteristics of credit access, an anticipated shock need not necessarily have the same effect as one that has not been anticipated.

Acemoglu and Pischke (2000) also propose models that link economic change with human capital accumulation in a context of credit restrictions. Barham et al (1995) develop a theoretical model in which family wealth affects whether a child receives an education and cash restrictions can entail lower than optimum investment in education, given the child's ability. Similarly Jacoby (1994), on the basis of results obtained from an analysis of the link between family income and falling behind at school, shows that credit restrictions are one mechanism of intergenerational transmission of poverty – the possession of durable assets and capital had a significant effect on the likelihood of a child falling behind at school.

1 To this we could add that a shock perceived by the family as temporary will not have the same effect as a shock perceived as permanent.

Another market that affects the relationship between economics and the accumulation of human capital is the child labour market. In theory, this is due to the fact that families take decisions about children's work and school attendance simultaneously. The likelihood of school attendance is conditioned to the opportunity cost of studying, which depends on the specific individual and household characteristics as well as the state of the labour market. In certain circumstances, households may opt for children to stop going to school and to start working outside the household, or to take over household chores from an adult who decides to go out to work. Duryea and Arends-Kuenning (2001) found that in Brazil negative aggregate shocks that reduce household income do not in general entail more child labour or less school attendance since in these contexts the cost of the children's opportunity is lowered – as is that of adults – in the labour market. Neri et al (2000) found that in Brazil changes in the father's income had an effect on the likelihood of dropping out of school and of repetition but not on the likelihood that the child would start working. Periods of unemployment, however, have an impact on all these variables simultaneously. In general, studies available for Brazil show that child labour is pro-cyclical (Duryea and Arends-Kuenning, 2001). Jacoby and Skoufias (1997) find that in India, an increase in children's salaries has a negative effect on school attendance in rural areas. Shady (2002) includes child labour in the factors that decide the level of school attendance in the household, and suggests that the total effect of a negative shock on school attendance depends on the marginal costs and benefits of education and on the cross price elasticity of child and adult labour. In Peru, he finds that child labour is not related to recessions or school attendance patterns. For Mexico, according to Binder (1999), in periods of recession school attendance indicators are influenced by two contrary effects: while lower opportunity costs improve such indicators, income reduction tends to worsen them. Binder states that the latter effect tends to be greater than the former, which results in worsening school attendance in times of recession.

For Peru, there is evidence using cross-sectional data that income and credit restrictions affect attendance and spending on education. Jacoby (1994), by estimating a model of human capital accumulation that includes financial constraints, shows that children who belong to lower income families that find it harder to obtain loans, run a higher risk of falling behind at school. Similarly, Saavedra and Suárez (2002) analyse the determining factors of family expenditure on primary and secondary education and find that children from households with a higher per capita expenditure experience greater spending on their education. Again, evidence from household surveys shows that, as might be expected, the higher the socio-economic level the lower the repetition and drop-out rates (Saavedra and Cárdenas, 2001). With regard to economic shocks on human capital accumulation, evidence is scarce and unclear. Shady (2002) analyses the effect of economic crises on school attendance in Peru, using a pseudo-panel for 1985/86, 1991 and 1997 and finds a higher likelihood of working and going to school during a crisis compared to simply going to school in periods of growth. Shady also finds that an additional year of economic crisis may be associated with an increase in school attendance. These results may be partly explained by a reduction in the opportunity cost of child work during the crisis. Hence a reduction in the level of economic activity would not have a significant negative impact on the accumulation of human capital in the household, and the likelihood of finding dramatic increases in the drop-out rate at times of crisis will tend to be low.

Conceptual framework

Most empirical studies concentrate on the effects on attendance, the number of years of schooling and the drop-out rate, which are easy to observe and may be imagined to be affected by economic shocks.

All the literature reviewed attempts to identify the impact of shocks on the accumulation of human capital, analysing whether this process is affected or not. Empirically, this tends to be defined by the drop-out rate or a reduction in the number of years of schooling. This kind of effect can be defined as a 'quantity' effect of schooling. However, the adjustment by the household can be in terms of the quality of the time invested in education. Nevertheless, in the face of a reduction in available resources, given restrictions in the capital market, if the family have strong preferences for education they will clearly find ways of adjusting in order to avoid taking children out of school, even when this involves reducing the quality of the education received.

The following are some examples of alternative measures that might be denominated adjustments in 'quality': (i) giving the child less time to study (eg, so that the child can work at home or elsewhere) without the child leaving school, (ii) reducing the time parents spend helping the child with school work, and (iii) cutting back the child's leisure time. While it is true that in the short term this does not mean a reduction in school attendance, this type of action can have an effect on dropping out or repeating in the future. The family may also spend less on education, by sending the child to a cheaper school (eg, changing from a private to a public school) – and thereby possibly forfeiting quality – or by simply reducing spending through buying fewer school materials. So even if drop-out does not increase at the time of the shock or in its immediate aftermath, the other adjustment mechanisms might have an effect on the accumulation of human capital by reducing the quality of the education received.

Adjustments that change the quality of education can have an effect on the child's performance and opportunity to learn. In the end, they increase the likelihood of repetition, which translates into falling behind, having higher probabilities of dropping out, and accumulating less human capital through schooling.

Adjustments families make can be either discrete or continuous actions. Discrete adjustments are those associated with drastic changes – such as taking the child away from school or changing their school – and intuitively these would only be caused by major or extreme shocks. Continuous-type adjustments on the other hand allow gradual action and can respond to both extreme and small positive or negative shocks. Shady (2002) points out that economic crisis can affect the total amount of schooling chosen, the time allocated to achieving it and the combination of schooling and work established by the family. Jacoby (1994), when modelling the accumulation of human capital, distinguishes time spent at school (years of schooling) from 'amount of human capital accumulated', which depends on the time the child devotes to school, which may be total or partial.

We should bear in mind that taking a child away from school is a drastic measure for a household, and probably its last resort. Hence, to see whether economic shocks have an impact on accumulated human capital, it is necessary to analyse less drastic adjustment measures such as those associated with education quality.

2. Data

The main source of information used in this paper is a panel of children observed in 1997 and 2000, taken from the Peruvian Living Standards Measurement Studies (LSMS) – Instituto Cuánto (2000). These household surveys contain a wide range of information regarding schooling, type of school, repetition and enrolment. They also have disaggregated information about income from work and other sources, assets, and spending, which makes it possible to estimate the level of household spending on education. Each year the survey covers almost 4,000 households in urban and rural areas. However, we only have panel information from 1,767 households, of which 1,086 had children between 6 and 14 years of age in 1997. Of the 2,064 children in this age group living in panel households in 1997, it was possible to obtain information from 1,794 in 2000.

Other supplementary sources of information are the 1998 School Census (Ministerio de Educación, 1999), which made it possible to construct several indicators for school infrastructure availability in the district where the child went to school, and the FONCODES (2000) poverty map data which enabled calculation of district-level poverty rates and other community-level characteristics.

Table 1 shows averages and standard deviations of a series of variables that characterise the sample households and are related to decisions regarding households' investment in education. The table compares the averages in the 1997 survey of households with a child aged between 6 and 14 with the 1997-2000 panel. There are no statistically significant differences between the averages for any of the variables except household size, which is slightly higher in the panel. Similarly, when comparing variables for 6 to 14-year-olds, no major biases are found between the 1997 sample and the panel. So, although moving from the 1997 survey, which was representative at national level, to a panel – restricted to the population segment of households with children between 6 and 14 – leads, strictly speaking, to a loss of representativeness, no systematic differences were found in panel averages for a number of key variables, such as income, consumption, education and access to public services.

Families can modify their schooling decisions through several mechanisms that affect education quantity and/or quality. The variables used to identify these strategies are overage (which may be due to temporary drop-out or repetition), changes in education expenditure per student and the decision to change students to a different school system (state or private).

The school year in Peru begins in April and regulations state that children must have reached the age of six to enter first grade. This means that, in theory, only those who are six by April of each year are accepted. The surveys have been held at different times of the year,[2] which affects the estimate of overage. Overage (A) is calculated in this case as:

$$A_i = E_i - S_i - 6$$

where i denotes the child, E is the child's age and S the number of completed years of schooling. For those whose birthday is between April and the month prior to the survey, 7 is subtracted instead of 6.[3] Despite high enrolment rates in Peru, according to the LSMS 24.5 per cent of children between 6 and 14 are overaged. However, there are major differences within the country, with a ten-point gap between urban and rural areas. Similarly, this rate is much greater among the poor than among the non-poor in

2 The 1997 survey was held in the September and October and the 2000 survey between April and May.

3 In the overage calculation of the 1997 survey, 6 is also subtracted for children who were born in April or May and who figured as being under age. The same was done in the 2000 survey for those born in April and surveyed in May.

rural areas (23.4 versus 11.3 per cent). In urban areas the figures are 14.2 per cent for the poor and 4.9 per cent for the non-poor.

Additional overage is calculated for a reference period and may be due to the fact that the child stopped attending school temporarily during the analysis interval, repeated a grade or dropped out of school. Additional overage may be the result of the family devoting fewer household resources to the child's education, a reduction in the time the mother or other relative spends helping the child, or an increase in the time the child devotes to working instead of studying. Additional overage is obtained through the formula:

$$AA = S_i^{1997} - S_i^{2000} + 3$$

Analysis of the panel shows that in the 1997-2000 period half of all children did not fall behind, conditioned to their initial level of overage – or non-overage (Table 2). One-third had one year of additional overage, and the remainder two or three years. Additional overage was slightly higher in rural areas.

Spending on education is another variable that is part of the human capital investment decision. In Peru, public education, which accounts for nearly 90 per cent of enrolment in primary and secondary, is theoretically free of charge. Nevertheless, families contribute some 30 per cent of the total current expenditure on education. The families' average expenditure per student attending primary or secondary public schools in 2000 was US$84 per year; this translates into, on average, 4.3 per cent of the expenses of households with at least one child in the public system being allocated to public education (Saavedra and Suárez, 2002). Families' expenses comprise parents' association (APAFA) fees, classroom teaching materials, school materials, uniforms and transport, and money and in kind contributions for buying supplies, giving salary bonuses and paying for school maintenance and infrastructure.[4] Private schools are generally more expensive since families pay an enrolment fee, monthly tuition fees and also spend money on materials, uniform and transport. Saavedra and Suárez report that the average expenditure per student of urban families with children at private school was US$535 per year. Families with children in the private basic education (primary and secondary) system allocate on average 9 per cent of their expenditure to private primary and secondary education. As might be expected, education spending patterns vary with income. Saavedra and Suárez (2002) reported that family expenditure on public education in the richer quintiles is four times that of the poorest quintile. However, expenditure per student is six times greater, since the number of school-aged children in the poorer families is almost 73 per cent higher. Thus, in the poorest quintile, families spend US$39 per year per student, the equivalent of US$4.3 per month of school attendance, while in the richest quintile, family expenditure per student totals US$181, or US$20 per month. While the expenditure of the poorer families is certainly far less, the share of total family expenditure allocated to public education increases with the poverty of the family: thus families in the quintile with fewest resources devote 5.2 per cent of their total expenditure to public education, while those in the richest quintile devote 3.4 per cent.

The main factor that determines spending on education is total expenditure. Hence it is to be expected that when a family faces an economic downturn expenditure on education is reduced. However, as we can see in Table 3, changes in education expenditure vary sharply, even when the average income

4 In Peru, public schools receive government funds mainly to cover teachers' salaries. Only 7 per cent of public spending in education is allocated to cover goods and services. In the large majority of schools maintenance and minor capital investment depends entirely on parents' contributions.

falls substantially, as is the case during the analysis period. Between 1997 and 2000 some 29 per cent of families reduced their expenditure on education per student by over 50 per cent, while 27 per cent increased it by 50 per cent or more. As we will see below, this pattern is linked to the sharp variability observed in family expenditure.

Another adjustment measure that can be used to tackle altering levels of household income and expenditure is that of enrolment movements between public and private schools. In Peru, 90 per cent of children in basic education go to public schools. Private school enrolment is concentrated among the rich, with 79 per cent of families with children in private schools belonging to the two highest quintiles of the income distribution. Public school enrolment, however, is considerable in all the strata, and in fact almost half of the richest quintile households have children in this system.[5] Given the cost differences between schools in the two systems, a change from public to private education or vice versa also represents an adjustment mechanism. As Table 4 shows, between 1997 and 2000 about 5 per cent of students in urban areas moved over from public to private schools, and an inverse shift of similar size occurred at the same time.

The various adjustment mechanisms used to tackle economic shocks also seem to be interrelated. For instance, of the families who moved their children from a private to a public school, 49 per cent stated that they had reduced their total expenditure by 50 per cent or more. This figure is 11 per cent for those who moved their children from public to private schools, whereas almost half the children who made such a move were from families whose education expenditure rose over 50 per cent (Table 5). While these figures simply corroborate that the survey information reflects the facts adequately, they also suggest that extreme changes in education expenditure might implicitly indicate a change in public/private schooling choices.

Similarly, education expenditure seems to be related to overage in rural areas (Table 6). Some 45 per cent of children with two or three years of additional overage came from families whose expenditure on education had been cut by over 50 per cent, while only 27 per cent of children who did not have additional overage came from this group of households. In urban areas there is no clear relationship between overage and education expenditure.

Characterisation of shocks

At the household level, our income and expenditure data shows a high degree of mobility. At any point in time, whether in a period of expansion, stability or recession, there are families whose economic situation is improving and others whose situation is worsening. In this sense, aggregate shocks conceal great differences in idiosyncratic shocks. Moreover, many poor families may be vulnerable both in periods of recession and of expansion. In Peru, studying a fall of 11.8 per cent in per capita expenditure between 1997 and 2000, Ponce and Torres (2001) find a highly mobile per capita expenditure in households, with an average mobility rate of 45 per cent.[6] This enormous mobility has major implications for public policy, since the effect of economic shocks on human capital accumulation is a phenomenon that can affect a significant number of households even at times of growth, which may justify the existence of safety net programmes provided on a permanent basis and not just during recessions.

5 We should mention that private education is not available in rural areas.

6 This figure represents the average of the households' expenditure growth rates expressed in absolute values.

The variables used to define the short-term economic shocks suffered by households are changes in expenditure, changes in income and changes in labour status. As Table 7 shows, even in a recession household expenditure change is very heterogeneous. Between 1997 and 2000, 13.2 per cent of households experienced over 50 per cent drops in expenditure, while another 14.5 per cent had increases of over 50 per cent. In addition, 30 per cent of households experienced increases in expenditure of over 15 per cent. The proportion of households that suffered income drops of over 15 per cent was higher in rural than in urban areas. Figures 1a and 1b show the density function of the expenditure logarithm differences between 1997 and 2000. While it is true that the function is biased to the left in both urban and rural areas given that recession had occurred, a considerable proportion of families experienced higher levels of expenditure. In the case of changes in income, this is more prevalent in urban areas, although it should be borne in mind that in rural areas this variable faces measurement problems, since rural households have more difficulty assessing their net income adequately.

Analysing simple correlations, changes in household income and total expenditure do not seem to be clearly correlated with overage. As Table 8 shows, when the distribution of children is analysed, according to the size of the shock in income or expenditure faced by the family, we find that children with no additional overage and those who fell behind one year are distributed similarly to the total. Only in the case of children with two or three years of additional overage do we find that the percentage who have suffered considerable negative shocks is slightly higher than the average.[7]

Households of children who moved from private to public schools faced greater deterioration in income and expenditure – measured by the ratio of medians between 2000 and 1997. In contrast, households of children who changed from public to private and those that were always in the private system suffered on average either less deterioration or some increase in income or expenditure (Table 9). Consistent with this, there is a clearly positive and almost monotonous relationship between the change in expenditure on education and the logarithm difference in per capita income in urban areas. The association is weaker in rural areas and only in households with high income growth is there a clear increase in expenditure on education (Figures 2a and 2b).

Similarly, another indicator of an extreme shock that can alter the consumption and investment patterns of the household is change in the labour condition of the head of the household. As Table 10 shows, 2.4 per cent of children in the sample come from households where the head had become unemployed between 1997 and 2000, while 16.8 per cent of the children come from households where the head of the household had moved out of the formal sector into employment in the informal sector.

7 If expenditure rather than income is used, the same results are maintained in the urban areas. However, in rural areas the difference for children with two or three years of additional overage disappears.

3. The model

The indicators used to define changes in the patterns of investment in education during economic fluctuation are additional overage and changes in expenditure on education. No formal analysis is made of the changes between public and private school systems owing to the low number of observations.

The basic model is adapted from Cameron and Heckman (1998). Each household 'chooses' the additional overage AA it wants to 'acquire' among J alternatives AA_j that have increasing levels of overage, with j {1...J}. Only the actual choice of additional overage of the child can be observed at any given point in time, not the desired AA^*, a latent variable. The household chooses the additional overage level of the child that maximises its perceived utility, given some constraints. The perceived utility of the additional overage alternative AA_j is defined as the difference between expected returns and expected costs, given a set of child, household and contextual characteristics X. Estimation of the multinomial logit follows directly from expected utility maximisation. As with other random utility models, the multinomial logit assumes that a household chooses the level of additional overage its child should 'acquire' by comparing the indirect utility provided by each additional overage alternative path and choosing the one that provides the highest utility. In cases such as this one, where there is a natural way to order additional overage alternatives, we may rely on an ordered logit or an ordered probit instead of the multinomial logit.[8]

The latent demand for the desired level of additional overage in schooling, AA^*, is defined as an unobserved continuous variable:

$$AA^* = \beta' X + u$$

where u is a logistic, independently distributed disturbance term and β is the vector of coefficients to be estimated. Different levels of additional overage in schooling for the children, AA, which is the observed counterpart of AA^*, takes the values of 0 if the child has no additional overage in the observation period, 1 if the child has one year of additional overage and 2 if the additional overage is of two or three years. The model we end up estimating has the following form:

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

where

N_{t-1}	=	Characteristics of the child in the base period
H_{t-1}	=	Characteristics of the household and the head of the child's household
R_{t-1}	=	Variables of the economic situation of 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 probability that a child has additional overage – and how many years – may be determined by a series of characteristics of the child and their household in the base period, ie, the first year he/she is observed. Some of these characteristics are sex, health status, education level and labour situation of

8 A critical assumption of ordered models is the parallel slopes assumption (also known as the proportional odds assumption). That is to say, the impact of, for example, a shock is the same across all J possible values of AA. Though one should expect that the factors that affect AA at one level are the same as those that affect it at any other level, the intensities may be different in each case. In our case, however, we tested this assumption using a likelihood ratio test and found that the assumption was reasonable.

the child; the size and logarithm of household income; the sex, age and education of the head of the household; and the maximum number of years of schooling achieved by any member of the family. Similarly, the overage probability can be affected by the level of household assets, which would reflect both the household's level of wealth and the level of credit restrictions. The influence of the labour market on the overage probability may be defined through the potential income of the adult woman with the lowest education level in the household. The higher the potential income[9] the higher the cost of opportunity of the woman on the labour market and the higher the probability of her being replaced by a child in household chores, which is translated into a higher probability of overage.[10]

Similarly, overage may be affected by the presence of under fives, which increases the need for a child – usually a girl – to remain at home and take care of them. Finally, overage can depend on changes in the household economic situation, approximated by the shock variables described in the previous section. Other variables that can affect the probability of overage are related to the local education system attended by the child, such as the number of services the schools to which the child has access have.

During the analysis period there were no changes in the regulations regarding children's repetition, drop-out and enrolment. It is still possible, however, to argue that school practices can vary between regions, which requires the introduction of controls with variants at regional level, such as the department poverty rate, and other control variables related to the school system itself, that would vary at a department or a district level. We should mention that, in the study period, there were no major changes in the supply of schooling and hence it is sufficient to control for it at one point in time.

The equation that establishes the relationship between short-term economic shock and changes in education expenditure is given by:

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

where ΔG is the change in education expenditure between 1997 and 2000. The explanatory variables used are similar to those described in the case of additional overage, although they do not include the variables relating to the labour market situation. In this case the initial log education expenditure is included as a control.

When the shock is typified by the change in expenditure or total income, there is a problem of potential simultaneity between the change in the expenditure or income and the independent variables. For example, exogenous factors that entail the mother devoting more time to the labour market with the corresponding increase in household income, can also reduce the time she spends helping her child with school work or increase the time the child devotes to work, which can lead to additional overage. Similar examples can be found for changes in income simultaneously determined with the change in education expenditure. To solve the problem of simultaneity we use instrumental variables (IV) to capture the effect of income/expenditure economic shocks, as described below:

9 Potential income is calculated on the basis of the median income for adult women in the region and area with a similar education level and age. Thus two education levels and three age ranges for each of three regions (coast, highlands, jungle) and two areas (urban and rural) in each region, are included, making a total of thirty-six distinct values.

10 Presumably, during economic booms, the opportunity cost on the labour market both of this adult woman and the child rises. Thus, the insertion of the child in the labour market will depend on their opportunity cost relative to that of the adult they could replace. However, not enough information is available to define the opportunity cost of child labour using household surveys. In urban areas, child labour markets are in general very thin markets and are focused on specific occupations. In rural areas, where child labour is much more frequent, a large part of this work is in the home or on the farm and is rarely salaried work outside the home.

First, shock Se is defined as the difference between period t and t-1 of the log per capita potential income YP:

$$S_e = 1n(YP_t) - 1n(YP_{t-1})$$

Potential income is considered exogenous and is calculated as the sum of the potential per capita labour income, YLP, and the per capita non-labour income, YNL. The latter is calculated directly from the survey and it is assumed that the determining process of this income is independent of the dependent variable:

$$YP_t = YLP_t + YNL_t$$

Household annual labour income becomes exogenous by imputing to each household member the median work-day income of workers in the same area with similar education and experience to themselves using the formula:

$$YLP_t = \sum_i (8)(6)(4.3)(12) w_i^* h_i$$

where i stands for the type of individual according to sex, education and regional location of the household,[11] w_i^* is the median salary per hour of individuals of type i, and h_i is the number of members of type i in each household.[12]

Similarly, besides the calculation of a short-term exogenous shock, we used another specification of the shock, calculated as the income or expenditure difference, which may be regarded as endogenous. In this case, we used as instruments the mother tongue of the head of the household, the availability of drinking water and telephone services, the rate of household dependence, occupation variables and the district poverty rate. Finally we included as an instrument the exogenous labour income shock. In rural areas, we also included as instruments the size of the animal herds and the amount of land the household owns.

11 The country was divided into seven regions: Metropolitan Lima and six others obtained by combining coastal, highland and Amazon (jungle) regions with urban/rural areas.

12 Potential income is considered, implying working eight hours a day, six days a week and every week of the year.

4. Main results

Tables 11 and 12 show the estimates for our additional overage models using the panel of 6 to 14-year-olds, for urban and rural areas respectively. Column 1 of each table shows a profile of the overage level, which is not intended to be a behavioural equation but a profile of the variables related to it. As we can see, in urban areas overage is greater when the child is linked to the labour market or has a chronic disease. Similarly, households with a larger number of members, household living in the highlands, and those in which the head of the household is a woman tend to have more overage. Moreover, higher levels of education among the adults in the household are related to lower overage. In rural areas, the overage pattern is very like that seen in urban areas, both in the signs and in the size of the coefficients. However, in these areas, the greater the stock of assets the household has, the less the overage. Finally, income in urban areas and expenditure in rural areas is not related to the overage level. Similarly, there is no difference related to the sex of the child in either of the geographical areas.

Columns 2 to 5 of both tables report the results of the specifications for additional overage employing an ordered logit model using the exogenous shock variable described in the previous section.[13] For purposes of comparison, we also include the results of a specification in which the shock is calculated as the simple difference of logarithms of income or expenditure (denoted as 'endogenous' shock in the table). The final column reports an estimation using instrumental variables.[14] In urban areas, the income shock has no effect at all on additional overage in any specification. The only variable that is robust to the use of other controls and specification changes is family size. Overage only tends to worsen among children of large families. In rural areas, the education of the household adult members tends to reduce additional overage, while children living in jungle regions tend to accumulate greater overage. Again here, there is no effect of economic shocks on additional overage.

Moreover, as Table 13 shows, when other short-term economic shock measures are used, such as extreme changes in income or expenditure, transition from employed to unemployed, or the transition from formal to informal employment, there is no robust evidence of the impact of economic shocks on additional overage. Only where the shock is approximated by an extreme negative shock in expenditure is there a positive effect on the additional overage in urban areas. Similarly, in rural areas there is not very strong evidence that negative change in income or expenditure produces changes in overage. However, we should bear in mind, as we mentioned earlier, that in rural areas the income variable is not measured accurately. In conclusion, there may be some evidence that economic shocks have an effect on overage, although this is not robust to different specifications and shock measurements.

Another mechanism through which households can adjust to short-term economic shocks is that of changes in their expenditure patterns; in particular, it is interesting to analyse whether part of this adjustment is made in education expenditure. Reductions in education expenditure can have the effect

13 Choosing between an ordered logit and an ordered probit is a matter of choosing the model that best fits the data. Comparing the ordered logit results with those obtained from the ordered probit, which assumes a normal instead of a logistic distribution of the error term (the only difference is that it has thinner tails), shows almost identical results. We are reporting here, for convenience, only the results obtained from the ordered logit estimation.

14 The estimation of the ordered logit with instrumental variables produces inefficient standard errors. To correct for this, we have estimated corrected bootstrapped standard errors. The instruments used to define change in income in urban areas are exogenous labour income, a set of dummies if the head of the household speaks Spanish, if there is a telephone and drinking water, the dependence rate of the household, a dummy variable to indicate the formal or informal nature of the employment of the head of the household, and another to indicate whether he/she was unemployed. Similarly, other instruments are included such as the FONCODES poverty index and the proportion of household members who have a chronic disease. To instrumentalise total expenditure, which was used in rural area estimations, the variables used are the same plus an indicator of whether the child's household has electricity, an index of stock ownership and an index of land ownership. In this case the telephone ownership indicator is excluded.

of reducing quantity or quality of inputs included in the education production function. In addition, as shown above, expenditure reductions can reflect a change in the type of school the child attends (ie, private to public).

The results of the estimations are shown in Tables 14 and 15 for urban and rural areas respectively. The first column in each table shows an estimation of the equation of the level of education expenditure. The expenditure is greater for children in higher grades, and, unexpectedly, for those who are three or more years over age. In urban areas, expenditure per student is greater in families with higher income and more assets and whose members are more educated, and is less in larger families. In rural areas the expenditure is greater on boys, both in higher income households and where the head of the household is a man.

Columns 2 to 5 show the estimation results for the change in education expenditure, using the exogenous short-term shock as an explicative. Column 6 shows the results of the estimation using the 'endogenous' shock. The last column shows the results for the estimation through instrumental variables.[15] The results show that in urban areas there is a robust effect of income shock on education expenditure, and hence negative income shocks have a negative effect on education expenditure. It is interesting to note that the size of the coefficients is very different if we compare the specifications in which the shock is exogenous to those that include an instrumentalised shock. This difference is explained by the fact that if the shock is endogenous the parameter estimate depicted in column 6 is biased. The Wu-Hausman test performed to test if the shock was exogenous was rejected in both urban and rural areas at the 10 per cent significance level.

Other variables that influence the change in education expenditure are household size and initial per capita income. Similarly, the greater the availability of services in the area's primary schools, the greater the expenditure on education.

In rural areas, exogenous income shock has no effect. However, expenditure – which in this case is more accurately measured than income – shows the expected effect on education expenditure. Other variables that have a clear impact on change in education expenditure are the size of the family (which entails less increase in education expenditure), initial total expenditure, the initial ownership of assets, and the education of the household's adult members (which are positively related to change in education expenditure).

When using other definitions of economic shock (Table 16) we find that shocks and changes in education expenditure are clearly related. In urban areas, the exogenous income shock, the instrumentalised shock and the expenditure extreme negative shock affect education expenditure. Again, the change from being employed to being unemployed also has a negative effect on education expenditure. In rural areas, both per capita expenditure shock and the expenditure extreme negative shock have an impact on education expenditure.

15 In order to evaluate whether it is appropriate to instrumentalise, we used the Wu-Hausman test. Under the null hypothesis, this test shows that both the estimation through ordinary least squares (OLS) and the estimation through a two-stage least square regression using instrumental variables are consistent. The rejection of the null hypothesis implies that there is a difference between the two groups of estimators and hence we must consider the existence of an endogenous factor. In parallel, we used the Hansen-Sargan test that determines whether the definition of the instruments is correct. The null hypothesis of this test is that the instruments excluded from the estimation of the variable of interest (but included in the equation of the instrumentalised variable) are valid, ie, that they are not correlated with the estimation error term and that they are correctly excluded.

5. Discussion

The results of the estimations show that, in general, the effect of short-term shocks on human capital accumulation is not observed in variables related to the 'quantity' of education. The evidence that economic shocks have an effect on overage is not robust to different specifications and shock measurements. This is consistent with the results Shady (2002) found for Peru, that negative macroeconomic shocks had no negative impact on enrolment.

However, there is evidence of other adjustment mechanisms. The family may reduce education expenditure, by changing the child from a private to a public school, which is cheaper – with the consequent possible reduction in quality – or simply by cutting costs and buying fewer school materials. In effect, we found evidence that changes from private to public schools were more often in families whose income level was reduced proportionately more and among children whose household expenditure was cut. Similarly, we found robust evidence that negative expenditure or income shocks, corrected by potential problems of endogeneity, have a negative effect on education expenditure. Thus in urban areas, the exogenous income shock, the instrumentalised shock and the expenditure extreme negative shock affect changes in education spending. The move from employment to unemployment also has a negative effect on education expenditure. In rural areas, per capita expenditure and expenditure extreme negative shock also have an impact on education expenditure.

An important point in terms of policy is that short-term economic shocks can have effects on the processes of human capital accumulation beyond those that can be detected by analysing only enrolment or school attendance. Shocks have an effect on both the quality and quantity of education expenditure, which has an impact on human capital accumulation. Hence, even where the child does not drop out of school or has no additional overage, the quality of educational inputs may decrease, negatively affecting the learning process and hence the accumulation of human capital.

Our results also suggest that these schooling effects are not an issue related only to temporary aggregate shocks but that they can also be related to idiosyncratic shocks. Both in recessions and in booms there is great variability in households' expenditure changes. In this sense, these results are consistent with the concern to maintain mechanisms that guarantee that families will not reduce their investment in education.

Given a negative economic shock, families are not willing to reduce their investment drastically and withdraw their children from school. Moreover, if a drop in expenditure coincided with a recession for a family, the labour market would probably be less attractive. However, families do make small changes in their investments, which can have a long-term impact on their children's human capital. This result has implications for a number of education and social programmes. For example, cash transfer programmes related to school attendance may not be very effective in the Peruvian context, since drop-out does not seem to be a critical issue. It may be more important to ensure that public expenditure is protected, and, even more so, to ensure that education expenditure is markedly anti-cyclical.

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Table 1: Means for selected variables – 1997 data			
	Households with at least one member 6-14 years old in 1997 LSMS	**Households with at least one member 6-14 years old in 1997-2000 panel**	**T-test of equality of means**
Number of households	2,291	993	-
Annual per capita household income (in US$)	1,255	1,206	ns
Annual per capita household expenditure (in US$)	1,046	1,000	ns
Average schooling of the most educated adult household member	10.0	10.2	ns
Number of household members	6.0	6.1	**
Percentage of individuals in urban areas	59.2	59.3	ns
Percentage of men	49.5	49.6	ns
Percentage with electricity service	68.1	70.6	ns
Percentage with piped water	65.9	67.2	ns
Percentage with a telephone in their household	16.8	16.7	ns
Percentage with toilet	49.5	50.1	ns
Average value of household assets (in US$)	749	788	ns
Number of members who work	2.3	2.3	ns
Percentage of poor households	53.4	54.1	ns
Net primary enrolment rate	92.6	92.0	-
** difference of means significant at 5%; ns = not significant Source: LSMS 1997 and 2000			

Table 2: Overage and additional years of school overage between 1997 and 2000			
Overage in 1997	**Rural**	**Urban**	**Total**
Underage	31.1	37.1	34.4
Zero	40.5	44.9	42.9
One year	15.3	11.4	13.1
Two years	7.4	4.5	5.8
Three or more years	5.8	2.1	3.7
Additional overage	**Rural**	**Urban**	**Total**
Zero	43.2	55.1	49.9
One year	34.5	33.1	33.7
Two years	15.7	8.8	11.8
Three years	6.7	3.0	4.6
Source: LSMS 1997 and 2000			

Table 3: Changes in education expenditure between 1997 and 2000 by place of residence (%)*			
	Rural	**Urban**	**Total**
Fell by more than 50%	26.8	30.5	28.9
Fell between 15% and 50%	19.8	21.7	20.9
Fell or increased by less than 15%	11.4	12.2	11.9
Increased between 15% and 50%	9.0	12.2	10.9
Increased more than 50%	33.1	23.3	27.4
Number of observations	**590**	**810**	**1,400**
*Considering only households with non-zero expenditure on education in both years Source: LSMS 1997 and 2000			

Table 4: Changes of school regime by place of residence			
	Rural	**Urban**	**Total**
Public - Public	96.1	81.3	87.9
Public - Private	2.7	5.3	4.2
Private - Public	0.2	5.0	3.0
Private - Private	0.0	8.4	4.9
Number of observations	**588**	**818**	**1,406**
Source: LSMS 1997 and 2000			

Table 5: Changes in education expenditure and changes of school regime (%) - urban areas*					
	Public - Public	**Public - Private**	**Private - Public**	**Private - Private**	**Total**
Fell by more than 50%	31.7	11.4	48.7	19.7	30.6
Fell between 15% and 50%	21.9	20.0	20.5	24.2	21.9
Fell or increased by less than 15%	11.3	8.6	17.9	19.7	12.2
Increased between 15% and 50%	12.5	11.4	7.7	12.1	12.2
Increased more than 50%	22.6	48.6	5.1	24.2	23.0
Number of observations	**654**	**35**	**39**	**66**	**794**
*Considering only households with non-zero expenditure on education in both years Source: LSMS 1997 and 2000					

Table 6: Changes in education and changes in additional years of school overage by place of residence (%)*				
Urban	**0 years**	**1 year**	**2-3 years**	**Total**
Fell by more than 50%	32.2	29.5	35.4	31.7
Fell between 15% and 50%	21.2	23.8	14.6	21.3
Fell or increased by less than 15%	12.9	11.7	10.4	12.2
Increased between 15% and 50%	11.8	11.0	14.6	11.8
Increased more than 50%	21.9	23.8	25.0	22.9
Number of observations	**425**	**281**	**96**	**802**
Rural	**0 years**	**1 year**	**2-3 years**	**Total**
Fell by more than 50%	27.1	31.8	45.0	32.6
Fell between 15% and 50%	18.7	19.4	14.0	17.9
Fell or increased by less than 15%	11.1	12.0	9.3	11.0
Increased between 15% and 50%	9.5	6.5	6.2	7.7
Increased more than 50%	33.6	30.4	25.6	30.8
Number of observations	**262**	**217**	**129**	**608**
*Considering only households with non-zero expenditure on education in both years Source: LSMS 1997 and 2000				

Table 7: Changes in per capita expenditure between 1997 and 2000 by place of residence (%)			
Total expenditure	**Rural**	**Urban**	**Total**
Expenditure fell by more than 50%	13.5	12.9	13.2
Expenditure fell between 15% and 50%	39.6	33.3	36.1
Expenditure fell or increased by less than 15%	17.9	22.7	20.5
Expenditure Increased between 15% and 50%	14.7	16.4	15.7
Expenditure Increased more than 50%	14.4	14.7	14.5
Number of observations	**801**	**993**	**1,794**
Total Income	**Rural**	**Urban**	**Total**
Income fell by more than 50%	22.8	13.8	17.9
Income fell between 15% and 50%	29.1	31.5	30.4
Income fell or increased by less than 15%	17.7	23.4	20.9
Income increased between 15% and 50%	14.5	15.8	15.2
Income increased more than 50%	15.9	15.4	15.6
Number of observations	**801**	**991**	**1,792**
Source: LSMS 1997 and 2000			

Table 8: Children's additional overage and shocks in per capita household income between 1997 and 2000 (%)				
Rural Income	**0 years**	**1 year**	**2-3 years**	**Total**
Income fell by more than 50%	24.8	18.3	22.8	22.1
Income fell between 15% and 50%	25.2	31.9	34.1	29.5
Income fell or increased by less than 15%	18.9	17.5	15.6	17.7
Income increased between 15% and 50%	14.9	14.8	13.8	14.6
Income increased more than 50%	16.1	17.5	13.8	16.1
Number of observations	**322**	**257**	**167**	**746**
Urban Income	**0 years**	**1 year**	**2-3 years**	**Total**
Income fell by more than 50%	14.6	11.2	18.0	13.9
Income fell between 15% and 50%	31.3	29.7	36.9	31.4
Income fell or increased by less than 15%	23.6	22.4	22.5	23.1
Income increased between 15% and 50%	14.2	19.8	13.5	16.0
Income increased more than 50%	16.3	16.9	9.0	15.7
Number of observations	**521**	**313**	**111**	**945**
Source: LSMS 1997 and 2000				

Table 9: Ratio of medians of income and expenditure (2000/1997) by change of school regime		
	Total income	**Total expenditure**
Public - Public	0.90	0.85
Public - Private	0.91	1.01
Private - Public	0.71	0.80
Private - Private	1.05	0.88
Source: LSMS 1997 and 2000		

Table 10: Employment shocks and extreme income and expenditure shocks between 1997 and 2000		
	Rural	**Urban**
Percentage of children in households with head of household employed in 1997 but unemployed in 2000	0.0	2.4
Percentage of children in households with head of household in formal job in 1997 but in informal job in 2000	6.7	10.6
Percentage of children in urban households in which per capita income fell more than 50%	-	13.8
Percentage of children in rural households in which per capita expenditure fell more than 50%	13.5	-
Source: LSMS 1997 and 2000		

Table 11: Ordered logit estimation of additional overage – urban Peru							
	Additional overage between 1997 and 2000 – ordered logit estimates (0 = no overage; 1 = one year overage; 2 = 'two or three years' overage')						
	Overage (years) in 1997 – OLS	Exogenous income shock				Endogenous income shock	IV with exogenous labour income shock as an instrument – boot-strapped errors
Last grade completed	-0.024	-0.002	0.008	0.008	0.002	0.003	0.010
	(0.014)*	(0.030)	(0.031)	(0.032)	(0.031)	(0.031)	(0.032)
Child's sex (male = 1)	0.024	0.101	0.102	0.095	0.076	0.072	0.014
	(0.085)	(0.123)	(0.123)	(0.158)	(0.157)	(0.159)	(0.177)
Child working or searching for a job	0.498	0.237	0.217	0.208	0.251	0.259	0.367
	(0.172)***	(0.292)	(0.295)	(0.295)	(0.289)	(0.283)	(0.306)
Child with chronic disease	0.465	-0.061	0.023	0.028	-0.034	-0.042	-0.040
	(0.198)**	(0.248)	(0.246)	(0.251)	(0.247)	(0.246)	(0.300)
Child overaged (one year) in 1997		-0.203	-0.383	-0.387	-0.362	-0.358	-0.390
		(0.203)	(0.207)*	(0.210)*	(0.211)*	(0.212)*	(0.232)*
Child overaged (two years) in 1997		-0.042	-0.236	-0.335	-0.316	-0.323	-0.365
		(0.314)	(0.341)	(0.336)	(0.344)	(0.344)	(0.389)
Child overaged (three or more years) in 1997		1.235	0.901	0.894	0.921	0.903	0.735
		(0.453)***	(0.515)*	(0.515)*	(0.500)*	(0.505)*	(0.559)
Number of household members	0.108		0.126	0.113	0.115	0.116	0.089
	(0.022)***		(0.034)***	(0.036)***	(0.039)***	(0.039)***	(0.046)*
Sex of head of household (male =1)	-0.273		-0.267	-0.208	-0.233	-0.229	-0.233
	(0.145)*		(0.230)	(0.228)	(0.222)	(0.219)	(0.210)
Head of household's age	0.002		-0.002	-0.003	-0.004	-0.003	0.000
	(0.004)		(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Schooling of household's most educated member (18 or older)	-0.049		-0.042	-0.017	-0.019	-0.017	0.008
	(0.016)***		(0.023)*	(0.025)	(0.027)	(0.027)	(0.037)
Value of household's assets (thousands of soles)	-0.010			-0.009	-0.009	-0.009	0.010
	(0.008)			(0.021)	(0.021)	(0.021)	(0.026)
Potential income of household's female adult with fewest years of education	0.057			-0.263	-0.242	-0.231	-0.135
	(0.135)			(0.236)	(0.261)	(0.257)	(0.247)
Household with kids under 5 (yes = 1) x child's sex (female = 1)	-0.080			-0.032	-0.062	-0.073	-0.141
	(0.122)			(0.213)	(0.213)	(0.216)	(0.217)
Log household per capita income	0.058			-0.059	-0.055	-0.080	-0.529
	(0.082)			(0.158)	(0.157)	(0.163)	(0.435)

Table 11: Ordered logit estimation of additional overage – urban Peru							
	Additional overage between 1997 and 2000 – ordered logit estimates (0 = no overage; 1 = one year overage; 2 = 'two or three years' overage')						
	Overage (years) in 1997 – OLS	Exogenous income shock				Endogenous income shock	IV with exogenous labour income shock as an instrument – boot-strapped errors
Child lives in coastal region (except Lima)	-0.066				-0.081	-0.079	-0.070
	(0.106)				(0.219)	(0.218)	(0.210)
Child lives in highland region	-0.335				0.112	0.127	0.197
	(0.131)**				(0.275)	(0.275)	(0.242)
Child lives in jungle region	0.095				-0.363	-0.363	-0.502
	(0.114)				(0.255)	(0.260)	(0.273)*
Average number of utilities in public primary schools in the district	0.082				-0.137	-0.131	-0.152
	(0.068)				(0.130)	(0.131)	(0.144)
Average overage in other children in the same province					0.072	0.066	0.110
					(0.444)	(0.450)	(0.380)
Exogenous income shock		0.092	0.074	0.082	0.063		
		(0.129)	(0.135)	(0.141)	(0.135)		
Per capita income shock						-0.013	-0.742
						(0.138)	(0.664)
Observations Psuedo R-squared	927	947	947	940	939	939	939
	0.1157	0.0067	0.0189	0.0219	0.0251	0.0249	0.0259

Robust standard errors in parentheses
* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Table 12: Overage and additional overage - rural Peru							
	Additional overage between 1997 and 2000 – ordered logit estimates (0 = no overage; 1 = one year overage; 2 = 'two or three years' overage')						
	Overage (years) in 1997 – OLS	Exogenous income shock				Endogenous expenditure shock	IV with exogenous labour income shock as an instrument – boot-strapped errors
Last grade completed	-0.002	-0.059	-0.021	-0.017	-0.006	-0.006	-0.007
	(0.023)	(0.039)	(0.043)	(0.041)	(0.040)	(0.040)	(0.038)
Child's sex (male = 1)	0.166	-0.010	-0.009	-0.173	-0.145	-0.154	-0.136
	(0.142)	(0.148)	(0.160)	(0.224)	(0.222)	(0.222)	(0.211)
Child working or searching for a job	0.399	-0.007	-0.096	-0.191	-0.206	-0.199	-0.194
	(0.104)***	(0.159)	(0.172)	(0.168)	(0.169)	(0.172)	(0.173)
Child with chronic disease	0.569	0.181	0.272	0.444	0.455	0.465	0.503
	(0.470)	(0.287)	(0.320)	(0.361)	(0.375)	(0.388)	(0.475)
Child overaged (one year) in 1997		0.096	-0.115	-0.140	-0.167	-0.163	-0.169
		(0.184)	(0.197)	(0.206)	(0.206)	(0.209)	(0.224)
Child overaged (two years) in 1997		-0.089	-0.419	-0.393	-0.408	-0.442	-0.479
		(0.247)	(0.271)	(0.272)	(0.275)	(0.272)	(0.312
Child overaged (three or more years) in 1997		-0.128	-0.510	-0.498	-0.580	-0.595	-0.587
		(0.308)	(0.342)	(0.336)	(0.341)*	(0.340)*	(0.363)
Number of household members	0.075		0.050	0.060	0.056	0.050	0.061
	(0.027)***		(0.042)	(0.046)	(0.048)	(0.049)	(0.056)
Sex of head of household (male =1)	-0.247		-0.115	-0.108	-0.179	-0.205	-0.249
	(0.193)		(0.242)	(0.227)	(0.249)	(0.258)	(0.368)
Head of household's age	0.008		0.003	0.002	0.005	0.004	0.003
	(0.006)		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Schooling of household's most educated member (18 or older)	-0.074		-0.133	-0.108	-0.099	-0.101	-0.110
	(0.018)***		(0.022)***	(0.026)***	(0.027)***	(0.028)***	(0.039)***
Value of household's assets (thousands of soles)	-0.034			-0.155	-0.136	-0.130	-0.140
	(0.016)**			(0.082)*	(0.075)*	(0.077)*	(0.176)
Potential income of household's female adult with fewest years of education	0.329			-0.408	-0.484	-0.432	-0.486
	(0.316)			(0.325)	(0.412)	(0.408)	(0.428)
Household with kids under 5 (yes = 1) x child's sex (female = 1)	0.035			-0.289	-0.241	-0.245	-0.230
	(0.153)			(0.240)	(0.240)	(0.239)	(0.236)
Per capita expenditure (except child's education)	-0.147			-0.206	-0.209	-0.182	0.014
	(0.123)			(0.164)	(0.168)	(0.213)	(0.616)

Table 12: Overage and additional overage - rural Peru							
	Additional overage between 1997 and 2000 – ordered logit estimates (0 = no overage; 1 = one year overage; 2 = 'two or three years' overage')						
	Overage (years) in 1997 – OLS	Exogenous income shock				Endogenous expenditure shock	IV with exogenous labour income shock as an instrument – boot-strapped errors
Child lives in highland region	-0.232				0.096	0.167	0.140
	(0.194)				(0.237)	(0.227)	(0.281)
Child lives in jungle region	0.115				0.491	0.503	0.491
	(0.148)				(0.179)***	(0.178)***	(0.209)**
Average number of utilities in public primary schools in the district	0.032				-0.040	-0.017	-0.030
	(0.083)				(0.090)	(0.086)	(0.108)
Average overage in other children in the same province					0.068	0.067	0.122
					(0.307)	(0.303)	(0.350)
Exogenous income shock		-0.130	-0.196	-0.245	-0.278		
		(0.135)	(0.149)	(0.141)*	(0.147)*		
Per capita expenditure shock (except child's education)						0.041	0.337
						(0.242)	(0.909)
Observations Psuedo R-squared	741	746	746	743	743	743	743
	0.1153	0.0032	0.0286	0.0402	0.0464	0.0438	0.0439

Robust standard errors in parentheses
* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Table 13: Ordered logit estimates of the impact of economic shocks over additional overage		
(Dep. variable: 0 = no overage; 1 = one year; 2 = two or three years)		
	Urban	Rural
Per capita exogenous income shock	0.063	-0.278
	(0.135)	(0.147)*
Per capita income shock[1]	-0.742	
	(0.664)	
Per capita expenditure shock (except child's education)[1]		0.337
		(0.909)
Extreme income shock (change | ≥ | 50%)[1]	-1.641	
	(0.630)***	
Extreme expenditure shock (change | ≥ | 50%)		0.072
		(0.271)
Shift from formal job to informal job	-0.197	0.406
	(0.264)	(0.341)
Shift from employed to unemployed	0.379	
	(0.422)	

[1] Instrumental variables estimates. Shock is instrumentalised.
*significant at 10%; **significant at 5%; ***significant at 1%

Table 14: Regressions for education expenditure – urban Peru							
	Dependent variable: change in education expenditure between 1997 and 2000						
	Dep. variable: log education expenditure 1997	Exogenous income shock				Endogenous income shock	IV with exogenous labour income shock as an instrument
Log education expenditure 1997		-0.468	-0.552	-0.687	-0.702	-0.735	-0.776
		(9.48)***	(10.46)***	(13.92)***	(14.71)***	(15.72)***	(14.51)***
Last grade completed	0.041	0.065	0.060	0.062	0.060	0.062	0.063
	(0.017)**	(3.62)***	(3.41)***	(3.44)***	(3.48)***	(3.71)***	(3.66)***
Child's sex (male = 1)	0.034	0.014	0.023	0.029	0.023	0.047	0.068
	(0.050)	(0.23)	(0.41)	(0.51)	(0.41)	(0.91)	(1.21)
Child working or searching for a job	-0.094	-0.074	-0.087	-0.046	0.019	-0.040	-0.112
	(0.130)	(0.62)	(0.74)	(0.38)	(0.17)	(0.39)	(0.89)
Child with chronic disease	0.154	0.103	0.085	0.078	0.027	0.029	0.052
	(0.157)	(0.68)	(0.55)	(0.53)	(0.18)	(0.19)	(0.30)
Child overaged (one year) in 1997	0.107	-0.131	-0.039	-0.034	-0.038	-0.007	0.012
	(0.076)	(1.29)	(0.39)	(0.34)	(0.39)	(0.07)	(0.12)
Child overaged (two years) in 1997	-0.022	-0.274	-0.188	-0.163	-0.134	-0.131	-0.117
	(0.126)	(2.21)**	(1.58)	(1.36)	(1.12)	(1.07)	(0.89)
Child overaged (three or more years) in 1997	0.321	-0.568	-0.358	-0.276	-0.320	-0.262	-0.167
	(0.161)**	(2.95)***	(1.97)*	(1.69)*	(2.04)**	(1.54)	(0.93)
Number of household members	-0.069		-0.071	-0.052	-0.051	-0.033	-0.016
	(0.017)***		(3.52)***	(2.44)**	(2.43)**	(1.55)	(0.64)
Sex of head of household (male =1)	0.075		0.055	0.041	0.073	0.072	0.055
	(0.128)		(0.38)	(0.31)	(0.56)	(0.56)	(0.40)
Head of household's age	0.003		0.002	-0.000	-0.000	-0.002	-0.004
	(0.003)		(0.63)	(0.07)	(0.12)	(0.51)	(1.02)
Schooling of household's most educated member (18 or older)	0.045		0.039	0.009	0.005	-0.008	-0.024
	(0.012)***		(2.50)**	(0.56)	(0.29)	(0.46)	(1.18)
Value of household's assets (thousands of soles)	0.036			0.025	0.022	0.015	0.008
	(0.011)***			(2.05)**	(1.82)*	(1.45)	(0.73)
Log household income per capita	0.535			0.358	0.369	0.610	0.896
	(0.067)***			(4.01)***	(4.24)***	(5.95)***	(4.15)***
Child lives in coastal region (excluding Lima)	-0.042				0.053	0.058	0.066
	(0.100)				(0.44)	(0.49)	(0.55)
Child lives in highland region	0.072				0.110	0.121	0.100
	(0.124)				(0.78)	(0.92)	(0.80)

Table 14: Regressions for education expenditure – urban Peru							
	Dependent variable: change in education expenditure between 1997 and 2000						
	Dep. variable: log education expenditure 1997	Exogenous income shock				Endogenous income shock	IV with exogenous labour income shock as an instrument
Child lives in jungle region	-0.044				-0.091	0.004	0.093
	(0.062)				(0.69)	(0.03)	(0.67)
Average number of utilities in public primary schools in the district	-0.241				0.140	0.173	0.186
	(0.118)**				(1.84)*	(2.61)***	(2.67)***
Per capita exogenous income shock		0.097	0.107	0.185	0.159		
		(1.24)	(1.42)	(2.78)***	(2.49)**		
Per capita expenditure shock						0.430	0.867
						(5.36)***	(2.62)***
Constant	1.075	2.205	2.547	0.742	0.436	-1.281	-3.151
	(0.586)*	(7.38)***	(7.11)***	(1.07)	(0.63)	(1.71)*	(2.12)*
Observations	809	810	810	809	809	809	809
R-squared		0.201	0.228	0.278	0.292	0.333	0.318
Probability associated to J-Hansen							0.212
Probability associated to Wu-Hausman F test							0.079
Robust t statistics in parentheses * Significant at 10%; ** Significant at 5%; *** Significant at 1%							

Table 15: Regressions for education expenditure – rural Peru							
	Dependent variable: change in education expenditure between 1997 and 2000						
	Dep. variable: log education expenditure 1997	Exogenous income shock				Endogenous income shock	IV with exogenous labour income shock as an instrument
Log education expenditure 1997		-0.609	-0.659	-0.674	-0.670	-0.692	-0.722
		(11.25)***	(12.75)***	(12.64)***	(12.61)***	(14.15)***	(12.37)***
Last grade completed	0.174	0.133	0.115	0.112	0.107	0.113	0.119
	(0.020)***	(4.53)***	(4.18)***	(4.16)***	(4.06)***	(4.42)***	(4.22)***
Child's sex (male = 1)	0.130	-0.083	-0.079	-0.084	-0.073	-0.062	-0.049
	(0.067)*	(0.96)	(0.92)	(0.99)	(0.86)	(0.75)	(0.56)
Child working or searching for a job	-0.043	-0.032	-0.025	0.006	-0.038	-0.027	-0.010
	(0.082)	(0.33)	(0.25)	(0.07)	(0.39)	(0.29)	(0.10)
Child with chronic disease	-0.160	0.467	0.343	0.280	0.224	0.268	0.329
	(0.342)	(1.24)	(0.97)	(0.82)	(0.65)	(0.86)	(1.14)
Child overaged (one year) in 1997	-0.021	-0.067	0.007	0.032	0.048	0.046	0.042
	(0.088)	(0.65)	(0.07)	(0.33)	(0.49)	(0.46)	(0.39)
Child overaged (two years) in 1997	-0.230	0.043	0.169	0.195	0.215	0.127	0.005
	(0.141)	(0.27)	(1.03)	(1.22)	(1.32)	(0.80)	(0.03)
Child overaged (three or more years) in 1997	0.209	0.011	0.182	0.187	0.243	0.206	0.152
	(0.133)	(0.05)	(0.82)	(0.86)	(1.14)	(1.02)	(0.74)
Number of household members	0.008		-0.061	-0.080	-0.076	-0.050	-0.017
	(0.022)		(2.37)**	(2.81)***	(2.74)***	(1.94)*	(0.43)
Sex of head of household (male =1)	0.213		0.128	0.129	0.126	0.022	-0.121
	(0.109)*		(0.51)	(0.51)	(0.49)	(0.08)	(0.38)
Head of household's age	0.005		0.004	0.004	0.003	0.002	0.000
	(0.004)		(0.73)	(0.82)	(0.61)	(0.42)	(0.06)
Schooling of household's most educated member (18 or older)	0.009		0.057	0.055	0.050	0.030	0.001
	(0.013)		(3.33)***	(3.17)***	(2.92)***	(1.83)*	(0.05)
Value of household's assets (thousands of soles)	0.011			0.071	0.073	0.052	0.025
	(0.025)			(4.01)***	(3.79)***	(3.48)***	(1.01)
Log expenditure per capita (excluding education expenditure)	0.754			-0.022	-0.016	0.369	0.892
	(0.100)***			(0.18)	(0.13)	(2.60)**	(2.44)**
Child lives in highland region	-0.126				0.145	0.130	0.121
	(0.141)				(0.97)	(0.92)	(0.78)
Child lives in jungle region	-0.089				-0.119	-0.122	-0.124
	(0.139)				(0.84)	(0.93)	(0.90)

Table 15: Regressions for education expenditure – rural Peru							
	Dependent variable: change in education expenditure between 1997 and 2000						
	Dep. variable: log education expenditure 1997	Exogenous income shock				Endogenous income shock	IV with exogenous labour income shock as an instrument
Average number of utilities in public primary schools in the district	-0.055				0.044	0.003	-0.049
	(0.074)				(0.55)	(0.04)	(0.56)
Per capita exogenous income shock		-0.048	-0.017	0.007	0.042		
		(0.60)	(0.20)	(0.08)	(0.45)		
Per capita income shock (excludes education expenditure)						0.564	1.329
						(4.36)***	(2.39)**
Constant	-1.608	2.496	2.454	2.765	2.719	0.328	-2.911
	(0.759)**	(8.89)***	(5.28)***	(2.89)***	(2.76)***	(0.30)	(1.28)
Observations	590	590	590	590	590	590	590
R-squared		0.253	0.286	0.297	0.306	0.346	0.273
Probability associated to J-Hansen							0.193
Probability associated to Wu-Hausman F test							0.073

Robust t statistics in parentheses
* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Table 16: OLS estimates of the impact of economic shocks over education expenditures		
	Urban	**Rural**
Per capita exogenous income shock	0.159	0.042
	(2.49)**	(0.45)
Per capita income shock[1]	0.867	
	(2.62)***	
Per capita expenditure shock (except child's education)[1]		1.329
		(2.39)**
Extreme income shock (change |≥| 50%)[1]	0.716	
	(0.30)**	
Extreme expenditure shock (change |≥| 50%)		0.339
		(1.89)*
Shift from formal job to informal job	0.019	-0.082
	(0.14)	(0.43)
Shift from employed to unemployed	-0.825	
	(2.47)**	

[1] Instrumental variables estimates. Shock is instrumentalised.
*significant at 10%; **significant at 5%; ***significant at 1%

Figure 1a
Density function of the change in per capita expenditure (excluding child's education) by place of residence

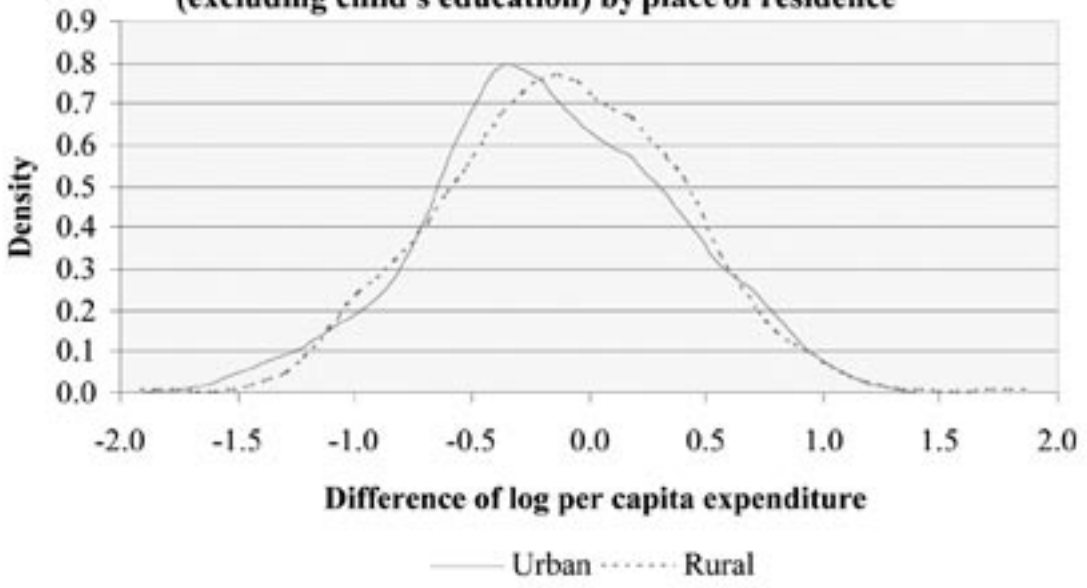


Figure 1b
Density function of the change in per capita income by place of residence

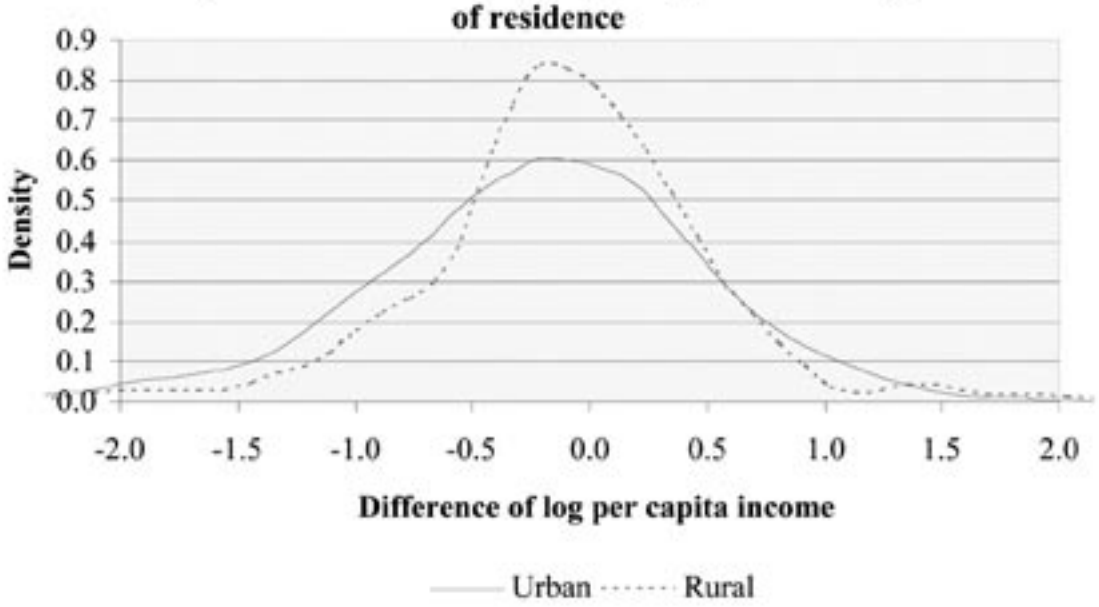


Figure 2a
Urban areas: average education expenditure 2000 / average education expenditure 1997 vs. changes in household per capita expenditure

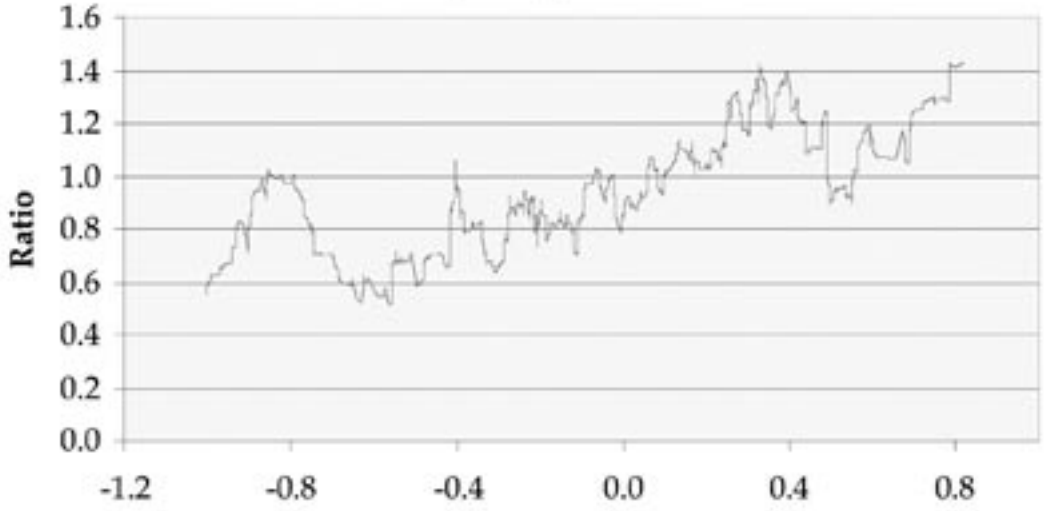
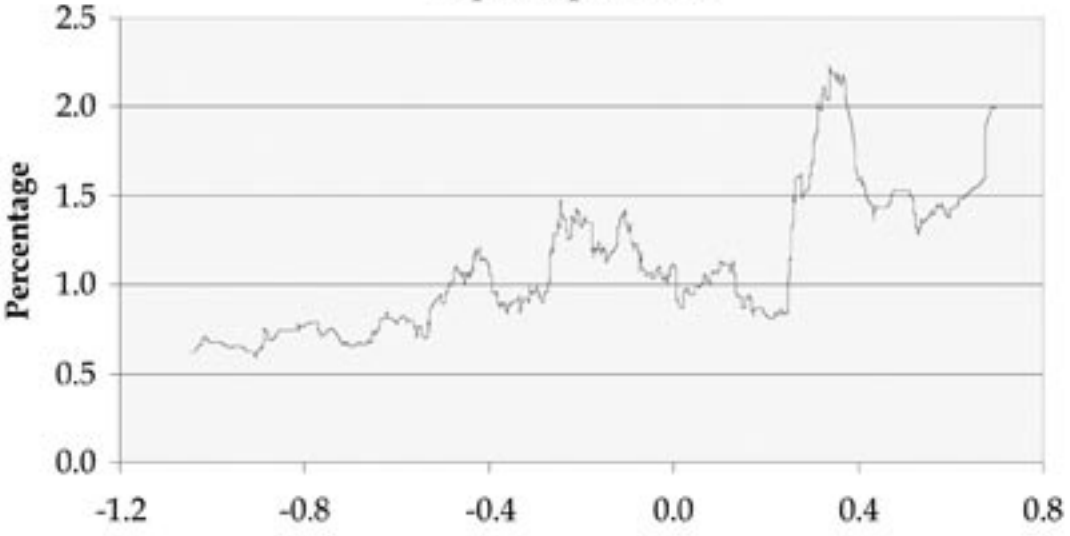


Figure 2b
Rural areas: average education expenditure 2000 / average education expenditure 1997 vs. changes in household per capita expenditure



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Young Lives is an international longitudinal study of childhood poverty, taking place in Ethiopia, India, Peru and Vietnam, and funded by DfID. The project aims to improve our understanding of the causes and consequences of childhood poverty in the developing world by following the lives of a group of 8000 children and their families over a 15 year period. Through the involvement of academic, government and NGO partners in the aforementioned countries, South Africa and the UK, the Young Lives project will highlight ways in which policy can be improved to more effectively tackle child poverty.

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