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Macro Shocks and Child Enrollment in Rural Pakistan

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Abstract

This study, with a unique focus on rural Pakistani children, examines the effects of idiosyncratic and macro shocks on the current school enrollment. Using longitudinal data from the Pakistan Rural Household Panel Survey (PRHPS) spanning 2012-2014, we analyze enrollment patterns for male and female children aged 5-18 with a pooled IV-probit model. The results show that idiosyncratic shocks have an insignificant impact on child enrollment, whereas macro shocks positively influence enrollment rates. This indicates that during macro shocks, the lower opportunity cost of schooling discourages child labor as a substitute for education, leading to higher enrollment. However, the interaction of macro shocks with child gender results in a negative effect on boys' enrollment, which implies that parents prioritize withdrawing boys from school amid macro shock. These findings emphasize prioritizing gender-specific policies, such as targeted financial incentives for boys' education, to mitigate the adverse effects of economic shocks on enrollment.

Key Words: Idiosyncratic and macro shocks, child enrolment, rural Pakistan

JEL classification: J22, I21, I29, D13

Introduction

In developing countries, households are exposed to various idiosyncratic and macro adverse shocks, resulting in income volatility. Idiosyncratic shocks are much localized, for example, crop failure, job loss, death or illness of a household member, etc. On the contrary, macro[2] shocks may prevail over the entire community, region, or economy. These aggregate shocks generally affect larger groups of households in the same area simultaneously, for example, market fluctuations, floods, or other disasters. In this context, community-wide informal support networks may not be able to support those affected by shock (Dercon, 2002; Hyder et al., 2015). Negative idiosyncratic shocks may be better coped with through formal insurance or credit. However, the formal insurance or credit market is either imperfect or absent in developing countries. Hence, the lack of formal insurance markets compels households to adopt different informal risk management strategies to cope with shocks, for instance, past savings, stopping sending their children to school, or compromising on the quality of schools

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[2] We have used *macro*, *aggregate*, and *covariate* shocks terminology interchangeably.

e quality of schools, or sending their children to the market for wages to compensate for the income loss in the short run. In rural Pakistan, Haq (2012) shows that the majority of people are prone to various types of shocks like floods, droughts (as covariate shocks), and illness, death, and job loss (as idiosyncratic shocks). They usually sell their assets, take informal loans at higher premiums, draw down their savings, or send children to the labor market to respond to these shocks.

The previous research highlights competing hypotheses about the relative importance of negative idiosyncratic or macro shocks' adverse influence on child school attendance or attainment. For instance, Ferreira and Schady (2009) and Hyder et. al. (2015) state that the direction of change in investment in education due to negative macro shocks is theoretically ambiguous, depending on whether the income effect[3] or substitution effect[4] dominates. If the adverse shocks are covariate, i.e., for the entire community, rather than idiosyncratic, other community members provide informal insurance to community members. In that case, the community insurance support/function may likely be lowered, and the income effect of the shock may be intensified. Hence, adverse macro shocks result in larger negative (when income effect leads) or smaller positive changes (when substitution effect leads) in education investment than negative individual/idiosyncratic shocks. For example, Goldin (1999), Ferreira and Schady (2009), Conceição et al. (2010), and Khan, & Hussain (2022) found a positive effect of negative covariate shocks on child schooling, showing that the substitution effect dominates the income effect. Besides, Espino and Sanchís (2009), Vásquez and Bohara (2010), Debebe (2010), Hunter and May (2011), and Colmer (2013) found no association between macro shocks and child schooling. At the same time, Skoufias and Parker (2002), Thai and Falaris (2014), Hyder et al. (2015), Ge (2016), Zamand and Hyder (2016), and Khan et al. (2020) reported the adverse impact of negative macro shocks on child schooling, consistent with the notion that income effect dominates the substitution effect.

In addition, the empirical studies of Skoufias and Parker (2006), Escobal et al.et al. et al. (2007), Guarcello et al. (2009), and Kim and Prskawetz (2010) argue that households adopt various risk-bearing strategies to better cope with idiosyncratic shocks, as a consequence, schooling may not get affected. Schaffner (2013) describes that households in developing countries rely on various risk-bearing strategies to smooth fluctuation in income and/or

[3] The change in consumption due to a change in real income.
[4] The change in consumption due to a change in the relative price of goods.

consumption, which include seasonal diversification of crops, special diversification of plots of different soil qualities and altitudes, saving up while spending less on current consumption or draw down on past saving, buying or selling durable goods like jewelry, relying on loan from informal or formal sources and might insure themselves informally through participation in mutually assistance agreements with family and friends in the community, e.g. gift transfers.

The literature summarized above focused on investigating the effect of negative shocks, either idiosyncratic or macro, on enrolment. This study focuses on both idiosyncratic and macro shocks for rural Pakistan, as more research is needed for Pakistan along these lines. Secondly, most of these studies are prone to the problem of not addressing the endogeneity of household vulnerability to income shocks. While the shock, idiosyncratic or macro, may be unpredictable to the household, however, the vulnerability and response to these shocks may not be random to the extent that a household is affected by it depends on characteristics that also may determine key outcomes. Whereas there are more or fewer acknowledgments of the endogeneity of income shocks but, there is a lack of emphasis on this potential bias in the literature (Beegle et al., 2006; Duryea et al., 2007; Krutikova, 2010). Additionally, our data permits us to measure the macro shock in two ways. First, we used the individual responses to shocks at the household level to compute the aggregate shocks at the community level. Second, the data we use has a special module on macro shocks in the community focus group questionnaire, indeed a more objective way to report such shocks.

The constitution of Pakistan asserts that education is compulsory and a basic need of children. However, early dropout is annoying for policymakers. Pakistan is lagging on the human development index compared to other South Asian countries. Pakistan ranked 134th of 157 countries in the human capital index of the World Bank in 2018. Hence, it is important to know the factors leading to low enrolment to address this problem effectively. This study investigates the relative role of idiosyncratic and macro shocks in children enrolment in rural Pakistan while utilizing data from the Pakistan Rural Household Panel Survey- PRHPS (2012, 13 and 14).

In this paper, we proceed as follows: The literature review is presented in Section 2. The material and methods are given in Section 3. Findings are reported in Section 4, whereas the last section concludes with recommendations.

2. Literature Review

This section reviews the literature on negative shocks and child education to provide a conceptual foundation for the study. Education is recognized as a key factor for well-being and development. However, in Pakistan, the current enrolment of children remains substantially low, indicating broader socio-economic and structural challenges. Contemporary research outlines several factors that contribute to low school enrolment in other countries, including poverty, household income constraints, and external economic environments. Among these, negative shock affects parental schooling decisions for their children due to reduced income, increased financial stress, and reallocation of resources, which may adversely affect children's school attendance. Shocks can be either idiosyncratic or covariate/macro in nature.

The direction of change in investment in education due to negative covariate shocks is theoretically ambiguous, depending on whether the income effect or substitution effect dominates (Ferreira and Schady,2009; Hyder et al., 2015). Besides, it is argued that households adopt various risk-bearing strategies to better cope with idiosyncratic shocks, and as a consequence, schooling may not be affected (Skoufias & Parker, 2006; Escobal et. al., 2007; Guarcello et. al., 2009; Kim and Prskawetz 2010; Khan and Hussain 2022).

Goldin (1999) pointed out that graduation rates and enrolment at the high school level increased during the great depression (1928-1938) due to a better-functioning insurance market. Conceição et al. (2010) investigated the impact of the global financial crisis on human capital development. It is determined that the impact of shock varies in countries defined along the axis of rich, middle, and high-income countries. Education and health are enhanced in rich countries but lowered in poorer countries. This is because rich countries' institutional structure is better than poorer countries. Insurance markets in developed countries are working better than those in poor countries. Households in rich countries can buffer shocks in the presence of formal insurance markets. Hence, their investment in human capital may not decrease even during shocks. Similar findings are reported by Fernandez et al. (2010) for five Latin American countries and Ferreira and Schady (2009) for rich countries like the USA, poor countries of South Africa, and low-income Asian countries. Kim and Garcia (2010) referred to the economic downturn in Jamaica and its impact on human capital. During the slowdown of economic growth in Jamaica, enrolment in primary

schools decreased. However, the children's attendance increased, which refers to the mixed impact of economic fluctuations.

Besides, Hunter and May's (2011) study for the South African region shows no association between children's schooling disruption (dropout from school and grade repetition) and covariate shocks. Espino and Sanchís (2009) examined the impact of economic shocks in the form of the economic crisis on the social well-being of five Latin American countries, i.e. Brazil, Argentina, Jamaica, Mexico, and Peru. Economic shock is defined as the decline in GDP per capita in these countries. Shocks were irrelevant in some countries, and education levels increased in other countries as the recession resulted in lower employment opportunities, so parents preferred to send their children to school. Vásquez and Bohara (2010) evaluated the effect of aggregate shock, i.e., natural disaster, on child education in Guatemala. The results show no effect of natural disasters on child schooling. Colmer (2013) stated that future income shock can be measured using climate change as a proxy. The study showed that parental income fluctuation due to negative aggregate climatic shocks does not affect child education but increases child working hours. Households increase child labor in farms to minimize the effect of future negative shocks on incomes. However, the increased time spent by children on farm activities affects their school performance as less time is available for studies. Similar evidence is reported by Debebe (2010) for Ethiopia.

Similarly, Skoufias and Parker (2002) said that aggregate-level shocks negatively affect children's time allocation. Mexico's peso crisis shocks in the labor market affected the time allocation of adults and children. The shocks increased the probability that children might not attend school next year. Gender difference is also found in the results, as girls are worse off. The macroeconomic crisis affects the labour income directly and indirectly, affecting household purchasing power by keeping salaries low and raising the inflation rate. Girls' schooling gets more affected by these shocks. So, the economic crisis not only increased the intergenerational poverty level but also inequality and gender-based preferences—Frankenberg et. al. (1999) found that the economic crisis in Indonesia affected many of its development indicators, including education. During 1997 and 1998, the enrolment rate of children aged 13-19 declined. The enrolment rate declined from 33 percent in 1997 to 38 percent in 1998. The two-year crisis also impacted the percentage of child dropouts (aged 7-12 years), which tripled due to the Indonesian crisis. The impact of the crisis is larger on poor

children than on rich ones. Similarly, the school dropout ratio of children from poor backgrounds was more affected than that of children with better backgrounds.

Thai and Falaris (2014) attempted to investigate the adverse effects of rainfall shock on child school entry and progress in Vietnam. The study shows that regions where families have fewer consumption smoothing opportunities are adversely affected. Vietnam is a developing country with a significant level of poverty and malnutrition. Social institutions in Vietnam are not that effective in helping rural households to survive adverse wealth shocks. The rainfall shocks affect child health, resulting in lower child schooling. Hyder et al. (2015) conducted a study to check the impact of shocks on child schooling attendance and child grade attainment in Malawi. They included both idiosyncratic and community-level shocks in the analysis. Their results show a significant impact of community-level shocks on child schooling compared to individual-level shocks. This shows that community support networks, if prevalent, enormously help mitigate idiosyncratic shocks. Besides, investment in female education is affected more than in male children. Zamand and Hyder (2016) state that idiosyncratic and aggregate negative shocks disturb human capital development. They took data from Ethiopia, Peru, Vietnam, and India. These countries have diverse backgrounds. In this context, they take human capital as schooling outcomes and health. The study reported the effect of shocks on children aged 14-16 years in these countries. Different types of shocks are considered: socioeconomic shocks, such as the death of parents and divorce; economic shocks, for instance, unemployment and livestock loss; and climatic shocks, for instance, floods and droughts. These shocks affect households' income, resulting in low welfare for their children in the short run. Hence, it affects child development in critical stages of their development. Another study is by Ge (2016), who investigated the impact of economic reforms on families of State-Owned Enterprises (SOEs) in China in the mid-1990s. The reform results in an earning gap between SOE workers and non-SOEs. The study compares the difference between the educational attainment of children whose fathers are working in SOEs and whose fathers are not working in SOEs. The children of SOE workers were less likely to attend high school and college than the children of non-SOE workers. The difference in the educational attainment of these children is due to the increase in the earning gap between SOE and non-SOE workers. This evidence supports the presumption that the shock of economic restructuring adversely affects children's educational attainment.

Kim and Prskawetz (2010) also determined the impact of idiosyncratic shocks on educational expenditure, fertility, and household consumption. Indonesian households use children for consumption smoothing by sending them to the labor market and compelling them to earn in case of parental unemployment. Hence, it affects human capital. Guarcello et al. (2009) assess the effect of idiosyncratic shocks and credit constraints on child time allocation decisions. Evidence supports that credit constraints determine schooling decisions and children's work. Exposure to shock forces parents to send their children to work. However, in the presence of insurance, schooling increased, and the chances of a child entering the market decreased. In various African countries, there exists a tradition of child fostering, where biological parents send their children to live with other families due to various circumstances. Significant shocks, such as economic hardship or health issues, can compel parents to foster their children. This practice often negatively affects child welfare, including reduced educational opportunities (Akresh, 2009). The study of Woldehanna and Hagos (2009) reports shock-related dropout of primary school children. The shocks were crop failure, drought, livestock death, or a household member's death. Their findings show significant effects of shocks on children dropping out of school. Dillon's (2008) study also supports the idea that child activities like schooling, market, and domestic work are affected by idiosyncratic shocks. Children do multiple domestic and market production activities for their households, which helps the household improve its income. The idiosyncratic shocks faced by households increase hours spent on work, which reduces schooling. Escobal et al. (2007) reported from Peru that parents decrease educational expenditure when sending their children to government schools rather than good-quality private schools. Government schools are not much more efficient in quality than private schools. Chaudhury et al. (2006) found that crop shocks adversely affect the enrolment of females as the enrolment of girls is 12 percent less than that of boys over the period of shocks. During the crises of the 1990s in Russia, income and consumption patterns fluctuated, resultantly many households received their wage arrears after the crisis (Mu, 2006). The idiosyncratic shocks in Mexico during the peso crisis do not affect schooling. Job loss of household heads does not significantly impact the schooling of their teenage children. However, some evidence shows a higher probability that adolescent girls may be unable to attend school. This is why those female partners started working as a coping mechanism for such idiosyncratic shocks in Mexico, due to which teenage females must do domestic chores (Skoufias & Parker, 2006). Pakistan does not have a very effective insurance mechanism against shocks. Households make their investment decision relying

only on their income. Any shock disturbing parental income impacts parental child schooling decisions (Burney & Irfan, 1991). A child's schooling depends on the parents' capability to invest in the child's human development. Economic shocks affect parents' capacity to invest in human capital. They found a positive association between parental income and child schooling.

The literature cited shows that around the world, various studies have reported the effect of negative shocks on households' decisions about their children's education. The effect of these shocks varies across countries due to context and experience. For instance, developed countries can cope with shocks due to well-structured insurance markets. Studies covering developing countries reported mixed results on idiosyncratic and covariate/macro shocks. Some reported a negative association between shocks and education, but no relation by others. Besides, most of these studies are prone to the problem of not addressing the endogeneity of household vulnerability to income shocks. This study incorporates both idiosyncratic and macro shocks and controls for the endogeneity of income shocks. Furthermore, the literature about enrolment decisions in times of negative economic shocks is not very extensive in the case of Pakistan. Hence, this study is pertinent to explore this issue more in Pakistan.

3. Methodology and Data

We have discussed in detail the estimation strategy and data sources in this section. The estimation techniques, the pooled IV-probit model for child enrolment, are given in section 3.1.

Section 3.2 discusses variables, such as child enrolment, idiosyncratic and macro shocks, and other control variables used in the analysis. Section 3.3 discusses the data source.

3.1 Estimation Strategy

We use a pooled IV-probit model to examine the impact of shocks on child (current) enrolment.

The pooled IV-probit model for the dependent variable child (current) enrolment is presented in Eq. 1

$$\boldsymbol{y_{it} = \alpha_{\circ} + \alpha_1 S_{it} + \alpha_2 C_{it} + \alpha_3 H_{it} + \alpha_4 U_{it} + \varepsilon_{it}} \qquad (\mathbf{1})$$

In Eq. 1, yit is the outcome (dependent) variable, which shows the enrolment of a child i at time *t*. S_{it} is the vector of independent variables, including two types of shocks: idiosyncratic, macro/aggregate shocks, and interactions of shock with child gender. The vector C_{it} indicates specific characteristics of the children, which include the child's age, age-squared, and the child's gender. Whereas H_{it} is the vector of household characteristics, i.e., household head education, household head gender, and household asset index at time *t*; vector U_{it} representing dummies for provinces and ε_{it} is the error term.

Variable $\boldsymbol{y_{it}}$, in Eq. 1, is the current enrolment of a child, whereas the unobserved latent variable $\boldsymbol{y}^*$ is the probability of a child's attendance, dependent on the independent variable($\boldsymbol{X}$) and error **($\boldsymbol{\varepsilon}$).**

The desired level of attendence is given below:

$$\boldsymbol{y}^* = \boldsymbol{\beta X} + \boldsymbol{\varepsilon}$$

The data we used had no information on the desired level of enrolment, but only had data on the current enrolment of a child. Child schooling is undertaken ($y = 1$) if the utility difference exceeds some threshold level **(** $y_i^* > 0$ **)** and zero otherwise **(** $y_i^* \leq 0$ **)**. Hence, the probit model for an individual effect model of the probability of child schooling is given as:

$$\textbf{Probability}(\boldsymbol{y_{it} = 1/X_{it}, \beta},) = \wedge (\boldsymbol{X'_{it}\beta})$$

However, we know that household vulnerability (measured through the household asset index A_{it}) may be endogenous to income shocks. While the shock, idiosyncratic or aggregate, may be unpredictable to the household but, the vulnerability and response to these shocks may not be random to the extent that a household is affected by it, depending on characteristics that also may determine key outcomes. This might create the issue of endogeneity (Beegle et al., 2006; Duryea et al., 2007; Krutikova, 2010).

To tackle this problem, we use the instrumental variables (IV) approach

$$A_{it} = \beta_0 + \beta_1 y_{it} + \beta_2 S_{it} + \beta_2 C_{it} + \beta_3 H_{it} + \beta_4 U_{it} + \beta_5 Z_1 + \mu_t \qquad (2)$$

$$y_{it} = \gamma_0 + \gamma_1 A_{it} + \gamma_2 S_{it} + \gamma_3 C_{it} + \gamma_4 H_{it} + \gamma_5 U_{it} + \varepsilon_t \qquad (3)$$

Z_1 in equation 2 is the instrumental variable. In this study, we use the lag value of the variable asset index as an instrument. As stated earlier, the child's current enrolment is a

dichotomous variable taking values 1 or 0; therefore, a pooled IV-probit model has been implemented. We also clustered over the cross-sectional identifier (children) to obtain valid inference (Papke and Wooldridge 2008).

3.2 Description of Variables

In this section, we provide a brief discussion of the variables used in our formal analysis.

3.2.1 Dependent Variable

Child Enrolment

In equation (1), the dependent variable enrolment (y_{it}) is a dichotomous (binary) variable that, if a child attends school, takes the value (1) and (0) otherwise.

3.2.2 Independent Variables

Vector of Shocks

In eq. (1) the vector of shocks (S_{it}) includes two kinds of shocks in the analysis. A variety of methods have been used in the literature to measure shocks. For instance, shock is measured through harvest quantity (Eozenov, 2008), crop profit's standard deviation (Kochar, 1999), and self-stated shocks based on respondents' perception (Hyder et. al., 2015). Hyder et. al. (2015) measured idiosyncratic shock as a dichotomous variable and aggregate shock as a continuous variable. The individual responses to shocks at the household level were used to calculate both the idiosyncratic shocks and aggregate shocks.

Our measures for shocks are also self-reported shocks based on the respondents' perceptions. We measure idiosyncratic shocks in categorical form from the individual responses to shocks at the household level, a dummy variable taking the value of 1 if any shock exists; otherwise, 0. However, our data permits us to measure the aggregate shock differently. First, we used the individual responses to shocks at the household level to compute the aggregate shocks at the community level (proportion of sampled individuals in the village that registered shocks (Macro Shocks 1)[5]. Second, the data we use has a special module on macro shocks in the community focus group questionnaire, indeed, a more objective way to report such shocks[6].

[5] Most commonly way to compute macro shocks in the previous literature.
[6] Community level indicators measure groups instead individuals. These are derived from the observation of aspects of the community rather than related with the community members. For instance, monitoring smoking through community level sales of cigarettes instead how many cigarettes each person smoked daily in a sample from the community. Most common advantages of using community level indicators are these are cheaper to collect, derived from "unobtrusive" observation,

Three members from each village have completed the focus group questionnaire. The group includes notables such as the village *numberdaar* or village watchman, a police official or the *patwari*/revenue official, politicians, businessmen, or a member of the Punjab Irrigation and Drainage Authority (PIDA) or Sindh Irrigation and Drainage Authority (SIDA) chairman or member. The members' selection of the focus group was scrutinized to ensure that members were the most knowledgeable and could answer questions on important community aspects. The enumerator's role was to encourage the group members to reach a consensus on the answers to questions through thorough discussion and deliberation. Here, we measure the macro shocks in categorical form from responses to macro shocks at the community level, a dummy variable taking the value of 1 if any shock exists, otherwise 0 (Macro Shocks 2).

The community information is collected from 76 mouzas in 19 districts of the three provinces. However, in each district, only four mouzas were selected. Respondents were asked about the types of shocks in each selected mouza. The shock types were crop insect/disease outbreak, flood/typhoon, earthquake, fire, etc. Besides macro shocks, a household may face an idiosyncratic shock independent from other households living nearby or in the same village. Among these more common events are medical expenses due to some injury/illness, house damage, wedding expenses, asset loss, loss of employment, death, etc.

Vector of Child Characteristics

The vector (C_{it}) in eq. (1) includes children's characteristics such as the child's gender, child age, and age squared. Gender is an important aspect of a child's enrolment. Research studies either use a dummy or separate equations for male and female children to estimate the effect of a child's gender on enrolment[7]. The gender variable takes (1) for a male child and 0 for a female. Child age is also an important factor in the same way. Literature shows that the effect of age is positive and quadratic. With the increase in child age, the chances of child attendance increase due to low opportunity cost; however, after a specific age, the opportunity cost increases as with the increase in child labour productivity (Bhalotra, 2003). Hence, to account for these effects, we use the age and age-square of the child in the analysis.

Vector of Household Characteristics

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which is not subject to the biases that result when people describe their own attitudes and behaviours (Rutman, 1984; Pietrzak, et al. 1990)

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[7] See for example Bhalotra (2003)

Likewise, we have also controlled for household-level factors that play an important role in school attendance. In this study, the vector of household characteristics (H_{it}) includes household head education, gender, head age, household wealth indices, etc. The variable head of education positively affects child schooling, as they value education and foresee returns to education. They also spend more on education due to higher incomes. Additionally, the household's head gender is also an important variable, as female-headed households have lower incomes because of wage discrimination and lower levels of education (Bhalotra, 2003). Likewise, to control for the income/wealth effect, we have also included the variable household assets in our analysis.

Besides, respondents who reported negative shocks may be prone to the problem that whether a particular event is a shock depends on respondents' characteristics, such as wealth and schooling. For instance, a respondent with no schooling and low wealth may see the effect of a price change as a big shock, but it may be seen as of lower intensity by a respondent with more schooling and wealth. The coefficient of the idiosyncratic shock, in the absence of control for such possibilities, may reveal the correlated schooling and wealth effects rather than the true impact of the shock alone (Hyder et. al., 2015). Hence, the inclusion of schooling attainment of the household head and household wealth indices among our right-hand side variables is to control for such possibilities. We use a comprehensive list[8] of household durable assets and household dwelling characteristics to construct the wealth indices while using the principal component analysis (Filmer and Pritchett 2001; Filmer and Scott 2008; Hyder et. al., 2015).

Vector of Provincial Level Dummies

Additionally, to account for inter-provincial differences in child enrolment in Pakistan, we included dummies for Punjab, Sindh, and Khyber Pakhtunkhwa (KPK) provinces.

3.3 Data Source

To investigate the effect of idiosyncratic and macro shocks on child enrolment, we used longitudinal panel data from the three waves of the Pakistan Rural Household Panel Survey (PRHPS) with survey waves in 2012, 2013, and 2014, implemented in the rural areas of Punjab, Khyber Pakhtunkhwa (KPK) and Sindh, covering almost 2090 households from 76 primary sampling units (mouzas). The survey contains extensive information on education,

[8] For example, dwelling type, possession of livestock, washing machine etc.

migration, assets, savings, participation in social safety nets, time use, sources of income, loans, credit, nature of employment, consumption patterns, shocks, household aspirations, among others. Our analysis covers a longitudinal panel of children between 5 to 18 years of age. In total, about 4794 children were matched, comprising 2454 boys and 2340 girls, on which we focus in this paper.

4. Results and Discussion

4.1 Introduction

In section 4, we report and discuss the findings of our analysis. First, we summarize our important variables. Onwards, we discuss the effect of idiosyncratic and macro shocks on child enrolment. We have presented the descriptive statistics of important variables in Table 1. The regression results (marginal effects) based on our model specified in Section 3 are given in Table 2. The first stage and simple probit estimates are given in Appendix A.

Table 1 shows that about 81, 92, and 86 percent of the children were exposed to idiosyncratic shocks (i.e., at the household level) in 2012, 2013, and 2014, respectively. The relative proportion for aggregate shocks (Macro shock 1) was 81.19 percent in 2012, 92.45 percent in 2013, and 86.23 percent in 2014. The measure of aggregate shock (Macro shock 2) from the focus group questionnaire shows that the relative proportion of macro shock in local communities was 74 percent in 2012, 62 percent in 2013, and 42 percent in 2014. The prevalence of macro shock events computed from the individual responses at the household level seems to be overstated compared to macro shock events reported in the community focus group questionnaire. The majority (roughly 99 percent in 2012, 98 percent in 2013, and 96 percent in the 2014 wave) of the household heads are male. Heads' education averages around 3.6 years in all rounds of the survey. As far as child enrolment is concerned, about 47, 54, and 52 percent of the children in 2012, 2013, and 2014, are currently attending in 2012, 2013, and 2014, attended school in all provinces, as shown in Table 1. Boys' attendance (current) is higher than girls' attendance in all survey waves. The enrolment rate is relatively low, which remains pertinent for both girls and boys in the survey area. Hence, it is worth investigating the factors contributing to such low enrollment in rural Pakistan.

Idiosyncratic and Covariate Shocks

We used a pooled IV-probit model to estimate the effect of shocks on children's current enrolment (Table 2). Results are reported for all children, male and female children. The estimated coefficient of idiosyncratic shock is insignificant, showing that household-level shocks do not affect child enrolment. Children's current enrolment in households that experience some idiosyncratic shock (i.e., illness, job loss, etc.) is not statistically different from those who did not experience any shock. This result is valid for all children and girls' regressions in Table 2. The interaction of idiosyncratic shock with child gender is also insignificant (models 1 and 4 in Table 2).

The estimated effect of variable Macro Shocks 1, the measure of macro shock computed from individual responses to shocks at the household level, on child enrolment is insignificant for all children and girls' regression (models 1 and 3). However, its estimated effect is positive and significant for boys. In contrast, the effect of Macro Shocks 2, the measure of aggregate shock from the focus group questionnaire, on children enrolment is statistically significant and positive in all regressions, i.e., for all children and separately, for boys and girls, showing that child enrolment is higher, on average, in communities who faces an aggregate shock than in communities who did not face the shock (model 4, 5 and 6 in Table 2). Ferreira and Schady (2009) illustrate that covariate shocks simultaneously affect household income and labor markets in rural communities. In response, the opportunity cost of child school attendance gets lower. Hence, children's labor market participation becomes less attractive for households to substitute child schooling with work.

Furthermore, the estimated effect of the interaction of Macro Shocks 2 with child gender on children's enrolment is statistically significant and negative (model 4, Table 2). This shows that boys' enrolment is decreasing in communities where aggregate shocks are the most prevalent. This effect can also be ascertained from the coefficient estimates of Macro Shocks 2 in columns 5 and 6. The marginal effect of Macro Shocks 2 on enrolment is quantitatively lower for boys than for girls. In addition, we also tabulated the children's dropout relative to currently enrolled children by Macro Shocks 2 and child gender in Table 3. The distribution of children for all three waves of the survey shows that boys' dropout is higher in communities having macro shocks relative to boys and girls in communities that did not report a macro shock (see waves 1 and 3 in Table 3). Besides, the dropout of boys is increasing over the waves/rounds (see waves 1 and 3) of the survey in communities having a

macro shock relative to communities that did not report a macro shock. This evidence is plausible in the sense that there is a high intensity of gender segregation in the labor market in terms of employment in Pakistan. Women do not have the same career prospects and opportunities relative to men. It is reported that women's physical mobility outside the home is restricted due to factors such as socio-cultural and religious norms, safety issues, and the non-availability of quality transport services (ADB, 2016). So, in the presence of shocks, parents' likely choice is to draw down on boys' enrolment and send them for labor, keeping the prevailing market conditions in their local communities.

Child Characteristics

We also control for the possible effect of children's characteristics like age, age-square, and gender. The effect of child age and age-square is positive and statistically significant at a 1 percent significance level, as shown in Table 2. The effect of age-square is negative, which conforms to the common notion that older children are easily involved in economic activities due to the higher opportunity cost of education as child age increases.

Household Characteristics

In the analysis, we also included important household characteristics like household head education, household wealth/asset index, household head gender, and age. These variables are assumed to play an important role in child schooling decisions.

The effect of household head education on child enrolment is statistically significant and positive. With the increase in household head education, the probability of current attendance increases for all children, boys, and girls. The result suggests that educated heads may have more opportunities to increase income and do not need additional labor from their children (Guarcello et al., 2010; Dillon, 2012; Thai & Falaris, 2014). Educated parents invest more in children's education as they have been to school and are aware of the importance of schooling (Alderman, 2001).

We also control for the effect of the gender of the household head. The data shows that most of the households are headed by male members. The estimated coefficient of household head gender is negative, but its effect on enrolment is statistically insignificant.

In addition, child attendance is increasing with household wealth. The variable household wealth index estimate is positive and statistically significant for all children, boys, and girls,

as shown in Table 2. The higher the household assets, the higher the enrolment rate (Guarcello et al., 2010).

We also include provincial-level dummies in our analysis. The data comprises three provinces in the country: Punjab, Sindh, and Khyber Pakhtunkhwa (KP). Their estimated effect shows that child enrolment, on average, is lower in Punjab and Sindh than in KP, as the estimated coefficients of provincial-level dummies are significantly different from zero in the regressions.

5. Conclusion

Negative idiosyncratic shocks may be better coped with formal insurance or credit, but the formal insurance or credit market is either imperfect or absent altogether in developing countries. Hence, households in developing countries are more vulnerable and are at greater risk due to negative shocks. The lack of formal insurance markets compels households to adopt different informal risk management strategies to cope with shocks. They may draw down on past savings, sell assets, take informal loans at higher premiums, etc. However, these informal instruments for shifting resources over the period are usually expensive; hence, negative shocks are likely to have greater adverse effects on child schooling investments in these countries.

Besides, for greater negative aggregate shocks, the direction of change in investment in education can be positive as the substitution effect dominates the income effect because of the lower opportunity cost of attending school in the form of low labor market returns. The majority of the studies reported the adverse impact of negative shocks on child schooling, consistent with the notion that the income effect dominates the substitution effect. However, some empirical studies also report the positive effect of negative aggregate shocks on child schooling, showing that investment in schooling increases as the substitution effect dominates the income effect.

In this study, we focused on reporting the effect of both idiosyncratic and macro shocks while using a longitudinal survey, the Pakistan Rural Household Panel Survey (PRHPS), for children ages 5-18 years. The data we use has a special module on macro shocks in the community focus group questionnaire, indeed, a more objective way to report such shocks. Similarly, the endogeneity of income shocks is acknowledged to varying degrees in the literature. We tried to control for this bias to a greater extent.

The results indicate that the effect of idiosyncratic shocks on enrolment is statistically insignificant, showing that household-level shocks do not affect child enrolment. In contrast, the effect of macro shocks, the measure of aggregate shock from the focus group questionnaire, on children's enrolment is statistically significant and positive in all regressions, showing that child enrolment is higher, on average, in communities who faces an aggregate shock than in communities who did not face the shock. Macro shocks simultaneously affect household income and labor markets in rural communities. In response, the opportunity cost of child school attendance gets lower. Hence, children's labor market participation becomes less attractive for households to substitute child schooling with work (Ferreira & Schady, 2009). Furthermore, the estimated effect of the interaction of aggregate shock with child gender on children's enrolment is statistically significant and negative. This shows that boys' enrolment is decreasing in communities where aggregate shocks are the most prevalent. There is a high intensity of gender segregation in the labor market in terms of employment in Pakistan due to factors such as socio-cultural and religious norms, safety issues, and the non-availability of quality transport services (ADB, 2016). So, in the presence of shocks, parents' likely choice is to draw down on boys' enrolment, keeping the prevailing market conditions in their local communities.

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Appendix

Table 1: Descriptive Statistics

Variables	Respondents	Observations			Mean			Standard Deviation		
		2012	2013	2014	2012	2013	2014	2012	2013	2014
Child enrolment	All Children	4,794	4,460	4,231	0.47	0.54	0.52	0.50	0.50	0.50
	Boys	2,454	2,306	2,231	0.55	0.62	0.59	0.50	0.49	0.49
	Girls	2,340	2,154	2,000	0.38	0.46	0.45	0.49	0.50	0.50
Idiosyncratic shock	All Children	4,795	4,516	4,505	0.81	0.92	0.86	0.39	0.27	0.34
	Boys	2,455	2,311	2,319	0.81	0.91	0.87	0.40	0.28	0.33
	Girls	2,340	2,205	2,186	0.82	0.93	0.85	0.38	0.25	0.36
Macro Shock 1(percent)	All Children	4,795	4,666	4,505	81.19	92.45	86.23	22.59	17.24	23.09
	Boys	2,455	2,389	2,319	80.63	91.80	86.67	23.08	17.98	22.69
	Girls	2,340	2,277	2,186	81.78	93.13	85.76	22.06	16.41	23.49
Macro Shock 2	All Children	4,795	4,666	4,461	0.74	0.62	0.42	0.44	0.49	0.49
	Boys	2,455	2,389	2,290	0.73	0.62	0.42	0.45	0.49	0.49
	Girls	2,340	2,277	2,171	0.75	0.62	0.42	0.43	0.49	0.49
Child education (years)	All Children	4,794	4,460	4,231	2.40	2.59	2.60	2.98	2.94	3.00
	Boys	2,454	2,306	2,231	2.77	2.94	2.86	3.14	3.09	3.11
	Girls	2,340	2,154	2,000	2.02	2.22	2.32	2.75	2.73	2.84
Child age (years)	All Children	4,795	4,666	4,505	11.12	11.24	11.26	4.02	3.99	4.02
	Boys	2,455	2,389	2,319	11.10	11.24	11.18	4.00	3.98	3.98
	Girls	2,340	2,277	2,186	11.15	11.24	11.34	4.03	4.01	4.06
Child gender (Male)		4,795	4,666	4,505	0.51	0.51	0.51	0.50	0.50	0.50
Asset index	All Children	4,790	4,516	4,505	0.02	-0.08	0.40	2.24	2.38	2.23
	Boys	2,454	2,311	2,319	-0.04	-0.17	0.31	2.23	2.37	2.22
	Girls	2,336	2,205	2,186	0.08	0.02	0.50	2.24	2.39	2.25
Head gender (Male)	All Children	4,795	4,666	4,505	0.99	0.98	0.96	0.12	0.14	0.20
	Boys	2,455	2,389	2,319	0.99	0.98	0.97	0.11	0.13	0.18
	Girls	2,340	2,277	2,186	0.98	0.98	0.95	0.13	0.15	0.21
Head education (years)	All Children	4,795	4,666	4,505	3.26	3.26	3.28	4.15	4.14	4.16
	Boys	2,455	2,389	2,319	3.21	3.19	3.22	4.15	4.13	4.11
	Girls	2,340	2,277	2,186	3.32	3.33	3.34	4.15	4.16	4.20
Head age (years)	All Children	4,795	4,666	4,505	47.39	47.70	47.89	11.56	11.70	11.69
	Boys	2,455	2,389	2,319	47.22	47.48	47.59	11.42	11.76	11.79

	Girls	2,340	2,277	2,186	47.57	47.93	48.21	11.70	11.63	11.58
Sindh		5,480	5,287	5,019	0.28	0.27	0.27	0.45	0.44	0.45
KP		5,480	5,287	5,019	0.10	0.10	0.11	0.30	0.31	0.31
Punjab		5,480	5,287	5,019	0.62	0.62	0.62	0.49	0.48	0.49

Source: Pakistan Rural Household Panel Survey PRHPS

Table 2: Marginal Effects of Pooled IV-Probit for Current Enrolment (All Children, Gender): Adjusted for Clusters in Children (Children Aged 5–18 Years).

	Macro shock1			**Macro shock 2**		
	(1)	(2)	(3)	(4)	(5)	(6)
	All Children	**Male Children**	**Female Children**	**All Children**	**Male Children**	**Female Children**
Idiosyncratic shock	-0.00996	-0.0280	-0.00677	-0.00614	0.00478	0.00219
	(0.0285)	(0.0273)	(0.0290)	(0.0212)	(0.0205)	(0.0218)
Macro shock1	0.000335	0.000775**	0.000422			
	(0.000403)	(0.000381)	(0.000411)			
Idiosyncratic shock × Child gender	-0.0216			0.0160		
	(0.0398)			(0.0297)		
Macro shock1× Child gender	0.000630					
	(0.000561)					
Macro shock2				0.0559***	0.0293**	0.0493***
				(0.0130)	(0.0125)	(0.0133)
Macro shock2× Child gender				-0.0301*		
				(0.0182)		
Child age (years)	0.0951***	0.124***	0.0663***	0.0960***	0.125***	0.0671***
	(0.0107)	(0.0143)	(0.0159)	(0.0107)	(0.0144)	(0.0159)
Child age square	-0.00579***	-0.00673***	-0.00490***	-0.00583***	-0.00677***	-0.00494***
	(0.000442)	(0.000586)	(0.000662)	(0.000442)	(0.000586)	(0.000662)

Child gender (male)	0.137*** (0.0385)			0.176*** (0.0286)		
Wealth/asset index	**0.0593*** **(0.00384)**	**0.0612*** **(0.00549)**	**0.0567*** **(0.00539)**	**0.0594*** **(0.00386)**	**0.0614*** **(0.00549)**	**0.0566*** **(0.00544)**
Head gender (male)	-0.0351 (0.0397)	-0.0442 (0.0683)	-0.0275 (0.0468)	-0.0317 (0.0399)	-0.0401 (0.0683)	-0.0259 (0.0471)
Head education (years)	0.00948*** (0.00164)	0.00835*** (0.00231)	0.0105*** (0.00230)	0.00955*** (0.00165)	0.00844*** (0.00233)	0.0106*** (0.00232)
Head age (years)	0.00137 (0.00305)	-0.00563 (0.00432)	0.0104** (0.00432)	0.00180 (0.00307)	-0.00515 (0.00435)	0.0107** (0.00433)
Head age square	-0.00000584 (0.0000297)	0.0000542 (0.0000425)	-0.0000831** (0.0000414)	-0.00000958 (0.0000299)	0.0000502 (0.0000429)	-0.0000858** (0.0000415)
Punjab	-0.0374* (0.0212)	-0.0902*** (0.0316)	0.00854 (0.0290)	-0.0566*** (0.0214)	-0.106*** (0.0319)	-0.0118 (0.0292)
Sindh	-0.248*** (0.0249)	-0.250*** (0.0360)	-0.269*** (0.0351)	-0.259*** (0.0250)	-0.256*** (0.0363)	-0.283*** (0.0352)
chi2	1429.4	625.5	728.0	1417.4	619.6	715.1
P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N	7732	4029	3703	7695	4003	3692
Wald Test of Exogeneity:						
Chi2(1)	41.26	18.49	22.43	39.38	17.98	20.92
P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Standard errors in parentheses (adjusted for clusters in id)
* $p < 0.10$, ** $p < 0.05$, *** $p < .01$

Table 3: Dropout Relative to Currently Enrolled Children by Aggregate Shock and Child Gender.

Survey	Dropout	Macro shock 2											
		No						Yes					
		Female		Male		Total		Female		Male		Total	
		N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
Wave 1	Yes	121	57.35	90	42.65	211	100.00	229	55.31	185	44.69	414	100.00
	No	279	39.19	433	60.81	712	100.00	617	40.12	921	59.88	1,538	100.00
Wave 2	Yes	136	51.52	128	48.48	264	100.00	269	57.60	198	42.40	467	100.00
	No	319	38.71	505	61.29	824	100.00	665	41.85	924	58.15	1,589	100.00
Wave 3	Yes	206	54.93	169	45.07	375	100.00	154	54.04	131	45.96	285	100.00
	No	542	41.69	758	58.31	1,300	100.00	363	40.15	541	59.85	904	100.00

Source: Pakistan Rural Household Panel Survey PRHPS

Table A1: First Stage Regression for IV-Probit Model (Dependent Varaible: Wealth/Asset Index)):Adjusted for Clusters in Children.

	Macro shock1			**Macro shock 2**		
	(1) **All Children**	(2) **Male Children**	(3) **Female Children**	(4) **All Children**	(5) **Male Children**	(6) **Female Children**
Idiosyncratic shock	0.0666	-0.0266	0.0623	0.0123	-0.0184	0.00711
	(0.0848)	(0.0840)	(0.0849)	(0.0601)	(0.0576)	(0.0607)
Macro shock1	-0.00172	-0.000316	-0.00174			
	(0.00120)	(0.00123)	(0.00121)			
Idiosyncratic shock × Child gender	-0.0979			-0.0353		
	(0.119)			(0.0826)		
Macro shock1× Child gender	0.00141					
	(0.00170)					

Macro shock2				-0.112***	-0.0829**	-0.107***
				(0.0407)	(0.0390)	(0.0406)
Macro shock2× Child gender				0.0349		
				(0.0562)		
Child age (years)	-0.0236	-0.0101	-0.0387	-0.0255	-0.0128	-0.0395
	(0.0272)	(0.0375)	(0.0394)	(0.0273)	(0.0376)	(0.0395)
Child age square	0.00149	0.000980	0.00204	0.00156	0.00107	0.00208
	(0.00112)	(0.00156)	(0.00160)	(0.00112)	(0.00157)	(0.00160)
Child gender (male)	-0.0873			-0.0365		
	(0.105)			(0.0782)		
Head gender (male)	-0.126	-0.110	-0.148	-0.132	-0.108	-0.158
	(0.101)	(0.162)	(0.126)	(0.100)	(0.161)	(0.125)
Head education (years)	0.0483***	0.0465***	0.0502***	0.0482***	0.0463***	0.0501***
	(0.00421)	(0.00571)	(0.00619)	(0.00422)	(0.00574)	(0.00620)
Head age (years)	0.0141**	0.0196**	0.00677	0.0135**	0.0192**	0.00590
	(0.00639)	(0.00855)	(0.00964)	(0.00644)	(0.00860)	(0.00972)
Head age square	-0.0000404	-0.000102	0.0000403	-0.0000343	-0.0000985	0.0000490
	(0.0000625)	(0.0000839)	(0.0000937)	(0.0000630)	(0.0000843)	(0.0000947)
Punjab	-0.218***	-0.152**	-0.295***	-0.179***	-0.122*	-0.248***
	(0.0532)	(0.0740)	(0.0768)	(0.0530)	(0.0738)	(0.0764)
Sindh	-0.836***	-0.750***	-0.938***	-0.814***	-0.733***	-0.911***
	(0.0600)	(0.0825)	(0.0879)	(0.0602)	(0.0831)	(0.0879)
Lag of Wealth/asset index	**0.744*** **	**0.751*** **	**0.735*** **	**0.744*** **	**0.752*** **	**0.735*** **
	(0.00916)	**(0.0128)**	**(0.0132)**	**(0.00918)**	**(0.0128)**	**(0.0132)**
_constant	0.146	-0.212	0.492	0.0992	-0.207	0.438
	(0.242)	(0.323)	(0.356)	(0.240)	(0.322)	(0.356)

N	7732	4029	3703	7695	4003	3692

Standard errors in parentheses (adjusted for clusters in id)
* $p < 0.10$, ** $p < 0.05$, *** $p < .01$

Table A2: Pooled IV- Probit Model by (All Sample, Gender) (Dependent Variable: Current Enrollment):Adjusted for Clusters in Children.

	Macro shock1			**Macro shock 2**		
	(1)	(2)	(3)	(4)	(5)	(6)
	All Children	**Male Children**	**Female Children**	**All Children**	**Male Children**	**Female Children**
Wealth/asset index	**0.210*** **	**0.214*** **	**0.208*** **	**0.211*** **	**0.215*** **	**0.208*** **
	(0.0147)	**(0.0208)**	**(0.0211)**	**(0.0147)**	**(0.0208)**	**(0.0213)**
Idiosyncratic shock	-0.0353	-0.0981	-0.0249	-0.0218	0.0167	0.00804
	(0.101)	(0.0956)	(0.106)	(0.0753)	(0.0718)	(0.0800)
Macro shock1	0.00119	0.00271**	0.00155			
	(0.00143)	(0.00133)	(0.00151)			
Idiosyncratic shock × Child gender	-0.0767			0.0568		
	(0.141)			(0.105)		
Macro shock1× Child gender	0.00223					
	(0.00199)					
Macro shock2				0.198***	0.103**	0.181***
				(0.0462)	(0.0438)	(0.0491)
Macro shock2× Child gender				-0.107*		
				(0.0645)		
Child age (years)	0.337***	0.435***	0.244***	0.340***	0.437***	0.247***
	(0.0390)	(0.0527)	(0.0588)	(0.0390)	(0.0527)	(0.0589)

Child age square	-0.0205***	-0.0236***	-0.0180***	-0.0207***	-0.0237***	-0.0182***
	(0.00164)	(0.00221)	(0.00250)	(0.00164)	(0.00221)	(0.00251)
Child gender (male)	0.487***			0.623***		
	(0.137)			(0.102)		
Head gender (male)	-0.125	-0.155	-0.101	-0.113	-0.140	-0.0952
	(0.141)	(0.239)	(0.172)	(0.141)	(0.239)	(0.173)
Head education (years)	0.0336***	0.0292***	0.0386***	0.0339***	0.0295***	0.0389***
	(0.00586)	(0.00813)	(0.00854)	(0.00590)	(0.00818)	(0.00861)
Head age (years)	0.00487	-0.0197	0.0383**	0.00638	-0.0180	0.0394**
	(0.0108)	(0.0151)	(0.0159)	(0.0109)	(0.0153)	(0.0159)
Head age square	-0.0000207	0.000190	-0.000305**	-0.0000340	0.000175	-0.000316**
	(0.000105)	(0.000149)	(0.000152)	(0.000106)	(0.000150)	(0.000153)
Punjab	-0.133*	-0.316***	0.0314	-0.201***	-0.370***	-0.0435
	(0.0753)	(0.111)	(0.107)	(0.0758)	(0.111)	(0.107)
Sindh	-0.879***	-0.874***	-0.987***	-0.919***	-0.896***	-1.042***
	(0.0897)	(0.127)	(0.132)	(0.0901)	(0.128)	(0.133)
_constant	-0.991***	-0.322	-1.361**	-1.012***	-0.268	-1.328**
	(0.367)	(0.505)	(0.535)	(0.364)	(0.503)	(0.532)
Wald chi2	1429.4	625.5	728.0	1417.4	619.6	715.1
p	7.50e-297	4.96e-127	5.30e-149	2.87e-294	9.07e-126	3.19e-146
N	7732	4029	3703	7695	4003	3692
Wald Test of Exogeneity:						
Chi2(1)	41.26	18.49	22.43	39.38	17.98	20.92
P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Standard errors in parentheses (adjusted for clusters in id)
* $p < 0.10$, ** $p < 0.05$, *** $p < .01$