Student Paper

Young Lives

Breaking Out: Education and the Child in Poor Households

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The data used come from Young Lives, a longitudinal study of childhood poverty that is tracking the lives of 12,000 children in Ethiopia, India (in the states of Andhra Pradesh and Telangana), Peru and Vietnam over a 15-year period. www.younglives.org.uk

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Breaking Out: Education and the Child in Poor Households

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Summary

School completion plays a crucial role in shaping the child's future economic opportunities and social destiny. Moreover, children are deeply affected by their home environment and the social and economic disadvantages faced by families are bound to be passed onto the younger generations. This paper, therefore, believes it important to study child and household factors that determine educational outcomes of children. Using cross-sectional and panel data analysis, enrolment and standard test scores of children in Andhra Pradesh (India) are analysed. The results from our study confirm the established positive effects of household wealth and parental education. Caste, ethnic and religious inequalities are also important determinants of educational outcomes. Amongst child characteristics, age, gender and innate ability have a significant impact on school enrolment and learning.

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Abbreviations:

AP: Andhra Pradesh
CDA: Cognitive Development Assessment
FPE: Free Primary Education
IEA: International Association for the Evaluation of Educational Achievement
NFHS: National Family Health Survey (NFHS)
OBC: Other Backward Castes
OLS: Ordinary Least Squares
PPVT: Peabody Picture Vocabulary Test
PROBE Survey: Primary Report on Basic Education Survey
SC: Scheduled Castes
SSA: Sarva Shiksha Abhiyan
ST: Scheduled Tribes
TIMSS: Trends in International Mathematics and Science Study

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Preface

Children are deeply affected by their home environment; the social and economic disadvantages faced by families are more often than not passed on to the former. Education deprivation is seen as another aspect of what defines poverty. In such a case, it becomes imperative to study the influence of child, household and school characteristics in determining educational outcomes. This paper aims to do just that by looking at school enrolment and learning abilities (measured by standard test scores) of children in India (Andhra Pradesh).

School enrolment is studied using a probit model and test scores are first analysed using two cross-sections. Subsequently, the construction of a panel is made possible and estimation is carried out using the first-difference model.

The main source of data for this work is Young Lives, a 15-year study of the changing nature of childhood poverty in India (Andhra Pradesh), Ethiopia, Peru and Vietnam (www.younglives.org.uk).

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1. Introduction

The positive effects of education on the economic and social development of an individual have persistently been highlighted through empirical evidence and literature. For instance, school completion is acknowledged to be a central indicator of earnings. The social rate of return to education, in developing countries, has been estimated to be as high as 27% for primary school and 16% for secondary school; its private rates of return are even higher (Holmes, 2003: 1). The World Development Report (1998) too, confirms that sustained levels of growth in the East Asian countries can be explained by the increasing enrolment in primary and secondary education (Pradhan and Subramanian 2000: pg 12). Moreover, education positively impacts agricultural development as well. This is particularly relevant for countries relying heavily on domestically produced agricultural output. Economic growth will tend to be more rapid, in countries that have a high quality of education; this is confirmed by a latest review of results relating effects of high quality of education (as measured by internationally standardized achievement test scores) to drive economic growth (Hanushek, 2008 as cited in Goldschmidt et al 2009: 395).

Thus, an enormous amount of literature has interpreted educational outcomes through a series of key measures – School completion (number of grades completed), drop-out rates, test scores (cognitive development, literacy, writing, basic numeracy, arithmetic skills), and school enrolment.

In light of the established advantages of education which extend to every sphere of human development, research has been divided on the question of the comparative importance between household factors on one hand, such as household income and assets, household composition, parental education and school characteristics on the other, for instance cost, distance and quality. The present paper, however, believes the roles of home and family background, apart from child factors also, to be crucial in shaping children's human capital, measured by their education level. In fact, it is possible that through low investments in children by poor or poorly educated parents, there exists a major transmission of poverty across generations (Glick et al, 2011: 363). Therefore, we argue that by exploring specific family characteristics, the nature of poverty and inequality can be exposed.

The paper is focused around the educational scenario in one specific state of India. With the country's recent sound economic growth, there was much confidence about improving development indicators. However, it should be questioned whether there has been complementary progress in the measures of educational outcomes. Educational accomplishments in India have had a mixed progress trajectory.

In spite of having 22 per cent of the world's population, 46 per cent of the world's illiterates reside in India along with a high proportion of the world's out-of-school children and youth (Kingdon, 2007: 168). On the progressive side, it has made encouraging improvement recently in raising school enrolment. An enrolment ratio of 93% for elementary school children (6–14 year olds) is a very heartening figure (Pratham, 2007). It reflects the substantial progress that has been made possible through the government's flagship program – *Sarva Shiksha Abhiyan* (SSA) – 'Campaign for Universal Education'- to universalize elementary level education.[1] Even though corresponding statistics for secondary and senior secondary education level are lower than the elementary-level figure, they have risen steeply compared to the previous years. Also, a number of well-educated computer-science and other graduates from India have contributed substantially to the worldwide information technology revolution.

Nevertheless, the alarming fact is that since most of the economic and human-capital resources had been mobilized to concentrate on increasing quantity (school enrolment), the quality of education in the country has suffered tremendously. Recent studies have found very low student achievement in India (Pratham, 2007; Goyal 2009; Kingdon 2007, as cited in Goldschmidt et al 2009: 395).

Our paper, specifically discusses the situation in Andhra Pradesh (AP), India's fourth largest state.[2] Poverty in rural Andhra Pradesh is lesser in comparison with national figures, which is a very promising statistic[3]. In fact, rural poverty is lower than urban poverty in AP. Level of per capita income in AP, though, is a lot lower than for India as a whole.

The state is largely rural with only 27 % residing in urban areas; consequently, the rural fragment of the state is the main engine of growth. Thus, AP is an excellent example of the inequalities describing the Indian economy: Hyderabad, the capital of AP, is one of the leading centres of the IT revolution, while there has been an agrarian crisis causing much distress to huge areas in Telangana for several years consecutively (Galab et al, 2008: 4). There have been several developments in recent years that have merited attention from the media, researchers and policy-makers. These have been highlighted briefly in Appendix1, and the present paper's results and conclusion should be viewed within this broader context.

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[1] *Sarva Shiksha Abhiyan* (SSA) - 'Campaign for Universal Education'- is a scheme sponsored by the central government and funded out of tax revenues. It provides additional funding to states to enroll out-of-school children and to improve school quality through supply-side interventions. Additionally, demand-side measures to close caste and gender gaps in education were also introduced (Kingdon, 2007: 188).

[2] AP has a population of about 76.2 million that accounts for over 7 % of India's population. With an area of 276,754 sq. km., it is sizably larger in population than France, and in area larger than the United Kingdom. Telugu is the mother tongue of 85 % of AP's population, apart from other languages spoken in the state. The dominant religion in Andhra Pradesh is Hinduism (75 per cent) followed by Islam (11 per cent), and Christianity (3.5 per cent).

[3] AP's poverty estimate was 11 % compared to the national average of 28 % in 2004-05

In relation to child development indicators, AP has achieved considerable progress. Yet, despite this growth, significant class, caste, gender and geography based disparities remain (Galab et al, 2008:5).

AP has witnessed a continuous rise in education rates since the past four decades. A reason for the growth in women's education, Reddy and Rao (2003: 1242) suggest, could be because of Akshara Sankranti, a state sponsored literacy campaign started in 2000. Thus, the state has been able to tackle issues related to child education in a noteworthy manner; however, while the substantial increase in enrolment ratio is quite commendable, the learning rate in AP has always been below the national average. Moreover, academic learning has been a grave concern in the state, with over 49 % of women unable to read or write in 2001 (Galab et al, 2008:5).

In recent Indian policy debates, the distressing low quality of education is widely being discussed. UNESCO defined educational quality as "learners' cognitive development, advancement of values and attitudes of responsible citizenship and the nurturing and creation of emotional development…" (UNESCO 2004 as cited in Brownlee et al 2012: 440).

Thus, with elementary education approaching universal coverage, attention is now being focused on the long-neglected problems of secondary education, along with raising quality through student achievement at every education level.

It cannot be denied that poverty is still a major deterrent to educational enrolment in India.

Although hypothetically free, public or government schools place sizeable financial stress on parents. Thus, their decisions about whether or not to send their children to school depend upon their ability to pay for clothing (that is, a uniform), transport and books (Tilak, 1996: 356). The private sector on the other hand charges parents more for its services and operates on business principles, although frequently offers concessions to some poor children. The popularity of private unaided schools is growing in AP. Despite the costs, poor parents aim to send their children to private schools which are typically seem as providing higher quality education. In fact, a recent study (Tooley, 2005) of low-income families in different African and Indian settings found poor school children attending private schools perform better than the children in government schools; the mean maths scores were about 22 % - 25% higher in private schools respectively than in government schools.

There is an emerging consensus regarding a link between education quality and economic growth, though how to improve learning abilities is still a challenge for policymakers. While school enrolment and child learning is unquestionably determined by the quality of teaching in the classroom, along with other school-level factors, it has been suggested that the home environment is important too. Children learn in classrooms as well as outside them.

Reading, writing and arithmetic skills obtained in school can be significantly improved through the home and community environment. In India, however, poverty can manifest itself directly or indirectly. Low parental education, disadvantaged castes and religions, rural status are all intermediate variables which can influence educational outcomes; though the initial effect still remains of poverty. For instance, children from wealthier households, not surprisingly, tend to get more help from educated family members. This might not be the case for children coming from poorer and uneducated households; the latter might also have pressures of house chores or employment which have serious implications on their ability to learn.

Moreover, much of the existing literature on educational outcomes discusses the lack in the supply side of education by highlighting the inadequate government efforts in purveying schools, infrastructure, teachers and the like. In all this, the demand perspective of education, however, has often been taken for granted, specifically by policy-makers in India. Moreover, in public discussions, usually only a single 'explanation' is underlined. For instance, the problem is often blamed on parent's indifference towards education. Others believe that child labour is the main obstruction: according to the Campaign Against Child Labour (1997), India has more than 60 million child labourers, working 12 hours a day on average (Dreze and Kingdon, 2001: pg1).

However, the real challenge lies in building a balanced argument of the determinants of school enrollment and achievement, which merges several lines of explanations: parental education, motivation and support; direct costs, child labour demands, decreased quality of schooling, among others.

As a modest step in that direction, this paper presents an analysis of the determinants of both school enrolment and child learning for the state of Andhra Pradesh, India. Our results show existence of inequalities on the basis of gender, caste, ethnicity and religion in the education sector. Parental education, household wealth, child nutrition, and innate ability are found to have a significant positive effect on test scores particularly. An interesting case is of the Coastal Andhra region which seems to be the most educationally progressive out of the three regions of AP.

The structure of the paper is such: section two described the conceptual framework while analysing both enrolment and child learning outcomes, section three gives a detailed and relevant literature review including research done on various child, household and school characteristics. The paper then goes on to describe the data used, the econometric methodology adopted and a brief description of relevant variables. Section seven presents the descriptive analysis of the data and section eight presents the results of the regressions estimated. In the end, the paper covers the conclusion and further research possibilities.

2. Conceptual Framework

Education empowers people and improves their ability to communicate, argue, and choose in informed ways (Sen, 1999). It also plays a fundamental part in shaping a child's future economic prospects and social development.

Outcomes from education can be measured in different ways; substantial literature interprets them as school enrolment, school completion (number of grades completed), drop-out rates and test scores (literacy, writing, basic numeracy and arithmetic skills).

Children's educational attainment is seen as a function of three main factors: demand, supply and government policy. Educational demand is determined by the parents' decision to send their children to school based on a cost-benefit analysis (Woldehanna et al, 2005: 3). Children could drop out of school due to supply-side reasons too, such as, inadequate infrastructure, teacher quality and limited access to schools. Government's education policy may also affect the demand for, and supply of education (Woldehanna et al, 2005: 4). Policy reforms aimed at encouraging universal education, for instance, compulsory education, subsidized education, changing age at which children start school may greatly influence the decision-making about whether households should enrol or continue sending their children to school.

The objective of this paper, however, is to determine which child, household and school characteristics influence the school enrolment and achievement.

In the wide literature (Glewwe and Jacoby, 1993; Dostie and Jayaraman, 2006; Dreze and Kingdon, 2001; Holmes, 2003) on the importance of educational outcomes, existing models predominantly revolve around school enrolment and completion, rather than other determinants.

Following Maddala (1983) and Glewwe and Jacoby (1993), a simple model of school choice is discussed below. This model is from the demand perspective; parents compare the expected returns against the costs of additional years of schooling. Costs comprise direct costs (school fees, clothing, and transport costs), indirect opportunity costs (such as foregoing wage income or home production) and even non-monetary costs, such as, whether the child enjoys school. Benefits include higher earning capacity and improved standard of living.

Glewwe and Zhao (2010: 452), who also adopt the same model, highlight four types of characteristics that can affect these benefits and costs, in turn affecting a household's demand for years of schooling, denoted by S: child personal characteristics (**PC**), household characteristics (**HC**), community characteristics (**CC**), and school and teacher characteristics (**SC**). This demand function can be expressed as:

$$S = f(PC, HC, CC, SC) + \varepsilon \qquad (1)$$

where ε measures the components in PC, HC, CC and SC that are missing in the data as well as measurement error in S.

Demand for education is an unobserved variable, and is captured in economic theory through observed years of schooling. To estimate this equation, Glewwe and Zhao use the censored ordered logit econometric methodology. By incorporating the children who are still in school as part of the sample, the ordered logit model uses data on years of schooling to estimate the unobserved demand for education.

The vector PC comprises of all child characteristics that affect the demand for education, including the child's motivation, preferences for schooling, and innate ability. These variables are usually omitted because they are difficult to measure and, are thus combined with ε in Eq. (1). Some studies, however, use observed child variables as proxies for unobserved child characteristics. For instance differences in gender, age, nutritional status or cognitive test scores may in part explain innate ability of a child.

Household characteristics (HC) can also influence child schooling: parental education levels, household composition, attitudes and preferences of parents toward female education along with their expectations about the education level for their child. Household wealth measured by household expenditure, income or assets owned is another determinant of child schooling. Budget constraints due to a low income might constrain parent's ability to invest in education; this might lower the demand for education.

Child education, moreover, can be affected by community factors (CC), such as availability of schools (number of schools in the community), access to schools (the distance between the child's home and school) and the returns to education (through labour market condition). Another community factor appraised by Glewwe and Zhao is the percentage of secondary degree holders among the community's adults, which can be used as a measure of community norms regarding education.

School and teacher characteristics (SC) too play crucial roles in explaining the demand for education. Better school facilities and more skilled teachers are seen to increase child learning, and thus knowledge is augmented through the learning production function. This increases the returns to investment in education.

While the paper analyses determinants of both school enrolment and educational achievement this paper focuses more towards the latter. The reason is that in developing countries, the educational policy debate has shifted more towards quality, rather than the quantity of schooling. The paper takes a special interest in the state of Andhra Pradesh, India. Starting 2001, India has made considerable effort to ensure basic education for all its children through its flagship educational programme – the SSA, 'Campaign for Universal Education' – to universalize elementary

education (grades 1–8). Net primary enrolment in India, now, has risen steadily over the last several decades and exceeds 90 percent in most of the country (Das and Zajonc, 2008: 1). Thus, the discussion has recently moved from raising enrolments, resources, amount of children in school to what they are learning. That said, with the focus shifting recently towards strengthening quality rather than quantity of schooling, research in this area is on the rise. Within the conceptual framework of factors influencing the educational achievement of children, the following may be construed as more significant.

Child Characteristics:

Gender roles in India are clearly defined. Boys are seen as future earners for the household and girls fulfil domestic responsibilities as future mothers (child rearing). In a traditional Indian setting, girls after marriage move away to their husband's household and are 'lost' to their parents. Thus daughters might not be sent to school, since investments in daughters' education accrue to their future husband's family, whereas boys are readily enrolled, since investments in their education stay in the family. This phenomenon may be responsible for continuing wide gaps in education across gender in patriarchal areas. Parents from low income households are hesitant to pay to send their daughters to private schools, thus girls mostly from poor or disadvantaged backgrounds find themselves in government schools. The different treatment of girls in the intra-household allocation of resources and lack of the school-level involvement worsens the gender gap in education, girls' academic achievement, and future job prospects (Kingdon and Unni, 2001: 191).

Over the past decade, substantial government efforts have been made in India to narrow gender gaps in educational outcomes. The National Program for Education of Girls at Elementary Level (NPEGEL) funds sub districts with female literacy below the national average (Lewis and Lockheed, 2007: 126). It organizes the community to target out-of-school girls, girls from marginalized social groups, and girls with low achievement.

Thus it becomes important to assess whether the gender gap problem is still hampering the educational achievement of girls.

A student characteristic that is frequently mentioned in studies is innate intelligence or IQ; it is usually found to be an important factor in learning achievement (Boissiere et al. 1985, Glewwe 200 as cited in Boissiere, 2004: 26). The innate component of ability, for instance, the ability to learn reading and mathematics, in a child is also part of intelligence. It is imperative to account for innate ability in the determinants of student achievement; otherwise it might lead to biased results.

The health and nutrition status of a child can both contribute to and be a result of schooling. As a contributing factor, various illnesses are recognised, such as, malaria in tropical countries, that

can cause absenteeism as well as reduced energy levels in class. Even if attendance is regular, various physical and mental disabilities, apart from poor school performance can occur due to the lack of nutrition at home. Studies show that learning capacity is also reduced because of poor health and nutrition in poverty-stricken households. According to Flynn (1987) the increase of IQ scores over time in the high-income countries, is to a large extent due to improved health and nutrition (Boissiere, 2004: 26)

The Midday Meal Scheme in India is the largest school meal programme in the world, covering an estimated 139 million children[4]. Under this programme, all government primary schools are supposed to give prepared mid-day meals to students. School meal programmes can contribute to better educational achievements by improving the nutritional status of enrolled children.

Caste (scheduled castes, SC) and ethnicity (scheduled tribes, ST) are important distinctions in the Indian society which greatly influence school enrolment and how much a child (Jayaraman 1967 as cited in Desai, 1991). The caste or ethnic status of a child is likely to act a limitation to her/his access to education, and consequently to educational achievement. For instance, 'dalits' recognized and protected by the government of India as Scheduled Castes, constitute the erstwhile category of 'untouchables' of India and account for, approximately, 17.5 per cent of India's population[5]. The practice of 'untouchability' is illegal in India; however, in reality this is very different: dalits are frequently found residing in isolated colonies on the outskirts of villages. Children from SC, ST and Other Backward Castes (OBC) households tend to underperform compared to others because of social discrimination that limits upward mobility, awkwardness in an unfamiliar academic context, and feelings of alienation, resignation, and frustration (Desai, 1991: 12).

An important explanation for low school participation rates among Muslims is the significant role played by religious institutions and, in particular, of the local clergy. Conventionally, it is claimed that Islam believes Muslim parents may spend less on the education of their daughters than of their sons and that they may also be reluctant to send their children to government funded schools. This is because of the alternatives existing in community-based schooling (in the form of madrasas) and most particularly on account of the lack of Urdu language teaching in the formal system. These non-economic sociological factors, thus become crucial to study as they might significantly influence schooling decisions, despite controlling for the economic factors that affect them(Iyer, 2002, as cited in Borooah and Iyer, 2005: 1378).

[1] http://recoup.educ.cam.ac.uk/publications/OXREPDownloadedpaper1.pdf

[2] http://www.tandfonline.com/doi/pdf/10.1080/00220380500186960

Household Characteristics

According to theoretical analysis, children whose parents are more educated grow up in an intellectually stimulating environment. Children are also better assisted in their schoolwork by educated parents. Moreover, parents once attaining a certain educational level might expect their children to achieve at least that level. Mother's education might prove to be especially important for the educational enrolment of girls in particular. Once a certain level of education is achieved by mothers, its value is what they tend to pass on to their children. Educated mothers would want to use their cultural power and insights gained from their advanced education to make sure their daughters are educated too. Therefore, we can easily suppose parental educational to have an increasing effect on academic achievement. Drèze and Sen (2002: 2) propose parental motivation and aspirations too to have a significant influence on schooling attainment in India. Parental attitudes towards education also reflect the heterogeneity in household preferences, e.g. weight put on child education in the household utility function (Glewwe and Zhao, 2010: 452). However, literature has not given the role of parental aspirations and preferences for their children's future, a potential driver of schooling outcomes, much attention.

Whether a household is capable of investing in their child's education is clearly determined by household wealth. It can be interpreted as a sum of household income and any productive assets (land and livestock) the household has. When economic resources become scarce, essential items such as food, shelter and clothing may compete with uses for education (Woldehanna et al, 2005: 8). Poverty is seen as a major obstacle to education in India, making the direct costs of schooling too expensive for many families. Thus, poor households either tend to fail to enrol their children into schools or withdraw them prematurely. We thus expect the educational achievement to improve with household wealth.

Education of the child can also be affected by the size and composition of the household unit.

Children from smaller families tend to show better performance in school outcomes than those from larger families (Woldehanna et al, 2005: 9). Children with more siblings face greater competition for the distribution of scarce socio-economic resources. In fact, for most developing countries, there is evidence that older siblings, as compared to younger ones, are more likely to suffer the consequence of increased fertility, as the former are often involved in household responsibilities and take care of their younger siblings or contribute to the family income by earning extra money. Thus, for successful family planning, magnitude of the impact of household composition on educational performance should be assessed. Despite many studies showing large family size to be having a negative effect educational achievement, living in an extended family could mean a lot of relatives available to help out in the household and add to the household income which could make it easier to go to school.

School Characteristics

Access to and distribution of schools across the country may play a role in providing an education. Children often drop-out or don't attend school regularly because the distance between their home and school is substantial.

In India, between 2001 and 2005, total public expenditure in elementary education nearly doubled.[6] Consequently, a greater number of children were enabled admission to a government school. Even the number of private schools has increased tremendously. While the progress of private schools has been faster in urban areas, such schools have come up at a tremendous rate in rural parts of most states. However, school fees in private schools are much higher than that in public or government schools. Despite these costs, poor parents intend to enrol their children in private schools which generally provide better quality education. In fact students in these schools, on an average, perform much better in test scores; and frequently it seems that private schools achieve this better performance even with much lower expenditure per pupil than government/public schools. Thus, there are valid apprehensions about drop-out rates and the quality of education in public schools.

Additionally, in India there are many single and two-teacher schools. These schools have to rely on multi-grade teaching, which has a negative impact on educational attainment (Muralidharan & Kremer, 2009: 12).

Availability of resources in schools that facilitate learning, for instance, school books, electricity, blackboards, drinking water facilities and separate toilets for girls exert an important influence. Monetary incentives, such as scholarships for girls and deprived castes, programs that cut costs of schooling, or free clothes, substantially improve participation of poor children, girls and the disadvantaged castes.

As mentioned above, the provision of mid-day meals in school can play an important facilitating role in the universalization of elementary education by enhancing enrolment, attendance and retention. In order to frame better educational policies, it is necessary to understand the influence school facilities have on child development.

Giving, a conceptual framework, the strategy for our study becomes clearer. The present paper uses data which is in the form of two cohort rounds in the years 2006 and 2009. Given the nature and admirable quality of the data, this paper is able to assesses the impact of a wide selection of child, household and school characteristics on school enrolment and achievement (through test scores). Only year 2006 is analysed for school enrolment ratio (whether the child is enrolled in school or not) using a probit model as the econometric approach.

[6] http://www.tandfonline.com/doi/pdf/10.1080/09645290903142577

By 2009, the goal of universal school enrolment had almost been achieved in India. Studying children's learning achievements thus becomes more significant. By selecting standard tests that have been administered to the children in the sample, this paper focuses more on studying the determinants of child learning, as compared to school enrolment. Since the test scores' results are continuous variables, initially, an OLS econometric methodology is adopted for cross-sectional data regressions for the two years and their respective cohorts. Data allows the construction of a panel which is analysed through the first-difference model. Moreover, pooling and increasing the dataset implies improvement in the efficiency of results.

3. Literature Review

Studies that appraise the determinants of education play a crucial role in initiating a process of corrective policy-making that in turn would address the lacunae and inefficiencies in any educational programme.

As mentioned in the conceptual framework, children's educational outcomes are functions of three main factors: demand, supply and government policy. Literature, however, takes mainly two approaches: it either focuses on the role of parental characteristics and the home environment or it examines the influence of school characteristics while analysing enrolment and educational achievements.

Despite recent improvements, analysis of education in India is hampered by the lack of reliable data. Official data collection is only from the so-called ''recognized'' schools. Thus, a huge number of private schools is not included in official data since they are ''unrecognized'' (Kingdon 1996, as cited in Kingdon, 2008: 111). Enrolment data recorded by the schools themselves, are undependable because substandard government sponsored schools might overstate their student numbers to substantiate their existence (Dreze and Kingdon 1998, as cited in Kingdon, 2008: 111). There is not much government data collected on student learning achievement at various education levels, and while exam boards do have achievement data these are not publicly available to researchers. Therefore due to data limitations, there is a serious lack of good quality research on educational issues in India.

Moreover, much of the existing research is based on small surveys and these studies use enrolment and achievement production functions simply for establishing correlations rather than causation between student achievement and particular school inputs.

However, given the data that is available, there is substantial literature relating to Indian education. School completion (number of grades completed), drop-out rates, test scores (literacy, writing, basic numeracy, arithmetic skills) and school enrolment, have been the variables of interest in many studies by Singh (2013); Huisman et al (2011); Kingdon (2007); Dreze and Kingdon (2001); Jayachandran (2001); Desai (1991) and many more.This paper, as specified earlier, believes learning achievement (measured by standard test scores) of children to be of particular concern, and tries to assess factors that influence this achievement at the household and child level. It also sheds some light on the educational enrolment scenario of children in Andhra Pradesh, India.

Following is a review of the literature studied to carry out the current analysis:

Enrolment and Learning Achievement Literature

Advocating the prominence of basic education as an input into social and economic development, researchers are extremely keen to examine the relative importance of socio-economic characteristics connected with child enrolment. Usually, the inclination is to emphasize a 'single' explanation in illustrating deteriorating indicators of education (Dreze and Kingdon, 2001: 1); yet, the actual task is to build a good representation, one which incorporates diverse theories about the determinants of schooling participation.

Huisman et al (2010: 2) argue that much of the variation in educational enrolment, at least in urban areas is swayed by characteristics at the household level more than anything else. But, in rural areas, supply-side factors (school facilities and quality of teachers) play a more crucial role. At the same time, a rich literature can also be found on more aggregate influences on school enrolment through village- and community-level studies. One such interesting study is conducted by Dostie and Jayaraman (2002) using the 1997–98 UP-Bihar Survey of Living Conditions data set. They exploited the elaborate village survey included in the dataset to capture contextual effects. Despite existence of many problems related to the inclusion of group-level variables (village-level school characteristics), the authors have successfully managed to take care in selecting only those village-level variables that can reasonably be defended as being exogenous.

Evidence from the two Indian states, Bihar and UP, apart from highlighting other characteristics, suggested contextual effects (village's socio-economic composition) too, have a bearing on a household's decision to enrol children in school. Village road access seemed important in encouraging boys' school enrolment. Increased investment in road infrastructure was thus the likely policy recommendation.

Many studies argue that despite making enormous progress in increasing school enrolment, particularly after the implementation of the SSSA in 2001, this goal remains obscure for many children, especially in rural India (Dreze and Kingdon, 2001: 1; Dostie and Jayaraman, 2006: 405).

Dreze and Kingdon (2001: 11) use the PROBE survey[7] which contains comprehensive evidence not only on the characteristics of about 4400 children and their households, but also on schools to which these children have access. Their study considers three dependent variables: initial enrolment (if the child has ever been enrolled in school), current enrolment (child is currently enrolled in school), and grade attainment (highest grade achieved by the child). The paper gives some valuable insights; its results extend support to a 'pluralist' view of the causes of educational deprivation in rural India. Household resources, parental education and motivation, child labour

[7] PROBE Survey: Primary Report on Basic Education survey is an extensive survey for five north Indian states (Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh and Himachal Pradesh) that account for about 40 per cent of India's population.

returns and school quality are recognized as key determinants. However, due to data limitations, the model used focuses only on a single child; effects of siblings are not included.

Jayachandran's (2002) study is an attempt to move the research further on investigating the possible reasons for low levels of primary schooling enrolment and high drop-outs. The determinants of male and female schooling in the 5-14 age groups are first studied as cross-sections for 1981 and 1991 India Census; this has enabled Jayachandran to highlight variations in educational outcomes across eighteen states of India and moreover to examine the link between these outcomes and other socio-economic variables. 1981 and 1991 cross-sections are consequently pooled to get a time panel dataset which is further studied. Results illustrate the important role women play in educating children through adult female work force participation, with adult female literacy having a positive impact on school enrolment. By pooling datasets of two years, panel data ensures that any possibility of biased results is eliminated.

A study that uses an even bigger dataset, but is not panel data, is Huisman et al (2010). The authors use data from the 1998/99 National Family Health Survey (NFHS)[8]. The dataset contains detailed information on education and family background at the household level and offers excellent possibilities for studying context effects. Moreover, because the sample is large, the authors were able to construct variables indicating the level of development, labour market structure and culture. Their analysis shows that most of the variation in educational participation (about 70%) is because of household level characteristics. If the household is wealthier, if the parents have more education, or if they possess more agricultural land, the likelihood of children being in school is substantially increased.

A part of the literature discovers other explanatory variables apart from the established ones; for instance Lincove (2009: 474) argues that disregarding costs from the school enrolment model limits one's understanding of household decision making. The author believes Nigeria to be an exceptional example of why costs should be examined too. This is because only 15% of children in the sample benefited from the national policy of Free Primary Education (FPE), and 33% of children were not attending school (Lincove, 2009: 483). As wealth increases, the chances of receiving FPE in Nigeria increase, indicating that these subsidies are not always targeted to assist poor households. It becomes essential to carry out such an analysis even in countries that have declared primary school to be universal and free, for instance India. The main insight emerging from Lincove's study suggests that to promote universal access to schooling, simply eliminating costs (or subsidizing education) is not enough. Other hindrances, both societal and economic, may keep some groups out of school even if access is truly free.

[8] The National Family Health Survey (NFHS-2) is a large representative survey covering over 99% of India's population.

Woldehanna et al (2005) is another such study that includes two variables that immediately catch the reader's attention – social capital and number of economic shocks (negative shocks) suffered by the household; little discussion regarding these variables is present in the literature. Similar to our study, Woldehanna et al use the Young Lives dataset, but for Ethiopia. They assess the determinants of eight-year-old children's primary school enrolment based on human, financial, physical and social capital factors. Social capital can be interpreted as the formal and informal relationships between individuals and communities including relationships of trust and tolerance. The authors hypothesize social capital to influence child schooling in two ways: it can facilitate communication between economic agents when the information flow between the two is constrained. Also, communities with stronger social capital can pressure the local, regional and national government more to invest greater resources in education. According to their results, frequency of economic shocks faced significantly reduces the probability of the household to send their child to school.

Of the papers discussed above, Dostie and Jayaraman, Lincove and Woldehanna et al use probit models to analyse school enrolment, viewed as a binary dependent variable (taking on a value of 1 if child is enrolled, 0=otherwise). However, to incorporate a maximum likelihood framework, Dreze and Kingdon and Huisman et al believed logit model to be the natural estimation method.

Infact, in Huisman et al's study multilevel analysis was conducted to include dependent variables at different levels (family-level, district-level and state level) simultaneously and interactions among levels were studied too.

Jayachandran (2002) on the other hand prefers to stick to the linear probability model to assess school participation, apart from presenting results of the random effects model used to study the panel dataset. Panel data results support the cross-sectional findings in her study and give a consistent representation of the connection between girls and boys school enrolment and the explanatory variables used. The use of panel methods also increases the efficiency in estimation due to the increased size of the pooled dataset.

Recent studies on learning outcomes of children in India point towards very low educational achievement (Pratham, 2007; Goyal, 2009; Kingdon, 2007; cited in Goldschmidt et al, 2009: 395). In light of this recent shift in the concentration of literature towards quality of schooling rather than quantity, it is crucial to discuss the results various studies have reached.

Discussing the literature reviewed, it should be mentioned that a central constraint on research conducted has been the concentration on school attainment/grade attainment as the primary measure, rather than directly measuring learning skills. Grade attainment is taken up as a measure mainly because quality of schooling can be judged if a student remains in school for many years without gaining basic skills (Glewwe and Kremer, 2006, as cited in Glick et al, 2011: 363). Yet,

Hanushek and Woessman, (2008: 649) highlight that, difference in skills between students at comparable grade levels across countries seems to be a lot higher than the gap in grade attainment. This is indicative of the significance that needs to be given to measuring cognitive test scores of children. A thorough assessment of developing and developed country evidence (Hanushek and Woessman, 2008: 608) argues that cognitive skills are important factors influencing future personal earnings, inequality level and economic growth of a country. Even when individual or country-level grade attainment is taken into account, cognitive skills matter, implying that attainment and skills (interpreted as human capital) are not the same, and studying both is equally crucial. This has been strongly advocated by a number of studies (Hanushek and Woessman, 2008, World Bank 2008, as cited in Glick et al: 364).

Yet, there is a substantial lack of research on cognitive skills or test scores of children. Studies that do take up this issue, mostly take up school-based data. There are many problems with such a dataset:

First is sample selection; school centred studies involve merely those children who are enrolled in school or have stayed in school till that time. Children who might have dropped out due to socio-economic compulsions, from the school being considered, may not be included in the survey (Glick et al, 2011: 364).

A second problem is that, even though school-based studies might include comprehensive data on school factors – they are straightforward and easy to administer (Glick et al 2011) – many of them do not include home, family or community characteristics. Yet, socio-economic status of a student, for instance, household income, or even parental education may be correlated with included school characteristics; in such a case estimates of school-based may be biased. It is usually household based surveys that try and capture family environment, along with cognitive skills by administering tests to students.

Third, a problem that actually might be present in both school- and household- based surveys is that local school standard might be non-random to academic outcomes. Good quality schools may come up in posh communities with well-educated parents motivating their child to do better, and also ensuring higher outcomes through other means (such as private tuitions), information for which might not be covered in the school-based surveys. On the other hand, even governments may shift more resources towards poor-quality schools where educational outcomes tend to be low, thus leading to biased downward school quality effects.

These problems in measurement and omitted variable bias can probably explain the wide variation in estimates of key variables. For instance, empirical studies from 30 developing countries reviewed by Hanushek (1995), 8 were found to a significant positive effect of the teacher-pupil ratio

variable on student learning, 8 found significant negative impacts, and 14 found no significant impact at all.

There is indeed a requirement of literature that views both home and school environments in context of measuring cognitive testing of children. One such study, Glick et al (2011) find mother's schooling to be far more important than father's schooling for child learning in Madagascar. This impact is more significant for older than younger children, however, it is the other way around when the effect of wealth is seen. An explanation for this trend could be that household wealth matters for school enrolment, specifically at primary grades, but its marginal effect weakens thereafter. Parental education, however, continues to affect learning each year.

A research area that needs further study is the age-specific effects of family and school factors. Recent research in the USA argues that family environment during the pre-school years has a strong impact on child's academic development in school and later labour market progress (Carneiro and Heckman, 2004, as cited in Glick et al: 365)

Paxson and Schady (2005) in the developing country (Ecuador) context find household factors might impact performance on tests in the early years of a child's schooling itself, before the effects of low or high quality schooling become apparent. Extending the Indian literature on this issue, Singh (2013) shows that huge gaps exist in the test scores of children even at the start of formal schooling, and these can be traced back to previous attendance in private and public pre-schools. The author is able to conclude that attending private pre-schools leads to higher test scores as compared to test scores when enrolled in public pre-schools. Moreover, two-thirds of this gap in scores can be explained by controlling for parental background, household income and particular child characteristics.

Apart from the detailed review presented above of the theoretical strategies, data sets and methodologies adopted by specific papers, following is a quick summary of the various factors that were found to hugely influence school enrolment and educational achievement in the extended literature reviewed:

Child Characteristics

Some studies found the possibility of attending school increasing with age for young children, and then decreasing as teenagers dropped out for marriage or work (Chernichovsky, 1985, Wolfe & Behrman, 1984, cited in Lincove, 2009: 474).

Wide gaps in education in developing countries can, more often than not be explained by persistent gender bias. Broaded and Liu (1996: 53) show that, even in large urban areas in China, a

lot of importance is attached to gender as a determinant of both educational aspirations and high school enrolment. In rural North India, Dreze and Kingdon (2001: 16) find the gender dummy (male=1, female=0) to be always significant and positive in their regressions, thus indicative of a sharp gender bias.

Low school attendance and poor achievement of students were significantly associated with under‐nutrition and hunger in the Vietnam (Glewwe *et al*., 2001: 3) and Chile (Ivanovic *et al*., 1996: 8). In India, even though advances in overall nutrition took place in the 1990s, improvements in anthropometric measures are "slow, relative to what might be expected… in light of India's recent high rates of economic growth" (Deaton & Dr`eze, 2008: 1).Recently, randomized evaluations are frequently being used to establish connecting links between children having an illness and school participation. Bobonis *et al*. (2006) examine the effect of a health intervention distributing iron supplements and deworming drugs in preschools in Delhi. Pre-school participation rates rose by 5.8 % points in the first five months of the programme. Kingdon and Monk (2010) using new and unique panel data from rural India present evidence that height-for-age z, a measure of long-term health, has a significant positive effect on schooling achievement.

It is necessary to account for innate learning abilities of a child as they can substantially increase the productivity of education. For instance, higher achievements and cognitive skill were found to reduce the likelihood of dropping out in Egypt (Hanushek et al, 2006).

Returns from education are lower for some social groups in; the reason is the discrimination based on caste and religion practised in the labour market. Unni (2007, cited in Kingdon 2007: 174) finds wage returns to education to be significantly lower for Muslims, Christians, and ST groups than for the majority Hindu group.

Child labour is usually a manifestation of constrained household resources and is a consequence of poverty. Most working children in developing countries are engaged in domestic tasks, such as caring for other dependants in the household and assisting on the family farm/business. While these children are not involved in 'hazardous' forms of child labour targeted by the International Labour Organisation (ILO), the tasks they undertake may nevertheless have adverse effects, including permanent loss of education (Krutikova, 2009: 1).

Household Characteristics:

Research has extensively found parental education to be a significant factor in determining educational outcomes (Holmes, 2003; Woldehanna et al, 2005; Dreze and Kingdon, 2001; Dostie and Jayachandran, 2006, Galab et al, 2005, Glick et al, 2011).

An interesting aspect of parental education is the separate influences of maternal and paternal education on enrolment and test scores. Jayachandran (1997, as cited in Dreze and Kingdon, 2001: 17) through a previous study recommends that inter-generational same-sex effects are greater than the cross-sex effects; i.e girls' schooling is more sensitive to mother's education than to father's education and vice-versa for boys. However, these inter-generational correlations require further study as they could reveal the influence of omitted variables. However, Desai's (1991: 254) two possible explanations for why parental education might not affect child schooling: parents with some education may not feel their education is relevant to their lifestyle or employment; thus, they don't encourage their children towards education. Additionally, uneducated parents may have a greater tendency to push their children more in acquiring skills and an education which they couldn't access.

Income constraints frequently emerge as an important obstruction to school attainment (Woldehanna et al, 2005: 8). There is evidence of a positive relation between household income and schooling outcomes (Dreze and Kingdon, 2001; Dostie and Jayaraman, 2006; Lincove, 2009; Connelly and Zheng, 2002; Holmes 2003). Moreover, there is ample literature suggesting that poverty significantly leads to learning disabilities (Chernichovsky and Meesook, 1985, King and Lillard, 1987, Moock and Leslie 1986, and Venkatasubramanian, 1978, as cited in Desai, 1991: 252).

School Characteristics:

Availability and quality of schools are central determinants of educational participation, particularly for specific groups like the poor and girls (Buchmann and Hannum, 2001; Colclough, Rose and Tembon, 2000, cited in Huisman, 2010: 3)

As distance from the home to school increases, people living far away from the child's school may face higher opportunity costs of enrolling and attending school as direct costs (transport) are likely to shoot up. Many studies established educational outcomes to be negatively affected by distance to school, particularly for females and children from rural areas (World Bank, 1996, Befekadu et al, 2002, Mulat, 1997, cited in Woldehanna et al, 2005: 9).

Concerning school quality, the conclusion of private schools in India imparting better quality education has been reached by many studies such as, Tooley and Dixon (2005), Kingdon (1996) and Galab et al (2005).

Several micro studies have pointed to substantial additions in enrolment immediately after the mid-day meal scheme started (Khera, 2006: 4742). Dreze and Kingdon (2001: 19) have noted that female enrolment increases about 15 percentage points more when the school offers a mid-day meal than when it does not; as observed by the PROBE Team (1999: 97): '... parents are not generally opposed to female education, but they are reluctant to pay for it. School meals could make a big difference here, by reducing the private costs of schooling.'

4. Data Used

Analysis is conducted using data from Young Lives, a longitudinal cohort study of childhood poverty across four countries: Ethiopia, Peru, Vietnam and India (Andhra Pradesh). In each country, two cohorts of children (one born in 1994/5 and the other in 2001/2) were identified in the baseline survey (2001/2) to take part in the 15-year study. In India, data was collected specifically from the state of Andhra Pradesh, across the three distinct agro-climatic regions, namely, Coastal Andhra, Rayalaseema and Telangana from 20 sentinel sites.

The Young Lives household surveys across three rounds contain detailed information on household characteristics, such as, household composition, livelihood and assets, socio-economic status, parental education and access to basic services. Moreover, the survey includes information about the schooling of children, such as the age at which they started pre-school, whether they have begun formal schooling, type of school attended (whether private or public) and distance from the school. Additionally, given a background of a lack of reliable educational data in India, the effort Young Lives has made to collect every child's learning achievement measure (in the form of administering recognized cognitive tests), apart from other educational outcomes, is commendable.

There are three significant features of the data. First, the sampling scheme adopted by Young Lives was designed to identify interregional variations with the following priorities[9]:

- A uniform distribution of sample districts across the three regions to ensure full representation
- The selection of one poor and one non-poor district from each region, with district poverty classification based on development ranking
- When selecting poor districts and mandals, consideration was given to issues which might impact upon childhood poverty, including the presence or non-presence of the Andhra Pradesh District Poverty Initiative Programme (APDPIP)

Second, this survey only covers Andhra Pradesh, and even though Andhra Pradesh is the fifth largest state in India[10], it may be inaccurate to generalize the results of this study for other states. Yet, the results could be treated as the benchmark for what we may expect to find in the other states.

Third, the numerous tests conducted by Young Lives were taken by all the children in the sample, they were not school-based tests, and were administered to each child personally. This

[9]For greater detail about the sampling strategy please see: http://www.younglives.org.uk/files/country-reports/country-report-india-2008

[10] http://www.younglives.org.uk/files/country-reports/country-report-india-2008

provides a more realistic picture of the issue at hand as results will not be biased towards factors that only influence school children. The only limitations were when the child said she didn't know the answer or refused to answer the question or her response wasn't applicable.

In the baseline survey (2001/2) the Younger Cohort includes 2011 index children aged 6 months to 18 months, 54 per cent were male; 75 per cent lived in rural communities; 99 per cent were cared for by their biological mother.

The Older Cohort, on the other hand, includes 1008 children, mean age 8 years. From these, about 49per cent were male; 75 per cent reside in rural areas; 96 per cent were cared for by their biological mother

In this study, from the second round (2006/7), 1950 children of the younger cohort, and 994 children of the older cohort and in the third round (2009/10), 1930 of the younger cohort and 977 of the older cohort could be traced and resurveyed; attrition rates in the longitudinal data are low and therefore do not pose a problem for analysis.

5. Econometric Methodology

After a detailed descriptive analysis of the data in the following section, multivariate analysis is conducted to explore the correlation between children's educational outcomes (school enrolment and test scores) and gender, age, height-for-age z scores, innate ability, child labour, religion, caste, household wealth, indebtedness, urban/rural status, region, parental education, older/younger siblings, mid-day meals, type of school attended (government or private). All the regressions were conducted using STATA version 11.2.

With a national policy aiming at access to free and universal primary schooling, it is crucial to first assess how the enrolment in the Andhra Pradesh sample has fared. This is done by using a probit regression model as the econometric methodology. For the older cohort the dependent variable is school enrolment, a dummy variable taking on a value of 1 if the child is currently enrolled in formal school and 0 otherwise. For the younger cohort, some proportion of the sample is enrolled in pre-schools and some have begun formal primary school, thus, we consider it necessary to study both. The dependent variable, pre-school enrolment, is a dummy variable that takes on a value of 1 if the child is currently enrolled in pre-school, and 0 otherwise. Similarly, for formal school enrolment, the dependent variable of whether a child is enrolled in formal school (binary dependent variable, 1-0) is regressed on a wide selection of child, household and school characteristics.

However, the main objective of the paper is to analyse learning achievement of children through test scores. This, the paper does by choosing standard test scores that have been administered to the children in the sample, and regressing them on the decided explanatory variables. Using longitudinal data for the two rounds, we have been able to construct a panel. This has enabled a more thorough study; pooling the data for two rounds increases the number of observations for each cohort and thus increases the power in hypothesis testing and efficiency in estimation.

First, cross-sectional test score analysis of each cohort is implemented. The dependent variables in this case were the standardized test scores: math test for the younger cohort (of both years) and the math and reading test for the older cohort (of both years). Since the test scores constitute a continuous variable, OLS strategy is thought to be most appropriate. The results in section eight compare findings from the younger cohort regressions of both years and older cohort regressions of both years. Considering past studies, our regressions are also disaggregated on the basis of gender to examine carefully, the gender inequalities that an Indian dataset would involve.

Thereafter, the first-difference model, a variant of the fixed effects model is used for analysis of panel data.

Almost all cross-section equations are likely to suffer from omitted variable bias. One possible solution in such a case would be to control for different variables such as, gender, caste, ethnicity, religion and so on, in a multi-regression analysis. Our thorough study of analysing educational outcomes has already covered that part. Extending our examination further, we acknowledge that there could be other variables that were difficult to control for. And the way this question has been solved by us, is to take up panel data analysis, in which the unobserved variable has two kinds of effects on the dependent variable: it can either be a time-invariant, constant effect or it can be one that changes over time.

The first-difference model is most suitable for the question we are focusing on because some household and child characteristics don't change much over time, such as gender of child, religion, caste, parental education, urban/rural status, ethnicity and region. Theoretically, these should be included in the regression model, as excluding them might lead to omitted variable bias. However, suppose all relevant fixed factors cannot be observed or measured, then by removing the time-invariant terms, a suitable equation can be estimated.

More precisely, for a cross-sectional (Round 2 and 3 in the YL data) child observation, i, household observation, h, and unobserved effects included in a_i, the regression equations for the test score, y, across two years (t=6, 9) can be written as

$$y_{ih9} = (\beta_0 + \delta_0) + \beta_1 x_{ih9} + a_{ih} + u_{ih9} \quad (t = 2009)$$

$$y_{ih6} = \beta_0 + \beta_1 x_{ih6} + a_{ih} + u_{ih6} \quad (t = 2006)$$

Subtracting the second equation from the first, we obtain

$$(y_{ih9} - y_{ih6}) = \delta_0 + \beta_1 (x_{ih9} - x_{ih6}) + (u_{ih9} - u_{ih6}),$$

or

$$\Delta y_{ih} = \delta_0 + \beta_1 \Delta x_{ih} + \Delta u_{ih} \tag{2}$$

where "Δ" signifies the change from t=2009 to t=2006. The unobserved effect, a_i, is generally referred to as a 'fixed effect'. It is constant over time (thus doesn't have a time subscript) and does not appear in Eq. (4) as it has been "differenced away". Also the intercept term in Eq. (2) is actually the change in intercept from *t=2006* to *t=2009*.

Eq. (2) is known as the first-differenced equation, which is simply a cross-sectional equation but each of its variable is differenced over time. The error term, u_i, is the idiosyncratic error or time-varying error, as it represents unobserved factors that change over time and may affect y_i.

The most important assumption for this model is that Δu_i is uncorrelated with Δx_i. Upon getting the OLS estimator of β_1 from Eq. (2), the resulting estimator is called the first-differenced (or in this case, third-differenced, since the gap between data rounds is three years) estimator. The first-difference estimator is thus used to address the problem of omitted variables bias in the panel.

Pooling the two years' data and running OLS could be one option too, however, this method has two limitations. To produce a consistent β_1, an assumption that the unobserved effect, a_i, is uncorrelated with x_{iht} would have to be made. Thus a heterogeneity bias comes about by pooled OLS; it is just the bias caused by omitting a time-constant variable, since, the main objective of looking at panel data is to allow for the unobserved effect to be correlated with explanatory variables. First-difference does this by taking the difference of each variable over time.

One drawback of the model is that even though the first-difference model can correct the problem of unobserved (time-constant) characteristics, in doing so it eliminates a large amount of variation in the data. This tends to aggravate problems with measurement error bias (Wooldridge, 2006: 463). Another drawback worth mentioning is the strict exogeneity bias, discussed above, which implies that the idiosyncratic error in each time period should be uncorrelated with the explanatory variables.

6. Description of Variables

Children in the sample were given different learning tests depending on the age group they belonged to. The aim was to test the children on their cognitive development, mathematics and reading skills.

The first test of a cognitive kind is the Peabody Picture Vocabulary Test (PPVT); it is a widely used test of receptive vocabulary. The test is individually and orally administered, untimed, and norm referenced. The task of the test taker is to select the picture that best represents the meaning of a stimulus word presented orally by the examiner (Cueto et al, 2009: 12). It has originally been designed for testing individuals in English, but was adopted into local languages in the Young Lives dataset. For this analysis, the focus is on children who took the test in Telugu, which accounts for 95 % of the sample. Also, for the Indian case, PPVT III version of the test has been used. PPVT has been administered to both cohorts in 2006 and 2009.

The younger cohort of 2006 took the Cognitive Development Assessment (CDA), which tests the effect of attending a pre-school center in the cognitive development of 4 year old children. The CDA comprises different sub-sections measuring the child's grasp of spatial relations, quantities and time; for the given sample, only the quantitative sub-scale of the CDA was administered. The child was asked to pick an image from a selection of three or four that best reflected the concept verbalized by the examiner (e.g. few, most, nothing, etc); fifteen items were tested.

A third test was the Mathematics Test; it was administered to the older cohort of 2006 and both cohorts of 2009. For the 2006 cohort, most of the items included in the test were selected from publicly released items of the Trends in International Mathematics and Science Study (TIMSS) developed by the International Association for the Evaluation of Educational Achievement (IEA) in 2003. [11]

For the 2009 younger cohort, the first section of the mathematics test aimed to measure basic quantitative and number notions. The second section aimed to measure ability to perform basic mathematics operations with numbers. The older cohort of 2009 had a little more advanced test, the first section aimed at the same goals as part 2 of the YC test. Section 2 contained items on mathematics problem solving: (1) data interpretation, (2) number problem solving, (3) measurement, and (4) basic knowledge of geometry.

The Reading Test administered to the older cohort of 2006 was part of the common achievement items across rounds. The original reading item consisted of three letters ('T, A, H'), one word ('hat'), and one sentence ('The sun is hot'). However, for the reading test, countries adapted these sentences to specific languages and cultural contexts, so that the sentences may not always be the same – but it is assumed that the levels of difficulty are comparable.

[11] Further information about TIMSS and the released items is available at: http://timss.bc.edu/timss2003i/released.html

For the OC of 2009, the Cloze test was administered as the reading test. It measures reading-comprehension abilities in which the person is asked to read a sentence or a short paragraph that lacks one or more words. All the test scores were normalized to have a mean of zero, with a standard deviation of one in the sample.

For enrolment, the dependent variable was 'current' (that is in the year of the survey) school enrolment. For the younger cohort of 2006, both pre-school enrolment and formal school enrolment have been modelled. And for the older cohort, formal school enrolment is the dependent variable.

To determine factors that influence child learning outcomes, the dependent variables were: for the younger cohort of the two years, the mathematics test (CDA and Mathematics Test) and for the older cohort the mathematics (Mathematics Test) and reading test.

The independent variables can be categorized as child-, household-, and school characteristics; measurement of some requires an explanation:

Predominant religions of AP, are construed as 'Hindu' and 'Muslim', and 'Other' religions (Christian: Protestant, Orthodox, Evangelic or Buddhist or Sikh) are clubbed into one variable.

Caste is seen to pick up real differences in data and it is classified as SC, ST, OBC and General Castes.

Coastal Andhra, Telangana and Ralayaseema, the three agro-climatic regions of AP are categorized as dummies.

Household Wealth: A proxy for income, a composite household wealth index was constructed by Young Lives. It is an average score ranging from 0 to 1 created from:

- Housing quality index: the average number of rooms per person; floor, roof and wall type
- Consumer durables index: the scaled sum of consumer durables[12]
- Housing services index: the simple average of drinking water, electricity, toilet facilities and cooking fuel

In this paper, the wealth index is used as a continuous variable for the first-difference model and has been disaggregated into three categories for other regressions:

- >= 0.4, Least Poor (1 if child belong to a 'least poor' household, 0 otherwise)

[12] A list of the consumer durables includes: radio, refrigerator, bicycle, television, motorbike, motor vehicle, mobile phone, land phone and a working fan.

- 0.2 - <0.4, Very Poor (1 if child belong to a 'vary poor' household, 0 otherwise)
- <0.2, Poorest (1 if child belong to a 'poorest' household, 0 otherwise)

Parental Education: In the regression analysis, three dummies are constructed for mother's and father's educational level; for the primary level (1 if mother/father is educated till primary level, 0 otherwise), secondary level (1 if mother/father is educated till secondary level, 0 otherwise), higher education (1 if mother/father is educated beyond grade 10, 0 otherwise).

Innate learning ability: In accordance with the literature, a variable for innate ability of a child is found in the PPVT test score. The variable is a continuous one, and has been normalized to have a mean of zero and standard deviation of 1.

Appropriate grade: In India, often children are pre-maturely enrolled in school in order to make use of school facilities being provided, for instance, the mid-day meal. There could be adverse effects of enrolling early on the cognitive development of a child. In order, taking account of this, the 'appropriate grade' variable is when a child is enrolled in the grade corresponding to their age.

For the first difference method adopted in the analysis, the first difference of the following variables is taken: normalized math and reading test score, normalized PPVT score, wealth index, age in months, height-for-age z score, if child is working, whether household has serious debts, whether child is enrolled in government school, time taken to reach school.

Consequently, we regress the first-differenced test scores on the above explanatory variables. Time-invariant characteristics, for instance, gender, caste, religion, parent's education and so on are eliminated because we take first-differences.

7. Descriptive Statistics

In this section, a summary of the initial review of the data used is presented through the descriptive statistics of the younger and older cohorts of the two years. Initially enrolment descriptive statistics are described for 2006 and then test result descriptive statistics for both years.

Please see Appendix 2 for the summary statistic of all four cohorts given in Tables 2.1-2.4

Enrolment Rates

Beginning with the enrolment descriptive statistics for Round 2 (2006) Young Lives data, Table1 & Table2 present absolute numbers and percentages of enrolment rates disaggregated by child and household characteristics as present in the sample.

For the younger cohort, over 86 per cent of children are reported to have ever attended a pre-school, whereas about 50 per cent were enrolled in a pre-school in 2006. Around 44 per cent of children are claimed to be already enrolled in primary (or formal) school. The latter figure is puzzling, given that only 1.5 per cent of the population in the sample is 6 years or older, the age at which children in Andhra Pradesh formally become eligible to be enrolled in school[13]. Disaggregation on the basis of caste, rural status, wealth and type of school attended sheds some light, maximum proportion of the disadvantaged classes, SC (53%), ST (58%) and OBC (42%) are enrolled in formal school. A greater proportion of those living in rural areas are enrolled in pre-school (84%) than in primary school (74%). The wealth divisions tell the same story too; for both the 'very poorest' and 'poorest' sections, more children are enrolled in formal school than pre-school. In contrast, the 'least poor' category doesn't show the same trend. Further analysis shows that from the 44 per cent children who are prematurely sent to school - nearly 80 per cent of those attend government school. These children come mainly from rural and poorer households; it is highly likely that the free midday meal provided by the state encourages poorer parents to enroll their children at an early age. Recent studies have documented this phenomenon extensively (Dreze and Goyal 2003; Khera 2006).

For the older cohort, approximately 89 per cent of the YL children surveyed were enrolled in school in 2006. The gender divide in school enrolment can evidently be seen by the 3 per cent difference between boys' (90%) and girls' (87%) enrolments. Interestingly, this difference is not statistically significant. Enrolment is low for rural areas than urban areas, Hindus (89%) rather than Muslims (91%), SC (85%) and ST (85%) and poorest section of the society (74%).

[13] http://www.aponline.gov.in/Apportal/HumanDevelopmentReport2007/APHDR_2007_Chapter8.pdf, pg: 99

Table1: *Descriptive statistics for enrolment of Younger Cohort (2006: 5 yrs old) by different characteristics*

Characteristics	No. of Observations	From Sample Surveyed (%)	Enrolled in pre-school (%)	Enrolled in formal school (%)
Overall	1950	N.A	49.6	44.3
Child Characteristics				
Male	1039	53.3	54.2	43.8
Female	911	46.7	45.8	44.9
Hindu	1788	91.7	48.4	45.4
Muslim	143	7.3	65.0	30.8
From other religions	19	0.9	47.4	47.4
Scheduled Castes (SC)	354	18.1	37.6	53.1
Scheduled Tribes (ST)	250	12.8	34.0	57.6
Other backward Castes (OBC)	933	47.8	53.4	41.6
General Castes	410	21.0	60.5	34.9
Child Works	3	0.16	0.11	0.0
Child doesn't Work	1846	99.8	99.9	100.0
Region				
Urban	499	25.59	36.8	15.7
Rural	1451	74.41	63.2	84.3
Coastal andhra	688	35.28	35.1	37.5
Rayalaseema	579	29.69	27.3	31.0
Telangana	680	34.87	37.4	31.4
Household characteristics				
Wealth Index: Least Poor	1146	58.77	65.7	52.9
Wealth Index: Very Poor	596	30.6	26.1	34.7
Wealth Index: Poorest	208	10.7	8.3	12.4
Household has serious debts	916	47.0	45	49.4
Household doesn't have serious debts	1028	52.7	50.3	25.0
Mother's Education level : None	996	51.1	43.3	57.2
Mother's Education level : Primary	289	14.8	14.7	14.8
Mother's Education level : Secondary	767	39.3	45.0	35.1
Mother's Education level : Higher	187	9.6	11.7	7.7
Father's Education level : None	645	33.1	29.0	36.5
Father's Education level : Primary	344	17.6	15.3	20.4
Father's Education level : Secondary	928	47.6	47.2	48.8
Father's Education level : Higher	377	19.3	23.9	14.7
Child has Younger Sibling(s)	936	48.0	47.0	49.6
Child has NO Younger Sibling(s)	1014	52.0	53.0	50.3
Child has Older Sibling(s)	1191	61.1	61.0	61.1
Child has NO Older Sibling(s)	759	38.9	39.0	38.9

Table2: *Descriptive statistics for enrolment of Older Cohort (2006: 12 yrs old) by different characteristics*

Characteristics	No. of Observations	From Sample Surveyed (%)	Enrolled in school (%)
Overall	994		88.8
Child Characteristics			
Male	485	48.8	90.3
Female	509	51.2	87.4
Hindu	916	92.1	88.6
Muslim	65	6.5	90.8
From other religions	13	1.3	92.3
Scheduled Castes (SC)	202	20.3	84.6
Scheduled Tribes (ST)	100	10.1	85.0
Other backward Castes (OBC)	485	48.8	88.2
General Castes	205	20.6	96.1
Child Works	766	19.54	65.6
Child doesn't Work	186	80.46	96.3
Region			
Urban	249	25.0	94.8
Rural	745	74.9	86.8
Coastal andhra	345	34.7	90.4
Rayalaseema	302	30.4	88.4
Telangana	347	34.9	87.6
Household characteristics			
Wealth Index: Least Poor	587	59.0	92.7
Wealth Index: Very Poor	307	30.9	86.3
Wealth Index: Poorest	100	10.1	74.0
Household has serious debts	513	51.6	90.7
Household doesn't have serious debts	481	48.4	89.9
Mother's Education level : None	595	59.9	83.9
Mother's Education level : Primary	129	12.9	94.6
Mother's Education level : Secondary	299	30.1	96.3
Mother's Education level : Higher	100	10.1	96.0
Father's Education level : None	421	42.3	81.5
Father's Education level : Primary	163	16.4	88.3
Father's Education level : Secondary	422	42.4	93.8
Father's Education level : Higher	151	15.2	95.4
Child has Younger Sibling(s)	577	58.0	89.4
Child has NO Younger Sibling(s)	417	41.9	88.0
Child has Older Sibling(s)	684	68.8	86.7
Child has NO Older Sibling(s)	310	31.2	93.5

Test Scores

Test Scores are standardized with mean equal to zero and a standard deviation of one and are presented in Tables 3-6

For the younger cohort in 2006, looking at Table3, the math test score results are highly consistent with the literature; they are higher for boys, general castes, children who don't work urban areas, and the least poor.

Test scores increase with parents' education level, and the child shows better test results if her/his mother is educated beyond grade 10, than if the father is educated beyond grade 10.

Number of older or younger siblings, indicative of the household composition, seem to point towards the fact that having no siblings leads to greater math test scores.

However, a surprising result is to see that the mid-day meal which has shown important gains in learning and nutrition (Singh 2012) results in a lower cognitive development score than children who don't receive a mid-day meal in school. The mid-day meal scheme is existent mostly in government schools, and the poor quality of teaching and learning in these schools (Muralidharan and Kremer, 2006, Tooley and Dixon, 2005, Kingdon, 1996) could possibly explain the decreased test scores.

For the older cohort in 2006, Hindus, general castes, children who don't work, urban areas, least poor, and the Coastal Andhra child population have done better on both Math and Reading test scores.

Unlike in the younger cohort, Telangana records a low score on both the tests as well as the lowest enrolment rate compared to the other two regions in Andhra Pradesh. On the other hand, whether we consider proportion of children enrolled in school or the reading and mathematics test scores, the region of Coastal Andhra seems to be doing quite well. For the older cohort, children who receive a mid-day meal score extremely low results on the math test score.

Table3: *Descriptive statistics for Math test score of Younger Cohort (2006: 5 yrs old) by different characteristics*

Characteristics	Number of Observations	From Sample Surveyed (%)	Mean Math Test Score
Overall	1950	N.A	0
Child Characteristics			
Male	1039	53.3	0.019
Female	911	46.7	0.016
Hindu	1788	91.7	0.019
Muslim	143	7.3	0.258
From other religions	19	0.9	-0.111
Scheduled Castes (SC)	354	18.1	-0.191
Scheduled Tribes (ST)	250	12.8	0.024
Other backward Castes (OBC)	933	47.8	-0.032
General Castes	410	21.0	0.318
Child Works	3	0.16	-0.408
Child doesn't Work	1846	99.8	0.019
Region			
Urban	499	25.59	0.306
Rural	1451	74.41	-0.079
Coastal andhra	688	35.28	-0.033
Rayalaseema	579	29.69	0.036
Telangana	680	34.87	0.055
Household characteristics			
Wealth Index: Least Poor	1146	58.77	0.129
Wealth Index: Very Poor	596	30.6	-0.096
Wealth Index: Poorest	208	10.7	-0.259
Household has serious debts	916	47.0	0.025
Household doesn't have serious debts	1028	52.7	0.009
Mother's Education level : None	996	51.1	-0.222
Mother's Education level : Primary	289	14.8	0.018
Mother's Education level : Secondary	767	39.3	0.198
Mother's Education level : Higher	187	9.6	0.547
Father's Education level : None	645	33.1	-0.297
Father's Education level : Primary	344	17.6	-0.055
Father's Education level : Secondary	928	47.6	0.065
Father's Education level : Higher	377	19.3	0.432
Child has Younger Sibling(s)	936	48.0	-0.008
Child has NO Younger Sibling(s)	1014	52.0	0.042
Child has Older Sibling(s)	1191	61.1	0.028
Child has NO Older Sibling(s)	759	38.9	0.091
School characteristics			
Child receives midday meals in school	665	N.A	-0.0467
Child doesn't receive mid-day meals in school	1285	N.A	0.0524
Attends Government school	1231	N.A	-0.1581
Doesn't attend Government school	719	N.A	0.3246

Table4: *Descriptive statistics for Test Scores of Older Cohort (2006: 12 yrs old) by different characteristics*

Characteristics	No. of Observations	From Sample Surveyed (%)	Mean Maths Test Score	Mean Reading Test Score
Overall	994		0	0
Child Characteristics				
Male	485	48.8	0.083	0.010
Female	509	51.2	-0.015	0.010
Hindu	916	92.1	0.033	0.006
Muslim	65	6.5	0.001	-0.001
From other religions	13	1.3	0.114	0.328
Scheduled Castes (SC)	202	20.3	-0.291	-0.154
Scheduled Tribes (ST)	100	10.1	0.408	0.014
Other backward Castes (OBC)	485	48.8	-0.004	0.016
General Castes	205	20.6	0.258	0.163
Child Works	766	19.54	0.141	-0.515
Child doesn't Work	186	80.46	0.414	0.138
Region				
Urban	249	25.0	0.292	0.142
Rural	745	74.9	-0.052	0.033
Coastal andhra	345	34.7	0.311	0.058
Rayalaseema	302	30.4	0.081	-0.009
Telangana	347	34.9	-0.148	-0.020
Household characteristics				
Wealth Index: Least Poor	587	59.0	0.147	0.875
Wealth Index: Very Poor	307	30.9	-0.135	-0.039
Wealth Index: Poorest	100	10.1	-0.138	-0.459
Household has serious debts	513	51.6	-0.058	-0.008
Household doesn't have serious debts	481	48.4	0.130	0.030
Mother's Education level : None	595	59.9	-0.161	-0.142
Mother's Education level : Primary	129	12.9	0.184	0.078
Mother's Education level : Secondary	299	30.1	0.346	0.215
Mother's Education level : Higher	100	10.1	0.230	0.285
Father's Education level : None	421	42.3	-0.222	-0.241
Father's Education level : Primary	163	16.4	0.026	0.143
Father's Education level : Secondary	422	42.4	0.170	0.169
Father's Education level : Higher	151	15.2	0.355	0.262
Child has Younger Sibling(s)	577	58.0	0.091	0.012
Child has NO Younger Sibling(s)	417	41.9	-0.049	0.007
Child has Older Sibling(s)	684	68.8	0.043	-0.033
Child has NO Older Sibling(s)	310	31.2	0.198	0.106
School characteristics				
Child receives midday meals in school	N.A	N.A	-0.00008	0.148
Child doesn't receive mid-day meals in school	N.A	N.A	0.042	-0.028
Attends Government school	N.A	N.A	0.084	0.140
Doesn't attend Government. school	N.A	N.A	0.056	-0.216

For the two cohorts of 2009, descriptive statistics are highlighted only for test scores of children in Table5 & Table6. Considering the younger cohort, female, other religions, Scheduled Caste, rural and poorest children underperform on the math test as compared to other categories. Additionally, children who are working or belong to the Telangana region also do badly on the math test. Children of uneducated parents do not show good results on the test, as compared to children with educated parents. Again, similar to younger cohort of 2006, mother's education comes across as being more important than father's education.

In view of the school characteristics, children who do not receive mid-day meals and do not attend government schools, do significantly well on the math test.

For the older cohort of 2009, female children, Muslims, Scheduled Castes, children who work and those coming from rural and very poor households perform the worst on both reading and math tests. In fact the difference between scores of male and female children is alarming. The gender bias seems to increase substantially at the secondary school level.

In the Indian context, older siblings and adult members are known to substitute for each other's household labour. In our descriptive statistics, existence of older or younger siblings reflecting household composition tells us that children who have older sibling(s) or no younger sibling(s) have enhanced test scores. Thus, having an older sibling(s) take care of household responsibilities allows the younger sibling to focus on their school work. Additionally they are in a position to get help from their older siblings too. Alternatively, having a younger sibling usually requires the older sibling to take care of him/her, especially in rural and poor households in India, and in such a case school work and thus learning of the older sibling is hampered. Having no information on the midday meal scheme variable for year 2009, descriptive statistics of the same could not be presented.

Table5: *Descriptive statistics for Test Scores of Younger Cohort (2009: 8 yrs old) by different characteristics*

Characteristics	No. of Observations	From Sample Surveyed (%)	Mean Math Test Score
Overall	1887	N.A	0
Child Characteristics			
Male	1001	46.9	0.009
Female	885	53.1	-0.008
Hindu	1731	91.8	0.014
Muslim	137	7.3	-0.139
From other religions	18	0.9	-0.285
Scheduled Castes (SC)	339	18.0	-0.096
Scheduled Tribes (ST)	243	12.9	-0.528
Other backward Castes (OBC)	908	48.1	0.034
General Castes	393	20.8	0.336
Child Works	650	34.4	-0.158
Child doesn't Work	1237	65.5	0.083
Region			
Urban	1410	74.8	0.157
Rural	476	25.2	-0.052
Coastal andhra	666	35.3	0.026
Rayalaseema	557	29.5	0.410
Telangana	660	35.0	-0.372
Household characteristics			
Wealth Index: Least Poor	1364	72.3	0.112
Wealth Index: Very Poor	438	23.2	-0.199
Wealth Index: Poorest	85	4.5	-0.771
Household has serious debts	655	34.7	0.109
Household doesn't have serious debts	1232	65.3	-0.058
Mother's Education level : None	958	50.8	-0.313
Mother's Education level : Primary	281	14.9	0.100
Mother's Education level : Secondary	747	39.6	0.247
Mother's Education level : Higher	181	9.6	0.650
Father's Education level : None	618	32.8	-0.349
Father's Education level : Primary	337	17.9	-0.072
Father's Education level : Secondary	902	47.8	0.049
Father's Education level : Higher	366	19.4	0.473
Child has Younger Sibling(s)	958	50.8	0.036
Child has NO Younger Sibling(s)	929	49.2	-0.037
Child has Older Sibling(s)	1104	58.5	-0.019
Child has NO Older Sibling(s)	783	41.5	0.026
School characteristics			
Child receives midday meals in school	960	50.9	-0.134
Child doesn't receive mid-day meals in school	927	49.1	0.139
Attends Government school	1026	54.4	-0.131
Doesn't attend Government school	861	45.6	0.157

Table6: *Descriptive statistics for Test Scores of Older Cohort (2009: 15yrs old) by different characteristics*

Characteristics	No. of Observations	From Sample Surveyed (%)	Mean Math Test Score	Mean Reading Test Score
Overall	861	N.A	0	0
Child Characteristics				
Male	426	49.0	0.308	0.210
Female	409	51.0	-0.192	-0.139
Hindu	773	92.6	0.072	0.061
Muslim	50	6.0	-0.221	-0.478
From other religions	12	1.4	-0.073	0.252
Scheduled Castes (SC)	157	18.8	-0.311	-0.111
Scheduled Tribes (ST)	84	10.1	-0.113	-0.078
Other backward Castes (OBC)	411	49.2	0.068	0.005
General Castes	181	21.7	0.416	0.264
Child Works	676	78.5	-0.426	-0.316
Child doesn't Work	185	21.5	0.163	0.098
Region				
Urban	211	25.3	0.351	0.068
Rural	624	74.7	-0.047	0.019
Coastal andhra	305	36.5	0.245	0.183
Rayalaseema	252	30.2	0.100	0.085
Telangana	278	33.3	-0.200	-0.182
Household characteristics				
Wealth Index: Least Poor	657	76.3	0.136	0.056
Wealth Index: Very Poor	179	20.8	-0.250	-0.083
Wealth Index: Poorest	25	2.9	-0.533	-0.573
Household has serious debts	275	32.0	-0.061	-0.035
Household doesn't have serious debts	585	68.0	0.082	0.029
Mother's Education level : None	477	57.1	-0.198	-0.147
Mother's Education level : Primary	115	13.8	0.205	0.169
Mother's Education level : Secondary	267	32.0	0.374	0.307
Mother's Education level : Higher	91	10.9	0.428	0.168
Father's Education level : None	331	39.6	-0.207	-0.163
Father's Education level : Primary	138	16.5	-0.195	-0.068
Father's Education level : Secondary	365	43.7	0.119	0.086
Father's Education level : Higher	139	16.6	0.498	0.354
Child has Younger Sibling(s)	390	45.3	0.024	-0.016
Child has NO Younger Sibling(s)	471	54.7	0.046	0.030
Child has Older Sibling(s)	574	66.7	0.065	0.025
Child has NO Older Sibling(s)	287	33.3	-0.022	-0.024
School characteristics				
Attends Government school	N.A	N.A	-0.103	-0.019
Doesn't attend Government school	N.A	N.A	0.199	0.042

8. Regression Results

For the regression results too, first the paper discusses enrolment regressions; thereafter we compare the test score regressions of the younger and older cohort by year-wise cross-sections. This section concludes with results from a first-difference model, as a variant of the fixed effects model, which has been used to analyse the panels of the younger and older cohorts.

Enrolment Regression Results

For the enrolment regressions, the econometric methodology used was a probit model with the dependent variable being school enrolment (child enrolled in school=1, and not enrolled=0).

Enrolment for the younger cohort is divided between pre-school and formal school. Conforming to the issues raised in the literature review, regressions are disaggregated on the basis of gender; a number of useful insights arise from the probit regression results.

Table5 describes the probability that a child (mean age: 5 years) is enrolled in pre-school. Results indicate age in months to be highly significant, but with a negative sign indicating that as a child grows up she gets ready to shift into formal school. If the age of the child increases by one month, the probability of being enrolled in school decreases by about 0.24 per cent points, this effect is even more pronounced for boys (0.42 per cent).

Like Unni (2007, cited in Kingdon, 2007: 174) has stated, Muslim children (especially boys) are less likely to be enrolled in pre-school as compared to Hindus (base category), as can be seen from the substantially negative marginal effect and statistically significant z values.

Considering specific regions of AP, the expenditure per student is greater in Coastal Andhra followed by Rayalaseema and Telangana; this possibly indicates the perceived higher returns to education and therefore greater investment in human capital in the developed region (Reddy and Bantilan, 2012: 124). It is evident from the regression results that girls in Rayalaseema and Coastal Andhra as compared to Telangana are more likely to be enrolled in schools, thereby reinforcing regional disparities.

The sign and significance level of the urban variable is widely confirmed in studies. Availability of schooling infrastructure varies markedly between rural and urban areas in India; the urban population has an edge over the rural population due to the comparatively higher magnitude of facilities present in schools. Moreover, a good proportion of the rural families migrate, specifically to take advantage of the better education provided in urban schools.

We know from the descriptive analysis, that only 2.2 per cent of the children surveyed receive a mid-day meal in pre-school; this is the main reason why some children are prematurely enrolled in formal schools where the provision of the mid-day meal is greater. Thus the mid-day meal

variable is seen to have a huge negative marginal effect and even the z-value is statistically significant at the 1 per cent level.

Using the log likelihood figures for the probit regression and its gender disaggregation in the Likelihood Ratio (LR) chi-square test indicates the null hypothesis to be rejected, and thus at least one of the regression coefficients is not equal to zero.

Table6 presents the results of the probit regression of whether the child is enrolled in formal school or not, for the younger cohort. Unlike for pre-school enrolment, age (in months) is highly significant and positively related to enrolment of children (particularly boys). If the child grows old by a month, probability of being enrolled in formal school rises as much as 0.43 percentage points. The disadvantage of the SC, ST and OBC population as compared to the general castes is evident from the negative marginal effects. However, only OBC and ST castes show statistical significance that too for boys. Completely opposite to the pre-school result, girls in Rayalaseema and Coastal Andhra are less likely to be enrolled in formal schools. Wealth provides people with better social and economic opportunities, as compared to low income households; regression results find the probability of school enrolment increasing with wealth.

A phenomenon was noticed according to which poorer parents tended to send their children to school early, probably to avail of the mid-day meal scheme. This clearly shows through the phenomenal marginal effect of the variable. As pointed out by the PROBE Team (1999: 97), provision of mid-day meals, by reducing costs of education, could encourage parents to send their girl children to school. The marginal effect of mid-day meals for girls is higher (17.56), as compared to boys (16.35).

Table7: *Probit Regression Results for Younger Cohort (2006), disaggregated by gender*
Dependent Var: If the child is enrolled in pre-school=1, otherwise=0

Explanatory Variables	Main Regression		Boys		Girls	
	Marginal Effect	z-value	Marginal Effect	z-value	Marginal Effect	z-value
Child Characteristics						
Gender	-0.028	-1.06				
Age in months	-0.238	-2.17**	-0.419	-2.53**	-0.085	-0.56
Age in months (squared)	0.001	2.02**	0.003	2.44**	0.0005	0.44
Muslim	-0.140	-2.24**	-0.211	-2.53**	-0.057	-0.58
From other religions	0.097	0.70	0.097	0.52	0.103	0.49
Scheduled Castes (SC)	-0.055	-1.13	-0.098	-1.44	-0.025	-0.34
Scheduled Tribes (ST)	0.013	0.24	0.097	1.31	-0.081	-0.93
Other backward Castes (OBC)	-0.011	-0.27	0.059	1.07	-0.086	-1.40
Region						
Urban	0.139	3.79***	0.149	2.88***	0.141	2.62***
Rayalaseema	0.063	1.85*	-0.025	-0.53	0.180	3.59***
Costal Andhra	0.028	0.82	-0.056	-1.17	0.128	2.49**
Household Characteristics						
Household Size	-0.0007	-0.12	-0.005	-0.62	0.002	0.32
Wealth Index: Least Poor	-0.055	-1.10	-0.053	-0.75	-0.069	-0.95
Wealth Index: Very Poor	-0.043	-0.85	-0.060	-0.85	-0.021	-0.29
Household has serious debts	0.001	0.31	0.0007	0.18	0.002	0.26
Mother's Education level : None	0.050	0.92	0.017	0.23	0.101	1.25
Mother's Education level : Primary	-0.016	-0.36	-0.011	-0.18	-0.023	-0.36
Mother's Education level : Secondary	0.110	2.16**	0.075	1.06	0.167	2.21**
Father's Education level : None	0.115	2.56**	0.072	1.11	0.137	2.10**
Father's Education level : Primary	0.0007	0.02	-0.007	-0.13	-0.011	-0.20
Father's Education level : Secondary	-0.003	-0.08	-0.030	-0.54	0.011	0.20
Child has Younger Sibling(s)	0.040	1.75*	0.085	2.40**	0.018	0.56
Child has Older Sibling(s)	0.017	1.30	0.028	1.50	0.007	0.39
School Characteristics						
Child receives midday meals in school	-0.644	-22.40***	-0.667	-6.33***	-0.647	-15.26***
PPVT Test Score	-0.002	-3.82***	-0.002	-2.48**	-0.003	-3.16***
Constant term	N.A	2.41	N.A	2.70	N.A	0.73
Number of Observations	1851		989		862	
Pseudo R^2	0.3511		0.3694		0.3607	
Log Likelihood	863.09		483.38		414.50	

z values: ***significant at 1%; ** significant at 5%; *significant at 10%

Table8: *Probit Regression Results for Younger Cohort (2006), disaggregated by gender*
Dependent Var: If the child is enrolled in formal-school=1, otherwise=0

Explanatory Variables	Main Regression		Boys		Girls	
	Marg. Effect	z-value	Marg. Effect	z-value	Marg. Effect	z-value
Child Characteristics						
Gender	0.047	1.43				
Age in months	0.427	3.21***	0.700	3.50***	0.195	1.02
Age in months (squared)	-0.003	-3.05***	-0.005	-3.41***	-0.001	-0.89
Muslim	-0.031	-0.47	0.049	0.57	-0.155	-1.37
From other religions	0.173	1.22	0.108	0.55	0.196	0.91
Scheduled Castes (SC)	-0.059	-0.99	-0.086	-1.06	-0.043	-0.47
Scheduled Tribes (ST)	-0.050	-0.73	-0.224	-2.33**	0.145	1.38
Other backward Castes (OBC)	-0.109	-2.35**	-0.123	-1.96**	-0.096	-1.31
Region						
Urban	-0.005	-0.12	-0.051	-0.86	0.038	0.59
Rayalaseema	-0.077	-1.78*	0.059	0.99	-0.242	-3.54***
Costal Andhra	-0.025	-0.61	0.079	1.37	-0.160	-2.48**
Household Characteristics						
Household Size	0.004	0.61	0.008	0.73	0.002	0.27
Wealth Index: Least Poor	0.173	2.46**	0.149	1.49	0.194	1.83*
Wealth Index: Very Poor	0.104	1.49	0.129	1.31	0.038	0.37
Household has serious debts	0.005	1.65*	0.016	1.79*	-0.007	-0.36
Mother's Education level : None	0.056	0.84	0.072	0.79	0.002	0.03
Mother's Education level : Primary	-0.000	-0.00	-0.009	-0.13	0.004	0.06
Mother's Education level : Secondary	0.018	0.30	0.028	0.35	-0.010	-0.11
Father's Education level : None	-0.018	-0.33	0.015	0.19	-0.024	-0.29
Father's Education level : Primary	0.077	1.53	0.035	0.50	0.147	1.96**
Father's Education level : Secondary	0.012	0.27	0.022	0.35	0.025	0.34
Child has Younger Sibling(s)	0.002	0.08	-0.009	-0.21	-0.006	-0.15
Child has Older Sibling(s)	-0.027	-1.52	-0.022	-0.91	-0.026	-0.97
Child receives midday meals in school	0.822	24.73***	0.821	16.35***	0.846	17.56***
PPVT Test Score	0.004	5.01***	0.005	4.45***	0.003	2.69***
Constant term	N.A	-3.51	N.A	-3.68	N.A	-1.24
Number of Observations (N)	1851		989		862	
Pseudo R^2	0.5336		0.5308		0.5707	
Log Likelihood	1358.66		720.39		678.32	

z values: ***significant at 1%; ** significant at 5%; *significant at 10%

For the older cohort, probability of school enrolment increases with age in the main regression. A more appropriate story is told through the results disaggregated by gender. The 'agemon' variable is positive and highly significant for girls, with a considerably large marginal effect. But, for boys, age is negatively related to enrolment, it could be because male children start getting absorbed in the labour market at this age. In fact 20% of the children surveyed have worked in the year 2006, and half of them (55%) are boys.

With 'Hindu' as the base category for religion, being Muslim has a negative and statistically significant impact on school enrolment in the main regression; the effect is more pronounced and significant for boys than girls. Low parental education of Muslim children, indicated by the data, can

probably explain this negative effect. Consistent with the studies based on India, caste is an important determinant of school enrolment; children belonging to SC, ST and OBC are less likely to go to school than children belonging to the general castes (base category). This applies particularly to girls: for boys, the effect is not statistically significant.

Table9: *Probit Regression Results for Older Cohort (2006), disaggregated by gender*
Dependent Var: If the child is enrolled in formal-school=1, otherwise=0

Explanatory Variables	Main Regression		Boys		Girls	
	Marg. Effect	z-value	Marg. Effect	z-value	Marg. Effect	z-value
Child Characteristics						
Gender	0.008	1.07				
Age in months	0.067	0.93	-0.119	-1.86*	0.376	3.14***
Age in months (squared)	-0.0002	-0.97	0.0003	1.84*	-0.001	-3.16***
Muslim	-0.076	-1.79*	-0.095	-1.78*	-0.105	-1.05
From other religions	-0.043	-0.81	omitted	omitted	-0.187	-1.28
Scheduled Castes (SC)	-0.069	-2.24**	-0.007	-0.50	-0.262	-2.15**
Scheduled Tribes (ST)	-0.093	-2.22**	-0.008	-0.44	-0.342	-2.23**
Other backward Castes (OBC)	-0.036	-1.92*	-0.001	-0.13	-0.120	-1.97**
Region						
Urban	0.0006	0.05	-0.001	-0.13	0.018	0.73
Rayalaseema	-0.027	-2.23**	-0.047	-3.09***	-0.011	-0.54
Costal Andhra	-0.018	-1.42	-0.045	-3.04***	0.018	0.81
Household Characteristics						
Household Size	0.003	1.27	-0.0004	-0.25	0.015	2.29**
Wealth Index: Least Poor	0.030	2.13**	0.040	3.13***	-0.030	-1.02
Wealth Index: Very Poor	0.017	1.55	0.009	1.47	-0.025	-0.75
Household has serious debts	0.004	0.52	0.003	0.69	-0.007	-0.42
Mother's Education level : None	-0.024	-1.48	-0.014	-1.30	-0.047	-1.31
Mother's Education level : Primary	-0.000	-0.02	0.005	0.41	-0.057	-0.86
Mother's Education level : Secondary	-0.002	-0.12	-0.001	-0.11	0.002	0.06
Father's Education level : None	-0.011	-0.71	0.003	0.32	-0.059	-1.55
Father's Education level : Primary	-0.141	-3.76***	-0.168	-2.72***	-0.106	-2.04**
Father's Education level : Secondary	0.046	2.43**	0.040	2.35**	0.028	0.74
Child has Younger Sibling(s)	-0.003	-0.43	-0.002	-0.42	-0.012	-0.66
Child has Older Sibling(s)	-0.017	-1.81*	-0.004	-0.70	-0.032	-1.66*
Child receives midday meals in school	0.051	5.33***	0.018	3.39***	0.049	omitted
PPVT Test Score	0.001	6.83***	0.0006	5.15***	0.001	4.45***
Constant term	N.A	0.89	N.A	1.88	N.A	-3.11
Observations(N)	952		458		387	
Pseudo R2	0.3332		0.4233		0.3232	
Log Likelihood	201.53		112.90		99.90	

z values: ***significant at 1%; ** significant at 5%; *significant at 10%

The paper now presents a summary of the cross-section results for tests scores. A better understanding can be gained by comparing the results of each cohort by year-wise cross sections.

Cross-Sectional Test Score Regression Results: Younger Cohort

The test used to explore the determinants of child learning outcomes for the younger cohort is the math test and results are presented in Table8 and Table9. The R^2 of the main regression is higher for 2009 indicating that the chosen variables (which are the same for the two years) are better able to explain the test score results than in 2006, when the child is just at the age of entering a formal school environment.

The PPVT score (a measure of innate cognitive ability), as expected, shows to be positively and significantly associated with the math test score, in particular for girl children. The coefficient of the same is very high. This implies that if the PPVT score increases by one standard deviation, keeping all other factors constant, a child's math test score would change between the range of 0.32-0.37 points of a standard deviation.

Having kept Hindu as the base category for religion, the dummy for Muslim is negatively significant with high coefficient in the main regression, upon disaggregation, boys are more negatively affected than girls. Being a Muslim, a child scores 0.39 standard deviation less on the math test. This significant result regarding religion is only present for 2009.

In 2006, for all the regressions (main, boys and girls) it is Scheduled Castes which have a greater and significant disadvantage in learning outcomes, when compared to the general caste category; and in 2009 both SC and ST coefficients are negative and significant for math test scores. Household financial constraints or the child being engaged in non-school paid activity are the main demand side factors that influence educational outcomes for SC children (Borooah and Iyer, 2005: 1377) . Our data sample indicates that 42 per cent of the scheduled caste children doing paid work are also enrolled in school. Thus, irregular school participation and neglecting school work results in very low scores of these on the tests compared to other castes.

A disheartening finding is that for both the years, specifically 2009, girls have larger negative coefficient for the caste status as compared to boys. In a way, they face a double burden of being girls and belonging to disadvantaged families which emerges while measuring education outcomes.

The sign and statistical significance of the urban dummy in year 2009 is unexpected, as it is negative. This implies children from rural areas showcase better results on math tests than urban children, which is contrary to what the literature suggests.

The region of Coastal Andhra in 2006, with Telangana as the base category for region, negatively seems to affect child math scores. This result gathers a high level of significance too, with the magnitude of the effect being almost equal for boys and girls. However proceeding to 2009, test scores for Coastal Andhra and Rayalseema are positively affected by the region as compared to

Table10: *OLS Regression Results for Younger Cohort (2006) disaggregated by gender*
Dependent Var: Standardized Math Test Score

Explanatory variables	Main Regression		Girls		Boys	
	Coef.	t-value	Coef.	t-value	Coef.	t-value
Child Characteristics						
Gender	-0.024	-0.63				
Age in months	0.184	1.19	0.234	1.05	0.117	0.54
Age in months (squared)	-0.001	-0.99	-0.001	-0.92	-0.0006	-0.40
Height-for-age z value	0.071	3.18***	0.062	1.94*	0.085	2.71***
PPVT score	0.377	16.75***	0.405	12.22***	0.350	11.22***
Has attended pre-school	0.122	2.73***	0.151	1.75*	0.102	1.19
Currently enrolled in school	0.124	2.05**	0.091	1.40	0.160	2.56**
Muslim	-0.118	-1.31	-0.082	-0.60	-0.112	-0.91
From other religions	-0.198	-1.02	0.173	0.62	-0.459	-1.66*
Scheduled Castes (SC)	-0.205	-2.83***	-0.243	-2.30**	-0.173	-1.70*
Scheduled Tribes (ST)	-0.066	-0.80	-0.220	-1.78*	0.080	0.69
Other backward Castes (OBC)	-0.081	-1.34	-0.149	-1.70*	-0.025	-0.31
Region						
Urban	0.059	1.01	0.171	2.00**	-0.036	-0.44
Coastal Andhra	-0.334	-6.53***	-0.336	-4.46***	-0.319	-4.50***
Rayalaseema	-0.081	-1.59	-0.108	-1.45	-0.058	-0.83
Household Characteristics						
Wealth Index: Least Poor	-0.029	-0.39	-0.137	-1.29	0.073	0.70
Wealth Index: Very Poor	0.016	0.23	-0.064	-0.63	0.089	0.88
Household has serious debts	0.003	0.71	0.002	0.39	0.003	0.61
Mother's Education level : None	-0.209	-2.58***	-0.091	-0.77	-0.308	-2.74***
Mother's Education level : Primary	-0.087	-1.32	-0.113	-1.19	-0.065	-0.69
Mother's Education level : Secondary	-0.035	-0.46	0.028	0.25	-0.102	-0.96
Father's Education level : None	-0.205	-3.03***	-0.226	-2.31**	-0.220	-2.28**
Father's Education level : Primary	-0.000	-0.01	0.050	0.59	-0.056	-0.66
Father's Education level : Secondary	-0.101	-1.70*	-0.194	-2.26**	-0.034	-0.42
Household Size	0.011	1.21	0.016	1.32	0.006	0.47
Child has Younger Sibling(s)	-0.075	-1.63	-0.053	-0.79	-0.081	-1.23
Child has Older Sibling(s)	-0.091	-1.94*	-0.044	-0.67	-0.141	-2.10**
School Characteristics						
Attends Government school	-0.102	-1.83	-0.072	-0.87	-0.114	-1.50
Constant	-6.392	-1.28	-8.023	-1.12	-4.215	-0.60
Number of observations	1846		860		986	
R^2	0.2951		0.3129		0.2958	
Adjusted R^2	0.2843		0.2906		0.2760	

z values: ***significant at 1%; ** significant at 5%; *significant at 10%

Telangana. A plausible explanation could be the growing agrarian crisis and movement for a separate state in Telangana which caused much havoc in the region in 2009/10. Additionally, Reddy and Mishra (2010) emphasize that there has been increasing pressure on famers in the region to meet basic services of education and health, which are becoming more and more privatized. Thus, a major portion of their domestic expenditure accounts for these expenses. In such a stressful environment children are not able to perform well on tests and lag behind in their cognitive development.

Parental education and family interaction patterns in childhood are directly linked to a child's academic success (Dubow et al, 2009: 3). In the general social-cognitive framework (Bandura, 1986, as cited in Dubow et al, 2009: 3), behaviour of the child is shaped by a major extent through observational and direct learning experience. When children see their parents involved with educational activities, such as obtaining advanced degrees, reading regularly, motivating child about school work and participation, they believe educational achievement should be valued, pursued and anticipated. Consistent with the ample literature confirming the importance of parental education on child learning, our results too, show child test scores (whether boys or girls) are negatively correlated with uneducated parents.

Government school education shows negative significance for child math scores. Even at the age of 8 years when the child has just been enrolled in school for two years, the low quality of education in these school is able to affect child learning, which is similar to what Galab et al (2005) had to say.

Table11: *OLS Regression Results for Younger Cohort (2009), disaggregated by gender*
Dependent Var: Standardized Math Test Score

Explanatory variables	Main Regression		Girls		Boys	
	Coef.	t-value	Coef.	t-value	Coef.	t-value
Child Characteristics						
Gender	0.007					
Age in months	0.203	1.04	0.224	0.78	0.201	0.74
Age in months (squared)	-0.000	-0.86	-0.001	-0.68	-0.0008	-0.60
Height-for-age z value	0.097	5.22***	0.124	4.47***	0.079	3.11***
PPVT score	.328	16.36***	0.366	11.78***	0.299	11.25***
Attended Pre-school	0.084	1.68*	0.159	2.17**	0.021	0.30
Currently enrolled in school	0.494	1.91*	0.397	1.24	0.657	1.47
Muslim	-0.360	-4.41***	-0.296	-2.37**	-0.395	-3.61***
From other religions	-0.219	-1.20	-0.128	-0.47	-0.231	-0.93
Scheduled Castes (SC)	-0.205	-3.11***	-0.292	-3.04***	-0.146	-1.58
Scheduled Tribes (ST)	-0.371	-4.94***	-0.530	-4.76***	-0.256	-2.48**
Other backward Castes (OBC)	-0.099	-1.82*	-0.147	-1.83*	-0.078	-1.05
Region						
Urban	-0.254	-4.99***	-0.266	-3.53***	-0.233	-3.30***
Coastal Andhra	0.146	3.14***	0.079	1.15	0.212	3.32***
Rayalaseema	0.324	6.54***	0.260	3.68***	0.408	5.78***
Household Characteristics						
Wealth Index: Least Poor	0.449	4.88***	0.350	2.66***	0.528	4.08***
Wealth Index: Very Poor	0.413	4.44***	0.236	1.77*	0.567	4.35***
Household has serious debts	0.108	2.79***	0.097	1.74*	0.108	1.99**
Mother's Education level : None	-0.333	-4.58***	-0.384	-3.61***	-0.276	-2.75***
Mother's Education level : Primary	-0.115	-1.92*	-0.127	-1.48	-0.097	-1.14
Mother's Education level : Secondary	-0.077	-1.12	-0.078	-0.77	-0.077	-0.81
Father's Education level : None	-0.220	-3.63***	-0.242	-2.76***	-0.208	-2.43**
Father's Education level : Primary	-0.001	-0.03	-0.077	-0.99	0.078	1.03
Father's Education level : Secondary	-.0138	-2.58***	-0.141	-1.80*	-0.152	-2.06**
Household Size	0.011	1.46	0.009	0.84	0.011	0.98
Child has Younger Sibling(s)	-0.015	-0.23	-0.044	-0.48	-0.007	-0.08
Child has Older Sibling(s)	-0.059	-0.92	-0.028	-0.30	-0.096	-1.08
School Characteristics						
Attends Government school	-0.119	-2.53**	-0.058	-0.82	-0.167	-2.61***
Constant	-12.091	-1.28	-12.518	-0.91	-12.532	-0.96
Number of observations	1886		885		1001	
R^2	0.4313		0.4489		0.4340	
Adjusted R^2	0.4224		0.4309		0.4177	

z values: ***significant at 1%; ** significant at 5%; *significant at 10%

Cross-Sectional Test Score Regression Results: Older Cohort

For the older cohort, the children are 12 years old in 2006 and become 15 in 2009. Table10 & Table11 present the OLS regression results for the math and reading scores with child, household and school characteristics as explanatory variables. The disaggregated gender regressions of the main regression are included in Appendix 3. All the test score regressions have adjusted R^2s ranging between 0.40 and 0.50.

We see from Table11 that if children, belong to Muslim household, the math test score decreases for them by 0.48 of a standard deviation, holding all other factors constant; this result is significant for girls. Low school enrolment ratio of Muslim girl children at the secondary level reinforces our finding about test outcomes. There are many reasons which might contribute to low academic achievement of Muslim children: One explanation is that there is a lot of, Muslim discontent with the Indian public education system, it is related to the structure of the system and the curriculum followed. A number of Muslim families would want the education to be in Urdu, their mother tongue. Moreover, according to Desai and Kulkarni (2008: 249) children often face harassment and ridicule in schools which might lead to escalated religious tensions; this might lead to the child isolating her/himself from the school. A major obstacle would be if the teachers also provide a hostile studying environment to the child in school.

Similarly, for children belonging to SC and ST households too, disparities in the test scores exist compared to the general castes. It can be inferred that division of Indian society is reflected in the inequalities in test scores and school enrolment across caste, religion and ethnic boundaries (Dreze and Sen 1995)

An inconsistent result is with respect to child labour, in 2006, is the positive impact of doing child labour on the math test score. 20 per cent of the children surveyed are doing paid work in 2006, and yet the coeffient for child work is positive and significant, in particular for boys. This is only true of year 2006. For the reading test score, however, child work negatively affects the former. A probable explanation for this is because of calculation and basic maths involved with working. Also this result is statistically significant for boys, and descriptive analysis shows 56% of children working are boys.

In 2006, household wealth measures such as the income class the household belongs too and household debt match what the literature establishes. Least poor and very poor sections of the society give better test score results for children than the poorest section. With greater wealth come greater opportunities and a better standard of life which substantially facilitate higher child learning.

Similar to earlier results, being enrolled in government school negatively affects math and reading test scores). In Indian government schools, multi-grade teaching (the practice of one teacher simultaneously teaching multiple grades in the same room) is adopted widely (Muralidharan &

Kremer, 2009: 12). This implies a very high teacher-pupil ratio which substantially reduces the quality of education. Private Indian schools, on the other hand have infrastructure and practices that build an environment conducive for learning. English-medium education, not as much of multi-grade teaching, smaller class size, more accountable teachers are supply side factors that have a major influence on demand for education.

Table12: *OLS Regression Results for Older Cohort (2006), Dependent Var: Standardized Math and Reading Test Score*

Explanatory variables	Math Test		Reading Test	
	Coef.	t-value	Coef.	t-value
Child Characteristics				
Gender	0.022	0.48	-0.014	-0.26
Age in months	0.567	1.50	-0.162	-0.36
Age in months (squared)	-0.001	-1.51	0.0005	0.35
PPVT score	0.411	14.61***	0.141	4.17***
Currently enrolled in school	1.103	8.87***	1.075	7.21***
Muslim	-0.059	-0.54	-0.087	-0.66
From other religions	-0.016	-0.08	0.267	1.08
Scheduled Castes (SC)	-0.103	-1.21	-0.014	-0.14
Scheduled Tribes (ST)	0.166	1.57	0.087	0.69
Other backward Castes (OBC)	-0.008	-0.13	0.044	0.54
Child Works	0.166	2.30**	-0.161	-1.85*
Region				
Urban	-0.006	-0.10	-0.111	-1.37
Coastal Andhra	0.155	2.32**	-0.122	-1.52
Rayalaseema	0.082	1.24	-0.118	-1.48
Household Characteristics				
Wealth Index: Least Poor	-0.079	-0.89	0.276	2.56**
Wealth Index: Very Poor	-0.063	-0.72	0.241	2.27**
Household has serious Debts	-0.105	-2.19**	-0.028	-0.49
Mother's Education level : None	0.004	0.04	-0.175	-1.57
Mother's Education level : Primary	-0.111	-1.24	-0.177	-1.65*
Mother's Education level : Secondary	0.112	1.17	-0.022	-0.20
Father's Education level : None	-0.122	-1.41	-0.155	-1.49
Father's Education level : Primary	-0.059	-0.77	0.105	1.13
Father's Education level : Secondary	0.006	0.08	-0.025	-0.27
School Characteristics				
Attends Government school	-0.135	-2.06**	0.082	1.05
Appropriate grade for age	0.186	2.32**	0.080	0.83
Constant	-42.728	-1.53	11.257	0.33
Number of observations	952		952	
R^2	0.4688		0.2622	
Adjusted R^2	0.4533		0.2423	

z values: ***significant at 1%; ** significant at 5%; *significant at 10%

Table13: *OLS Regression Results for Older Cohort (2009), Dependent Var: Standardized Math and Reading Test Score*

	Maths Test		Reading Test	
Explanatory variables	Coef.	t-value	Coef.	t-value
Child Characteristics				
Gender	0.251	4.29***	0.097	0.19
Age in months	0.196	0.36	-0.0002	-0.16
Age in months (squared)	-0.0005	-0.34	0.056	1.04
PPVT score	0.478	13.57***	0.556	17.20***
Currently enrolled in school	-0.747	-0.99	0.258	2.21**
Muslim	-0.487	-3.53***	-0.538	-4.38***
From other religions	-0.396	-1.64	-0.072	-0.32
Scheduled Castes (SC)	-0.346	-3.40***	-0.082	-0.87
Scheduled Tribes (ST)	-0.212	-1.69*	-0.146	-1.27
Other backward Castes (OBC)	-0.090	-1.16	-0.112	-1.52
Child Works	-0.012	-0.15	-0.010	-0.15
Region				
Urban	-0.015	-0.21	-0.214	-3.10***
Coastal Andhra	0.134	1.79*	0.046	0.67
Rayalaseema	0.074	0.90	-0.016	-0.22
Household Characteristics				
Wealth Index: Least Poor	0.144	0.81	0.150	0.90
Wealth Index: Very Poor	0.097	0.55	0.295	1.77*
Household has serious debts	-0.119	-1.85*	-0.016	-0.27
Mother's Education level : None	-0.042	-0.40	0.215	2.10**
Mother's Education level : Primary	-0.041	-0.41	-0.140	-1.45
Mother's Education level : Secondary	0.017	0.16	0.306	2.94***
Father's Education level : None	-0.179	-1.77*	-0.229	-2.42**
Father's Education level : Primary	-0.330	-3.61***	-0.124	-1.46
Father's Education level : Secondary	-0.058	-0.67	-0.125	-1.47
School Characteristics				
Attends Government school	-0.374	-5.37***	-0.199	-2.93***
Appropriate grade for age	0.163	1.95**	0.322	3.72***
Constant	-17.502	-0.35	-10.825	-0.24
Number of observations	701		834	
R^2	0.4617		0.4558	
Adjusted R^2	0.4401		0.4390	

z values: ***significant at 1%; ** significant at 5%; *significant at 10%

First-Difference Test Score Regression Results: Younger Cohort

For the first-difference model, the paper analyses the effect of time-variant characteristics on the math and reading test score of the cohorts across the two years.

For the younger cohort, the results are presented in Table 12, with D. signifying the first-difference of each variable.The F test for joint significance of gives a statistically significant p-value; implying that all variables are jointly significant and at least one of them is non-zero.

Amongst the child characteristics, age in months, is positively related to the math test score. If a child's age increases by one month, the math score increases by 0.001 of standard deviation, other factors staying constant. The height-for-age z scores, a measure of child nutrition is positively significant for the panel. The coefficient is in consistence with what the literature establishes. The measure for HAZ (Height-for age z scores) in Kingdon and Monk's (2010) study has a significant positive effect on schooling achievement. They believe health to be an under-studied part of educational outcomes, and stress upon the key role malnutrition plays in child development. Research has certainly established that malnutrition in the early years of child's life might contribute towards cognitive development deficiencies later.The positive link between better nutrition level, measured by the height-for-age z scores, and academic achievement has come forth in our panel regressions.

Table14: *First-difference model for Younger Cohort Panel, Dependent Var: First-difference of the Standardized Math Test Score*

Explanatory variables	Maths Test	
	Coeff.	t-value
D. (Age in months)	0.001	2.38**
D. (Height-for-age z score)	0.089	5.81***
D. (Child Works)	-0.226	-5.86***
D. (PPVT score)	0.010	2.65***
D. (Child has Older sibling)	-0.033	-1.06
D. (Child has Younger sibling)	0.025	0.85
D. (Household Wealth)	0.348	2.76***
D. (Household has serious debts)	0.018	2.29**
D. (Household size)	-0.002	-2.74***
D. (Time taken to reach school)	0.376	25.84***
D. (Attends Government school)	-0.047	-1.26
Constant	-0.001	-0.06
Number of observations	3725	
R-squared	0.1867	
F statistic	81.54	

t values: ***significant at 1%; ** significant at 5%; *significant at 10%

Child work is also found to be a major determinant of math test scores, having a negative effect on the latter. Krutikova (2009: 16) presents the case of child labour in Andhra Pradesh, using Young Lives data and concludes that income shocks may force credit-constrained households to adopt severe measures, and the child starts neglecting school work.

Household size as part of household composition has a negative effect on test scores, which is consistent with the literature. Resources and opportunities get sizeably divided as the number of members in a family increase. This reflects on the child's test scores.

According to Huisman et al (2010) in Indian rural areas, distance to school is particularly important, especially for girls. If there are great or better schools in the vicinity of the household, girls' educational participation increases tremendously. Both girls and boys are less in school if the distance between the home and school is a lot. Once attendance suffers, learning in school is bound to decrease. In our results, time taken to reach school variable has a significant and large coefficient, thus consistent with the literature.

First-Difference Test Score Regression Results: Older Cohort

According to Holmes (2003), age is relevant to a child's learning abilities, whether or not a child starts her/his schooling on time or over-age. Unlike the younger cohort, the age variable for the older cohort, as can be seen from Table13 negatively affects the difference in both maths and reading test scores. As children grow older, there are other responsibilities that come upon them which divert their mind from schooling; this is reflected in our results.

Household wealth or economic status of a household is one the major and most visible determinant of school enrolment, if not learning abilities. Educational disadvantage for the deprived castes exists mainly because of wealth constraints. Through increased wealth, a household possess the capability of providing a better study environment for the child. The wealth variable is positive and significant across the years and for all test scores.

Table15: *First-difference model for Younger Cohort Panel, Dependent Var: First-difference of the Standardized Math Test Score*

Explanatory variables	Math Test		Reading Test	
	Coeff.	t-value	Coeff.	t-value
D. (Age in months)	-0.002	-2.92***	-0.002	-2.80***
D. (Height-for-age z score)	-0.020	-1.24	0.025	1.44
D. (PPVT score)	0.442	18.05***	0.307	10.60***
D. (Child Works)	0.010	0.19	-0.068	-0.98
D. (Household Wealth)	0.354	2.24**	0.562	2.71***
D. (Household has serious debts)	-0.062	-1.58	-0.030	-0.66
D. (Child has Younger sibling)	0.122	3.09***	-0.013	-0.29
D. (Child has Older sibling)	0.124	2.67***	0.105	1.96**
D. (Time taken to reach school)	0.005	6.24***	0.005	4.72***
D. (Attends Government school)	-0.050	-0.96	0.108	1.68*
Constant	-0.006	-0.26	0.005	0.19
Number of observations	1511		1511	
R-squared	0.2637		0.1376	
F statistic	46.58		18.63	

t values: ***significant at 1%; ** significant at 5%; *significant at 10%

9. Conclusion

The objective of this study was to determine the child, household and school factors that influence educational outcomes, as measured by school enrolment and child learning (through standard test scores). Young Lives longitudinal data of two rounds (2006 and 2009), for Andhra Pradesh, India, consisting of two cohorts (younger and older) has been used. To analyse enrolment, probit model regression methodology was used; and for test scores, OLS cross-sectional regression study has been done. The paper was also able to get better and more efficient estimates from panel data set up for the two cohorts; a first-difference model to eliminate time-invariant factors was estimated.

After an exhaustive analysis of both educational outcomes, there are some useful insights that come forth.

There is increasing pre-mature enrolment in formal schools more often than not to make use of school facilities such as the mid-day meals. The latter might increase nutrition of children, however pre-mature enrolment can have a substantially adverse effect on the cognitive development of the child. Moreover, basic skills learnt in pre-school are a necessary stepping stone to formal schools' academic requirements.

PPVT scores, used as a measure of innate ability significantly affect learning abilities, and the magnitude of this effect increases with age. Height-for-age z scores, a measure of nutritional status is highly significant for young children.

The social structure of the Indian economy is reflected in the inequalities in educational attainment across caste, religion and ethic boundaries. Through our study, we have found SC, ST, OBC along with Muslims to be lagging behind in educational outcomes, whether in enrolment or learning scores. Their disadvantage can actually be linked to wealth. Substantial portion of the SC and ST are poor and/or reside in rural areas, and we through our results we know that better-off families having economic capabilities and with involved in non-farm livelihoods make fewer demands on a child's time and the latter can concentrate entirely on his/her education.

Analysing parental education informs us that children with parents who have higher-level education do significantly well than the children whose parents are uneducated.

Coastal Andhra is seen to perform better on tests compared to the other two regions. The fact, that Rayalaseema is famine and drought-prone and Telangana has semi-feudal oppressive agrarian relations as part of the state, probably have an indirect on children which explains their underperformance on educational tests.

Children are affected by the home environment and the disadvantages faced by families are passed on to the former. Thus, while viewing and measuring educational outcomes, it becomes crucial to incorporate child and household factors into the study. However, the most effective and justifiable policy approach would be to address together child, household and school factors, rather than implementing a programme benefitting only one area.

Young Lives still has two more survey rounds that would be completed by 2016. This would provide excellent opportunities for further research. Specifically for panel data research methods; this would enable inclusion of causality of factors, rather than being confined to correlation between the home or school environment and a child's educational outcomes.

Appendix 1: Recent developments in Andhra Pradesh

There have been several developments in recent years that have merited attention from the media, researchers and policy-makers. Three such issues are illustrated below to place in order our paper's research in AP.

The agrarian crisis- It is now widely recognized that India is suffering from a grave agrarian crisis that has devastated millions of households across several states. In recent years, the agrarian distress has become one of the major political issues in Andhra Pradesh. Farmers' suicides, indebtedness, and agrarian distress have become, even if belatedly, central to policy debates and initiatives.

Mid-Day Meal Scheme- In 2001, the Supreme Court directed all state governments to provide a cooked midday meal in all public primary schools within six months. By 2003, the scheme was universal in most states (including Andhra Pradesh which started providing midday meals from January 2003). The scheme in outreach at least, is one of the most successful public programmes introduced in recent years (Galab et al, 2008: 5)

National Rural Employment Guarantee Scheme- In 2005, with the enactment of the National Rural Employment Guarantee Act, the Union government unveiled the largest public employment generation programme in the world, guaranteeing 100 days of employment every year at minimum wages to each household in rural India.

The above policy overview provides a background, and this paper's results and policy implications should be placed within this broader context.

Appendix 2: Summary Statistics

Table2.1: *Summary Statistics of variables for Younger Cohort (2006)*

Variables	Mean	Sd	Min	Max
Age in months	64.86	3.85	54.9	76
Gender (male=1, female=0)	0.53	0.50	0.0	1
Height-for-age z-score	-1.64	1.08	-6.7	13
Hindu (=1 otherwise=0)	0.92	0.28	0.0	1
Muslim (=1 otherwise=0)	0.07	0.26	0.0	1
Other Religons (=1 otherwise=0)	0.01	0.10	0.0	1
Scheduled Castes (=1 otherwise=0)	0.18	0.39	0.0	1
Scheduled Tribes (=1 otherwise=0)	0.13	0.33	0.0	1
Other Backward Castes (=1 otherwise=0)	0.48	0.50	0.0	1
General Castes (=1 otherwise=0)	0.21	0.41	0.0	1
Currently enrolled in school (=1 otherwise=0)	0.45	0.50	0.0	1
Child Works (=1 otherwise=0)	0.00	0.04	0.0	1
Urban=1 Rural=0	0.25	0.43	0.0	1
Coastal Andhra (=1 otherwise=0)	0.36	0.48	0.0	1
Rayalaseema (=1 otherwise=0)	0.29	0.45	0.0	1
Telangana (=1 otherwise=0)	0.35	0.48	0.0	1
Wealth index	0.46	0.20	0.0	1
Least poor (=1 otherwise=0)	0.58	0.49	0.0	1
Very poor (=1 otherwise=0)	0.31	0.46	0.0	1
Poorest (=1 otherwise=0)	0.11	0.31	0.0	1
Household size	5.51	2.22	2.0	28
Household has serious Debts	0.73	4.38	0.0	77
Mother's Education level : None	0.51	0.50	0.0	1
Mother's Education level : Primary	0.15	0.35	0.0	1
Mother's Education level : Secondary	0.40	0.49	0.0	1
Mother's Education level : Higher	0.10	0.29	0.0	1
Father's Education level : None	0.33	0.47	0.0	1
Father's Education level : Primary	0.18	0.38	0.0	1
Father's Education level : Secondary	0.48	0.50	0.0	1
Father's Education level : Higher	0.20	0.40	0.0	1
Younger sibling(s) (=1 otherwise=0)	0.48	0.50	0.0	1
Older sibling(s) (=1 otherwise=0)	0.61	0.49	0.0	1
Attending Government School (=1 otherwise=0)	0.63	0.48	0.0	1
Time (in mins) to reach to school	10.76	11.36	-88.0	90
Appropriate grade(=1 otherwise=0)	0.50	0.50	0.0	1
Standardized score for ppvt	0.00	1.00	-1.2	4
Standardized score for math	0.02	0.98	-3.6	2
Observations	1849			

Table2.2: *Summary Statistics of variables for Older Cohort (2006)*

Variables	Mean	S.D	Min	Max
Age in months	148.49	4.23	133.8	158
Gender (male=1, female=0)	0.49	0.50	0.0	1
Height-for-age z-score	-1.65	1.68	-18.9	2
Hindu (=1 otherwise=0)	0.92	0.26	0.0	1
Muslim (=1 otherwise=0)	0.06	0.24	0.0	1
Other Religons (=1 otherwise=0)	0.01	0.12	0.0	1
Scheduled Castes (=1 otherwise=0)	0.20	0.40	0.0	1
Scheduled Tribes (=1 otherwise=0)	0.10	0.30	0.0	1
Other Backward Castes (=1 otherwise=0)	0.49	0.50	0.0	1
General Castes (=1 otherwise=0)	0.21	0.41	0.0	1
Currently enrolled in school (=1 otherwise=0)	0.90	0.30	0.0	1
Child Works (=1 otherwise=0)	0.20	0.40	0.0	1
Urban=1 Rural=0	0.25	0.43	0.0	1
Coastal Andhra (=1 otherwise=0)	0.35	0.48	0.0	1
Rayalaseema (=1 otherwise=0)	0.31	0.46	0.0	1
Telangana (=1 otherwise=0)	0.34	0.48	0.0	1
Wealth index	0.47	0.20	0.0	1
Least poor (=1 otherwise=0)	0.60	0.49	0.0	1
Very poor (=1 otherwise=0)	0.31	0.46	0.0	1
Poorest (=1 otherwise=0)	0.10	0.29	0.0	1
Household has serious Debts	0.52	0.50	0.0	1
Mother’s Education level : None	0.59	0.49	0.0	1
Mother’s Education level : Primary	0.13	0.34	0.0	1
Mother’s Education level : Secondary	0.30	0.46	0.0	1
Mother’s Education level : Higher	0.10	0.31	0.0	1
Father’s Education level : None	0.42	0.49	0.0	1
Father’s Education level : Primary	0.16	0.37	0.0	1
Father’s Education level : Secondary	0.42	0.49	0.0	1
Father’s Education level : Higher	0.15	0.36	0.0	1
Younger sibling(s) (=1 otherwise=0)	0.58	0.49	0.0	1
Older sibling(s) (=1 otherwise=0)	0.68	0.46	0.0	1
Attending Government School (=1 otherwise=0)	0.64	0.48	0.0	1
Time (in mins) to reach to school	6.51	35.53	-88.0	180
Appropriate grade(=1 otherwise=0)	0.80	0.40	0.0	1
Standardized score for ppvt	0.02	0.98	-3.0	1
Standardized score for math	0.03	0.97	-2.5	1
Standardized score for reading	0.01	0.99	-3.4	0
Observations	952			

Table2.3: *Summary Statistics of variables for Younger Cohort (2009)*

Variables	Mean	Sd	Min	Max
Age in months	96.03	3.92	86.2	106
Gender (male=1, female=0)	0.53	0.50	0.0	1
Height-for-age z-score	-1.42	1.17	-11.0	12
Hindu (=1 otherwise=0)	0.92	0.27	0.0	1
Muslim (=1 otherwise=0)	0.07	0.26	0.0	1
Other Religons (=1 otherwise=0)	0.01	0.10	0.0	1
Scheduled Castes (=1 otherwise=0)	0.18	0.38	0.0	1
Scheduled Tribes (=1 otherwise=0)	0.13	0.34	0.0	1
Other Backward Castes (=1 otherwise=0)	0.48	0.50	0.0	1
General Castes (=1 otherwise=0)	0.21	0.41	0.0	1
Currently enrolled in school (=1 otherwise=0)	1.00	0.07	0.0	1
Child Works (=1 otherwise=0)	0.34	0.48	0.0	1
Urban=1 Rural=0	0.25	0.43	0.0	1
Coastal Andhra (=1 otherwise=0)	0.35	0.48	0.0	1
Rayalaseema (=1 otherwise=0)	0.30	0.46	0.0	1
Telangana (=1 otherwise=0)	0.35	0.48	0.0	1
Wealth index	0.51	0.18	0.0	1
Least poor (=1 otherwise=0)	0.72	0.45	0.0	1
Very poor (=1 otherwise=0)	0.23	0.42	0.0	1
Poorest (=1 otherwise=0)	0.05	0.21	0.0	1
Household size	5.52	2.24	2.0	28
Household has serious Debts	0.35	0.48	0.0	1
Mother's Education level : None	0.51	0.50	0.0	1
Mother's Education level : Primary	0.15	0.36	0.0	1
Mother's Education level : Secondary	0.40	0.49	0.0	1
Mother's Education level : Higher	0.10	0.29	0.0	1
Father's Education level : None	0.33	0.47	0.0	1
Father's Education level : Primary	0.18	0.38	0.0	1
Father's Education level : Secondary	0.48	0.50	0.0	1
Father's Education level : Higher	0.19	0.40	0.0	1
Younger sibling(s) (=1 otherwise=0)	0.51	0.50	0.0	1
Older sibling(s) (=1 otherwise=0)	0.59	0.49	0.0	1
Attending Government School (=1 otherwise=0)	0.54	0.50	0.0	1
Time (in mins) to reach to school	13.56	14.80	0.0	90
Appropriate grade(=1 otherwise=0)	0.81	0.40	0.0	1
Standardized score for ppvt	0.01	1.00	-1.5	4
Standardized score for math	0.00	1.00	-1.9	3
Observations	1887			

Table2.4: *Summary Statistics of variables for Older Cohort (2009)*

Variables	Mean	Sd	Min	Max
Age in months	179.69	4.22	166.4	191
Gender (male=1, female=0)	0.49	0.50	0.0	1
Height-for-age z-score	-1.63	1.06	-6.8	2
Hindu (=1 otherwise=0)	0.93	0.26	0.0	1
Muslim (=1 otherwise=0)	0.06	0.24	0.0	1
Other Religons (=1 otherwise=0)	0.01	0.12	0.0	1
Scheduled Castes (=1 otherwise=0)	0.19	0.39	0.0	1
Scheduled Tribes (=1 otherwise=0)	0.10	0.30	0.0	1
Other Backward Castes (=1 otherwise=0)	0.49	0.50	0.0	1
General Castes (=1 otherwise=0)	0.22	0.41	0.0	1
Currently enrolled in school (=1 otherwise=0)	0.84	0.37	0.0	1
Child Works (=1 otherwise=0)	0.21	0.41	0.0	1
Urban=1 Rural=0	0.25	0.43	0.0	1
Coastal Andhra (=1 otherwise=0)	0.37	0.48	0.0	1
Rayalaseema (=1 otherwise=0)	0.30	0.46	0.0	1
Telangana (=1 otherwise=0)	0.33	0.47	0.0	1
Wealth index	0.53	0.17	0.0	1
Least poor (=1 otherwise=0)	0.76	0.43	0.0	1
Very poor (=1 otherwise=0)	0.21	0.41	0.0	1
Poorest (=1 otherwise=0)	0.03	0.17	0.0	1
Household has serious Debts	0.32	0.47	0.0	1
Mother's Education level : None	0.57	0.50	0.0	1
Mother's Education level : Primary	0.14	0.34	0.0	1
Mother's Education level : Secondary	0.32	0.47	0.0	1
Mother's Education level : Higher	0.11	0.31	0.0	1
Father's Education level : None	0.40	0.49	0.0	1
Father's Education level : Primary	0.17	0.37	0.0	1
Father's Education level : Secondary	0.44	0.50	0.0	1
Father's Education level : Higher	0.17	0.37	0.0	1
Younger sibling(s) (=1 otherwise=0)	0.45	0.50	0.0	1
Older sibling(s) (=1 otherwise=0)	0.67	0.47	0.0	1
Attending Government School (=1 otherwise=0)	0.54	0.50	0.0	1
Time (in mins) to reach to school	19.99	18.55	0.0	120
Appropriate grade(=1 otherwise=0)	0.73	0.45	0.0	1
Standardized score for ppvt	0.11	0.95	-2.5	2
Standardized score for math	0.04	1.00	-1.5	3
Standardized score for reading	0.01	1.00	-1.6	2
Observations	861			

Appendix 3: Disaggregation of Test Score Regressions by gender

Table3.1: *OLS Disaggregation by gender Results for Older Cohort (2006)*
Dependent Var: Standardized Math Test Score

	Girls		Boys	
Explanatory variables	Coef.	t-value	Coef.	t-value
Child Characteristics				
Age in months	0.972	1.89*	0.198	0.34
Age in months (squared)	-0.003	-1.89*	-0.0006	-0.36
PPVT score	0.389	9.76***	0.437	10.86***
Currently enrolled in school	1.176	6.85***	1.081	5.77***
Muslim	-0.112	-0.74	0.019	0.12
From other religions	0.123	0.44	-0.091	-0.31
Scheduled Castes (SC)	-0.086	-0.69	-0.197	-1.60
Scheduled Tribes (ST)	0.190	1.30	0.114	0.73
Other backward Castes (OBC)	0.051	0.52	-0.087	-0.89
Child Works	0.174	1.63	0.188	1.90*
Region				
Urban	0.047	0.49	-0.102	-1.03
Coastal Andhra	0.238	2.45**	0.084	0.90
Rayalaseema	0.037	0.39	0.166	1.73*
Household Characteristics				
Wealth Index: Least Poor	-0.100	-0.80	-0.119	-0.91
Wealth Index: Very Poor	-0.032	-0.26	-0.173	-1.35
Household has serious debts	-0.066	-0.97	-0.137	-1.99**
Mother's Education level : None	-0.031	-0.25	-0.005	-0.04
Mother's Education level : Primary	-0.325	-2.51**	0.014	0.12
Mother's Education level : Secondary	0.185	1.41	0.034	0.24
Father's Education level : None	-0.005	-0.05	-0.181	-1.42
Father's Education level : Primary	0.001	0.01	-0.127	-1.13
Father's Education level : Secondary	0.214	1.93*	-0.174	-1.51
School Characteristics				
Attends Government school	-.197	-2.05**	-0.109	-1.20
Appropriate grade for age	0.084	0.74	0.301	2.52**
Constant	-72.959	-1.92	-14.914	-0.35
Number of observations	488		464	
R^2	0.4793		0.4915	
Adjusted R^2	0.4499		0.4612	

Table3.2: *OLS Disaggregation by gender Results for Older Cohort (2006)*
Dependent Var: Standardized Reading Test Score

Explanatory variables	Girls		Boys	
	Coef.	t-value	Coef.	t-value
Child Characteristics				
Age in months	0.060	0.10	-0.398	-0.58
Age in months (squared)	-0.0002	-0.11	0.001	0.59
PPVT score	0.136	2.86***	0.111	2.33**
Currently enrolled in school	0.825	4.04***	1.571	7.07***
Muslim	0.113	0.63	-0.289	-1.52
From other religions	0.434	1.28	0.141	0.40
Scheduled Castes (SC)	-0.174	-1.18	0.041	0.28
Scheduled Tribes (ST)	0.099	0.57	0.022	0.12
Other backward Castes (OBC)	0.057	0.48	-0.0344	-0.29
Child Works	-0.267	-2.08**	-0.030	-0.25
Region				
Urban	-0.017	-0.15	-0.251	-2.16**
Coastal Andhra	-0.086	-0.74	-0.111	-1.00
Rayalaseema	-0.138	-1.23	-0.082	-0.72
Household Characteristics				
Wealth Index: Least Poor	0.184	1.23	0.249	1.61
Wealth Index: Very Poor	0.004	0.03	0.368	2.42**
Household has serious Debts	0.023	0.29	-0.067	-0.82
Mother's Education level : None	-0.228	-1.49	-0.101	-0.63
Mother's Education level : Primary	-0.043	-0.28	-0.344	-2.30**
Mother's Education level : Secondary	-0.070	-0.45	0.050	0.30
Father's Education level : None	-0.091	-0.63	-0.316	-2.09**
Father's Education level : Primary	0.130	1.01	0.077	0.58
Father's Education level : Secondary	0.067	0.51	-0.180	-1.31
School Characteristics				
Attends Government school	0.151	1.32	-0.004	-0.04
Appropriate grade for age	-0.169	-1.25	0.230	1.63
Constant	-4.740	-0.10	27.972	0.55
Number of observations	488		464	
R^2	0.2300		0.3631	
Adjusted R^2	0.1900		0.3283	

Table3.3: *OLS Disaggregation by gender Results for Older Cohort (2009)*
Dependent Var: Standardized Math Test Score

Explanatory variables	Girls		Boys	
	Coef.	t-value	Coef.	t-value
Child Characteristics				
Age in months	0.768	0.76	-0.041	-0.05
Age in months (squared)	-0.001	-0.74	0.0001	0.06
PPVT score	0.416	9.20***	0.537	9.65***
Currently enrolled in school	-0.383	-0.57	-0.357	-0.74
Muslim	-0.646	-3.89***	-0.335	-1.47
From other religions	-0.563	-1.66*	-0.244	-0.70
Scheduled Castes (SC)	-0.230	-1.70*	-0.503	-3.21***
Scheduled Tribes (ST)	-0.149	-0.94	-0.305	-1.51
Other backward Castes (OBC)	-0.109	-1.06	-0.097	-0.82
Child Works	-0.023	-0.21	0.005	0.04
Region				
Urban	0.044	0.45	-0.046	-0.40
Coastal Andhra	-0.0003	-0.00	0.246	2.15**
Rayalaseema	-0.003	-0.04	0.181	1.40
Household Characteristics				
Wealth Index: Least Poor	0.193	0.89	0.102	0.35
Wealth Index: Very Poor	0.176	0.81	0.042	0.15
Household has serious debts	-0.175	-2.21**	-0.078	-0.74
Mother's Education level : None	-0.236	-1.76*	0.082	0.48
Mother's Education level : Primary	-0.048	-0.37	-0.117	-0.76
Mother's Education level : Secondary	-0.029	-0.23	0.054	0.31
Father's Education level : None	-0.207	-1.57	-0.102	-0.65
Father's Education level : Primary	-0.269	-2.33**	-0.401	-2.79***
Father's Education level : Secondary	-0.052	-0.48	-0.041	-0.29
School Characteristics				
Attends Government school	-0.363	-3.90***	-0.346	-3.20***
Appropriate grade for age	0.325	3.95**	0.322	3.76***
Constant	-53.270	-0.77	3.251	0.05
Number of observations	339		362	
R^2	0.4974		0.4169	
Adjusted R^2	0.4555		0.3735	

Table3.4: *OLS Disaggregation by gender Results for Older Cohort (2009)*
Dependent Var: Standardized Reading Test Score

Explanatory variables	Girls		Boys	
	Coef.	t-value	Coef.	t-value
Child Characteristics				
Age in months	-.695	-0.95	.897	1.23
Age in months (squared)	.001	0.97	-.002	-1.19
PPVT score	.510	11.32***	.614	12.79***
Currently enrolled in school	.007	0.05	.554	3.04***
Muslim	-.650	-3.96***	-.400	-2.13**
From other religions	-.141	-0.45	-.050	-0.15
Scheduled Castes (SC)	-.087	-0.64	-.131	-0.95
Scheduled Tribes (ST)	-.329	-2.09**	-.012	-0.07
Other backward Castes (OBC)	-.121	-1.16	-.133	-1.23
Child Works	-.082	-0.82	.103	0.93
Region				
Urban	-.264	-2.74***	-.204	-1.98**
Coastal Andhra	.088	0.91	.001	0.02
Rayalaseema	-.125	-1.24	.081	0.72
Household Characteristics				
Wealth Index: Least Poor	.193	0.85	.125	0.51
Wealth Index: Very Poor	.389	1.69*	.227	0.92
Household has serious debts	.072	0.51	.311	2.03**
Mother's Education level : None	-.094	-1.22	.061	0.65
Mother's Education level : Primary	-.177	-1.28	-.104	-0.75
Mother's Education level : Secondary	.296	2.10**	.302	1.93*
Father's Education level : None	-.265	-2.02**	-.185	-1.31
Father's Education level : Primary	-.133	-1.14	-.105	-0.83
Father's Education level : Secondary	-.106	-0.92	-.165	-1.29
School Characteristics				
Attends Government school	-.130	-1.32	-.282	-2.87***
Appropriate grade for age	.401	3.16***	.278	2.25**
Constant	60.550	0.92	-83.314	-1.27
Number of observations	426		408	
R^2	0.4613		0.4500	
Adjusted R^2	0.4291		0.4156	

Bibliography:

Aber, J.L. Bennett, N.G, Conley, D.C., Li, J. (1997) 'The Effects of Poverty on Child Health and Development', Annual Review Public Health, 18, pp. 463-83.

Aturupane, H., Glewwe, P., & Wisniewski, S. (2011). The impact of school quality, socioeconomic factors and child health on students' academic performance: Evidence from Sri Lankan primary schools. Education Economics, 1, 2-37.

Beegle, K. Weerdt, J.D., Dercon, S. (2006) 'Orphanhood and the Long-Run Impact on Children', American Journal of Agricultural Economics, 88(5), pp. 1266-1272.

Bobonis, Gustavo, Edward Miguel and Charu Puri-Sharma. (2006). "Anemia and School Paricipation." Journal of Human Resources, 41(4): 692-721.

Broaded, C. M., & Liu, C. (1996) 'Family background, gender and educational attainment in urban China', The China Quarterly, 145, 53–86.

Brooks-Gunn, J. Duncan, G.J (1997) 'The Effects of Poverty on Children', The Future of Children, 7(2).

Brownlee, J., Syu, J. J., Mascadri, J., Cobb-Moore, C., Walker, S.,Johansson, E., et al. (2012). Teachers' and children's personal epistemologies for moral education: Case studies in early years elementary education. Teaching and Teacher Education, 28, 440–450.

Carneiro, P., Crawford, C., Goodman, A., (2007). The impact of early cognitive and noncognitive skills on later outcomes. CEE DP 92.

Colclough, C., Rose, P., Tembon, M. (2000) 'Gender inequalities in primary schooling: The roles of poverty and adverse cultural practice', International Journal of Educational Development, 20(1), pp.5-27.

Connelly, R. and Z. Zheng. (2003). "Determinants of School Enrollment and Completion of 10 to 18 Year Olds in China." Economics of Education Review 22:379–88.

Connelly, R., & Zheng, Z. (2003). Determinants of school enrollment and completion of 10 to 18 year olds in China. Economics of Education Review, 22(4), 379–388.

Cueto, S., Leon, J., Guerrero, G., & Munoz, I. (2009). Psychometric characteristics of cognitive development and achievement instruments in Round 2 of Young Lives. Young Lives Technical Note, No. 15. <http://www.younglives.org.uk/publications/technical-notes>.

Das, J. and Zajonc, T. (2008) 'India shining and Bharat drowning: Comparing two Indian states to

Deaton, A., Dre`ze, J.,(2007). Food and nutrition in India: facts and interpretations. Economic and Political Weekly 44 (7), 42–65.

Desai S, Kulkarni V (2008) Changing educational inequalities in India in the context of affirmative action. Demography 45: 245–270.

Desai U. (1991) 'Determinants of educational performance in India: role of home and family', International Review of Education 1991;37:245

Dostie, B., & Jayaraman, R. (2006) 'Determinants of school enrolment in Indian Villages. Economic Development and Cultural Change', 54(2), 405–421.

Dreze, J. Kingdon, G.G. (1999) School Participation in Rural India, Development Economics Discussion Paper Series, London School of Economics.

Drèze, Jean and Geeta Gandhi Kingdon (2001): School Participation in Rural India, Review of Development Economics, 5(1), 1-24.

Dubow, E. F., Boxer, P., & Huesmann, L. R. (2009). 'Long-term effects of parents' education on children's educational and occupational success: mediation by family interactions, child aggression, and teenage aspirations', Merrill-Palmer Quarterly, 55, 224–249.

EFA Global Monitoring Report (2006) Strong foundations: Early childhood care and education. United Nations Educational, Scientific and Cultural Organization (UNESCO), France.

Engle, P.L., Black, M.M. (2008) 'The Effect of Poverty on Child Development and Educational Outcomes', Annals of the New York Academy of Sciences, 1136, pp. 243-256.

Fryer, R., and Levitt,S. (2009). 'An Empirical Analysis of the Gender Gap in Mathematics, American Economic Journal', Applied Economics

Galab, S., Moestue, H., Anthony, P., McCoy, A., Ravi, C., Reddy, P.P (2005) 'The interplay between school and home' Young Lives Working Paper No. 27, Young Lives, Oxford

Galab, S., Reddy M. G., Antony P., McCoy, A., Ravi C., Raju D.S., Mayuri K., Reddy, P.P. (2003) Young Lives Preliminary Country Report: Andhra Pradesh, India, Oxford, UK: Young Lives. 75 pp.

Galab, S., Reddy, P.P, Himaz, R. (2008) 'Initial Findings: Andhra Pradesh, India' Young Lives Round 2 Survey Report, Young Lives, Oxford

Glewwe, P. (2002) 'Schools and Skills in Developing Countries: Educational Policies and Socioeconomic Outcomes.'' Journal of Economic Literature 40(2): 436–82.

Glewwe, P., S. Koch and B. Nguyen 2001. Child nutrition and economic growth in Vietnam in the 1990s. Paper presented to 2001 American Agricultural Economic Association, Chicago

Glewwe, Paul, and Hanan Jacoby. 1993. "Delayed primary school enrollment and childhood malnutrition in Ghana," World Bank Living Standards Measurement Survey. Working Paper No. 98.

Glewwe, Paul, Jacoby, Hanan, (1994). Student achievement and schooling choice in low income countries: evidence from Ghana. Journal of Human Resources 29 (3), 843–864

Glick , P., Randrianarisoa, J.C, Sahn, D. E (2011) Family background, school characteristics, and children's cognitive achievement in Madagascar, Education Economics, 19 (4), pp. 363-396

Glick, P, and Sahn D.E (2010) "Early Academic Performance, Grade Repetition, and School Attainment in Senegal: A Panel Data Analysis." World Bank Economic Review 24, no. 1:93–120.

Hanushek, E., and Woessmann, L. (2008): 'The Role of Cognitive Skills in Economic Development,' Journal of Economic Literature, 46, 607–668.

Holmes, J. (2003) 'Measuring the determinants of school completion in Pakistan: analysis of censoring and selection bias', Economics of Education Review, 22(3), pp.249 264.

Ivanovic, D., Leiva, B., Pérez, H., Almagià, A., Toro, T., & Urrutia, M.S. et al., (2002). 'Nutritional status, brain development and scholastic achievement of Chilean high school graduates from high and low intellectual quotient and socio-economic status', British Journal of Nutrition, 87, 81–92.

Jayachandran, U. (2002) Socio-Economic Determinants of School Attendance in India, Working Paper No.103, Center for Development Economics, Delhi.

Khera, R. (2006), 'Mid-day Meals in Primary Schools: Achievements and Challenges', Economic and Political Weekly, 18 November.

Kingdon, G. (1996) The quality and efficiency of public and private education: A case study of Urban India. Oxford Bulletin of Economics and Statistics 58, no. 1: 57–82.

Kingdon, G. (2008) School-sector effects on student achievement in India. In School choice international: Exploring public–private partnerships, ed. R. Chakrabarti and P. Petersen, chapter 6. Boston, MA: MIT Press.

Kingdon, G., Courtney, M., (2010) Health, nutrition and academic achievement: new evidence from India.Working paper. Centre for the Study of African Economies, Oxford.

Kingdon, G.G and Unni,J. (2001) 'Education and Women's Labour Market Outcomes in India', Education Economics, 9:2, 173-195

Kremer,M., Muralidharan, K., Chaudhury N.,Rogers, F.H, and Hammer, J.(2005): "Teacher Absence in India: A Snapshot," Journal of the European Economic Association, 3, 658-67.

Krutikova, S. (2009) Determinants of Child Labour: The Case of Andhra Pradesh. Young Lives Working Paper No. 48, Oxford, UK: Young Lives.

Lincove, J. A. (2009). Determinants of schooling for boys and girls in Nigeria under a policy of free primary education. Economics of Education Review, 28(4), 474–484. http://dx.doi.org/10.1016/j.econedurev.2008.10.001

Maddala, G. S, (1983) *Limited-Dependent and Qtmlitative Variables in Econometrics.* Cambridge: Cambridge University Press.

Maddala, G. S., "Limited Dependent Variable Models Using Panel Data," Journal of Human Resources, XXII (1987), 307-38.

Miguel, E., Kremer, M. (2004) 'Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities', Econometrica, 72(1), pp. 159-217.

Orkin, K. (2011) If God wills…next year I will send her back to school: The Effects of Child and Parental Illness on School Participation in Rural Ethiopia. In: CREATE Pathways to Access Series, Research Monograph Number 60., pp.1-67. ISBN 0-901881-74-0.

Pradhan,B.K., Subramanian, A. (2000) Education, Openness and The Poor: Analysis of an all-india sample of households. National Council of Applied Economic Research Discussion Paper, New Delhi, India.

Pratham (2007), 'ASER 2006—Annual Status of Education Report', New Delhi, Pratham, January.

Reddy, V.R. and R.N. Rao (2003) 'Primary Education: Progress and Constraints', Economic and Political Weekly, 22-29 March: 1242–51

Schady N, Paxson C. Cognitive development among young children in Ecuador: the roles of health, wealth and parenting. World Bank Policy Research Working Paper 3605, May, 2005. Washington DC:

Sen, A. (1999) Development as Freedom. Oxford University Press: New York.

Suryadama, D., Pakpahan, Y. M., Suryahadi, A. (2009) The Effects of Parental Death and Chronic Poverty on Children's Education and Health: Evidence from Indonesia. Chronic Poverty Research Centre Working Paper No. 133.

The PROBE Team (1999), Public Report on Basic Education in India (New Delhi: Oxford University Press).

Tilak, J. (1996), "How Free is 'Free' Primary Education in India?", Economic and Political Weekly, 31 (5 & 6) (3 & 10 February): 275–82; and 355–66

Todd, P. E., and K. I. Wolpin (2003): 'On the Specification and Estimation of the Production Function for Cognitive Achievement,'Economic Journal, 113, F3–F33.

Tooley, J. & Dixon, P. (2005) Private education is good for the poor—a study of private schools serving the poor in low-income countries (Washington DC, CATO Institute).

UNESCO Institute for Statistics (2005)Children out of school: Measuring Exclusion from Primary Education. Monreal, Quebec.

Vani K. Borooah & Sriya Iyer (2005) 'Vidya, Veda, and Varna: The influence of religion and caste on education in rural India', The Journal of Development Studies, 41:8, 1369-1404.

Vennam, U., Andharia, J. (2012) Chronic Poverty Amid Growth: Insights from Long-term Poverty Trajectory. Young Lives Working Paper No. 84, Oxford, UK: Young Lives.

Woldehanna, T., Jones, N., Tefera, B. (2005) Children's Educational Completion Rates and Achievement: Implications for Ethiopia's second Poverty Reduction strategy (2006-10). Young Lives Working Paper No.18, Oxford, UK: Young Lives.

Woldehanna, T., Mekonnen, A., Jones, N., Tefera, B., Seager, J., Alemu, T. and Asgedom, G. (2005) 'Education Choices in Ethiopia: What determines whether poor households send their children to school?' Young Lives *Working Paper* No. 15, London: Save the Children UK.

World Bank (1998) *Federal Democratic Republic of Ethiopia Education Sector Development* World Bank, 2005.

Wu, K.B, Goldschmidt P., Boscardin, C.K.,Sankar, D. (2009) International benchmarking and determinants of mathematics achievement in two Indian states,Education Economics, 17 (3), pp.395-411