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How properties depletes the cognitive ability of children

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Advanced Master in International and Development Economics

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HOW POVERTY DEPLETES THE COGNITIVE ABILITY OF CHILDREN
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1. INTRODUCTION

The World Bank report (2013) on the state of the poor, showed that the new estimated number of the worldwide people living in extreme poverty has significantly decreased to 1.9 billion in 2012. Nevertheless, 1.9 billion people living on less than \$1.25 a day is still an exceedingly big number.¹ In fact, poor people have less access to education, inadequate access to clean water, inadequate shelter and lack basic sanitation. Due to this problem, poor families cannot satisfy their basic needs and those of their children. This shortage to basic needs has many consequences on child development such as illness, poor physical health and development, low social development, and low cognitive ability. These consequences result in poverty due to low human capital (education, health), meaning that poverty limits the ability of parents and states to find resources that can be mobilized in health investments and in education. In society, a family plays a predominant role in investing in human capital especially in their children. But due to poverty, families are unable to invest in the human capital of their children (Engle et al., 2007; Engle & Black, 2008). In developing countries, more than 39% of children under age 5 are stunted, 31% have the problem of growth retardation, 200 million children under five years have the problem of low cognitive development while 38% of children from lowest quintile compared to these from top quintile never attend school (Engle et al., 2007; Grantham-McGregor et al., 2007).

Stunting is said to indicate the nutritional status of children. It exhibits and long-term consequences on children development. In the short-term, it increases the health expenditure, the opportunity cost for care of child who is sick, and it decreases child development through a decrease of motor, and language development. One can say that the severe consequences of stunting are particularly impaired cognitive abilities in the long-term through social and emotional ability, which induce low development quotient of children leading to reduction in school achievement, less capacity to adequately learn or play, and reduced working capacity and productivity during adulthood. The above figures show clearly how poverty can be transmitted from one generation to another. If 38% of children from lowest quintile never attend school, that means they cannot accumulate enough resources that help them to satisfy their needs, and during their adult period they will not be able to invest in human capital of their children in case there is no any kind of intervention or support program for them.

¹ <http://www-wds.worldbank.org>

Many authors have focused on cognitive ability as the main driver of this poverty trap, particularly from poverty to cognitive ability. Grantham-McGregor et al. (2007) shows that a child born in poverty has long-term negative effects on cognitive achievement at age 18, and being malnourished affects negatively the physical development of children leading to low energy level during adulthood.

Poverty could affect cognitive ability through many channels such as parental investment, malnutrition, cognitive stimulation, home environment, parental health and parental-child interactions, the quality of care, and neighbourhoods (Duncan & Brooks-Gunn, 2000 and Brooks Gunn & Duncan, 1997). The study focuses on children rather to see if and how intergenerational cycle of poverty persists or is broken up. When this problem of intergenerational cycle of poverty is transmitted from parents to children, it could be a barrier for language development of children while some researchers suggested that the number of words a child hears every day is indispensable to predict the later intelligence, social competence and school success. Children experience poverty differently from adults. Children have specific and different needs. A child needs more attention during the early years.

An adult may temporarily fall into poverty while the poverty of infants and children may last a lifetime. The consequence of poverty is an immense worldwide problem and possesses detrimental effects on about all aspects of human life and a child's cognitive ability. The question remains how poverty hinders the child's cognitive ability.

The researcher offers some theoretical considerations regarding the relationship between poverty and child cognitive ability and provides an analytical review of the related literature. Specifically, this study aims to address the following questions:

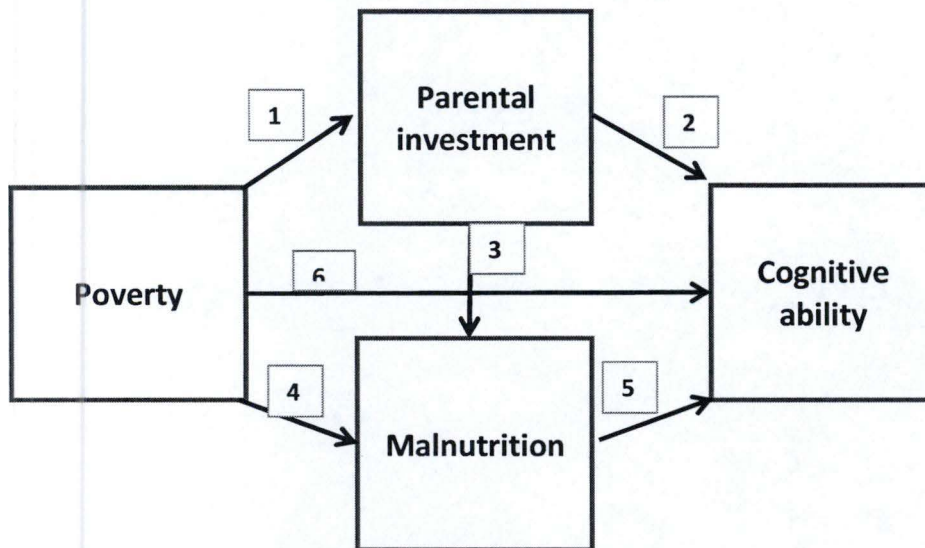
- 1) What are the channels through which poverty may affect cognitive ability of children?
- 2) What is the most influential channel?

The main objective of the research is to review the relevant literature that analyses how poverty hinders the cognitive ability of the child, examining more specifically the factors through which poverty can affect the cognitive ability of children.

The study is organized as follows: Section 2 provides a conceptual framework underlying this study and illustrates the main interactions that will be reviewed. Section 3 summarizes and evaluates the current state of the literature and Section 4 concludes.

2. CONCEPTUAL FRAMEWORK

Figure 1: Conceptual framework



The above graph shows channels from poverty to poor cognitive ability. Parental investment includes both monetary and non monetary investment. Monetary investment reflects the purchasing power of parents to buy learning and stimulation materials and service to invest in building the human capital of their children. These materials and services may comprise cognitive stimulation and activities, child care, medical care, housing, and neighbourhood environment. Non monetary investment reflects parental interactions and emotional with their children. It is observed that there are indirect and direct effects of poverty on the cognitive ability of children. The arrow one shows that poverty influences negatively the investment of parents through parental behaviour, learning resources, lack of stimulating activities, to visit the library, a place for doing homework, time to read to children, to help them reading, guidance in editing their book report themselves, and school support. All those dimensions are affected by poverty in a way that possibly leads to low cognitive ability of children. Recent studies report that low parental investment resulting from poverty hinders the cognitive ability of children (Dickerson et al., 2016 and Dahl et al., 2012). The arrow six shows that poverty influences negatively the cognitive ability of children (education and development of the children) through increasing the risk factors (delay in behavioural development, child and maternal underweight, unsafe water and sanitation, tobacco use, alcohol use), and limiting protection mechanism or factors and opportunities for learning and cognitive stimulation.

In addition, insufficient wealth influences negatively the cognitive ability of children by reducing the cognitive materials and activities (Dumas and Lambert, 2011) whereas income volatility induces higher school dropout (Gubert and Robilliard, 2008).

The arrow three shows that parental investment could also be linked with malnutrition. Malnutrition increases infectious diseases. Consequently, the cost of health care also increases, which forces parents to use their low income available to buy food and medicines. Therefore, they reduce the amount of money that can be used to provide learning materials and relative school support. In addition, most of the time low income families are more likely to be less educated even non educated which prevents parents to provide help for their children. Poor and uneducated parents lack the information needed to provide adequate childcare nutritional for their children which may increase the risks of childhood malnutrition. Some previous researchers have studied part of this framework but no specific discussion has been found on the link between parental investment and malnutrition.

The arrow four and five show that low income poverty is positively linked with malnutrition, which in turn induces low cognitive ability of children. In fact, malnutrition and micronutrient deficiency cause many diseases. Brooks-Gunn & Duncan (1997) and Walker et al. (2007) showed that malnourished children could experience high rates of malnutrition and increase exposure to infectious diseases caused by insufficient sanitation. Malnutrition may cause devastating consequences on physical and mental health of children, such as underweight (weight for age), stunting (height for age) and many diseases and illness, insufficient protein-energy, and inadequate of many other micronutrient, all these problems impair cognitive ability of children

2.1. Cognitive ability and its measurements

The terms ability and cognitive ability are in common usage in everyday talk and in scientific debate among educators, psychologists and many others scientists. The question is to know what cognitive ability is about. Cognitive ability has been defined by Greenhaus & Callanan (2006) and Carroll (1993) as the mental process of knowing that includes aspects of awareness, perception, reasoning, understanding, judgment, reading and mathematical reasoning. There is a linkage between cognitive ability and the ability of learning, remember, problem-solving, and the ability to pay attention. Different studies administered a large number of tests to measure cognitive ability.

Some studies use IQ measure, another measure sometimes used is the level of a child's speaking, verbal communication but one could also look at vocabulary test. Dickerson & Popli (2016) used naming vocabulary test to measure the language development and oral communication. They also used pattern construction, word reading test to measure the capacity of solving a problem, the level of thing, the child's educational knowledge of reading and child's receptive (hearing) vocabulary. Dahl & Lochner (2012) and Guo & Harris (2000) measured the level of child in word recognition, pronunciation, reading comprehensive, and the child's achievement in mathematics. Duncan & Brooks-Gunn (2000) measured cognitive ability through IQ through reading. There are a long list of cognitive measurements, this paper tried pick up some them (for more details, see the related cited papers). These measurements have been used by many researchers from different areas and countries. The selected children were given the same chance to sit for the same test in the same condition, which proves the quality of these tests.

2.2. Parental investment

Parents have to provide a good environment that allows their children to grow, develop and reach the potential emotionally, intellectually and physically. In addition, it is obvious that children succeed academically when they are well-prepared, and parents have to take time and help their children. However, it is difficult for poor parents to help their children doing well at school since poor parents devote all of the resources and more time looking for food and they do not have time, even non energy left to allocate for improving their children's ability.

Some researchers tried to measure parental investment, they use home learning environment as a measure of parental investment which covers a range of aspects of the parents and children relationship including (parent-child conversation, how parents interact with their children, reading to the children, helping children understand the homework, the time devoted to listening their children, School support, learning materials, language development, regular bed time, how often a child paints or draw at home, how often a child is helped with reading, how often the child is helped with writing, and with mathematics, and how often the child visits the library how much he/she watches TV and whether parents smack or shout at the child when he/she misbehaves (Dickerson & Popli, 2016 and Duncan & Brooks-Gunn, 2000).

Guo & Harris (2000) used the same kind of measure to measure the cognitive stimulation (books, magazines, mother reading to child record or tape and museum visits).

Poverty reduces the capacity of parents to invest in their children. The amount of money available to buy children's books, toys and other learning facilities are correlated by the level of parental income while the learning facilities are very important to stimulate the cognitive ability of a child. Having many other siblings also reduce the amount of money invested in education of the children as a large amount of money may be mobilized in family food.

Furthermore, parental investment is negatively associated with low income, influences the capacity of parents to provide an adequate and positive learning environment for their children, which in turn may negatively affect children's school outcomes. It can constitute a barrier for their children to enter school at early years while a research shows that entering school at early years has a positive effect on cognitive ability during the childhood (Stephen, 2013). In addition, low income families are stressed by the necessity to make ends meet (earn just enough money to live on) and raise their children in unsafe neighborhoods with less community resources. These stresses may lead to mental health problem such as depression, harsh, inconsistent practices, difficult for parents to provide care for their children, which lead to poor parent care, less or lack of emotional love and cognitive environment foster children's cognitive and emotional growth.

2.3. Malnutrition

According to World Food Program malnutrition refers to *"a state in which the physical growth of an individual is impeded to the point where he or she can no longer maintain adequate bodily performance process such as growth, pregnancy, lactation, physical work and resisting and recovering from disease"*.² Malnutrition can result from lack of proper nutrition caused by not having enough to eat, not eating enough of the right things or lack of a nutritious diet in low-income families and insufficient intake of nutrients and calories that does not meet the increased demands of child's body. Bourdillon and Boyden (2014) report that malnutrition causes physical and mental damage that can last a lifetime and can permanently limit the size and status of the future adult. These physical and mental limitations can create a 'malnutrition trap' in which malnutrition is transmitted from one generation to the next.

² <https://www.wfp.org/hunger/glossary>

These all problems are the results of poverty which is positively correlated with malnutrition because poverty reduces the amount of money available to buy the adequate nutrients which in turn lowers cognitive ability of children. In addition, malnourished children could be repeatedly ill, irritable, frustrated, lack iron, iodine, zinc, vitamin A or folate, stunting, underweight and many other micronutrients which can impact growth and immunity, some can cause specific clinical conditions such as anaemia (iron deficiency), hypothyroidism (iodine deficiency) or xerophthalmia (vitamin A deficiency) (Bank & Ainsworth, 2010; Ejide, 2013). All these consequences could lead to the intellectual disability which in return hinders cognitive ability of children. This term is used when a person has certain limitations in mental functioning and in skills such as communication, self-help, and social skills. In view of that, these limitations will cause a child to develop and learn more slowly than a child without malnutrition problem (Symaco, 2014).

Malnutrition is measured by low birth weight and stunted (low height-for-age) iodine and iron deficiency. According to World Health Organization, low birth weight refers to a birth weight of live-born child of less than 2,500 grams.³ This measure does not only reflect the status of new baby but also the nutrition status of the mother during pregnancy. That being said, the infant's growth and development are influenced by the past nutritional status of the mother. From this one could say that malnutrition is an intergenerational problem. Malnourished mother before and after pregnancy is at higher risk to suffer from iron deficiency and consequently give birth a child suffers from stunted physical, low birth weight and cognitive development. These measures are used by comparing the status of children with a reference for health children.

³ <http://www.who.int/nutgrowthdb>

3. EMPIRICAL LITERATURE REVIEW

Table 1: Summary of the empirical literature review

Link	Papers	Outcomes(IQ,SD etc	Relationship	Quality of paper
1 . Poverty and parental Investment	[3]	(Regular sleeping) ratio 1.4 Poor child to no poor child	Poor child can sleep well	Relevant reviewed study which focuses on the national longitudinalsets. It found the correlation effect.
	[16]	Using standardized coefficients, Poverty affect negatively the cognitive stimulation (learing materials such books, toys etc.) by 0.18,physical setting by 0.25 and parental style by 0.11	Poverty decrease the capacity of parents to provide learning materials and affect negativel the parents behavior	Good empirical study with large sample from national longitudinal survey of youth (12,686). The paper found causal effect . The use of structural equation model allow researchers to capture the endogeneity issues.
2. Parental investment and cognitive ability (indirect effect of poverty on parental investment which in return induce lower cognitive development	[7]	Parental Investment increase by1SD at age3 rises cognitive development age 5 by 0.269SD through an increase of language and communication measured by naming vocabulary test and capacity of problem solving and the level of thinking measured by pattern construction test Indirect EF: at age 5 is 0.387SD 11 percentile ranks age 7 is 0.479	Increase in parental investment induce an increase in cognitice ability	Relevant empirical study which uses a large sample cohort data(19,000). It found causal effects using structural model to deal with endogeneity issues .
	[9]	Literature reported low parental investment lead to s conflict between child and parents, lower school grades, reduced emotion resulting from economics pressure of parents	Low income parents report a higher level of frustration and aggravation with their children.	Good one, well documented and well known researcher.
	[3]	Grade repeated 2 Drop out 2.2	Low parental investment reduces lower cognitive ability through grage repetition and dropout aout.	Relevant reviewed study which focuses on the national longitudinalsets. It found the correlation effect.
	[16]	Using standardized cefficients,the found that Poverty reduces cognnitioce stmimulation by 0.18 which in return induces lower intellectual development by 0.34 Parental style induce lower intellectual development by 0.10 and physical settings reduces intellectual development by 0.04	parental investment influence negatively the intellectual development though, reading pronounciation, reading and comprehension, mathematics and vocabulary Positive relationship	Good empirical study with large sample from national longitudinal survey of youth (12,686). The paper found causal effect . The use of structural equation model allow researchers to capture the endogeneity issues
3 Parental investment and malnutrition	-	-	-	-
4 Poverty & malnutrition	[3]	Underweight(low birth weight 1.7 Illness 2.0times;Stunting (height for Age) 2.times,1.4 times days spending in bed.	Poverty increases malnutrition, there is a positive relationship	Relevant reviewed study which focuses on the national longitudinalsets. It found the correlation effect.

5 Malnutrition and cognitive ability	[3]	Ratio of Poor children to non poor children: Developmental delay 1.3 times Learning ability 1.4 times School drop out 2 times	Malnutrition has negative effect on cognitive ability of children	Relevant reviewed study which focuses on the national longitudinal sets. It found the correlation effect.
	[20]	Stunted children (growth retardation) affect social and emotion ability of children measured by developmental quotient (6 to 13 DQ) equivalent to 0.4 to 0.8 SD.	Growth retardation reduces development quotient of children (delay in development)	Good on it, it used cohort study and randomized trials.
	[17]	Children with were lower in IQ than better off children 9 to 13 IQ equivalent to 0.8 to 0.9 SD	iodine deficiency producing reductions in IQ	The paper uses meta-analyses with a large sample size (12,291 children). It reviewed the published original studies
6 Poverty and cognitive ability (Income and math & reading scores)	[5]	a 1000\$ increase in Family Income raise combined Maths & reading scores by 6% SD	Increase in family income lead to an increase of cognitive achievement.	Relevant empirical used data sets from national longitudinal survey of youth with sample size of 4,500 children. It used instrumental variables strategies to deal with endogeneity issues and for eliminate omitted variables measurement error. They study the Causal effect of income on child's math & reading
	[7]	At age 3 is 0.452 SDs 13 percentile below NP. (total effect 0.517 SD 15 ranks) Age 5 is 0.099 SD 3 percentile lower (total effect is 0.468 SD 13 ranks lower) Age 7 is 0.182 SD 5 Percentile ranks lower (total effect is 0.661 SD 19 ranks lower)	Poor children born in poverty and continue to live in poverty up to age 7 exhibit lower cognitive test scores, compare these who never experiences poverty	Relevant empirical study which uses a large sample cohort data (19,000). It found causal effects using structural model to deal with endogeneity issues. Good, this article focus on the causality
	[8]	Class repetition as a measure of Cognitive achievement 65% Children repeated at least one class during primary school. Increase of one quintile reduce the probability of school repetition by 0.262 while increase the education level of child by 14%.	The paper report that a decline in poverty is inversely related to school dropout, grade repetition and increase the level of schooling.	Relevant empirical study which uses survey data with sample of 1,800 households. It used instrumental variable method to deal with endogeneity issue and found causal effects.
	[15]	Any negative shock in household income (due to weather condition, crop shocks) by rises the probability of school dropout. Having younger brother increase the probability of school drop out	Negative effect through a decrease of school drop out	The use of five round of household panel data from four regions of rural Madagascar with big size (2,200)
	[13]	By comparing children from bottom and top quintile, Poverty at birth lowers IQ at age 7 to 9 by 0.42 to 1.25 SD	Negative influence on cognitive ability of children	Using literature review and some descriptive statistics. Their findings fit with existed literature. However, the study analyses the correlation not causality

3.1 Parental investment and cognitive ability

Poverty is negatively correlated with parental investment which in turn is positively correlated with cognitive ability. Poverty reduces the amount of parental resources available to invest in their children. Consequently, it affects the child's cognitive ability through reduction or lack of cognitive stimulation, availability of learning materials such toys, books, while an increase in parental income induces increase of the amount of money invested by parents in their children. Dickerson & Popli (2016) reported that when parental investment increases at age 3 by one SD, it raises the cognitive ability of a child at age 5 by 0.269 SD which is equivalent to an increase of 8 percentile ranks.

These findings are in line with evidences of some researchers: Dahl & Lochner, (2012) and Dumas & Lambert (2011), who suggested that any increase in parental income or wealth induces higher level of school performance.

One of these researchers shows that an annual increase in parental investment by \$1000 in the USA rises the mathematics and reading scores by 6% of standard deviation (Dahl & Lochner, 2012). On one side, a recent research indicates that due to economic hardship, 65% of Senegalese students who completed primary school have retaken a class at least once, which indicates their low cognitive ability to continue in the next class resulting in low performance of students. On the other hand, a shift of one quintile in parental wealth or income in Senegal rises the education level of children by 0.37 which is equivalent to 14% and reduces the probability of grade repetition by 0.262 (Dumas & Lambert, 2011). Dickerson & Popli (2016) showed that poverty reduces the capacity of parents to invest in their children, which in return exerts a large negative effects on poor children compared to non poor children. A poor child exhibits a lower cognitive ability scores than the non-poor child with the magnitude of 0.452 SD which is equivalent to 13 percentile ranks lower than a non-poor child. A child born in poverty and who continues to live in poverty at age 3, 5 and 7 has a negative cumulative effect on cognitive ability of a child with the magnitude of 0.517, 0.468 and 0.661SD which is equivalent to 15, 13, 19 percentile ranks lower at age 3, 5 and 7 respectively than the children who have never experienced poverty .

Another recent study reported that in 64 developing countries, every 10% increase in the prevalence of poverty is associated with a decrease in the number of children completing primary school by 6.4%. By comparing bottom and top quintiles in children from poor and richest families, wealth quintiles at birth is linked to lower IQ at age 8 in the Philippines, at age 7 in South Africa, and at age 9 in Indonesia in Brazil and Guatemala with the magnitude of 0.70 to 1.24 SD scores respectively. In addition, the study reported a large gap between children from low income families and children from better-off families. In Uganda, poor children were 10 times more likely to enter or start school later on than non-poor children while in Zambia it is 4 times (Grantham-McGregor et al., 2007).

Taking into account those findings, one can say that parental investment is one determinant of poor cognitive ability for children. When parents fail to provide learning facilities or lack cognitive stimulation, it impacts negatively the cognitive ability of children. Guo & Harris (2000) reported poverty affects negatively the cognitive stimulation with the magnitude of 0.18 SD while cognitive stimulation which is considered as parental investment in other researches is positively linked with the intellectual development with the magnitude of 0.34 mean SD. Those results show that poverty exerts a large negative effect on the child's home environment. This means that poor parents do not have the capacity to invest much money in their children, which in turn affects negatively home learning facilities, including how many times a child is taken to the library, number of hold by childre, toys and other learning materials that are aimed to stimulate a child's cognitive ability. In addition poverty could disturb the parental behavior vis-à-vis their children. Therefore, home environment or cognitive stimulation or simply parental investment is considered as a bridge through which poverty affects negatively the children's cognitive ability.

A recent study reported higher cognitive functioning in children in case children are provided with additional learning materials. Walker et al. (2007) report that 60 to 90 % of children in developing countries lack cognitive stimulation and learning opportunities. Only 10% of parents are able to provide the materials that can stimulate cognitive of the children (Walker et al., 2007). Some studies indicated that any transition changes in family income are associated with children's school dropout. This implies that parents facing the transitory income shock in rural Madagascar tend to take out of school their children. In addition, family size (with many siblings) increases the probability of school dropout. Gubert & Robilliard, (2008) reported that any negative shock in household income increases the probability of school dropout.

The results also show that having younger brothers during the period of transitory income increases the probability of school dropout. Furthermore, results indicate that the probability to drop out of school is higher for boys than girls and increases to reach 40% for boys and 35% for girls at age 18. These findings illustrate that poor parents tend to remove their children from the school. The intuition behind is that an increase in parental investment boosts up cognitive learning material, and reduces school dropout because students do not divert the time on working. Instead, they concentrate on their studies.

Furthermore, one could say that economic hardship experienced by parents is most of the time linked with depression, emotional stress and irritability. These qualities may cause parents to become authoritarian instead of friendship, inconsistent, punitive instead of collaborative which can cause the conflict between parents and teenagers, generally non supportive of their children. Consequently, these qualities cause less satisfactory social, emotional and cognitive development. As Guo & Harris (2000) reported, these bad qualities constitute parental style which is negatively influenced by poverty with the size effects of 0.11 mean SD. In turn, it exerts a positive influence on children's cognitive development with the magnitude of 0.10 mean SD. Consequently, low income may be the root of parental stress, depression and irritability leading to a deranged parenting style which in return disturbs the parent-child relationship and this may lead to poor long-term outcomes for the children.

Considering these findings, one could say that parental investment acts as a mediating factor of poverty and exhibits a large and persistent effect on children's cognitive ability. It could be said that an increase in parental investment corresponds to a decrease of grade repetition, an improvement in reading and mathematics score, an increase of school performance, and a rise in education level. That being said, it turns out that the more a family poverty decreases, more parents increase the amount of money spent to their children by providing better home environment, learning materials, improving quality of child care and by keeping children to school. This means that poverty reduction induces an increase in the amount of money and time that parents spent on the education of their children. However, an increase in parental investment does not necessarily mean an increase in the education of their children because a recent study conducted in 80 developing countries shows that 12% of children from top quintile of household never attended school. To this extent, an increase in parental investment could go hand in hand with some program aimed to help parents understand the role of children's education for their future life and for society.

3.2 Malnutrition and cognitive ability

Malnutrition as a mediating factor has a negative influence on physical growth, physical activities and mental retardation. Many studies have compared poor children who suffered from malnutrition to non-poor children. These studies generally reported that children who had suffered from undernutrition or malnutrition had poor physical health, development delay, learning disability and poor performance resulting in poverty (Brooks-Gunn & Duncan, 1997 and Duncan & Brooks-Gunn, 2000; Wachs et al., 2007).

Those studies report that poverty is the main cause of malnutrition. Brooks-Gunn & Duncan (1997) and Duncan & Brooks-Gunn (2000) both studies report the consequences of malnutrition on physical growth of poor children compared to non-poor children. They showed a high risk for physical health of poor children compared to non-poor children. They report that a poor child is 1.7 times as high for a low birth weight, 2 times as high for short stay hospital; 2 times as high for a stunting (height for age) and 1.4 times days spending in bed and 3.5 times.

Moreover, as already reviewed, comparing poor children with children from better off families, poor children experience risen rates of low birth weight and blood lead levels. In return, these conditions have been shown to increase rates of learning disabilities, grade repetition and school dropout with the rate of 1.3times, 2 times and 2.2 times respectively as high compared to non-poor children. Walker et al. (2007) showed a higher rate of stunted children(growth retardation) in developing countries. 31% have the problem of growth retardation result in malnutrition which affects negatively cognitive ability through social and emotional ability of children with the magnitude of 6 to 13DQ. These results are equivalent to an effect size of 0.4-0.8 standard deviations. A meta analysis showed 9-13IQ points difference comparing children from iodine deficiency with iodine sufficiency (Wachs et al., 2007). Another meta recent analysis of the study in China reported the same estimated comparison of 12.5IQ (Qian et al., 2005). These are equivalent to 0.8 to 0.9 standard deviations (SD) while comparing children with iron deficiency-anemia and non-iron deficiency 0.5-1.3standard deviations (SD) (Wachs et al., 2007). Some cross-sectional studies have shown connections between stunting and poor school progress. By comparing non-stunted children with stunted children, poor children were more likely to start school later in Tanzania, Nepal and Ghana; whereas in South Africa, Indonesia, Philippines, Brazil, Jamaica, and Peru stunted children compared with non stunted

(height for age greater than -1SD) were linked with less cognitive measurements with the size effect ranging between 0.40 and 1.05 SD respectively than non stunted children (Grantham-McGregor et al., 2007). The same study reports that in 79 developing countries, every 10% increase in stunting less than -2SD decreases the proportion of children reaching last grade of primary school by 7.9%. After controlling the years of schooling and parental income, the results of combined notion of reading and maths test scores for Philippines, stunted children were 0.72SD less than non-stunted children, while by controlling parental investment and grade repetition stunted children were 0.78 SD less scores in reading and maths than non-stunted children.

A recent study shows that low birth weight is negatively connected with lags developmental at nine months and at age 2 with the size effect of the infants score of 9.1 and 7.6 points lower than normal birth weight; and motor developmental at nine months and at age 2 with the magnitude of the infants score of 8.8 and 4 points score lower than normal birth weight which in turn hinders cognitive abilities of children (Datar & Jacknowitz, 2009).

Malnutrition cripples children, making them more vulnerable to disease, weaken their intellect, reduce their motivation and undermine their productivity. Malnutrition among children increases death, causes great physical and psychological suffering, and is the consequences of stunting and reduced life expectancy. Most of the time, malnourished child cannot go to school and has low physical health. These consequences impair the intellectual faculties of children by reducing the intellectual quotient, attention deficit which in return reduce the school performances of children. Malnutrition could have direct negative effects on child development in terms of disability and many diseases, low brain development, low education achievement or attainment; and additionally, it increases the medical costs. One could say that stunted children are more likely to become less educated adults, hence making malnutrition a long-term and intergenerational problem.

3.3 The most influential channel

The present paper reviewed parental investment and malnutrition as the pathways through which poverty could effect child's cognitive ability. The question is to assess which is the most influential driving factors of cognitive ability between parental investment and malnutrition. A study from (Dahl & Lochner, 2012) found that an increase of US\$1000 in parental investment

is reflected in a 0.06 standard deviation increase in reading and mathematics scores. This holds also for households which are on the threshold of poverty.

Assuming that children from poor families are concerned with stunted growth as a consequence of malnutrition, it can be inferred that an increase of US\$1000 in parental income could induce moving from stunted children to non-stunted ones. Another study comparing directly stunted children with non-stunted children Grantham-McGregor et al. (2007) found a 0.72 standard deviation difference in terms of reading and mathematics scores. If other (or all) things being equal, an increase of US\$1,000 induces both an increase in reading and mathematics scores by 0.06 standard deviation and moving from stunted children to non-stunted ones by 0.72 standard deviation, malnutrition seems to have a higher effect on cognitive ability of children.

Moreover, Grantham-McGregor et al. (2007), when comparing children from poorest and richest families, found that wealth in the bottom quintile at birth lowers intellectual quotient (IQ) by 0.70 to 1.24 standard deviation than children from the top quintile. Presuming that these children are also concerned with iodine and iron deficiency resulting from malnutrition, it could be deduced that wealth quintile at birth could cause lower intellectual quotient of children. Meta-analysis comparing children from iodine deficiency with iodine sufficiency (Qian et al., 2005; Walker et al., 2007) reported that 9 to 13 Intellectual Quotient (IQ) equivalent to 0.8 to 0.9 and Standard deviation respectively. That being said, parental investment seems to have a higher effect, but it is hard to compare.

In addition, reviewed study from Gubert & Robilliard (2008) found any negative shock in household income by one unit increases the probability of school drop out and having a younger brother during the period of transitory income rises the probability of school dropout. Assuming that transitory household income remains for a long period, and considering that children from poor families face stunting, this decline by one unit in household income could cause an increased probability of drop out by 0.079. Although, another study from Grantham-McGregor et al. (2007) reported 10% increase in stunting less than minus 2 SD induces an increase of the probability of drop out for children reaching last grade of primary school by 0.079 which indicates that, parental investment seems to have a higher effect on school dropout. The overall comparison shows that parental investment matters. In fact, an increase in parental investment could induce both an increase of purchasing power of parents that allows them to invest in the human capital of their children and an increase of the amount of time allocated to

their children. On the other hand, the economic hardship is associated with increased parental stress, poor health and parental depression, an increase in parental investment could induce a change in parental behavior toward their children which in return influences positively the cognitive ability of children.

4 .CONCLUSION

This paper analyses the effects of poverty on children's cognitive ability. It focuses more specifically on parental investment and malnutrition as mediating factors of effects of poverty on children's cognitive abilities.

The main objective of this paper was to contribute to the existing literature on how poverty impedes cognitive abilities of the children by highlighting the factors through which poverty influences the cognitive ability of the children. Many children in developing countries are exposed to the multiple risks for less development, malnutrition, poor health, learning disability, low brain development, low school performance, and many others.

The paper reviewed the related articles. First, Parental investment as mediating factor is related with different children's school performances or outcomes. The effect of poverty on cognitive ability was mediated by parental income. In crease if family income is associated with an improvement in health care, reduction in parental depression, and stress, increase in cognitive stimulation, dimensions linked to cognitive ability of children, and toschool outcomes of children, and the future human capital of the world.The increase in family income boost the cognitive abilities of children. In fact, a persistent increase in family income is negatively correlated with economics hardship, parents invest more in human capital of their children and improve health condition.

Secondly, the effects of poverty were indeed linked with malnutrition, which in return has devastating consequences on children's physical and mental development which reduce and hinder the cognitive ability of children. Most of these consequences may lead to poor health, low birth weight, low height-for-age (stunting), lower physical health, iron deficiency, iodine deficiency illness, delay in mental development and many diseases which may induce mental retardation. These diseases increase the cost of medical care. The parents cut back the income which could be used to invest in human capital of their children.

Although we attempt to analyze the link between parental investment and malnutrition, we predicted that parental investment could be associated with malnutrition, but we fail to find articles that provide empirical evidences on malnutrition and parental investment. Interesting for future research to find how parental income is linked with malnutrition.

The result of the present paper reports that a rise in parental investment is associated with a decrease of grade repetition, an improvement in reading and mathematics score, an increase of

school performance, and rises education level. In addition, the present paper find that the consequences of malnutrition impaired the intellectual faculties of children by reducing the intellectual quotient, attention deficit, and finally reduce the school performances of children. The question regarding the factor matter, by comparing the effect sizes for both malnutrition and parental investment, the results report that parental investment seems to matter more.

Although increase in parental investment can result in enhanced learning, cognitive materials, change in parenting behavior and improved health care. In addition, given the severe consequences of malnutrition such as low birth weight, stunting, iron and iodine deficiency on child's cognitive ability, the paper reports that parental investment matters, the future research could focus on the link between malnutrition and parental investment because most of the time lack of parental investment go hand in hand with malnutrition.

The present paper suggested that there is no unique pathway through which poverty could operate on cognitive abilities of children. Governments should undertake programs such as Public works programs. Public works programs in developing countries can reduce poverty in the long term and help low skilled workers cope with economic shocks in the short term. These aim at improving the capacity of parents in order to provide the cognitive stimulation in terms of materials. In addition, intervention to encourage parental commitment or engagement in reading to their children and help their children doing homework, improve home environment and the quality of parental interaction with their children are also recommended. While an improvement in cognitive activity such as extracurricular activities (Dahl & Lochner, 2012; Dickerson & Popli, 2016; Yeung, Linver, & Brooks-Gunn, 2002). These programs could emphasize on improving parenting behavior and their psychological change of well-being. (Duncan & Brooks-Gunn, 2000).

Moreover, malnutrition increases susceptibility to disease and leaves people powerless and lethargic, reducing their ability to work. Thus, it reduces productivity, hampers economic growth and investment efficiency in the areas of health and education, and increases poverty. Government authorities may undertake preventive measures and programs such as food stamps, Increase in maternal childcare knowledge, one cup of milk per child, the special supplemental food program for women, infants, and children and school nutrition programs could be successful at providing food assistance to low-income children, starting with the prenatal period and continuing through the school years. The food stamp program provides food assistance to all households solely on the basis of financial need and to the food

assistance safety net for low-income children. The increase in maternal childcare knowledge through nutrition/health education may contribute significantly to child's nutritional status , if there is concurrent improvement in socio economic circumstances of people living in deprived conditions. One cup of milk per child, milk has several advantages in fighting malnutrition. It is also a complete food that has proteins and key elements that are important for growth of children and for the support of pregnant mothers and is very high in calcium which is needed for bone development in infants. The government could promote it as a single major solution to malnutrition. The special supplemental food program for women, infants, and children program could help to reduce the prevalence of iron-deficiency anemia in infants and children and may induce increase intakes of certain targeted nutrients for program participants. These programs could have a positive effect on physical health and cognitive ability of children.

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