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Microcredit and Children's Cognitive Outcomes: Evidence from Indonesia

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Dedication Page

"For the one who consistently believes in me that I can reach anything even my mind constantly deny. I dedicated my signature work to you, Cynthia Centauri, MD, SpA (pediatrician). After all the ups and downs and the long journey through the winding roads, Let's take a short break, and enjoy all these moments. You (us) deserve it, Honey!"

"Thank you for bringing out the best in me. Ik hou van je!"

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List of Acronyms

BPR	*Bank Perkreditan Rakyat*/Rural Bank
CAPF	Cognitive Achievement Production Function
CLAD	Censored Least Absolution Deviation (CLAD)
DiD	Difference in Difference
ECD	Early Childhood Development
ECV	*Encuesta de Condiciones de Vida* (The largest multi purpose household survey in Ecuador)
EPF	Early Production Function
IFLS	Indonesian Family Life Survey
IV	Instrumental Variable
MFI	Microfinance Institution
NLSY	National Longitudinal Survey of Youth
OLS	Ordinary Least Square
OECD	Organization for Economic Cooperation and Development
PCE	Per Capita Expenditure
PCI	Per Capita Income
PIAT	Peabody Individual Achievement Tests (PIAT)
PISA	Program for International Student Assessment
PPVT	Peabody Picture Vocabulary Test (PPVT)
RCT	Randomized Control Trial
RDD	Regression-Discontinuity Design
ROSCA	Rotating Savings and Credit Associations
TIMSS	Trend in International Mathematics and Science Study
TVIP	*Test de Vocabulario en Ima'genes Peabody (*Spanish version of PPVT)
WHO	World Health Organization

Abstract

This paper studies the effect of microcredit on children's cognitive outcomes using panel data from Indonesia. The research paper attempts to provide novel evidence on the effect of microcredit on non-monetary outcomes such as human capital formation in children. To this end, the paper investigates the association between microcredit participation and the children's cognitive test score in two periods of time.

The data comes from the Indonesian Family Life Survey (IFLS), allowing for a panel analysis and a rich set of co-variate. The first two results from the analysis of descriptive statistics and household wealth indicators suggest that borrowers are wealthier and the microcedit participation notably generates income. However, there is no significant effect on child education. Further, there is suggestive evidence that microcredit is negatively associated with cognitive scores, yet the effect is insignificant and not robust. The paper then examines possible channels through which microcredit may impact child outcomes. It is found that microcredit does not increase the likelihood that mothers work nor the age of children. In sum, there is little evidence that microcredit impacts cognitive outcomes – for better and for worse. Further work is needed to examine the robustness of this finding and other channels and related heterogeneities.

Relevance to the Development Studies

The study contributes to the extensive inconclusive discussion of the microcredit effect on human capital formation like child education outcomes. In particular, the paper emphasised on the Indonesian context of microcredit utilization on producing children's cognitive skills.

Many scholars, development specialists, and government officials consider the well-acquired education may enhance the inter-generated household welfare. The statement is coherent with many government programmes aiming to eradicate poverty such as social net, education and health care subsidy. Therefore, this study resonates with the government objective that it is seen as an attempt to link between the relaxation of credit constraint and human capital investment in education.

Keywords

Microcredit, microfinance, MFI, cognitive outcome, IFLS, channels, mechanisms, Cognitive Achievement Production Function (CAPF), fixed effect model, control variables.

Chapter 1 Introduction

1.1 Background

The idea of noble prize winner Muhammad Yunus to disburse micro-loans to inhabitants of small villages in Bangladesh in the 1970s has changed the assumption that poor people are ineligible for financial aid by formal institutions. A massive empowerment programme for the poor and unskilled people now seems plausible. These people are given a small amount of credit without collateral or deposit, and most of them are able to repay the loans. This programme has inspired many leaders and has been replicated in other continents (Armendáriz de Aghion and Morduch 2005).

By the end of 2013, microcredit had scaled to an unprecedented level in terms of coverage and size of the economy. The Microcredit Summit Campaign (2015) reported 211 million microcredit participants all over the world. In the Asia Pacific region with the largest penetration, in 2012, out of 182, 4 million poor people, 125,53 million were given credit by microfinance institutions (Baskara 2013). The microcredit programme no longer depends on donors but has advanced enough to function as a commercial and institutional organisation. Microfinance experts, researchers, and policy makers are in the midst of discussions on the advantages of microcredit beyond economic impact such as business, savings, or consumption. The focus is on financial inclusion based on the measurement of the outreach, sustainability of the programme and institutions, and larger impact of the programme (Ledgerwood et al. 2013).

Considering the result of evaluation studies conducted decades ago, it was found that the programme has a positive, direct impact on increasing household income, savings, and consumption by reducing financial constraints and increasing business creation and performance (See the series of studies: Pitt and Khandker [1998] in rural India, Weiss & Montgomery [2005] in Asia and Latin America, Attanasio et al.[2014] in Mongolia, Kaboski & Townsend [2011, 2012] in Thailand, Augsburg et al.[2012] in Bosnia-Herzegovina)[1].

The interventions of micro-lending programmes also attracted researchers to carry out studies on aspects other than the direct economic implications. By incorporating a series of channels, they attempted to determine whether the relaxation of financial constraints would strengthen a household's income-generating capacity. This would lead to the possession of both physical and intangible assets. In the long run, it is assumed they have skills and ability to allocate household resources to human capital formation and other facets of human life.

[1] See also Banerjee (2013) that provided the comprehensive review of contemporary microfinance literature.

For instance, the programme was indicated to have a positive influence on women's empowerment, improving their participation in a household's decision-making process (Pitt and Khandker 1998) and enhancing their knowledge, e.g. preventing childbearing through the use of contraceptives (Ervani 2014, Buttenheim 2006, Schuler et al. 1997). Another study revealed that participation in microfinance may give a household the ability to achieve consumption smoothing during the adverse situations such as illness (Gertler et al. 2002) and lean season (Pitt and Khandker 2001).

Furthermore, it has been accepted that the most effective mechanism to accumulate human capital is investment in child health and education at the micro-level of a household. In the context of health outcomes, Deloach and Lamanna (2011) found that the presence of microfinance has a negative influence on children's height, with social capital and women empowerment nurtured in the lending group. On the contrary, the research of Armendáriz de Aghion and Morduch (2005) indicated that microfinance programme may prevent the decline in household health expenditure.

There are mixed results on the impact on children's education. This is because the researchers used a different point of view regarding the way children lived in poor households. They could be attending school, working in a household enterprise and/or be taking care of younger siblings, and doing domestic chores.

The other reason is the different research methodologies applied that lead to dissenting arguments and conclusions. Some argue the children of microfinance borrowers have higher chances of going to school, low schooling gap, and low likelihood of being removed from school (Maldonado and Gonzalez-Vega 2008), with a "…tendency to have better nutrition and health" (Littlefield et al. 2003:3-4) and reducing the prevalence of child labour (Shimamura & Lastarria-Cornhiel 2010). In addition, Becchetti and Conzo (2014) argued that microfinance has a positive effect on children's school attendance in the relatively higher living standard districts and at a further distance from school while Holvoet (2004) claimed that daughters of mothers engaging in microfinance had higher benefits in education. In the economic perspective, Golan (2009) and Doan et al. (2014) found the microcredit programme positively affected the total household educational expenditure in Indonesia and Vietnam, respectively.

However, in contrast, it was found that microcredit could lead to a household plunging into the poverty trap since for advancing a household's business force, the children will be forced to engage in labour instead of schooling (Islam and Choe 2009, Setyari 2012). These results are different from those pointed out by Coleman (1999) and Duflo et al. (2013), who showed that there is insignificant association between participation in microfinance and children's education or health as well as women's empowerment (You and

Annim 2014). Kondo et al. (2008) showed that there is no significant impact on human capital investment.

The results of the effect of microcredit on human capital formation are inconclusive, with some suggesting positive impacts in many different measurements and others indicating the opposite. Probably, previous studies emphasised only the short-term impact, leaving excessive room for further research on the medium and long-term impact of microfinance (You and Annim 2014). Moreover, Islam (2011), as cited in You and Annim (2014), argues that the indirect impact needs a long time to be measured since the household recipients need to capitalise the loans before earning the return on investment by building their own credit credibility and reinvesting the profit on children's health and education. Therefore, if a household head takes a decision to keep the children in school instead of having them engage in work, it means the future return on investment in education is predictably higher than that on child labour (Islam & Choe 2009, Becchetti & Conzo 2014).

In the context of outcomes, the researchers use schooling gap analysis, years of attendance, and total educational expenditure. These proxies can be categorised as the input of schooling process while there is a paucity of studies on the next phase of quantitative outcomes in the terms of grades or score tests. Possibly, the nexus may show higher precision when investigating the indirect influence of microfinance on a household's preparation for the future generations. Ample evidence supports the important role of cognitive development. The tests taken by children and adolescents are found to be good predictors of labour market success. This conclusion has attracted researchers to examine the determinants of inequality in adult earnings using premarket factors, defined to represent "…inherited ability, the effects of family background and the influence of schools" (Todd and Wolpin 2006:1).

Moreover, it is already common knowledge that "…educational achievement is one of the most important predictors that may contribute to children's future economic well-being" (Haveman & Wolfe 1995, McLahan & Sandefur 1994 as cited in Zhan 2006). Hence, it is suggested that children with higher cognitive skills and grades have the tendency to gain better jobs and income in the future. As a result, the parents will expect the return on investment on education to enhance the intergenerational welfare.

On the one hand, with regard to microcredit, it is assumed that microfinance has an impact in the long run on children's cognitive achievement through several channels. The channels theory developed by Maldonado and Gonzalo-Vega (2008) can be used to predict a child's cognitive development, which has been discussed in studies on socioeconomic status (SES), parenting and children endowment ability (Todd and Wolpin 2006, Paxson and Schady 2007, Heilmann 2013). On the other hand, microcredit enables a family to take a

loan for a business and then have less time for their children to stimulate their cognitive development processes. It is also imperative to control other vital factors that may affect cognitive performance like the premarket factors. Therefore, it is crucial to investigate these contradicting hypotheses for fulfilling the government's objective of providing financial access to poor people and improving their level of well-being.

1.2 Justification of the Study

Considering the country-level perspective, Becker (1993) found that investing in human capital in healthcare and education can drive a country's development by increasing the economic growth. Bardhan and Udry (1999) found that improvement in healthcare and education makes a positive contribution to a nation's development process. Galor and Moav (2004) support those claims, arguing that the nation's "..income inequality can be decreased by replacing the engine of economic growth from physical capital accumulation to human capital accumulation" (Galor and Moav 2004:1021).

Robinson (2002), Golan (2009) and You & Annim (2014) asserted that many Indonesian microfinance borrowers use part of their credit assistance to pay for education. However, there is a lack of extended studies on the outcome of investment in education. In fact, when we consider the human capital investment perspective, improved education/academic achievement is not the only factor to be attained or possessed. However, it is one of the most practical long-term instruments to improve the human capabilities since measuring the children's health is more difficult and requires larger relevant and reliable assessment data sets.

In addition, the microcredit intervention can also be seen as the policy recommended in many studies on children's cognitive achievement (Guo 2000, Yeung et al. 2002, Fernald et al. 2012). They suggested that it is imperative to establish large-scale economic intervention policies to ensure higher school enrolment by enhancing the parent's economic ability, so they can provide "…a better environment for their children' growth and development" (Fernald et al. 2012:17278).

The assumption above is supposed to be a reasonable argument to relate the microcredit program to the outcome of human capital formation. It is argued that there is a lack of research in Indonesia on the impact of microcredit effect as a tool for shaping the future generation. This paper attempts to contribute to this subject since no previous study has observed the impact on aspects other than school enrolment. Hence, the results of this paper can provide initial empirical evidence in order to enhance the policy-making process on setting the microcredit regulation per the human capital development perspective. Besides, it could be a starting point for other researchers to enrich the evaluation on Indonesia's microcredit situation in terms of quantitative analysis.

1.3 Research Objective

The main objective of this paper is to examine the hypothesis regarding the two possible directions of the effect of microcredit access on the outcome of children's cognitive development, where the proxy will be a step further than existing studies. To do so, the author will start the analysis with the effect of microcredit on household welfare indicators. This first analysis is imperative to capture the difference between treatment and control groups on SES.

The second part examines the direction of the effect of microcredit participation on children's cognitive score by examining the sensitivity of each channel, replicating Maldonado and Vega's (2008) theory. In addition, the paper examines mother-child interaction and children's age as the channels pertaining to microcredit may affect cognitive scores. These selections are considered crucial determinants of the cognitive achievement production function (CAPF), developed by Todd and Wolpin (2006).

1.4 Research Question

In order to attain the research objectives, this study will address the following question:

"How does microcredit participation affect the outcome of children's cognitive development?"

To address the research question, the following sub questions will be considered:

1. Does microcredit participation affect the cognitive score compared to that of a non-borrower household? If so, to what extent and what is the direction of the effect?
2. Out of the five effects of the channel theory, which has the most significant sensitivity?
3. To what extent do the parent-children interaction input and children innate input (age), as the mediation factors for microcredit, affect the cognitive score?

1.5 Scope and Limitations

This paper aims to measure the association between microcredit participation on children's education outcomes. Owing to data limitation and the context of Indonesian microcredit, this research was unable to observe the situation before the microfinance intervention. Consequently, the before-after and difference-in-difference analyses could not be performed. The analysis focused on the effect of microcredit participation controlled by five determinant inputs on the change in cognitive outcome in t1 (IFLS4) and t2 (IFLS5).

This research only examined the effect of parent-children interaction, mediating micro-lending, on children's cognitive attainment. This variable is one out of four essential determinant inputs of children's achievement along with mother's cognitive possession, child's innate ability, and school input –these three variables were not analysed owing to the

limitation of time and data availability. However, the last two inputs were included in specification model as covariates to accommodate the determinant inputs of cognitive theory.

1.6 Chapter Outline

Chapter One	This chapter presents the motive behind the research, the hypothesis, research objective, as well as the limitations and scope of the study.
Chapter Two	The second chapter considers the fundamental theoretical frameworks of children's cognitive achievement and the association between microcredit and the outcomes. It will also comparatively analyse the result of existing studies.
Chapter Three	The chapter presents a contextual description of Indonesian microcredit and children's cognitive achievement.
Chapter Four	This chapter provides the data sources, research methodology, and estimation models as well as the reasoning behind using the explanatory and dependent variables.
Chapter Five	This chapter discusses the descriptive statistics of the data source and results of statistic tests.
Chapter Six	This chapter provides the regression result.
Chapter Seven	The last chapter draws the conclusion and formulates the policy recommendations.

Chapter 2 Literature Review

2.1 Introduction

The first section discusses the underlying theory of the determinants of cognitive achievement and the channels of microfinance that influence children's education. The author incorporated these theories in two stages: in the first stage, it is a bridge that links microfinance to school enrolment and the second, it is a mechanism that links school enrolment and other control determinants as the input factors for cognitive performance. It is imperative to rationalise the prediction of the effect of microfinance on children's cognitive attainment.

The second segment reviews the results of previous empirical studies on both children's cognitive development and microcredit participation. It will then present the conclusion incorporating both theories to accommodate the research objectives.

2.2 Theoretical Framework

2.2.1 Children's Cognitive Achievement and Its Determinants

The underlying theory of children's attainment was developed by psychologists and sociologists while the economists came in late with a focus on the construction of a formal model of the achievement process (Haveman and Wolfe 1995). Hence, this paper discusses the theory both in terms of psychology and economics to enrich the knowledge on children's cognitive development.

2.2.1.1 Psychology

It has been acknowledged that intellectual intelligence or cognitive skill is not the single entity of the developed human mind for acquiring new knowledge. Gardner's (1993) concept of multiple intelligence has had a significant impact on educationalists who then rethought the concept of mind development[2]. However, the very first skill that children must be equipped with to understand daily events is cognitive skill; if this is not achieved, they may fail to grow optimally (Flavell et al. 1992).

The theory of cognitive achievement is strongly related to the underlying theoretical frameworks of children's cognitive development, which define the input, process, and output factors. The main difference between cognitive and intellectual development is the role of heredity or genetic factors and the culture factors also known as "nature vs. nurture".

[2]For a detailed explanation, see his most signature works on Frames of Mind: The Theory of Multiple Intelligences (1983) and Multiple Intelligences (1993).

It then defines the opposing concept of whether the cognitive skills are naturally inherited or generated from and influenced by the children's environment (Smith 2002, Sternberg 2002).

To name a few, Piaget's theory and Vygotsky's concept are the most celebrated frameworks in modern psychology for modelling the process of children gaining the knowledge (Goswami, 2002). Piaget denied the contestation between nurture and nature and the central idea in his theory of children's cognitive development is children's self-action and experience. The theory presents a constructivist perspective as per which intellectual growth consists of assimilation, accommodation, and equilibrium. He believes that action is the basis of knowledge, meaning children actively acquire new information, assimilate it using their senses and mind, rethink it (accommodation), and construct it into new knowledge (equilibrium)(Smith 2002, Pound 2005).

The theory defined four stages of development based on the complexity of the knowledge children could construct, which was automatically clustered by age[3]. This experience of active learning happens repeatedly and continually with age and reaches each of development stage sequentially before reaching adulthood (Smith 2002, Pound 2005).

Vygotsky's theory has a slightly different point of view. While Piaget stresses on intellectual construction, his model underscores the crucial role of social context and culture which is delivered effectively through language being central to the development of a child's cognitive ability. He states that children use language to attain the knowledge derived from intense interactions with their environment and cultural development. Therefore, the innate abilities of children, both mental and physical, are not the sole determinants shaping their cognition. He assumes children's intellectual ability works together and is mediated by social stimuli and cultural stimuli (Goswami 2002, Smith 2002, Pound 2005).

Then, this theory was developed by the new theory of connectionism and information-processing approaches to a new alternative cognitive development model since the above mentioned theories had limitations owing to the lack of empirical evidence[4]. The theory follows the main idea of Piaget, where awareness of their memory capacity and the decision to process or ignore the new information into new knowledge forms the centre of the model. Cognitive development is achieved by the complexity of the information processed. The theory emphasises the nature of input and output and connections through which children gain the cognitive skills and also follows Vygotsky's model by the inclusion of environment and social mechanisms (Goswami 2002, Halford 2002, Thomas and Karmiloff-

[3]The first stage is sensorimotor stage for infant and child up to 2 years of age where the knowledge acquired based on their senses, the second and the third are preoperational stage (2–6 yr) and concrete operational stage (7–10 yr) which based on representational thought and the last stage is formal operation stage (12–adulthood) which obtained by formal understanding (for details, see Smith 2002).

[4]Piaget's theory was constructed by observing the experiments and games with his own children while Vygotsky's works were still "untested ideas or hypotheses" because of his short life (Pound 2005: 38 and 41).

Smith 2002).

2.2.1.2 Economics

Economists have a different perspective on the issue of nature versus nurture in cognitive development, and state that knowledge through investment in a child's achievements is essential for its welfare in adulthood (Todd and Wolpin 2003), while Cunha and Heckman (2007, 2008) suggested that the cognitive skills acquisition can predict socioeconomic success. Therefore, the construction of cognitive production function is essential for explaining the process of knowledge acquisition in economics.

The first notable model was constructed by Becker and Tomes (1986) who introduced a single period of a child life cycle where "…investment inputs in any different stage of a child's age are perfect substitutes and equally productive". This theory was discredited by Cunha et al. (2006) and Cunha and Heckman (2007) who suggested "…multiple stages of childhood, where inputs at different stages are complements and there is self-productivity of investment" (Cunha and Heckman 2008:741). They refute the nature versus nurture concept and indicated that abilities are produced while the innate character is shaped by a child's environment. The non-cognitive skills such as self-esteem, motivation and perseverance were no longer considered peripherals. They specified the equal contribution of cognitive skills and non-cognitive skills and that they are complementary for knowledge acquisition. They then specified the time of investment in input into multi phases of a child's life formation, mainly divided into early and later child age (Cunha et al. 2006, Cunha and Heckman 2007).

While the concept of technology of skill formation emphasised the vital influence of a child's family in governing knowledge acquisition, the CAPF model constructed by Todd and Wolpin (2003, 2006) highlighted the dynamic key roles of family (parents) and school decision in shaping a child's cognitive ability. Originally, the CAPF was developed by Boardman and Murnane (1979) and further propounded by Cunha et al (2006) and Cunha and Heckman (as cited in Todd and Wolpin, 2006)[5]. The CAPF model attempts to be consistent with the notion that shaping and acquiring of knowledge is the cumulative process of past and current home and school invested inputs controlled by child's endowment skills. The concept can be explained by the equation below (Todd and Wolpin 2006):

[5]Todd and Wolpin referred to the first draft of Cunha and Heckman's paper "… that was presented at a conference at Minneapolis Federal Reserve in October 2003" (Cunha and Heckman, 2008:738). The paper was officially published in 2008 with the same title: Formulating, Identifying and Estimating the Technology of Cognitive and Noncognitive Skill Formation and already addressed the suggestion given by Todd and Wolpin (2003). Therefore, all the discussions in this paper related to Cunha and Heckman (2003) refers to Cunha and Heckman (2008) since the draft in 2003 could not be accessed.

$$\boldsymbol{A_{ija}} = \boldsymbol{A_a}\,(\boldsymbol{Z_{ija}}(a), \boldsymbol{\mu_{ij0}}) \tag{1a}$$

$\boldsymbol{A_{ija}}$ is the achievement of child *i* aged *a* in household j while $\boldsymbol{Z_{ija}}(a)$ is the vector of all, whenever invested, inputs until age *a* while $\boldsymbol{\mu_{ij0}}$ is the child's endowment. From the equation (1a), the classic issues when studying children cognitive development are the endogeneity of the inputs, extensive options of inputs (Cunha and Heckman 2008), how to deal with measurement errors, unobserved endowment ability, and lagged inputs (Todd & Wolpin 2006). Hence, the next two equations attempt to align the notion of CAPF as follows:

$$\boldsymbol{T_{ija}} = \boldsymbol{X_{ija}\alpha_1} + \boldsymbol{X_{ija-1}\alpha_2} + \ldots + \boldsymbol{X_{ija1}\alpha_a} + \tag{1b}$$

$$\boldsymbol{\beta_a\mu_{ij0}} + \boldsymbol{v_{ija}\rho_1} + \boldsymbol{v_{ija-1}\rho_2} + \ldots + \boldsymbol{v_{ij1}\rho_a} + \boldsymbol{\varepsilon_{ija}} \tag{1c}$$

$\boldsymbol{T_{ija}}$ denotes a child's cognitive score while $\boldsymbol{X_{ija}}$ and $\boldsymbol{v_{ija}}$ represent the observed and unobserved inputs. Building on this specification, researchers need to impose restrictions since they normally encounter data limitations in equation (1b) (Todd & Wolpin 2006). In order to solve this problem, they identified the specification model of contemporaneous input, value-added and cumulative models to define the process of cognitive skills acquisition[6].

While the first model of contemporaneous input contains inconsistent and illogical measurements, the latter two models are mainly used by researchers for dealing with data limitations. For the value-added model, Todd and Wolpin (2003, 2006) adopted the findings of Cunha and Heckman (2008): cognitive skills can be promoted by non-cognitive skills but not the other way around even though they did not address the distinction between cognitive and non-cognitive skills. In terms of Todd and Wolpin's (2006) theory, the above specification can be explained by adopting the skill technology estimation of Cunha and Heckman (2007) as follows:

$$\begin{pmatrix} \boldsymbol{T^N_{ijt+1}} \\ \boldsymbol{T^C_{ijt+1}} \end{pmatrix} = \boldsymbol{A_t}\begin{pmatrix} \boldsymbol{T^N_{ijt}} \\ \boldsymbol{T^C_{ijt}} \end{pmatrix} + \boldsymbol{\beta_t X_{ija}} + \begin{pmatrix} \boldsymbol{e^N_{ijt}} \\ \boldsymbol{e^C_{ijt}} \end{pmatrix} \tag{1c}$$

The specification above aims to resolve the missing or incomplete lagged input by using prior or historical outcomes as a proxy which is denoted by the incorporation $\boldsymbol{T^N_{ijt}}$ and $\boldsymbol{T^C_{ijt}}$, for non-cognitive and cognitive skills, respectively. $\boldsymbol{X_{ija}}$ represents observed inputs of family and school as well as a child's innate abilities and the $\boldsymbol{e^N_{ijt}}$ and $\boldsymbol{e^C_{ijt}}$ denote the residual

[6]See Todd and Wolpin (2003) for discussion on model selection problem and the specification of those three models where the main considerations are (i) the different kinds of data limitations & the missing data, (ii) endogeneity problem, (iii) extensive options for inputs, covering both current and historical data of cognitive outcome, home, parental, school inputs as well as child endowment abilities.

of non-cognitive and cognitive abilities, consisting of unobserved input and endowment and measurement error (Todd and Wolpin 2006).

The next specification model used by Todd and Wolpin (2006) is the cumulative within-child fixed effect since the model allows the existence of the endogeneity problem between the chosen inputs and unobserved child's genes and inherited abilities[7]. The model is consistently applicable under some requirements and restrictions. There must be many options "…on cognitive outcomes and on inputs for a given child at different ages" (Todd & Wolpin 2006:7). The model is explained below:

$$\boldsymbol{T_{ija}}\text{-}\boldsymbol{T_{ija-1}} = (\boldsymbol{X_{ija}}\text{-}\boldsymbol{X_{ija-1}})\boldsymbol{\alpha_1} + (\boldsymbol{X_{ija}}\text{-}\boldsymbol{X_{ija-1}}) + \ldots + (\boldsymbol{X_{ija}}\text{-}\boldsymbol{X_{ija-1}})\boldsymbol{\alpha_{a-1}} + \boldsymbol{X_{ija1}}\boldsymbol{\alpha_a} + [\boldsymbol{\beta_a}\text{-}\boldsymbol{\beta_{a'}}]\boldsymbol{\mu_{ij0}} + \boldsymbol{e_{ija}}\text{-}\boldsymbol{e_{ija-1}} \quad (1d)$$

The imposed assumptions are:
1) the effect of $\boldsymbol{\mu_{ij0}}$ (innate ability) on cognitive score must be time variant of age $[\boldsymbol{\beta_a}\text{-}\boldsymbol{\beta_{a'}}]$;
2) The endogeneity between the used inputs and a child's innate abilities can be relaxed;
3) The later input choices ($\boldsymbol{X_{ija}}$) are identical to prior given cognitive outcomes ($\boldsymbol{e_{ija-1}}$, $\boldsymbol{X_{ija}} = \boldsymbol{0}$);
4) the variation between applied inputs should be statistically independent with the variation between omitted inputs or it can be asserted that the omitted inputs are age-invariant

(Todd and Wolpin 2006:7).

The CAPF is also the method for mapping and accommodating the substantive determinants of the sharpening process for determining children's cognitive achievement. For this purpose, they integrated the theory of Early Childhood Development (ECD) literature that focuses on the role of parental and early home environment inputs in producing cognitive skills and education production function (EPF), which examines the crucial role of school inputs on a child's academic test scores (Todd and Wolpin 2003).

The CAPF defines four important factor inputs that may affect cognitive achievement. The first is historical and current home input that captures the effect of the interaction between the members of a house, especially mothers and the children. This relationship mediates the process of cognitive development with a series of interactions such as bedtime story telling, how many books the children read and mother helping the children enhance their basic cognition capacity.

[7]They also suggested resolving the problem by applying the combination of IV and fixed-effects model (Todd and Wolpin 2006) even though this remedy should be cautiously employed, given the controversy of the validity of restrictions (Cunha and Heckman 2008)

The second factor is maternal characteristics, which reflect the mother's capability and cognitive skills possession. It is assumed that the higher the cognitive skills of the mother the easier it is to transfer knowledge and nurture the children. The third factor is the child's characteristics such as gender, level of education, age, birth order, and endowed variables like birth weight and health status, which are essential inputs for cognitive skill attainment.

The last important determinant is school input which represents school qualities and competencies of the teachers. The predicted variables are pupil-teacher ratio and years of teaching experience. These four inputs are controlled by other important variables such as neighbourhood, village, and district characteristics in the context of SES (sanitation, electricity, clean water, and other public infrastructure).

2.2.2 Channels of Microcredit for Children's Education

Maldonado and Gonzalo-Vega (2008) formulated the theory of five channels or mechanisms through which microfinance affects children's education. The definition of children's education is the years they spend in school or school enrolment. The first channel is income effect on the household. It is believed that if microfinance is able to drive household income growth, the higher demand for children's schooling is expected to have a positive impact.

The second channel is the risk-management effect which explains a household's anticipation under the situation of adverse exogenous shocks. The theory highlights the parent's options of risk-coping strategies to smooth the consumption during times of uncertain income. This may hamper school enrolment because it would force the children to be pulled out from school to earn extra money or the school cost is no longer affordable for them. Most of the remedy options, such as diversification, migration, and selling assets, are costive and may worsen their level of consumption. Some empirical evidences show that the access to financial saving or credit is more likely to prevent children from dropping out of school. Therefore, if microfinance is the appropriate risk-coping strategy for the shocks, it is expected to have a positive influence on the demand for schooling.

The gender effect is the third channel that enhances the women's role in a household driven by their participation in microcredit. Many studies pointed out that participation in the microfinance programme improved women's knowledge, self-esteem, and self-efficacy, nurtured by women's credit groups. Thus, their bargaining position in a household's decision making is strengthened, especially regarding education preferences for the children. Therefore, it can be said if the direct link of credit to women can be enhanced by microfinance, this may improve a household's decision on human capital formation.

The fourth channel is the information effect. This theory is based on a previous study that showed the importance of parent's level of education on the schooling decision. Less educated parents may have a lack of information about the importance of opportunity and preferences in education. However, this situation changes and the new knowledge can be embraced through many channels, where the most natural medium is the parents' inner social circle. In the microfinance programme, the loan group naturally promotes and disseminates the ways to improve the standard of living and well-being through its training programme. Thus, the parents' choices may be enhanced if microfinance accommodates the transfer of knowledge and information on the value of school and the high return on investment in education. As a result, it may have a positive influence on the demand for schooling.

The child-labour demand effect is the last channel which assumes the decision of school or child labour is made in the same allocation time. Participation in microfinance can have a positive consequence if it improves the ability for educational consumption. However, there will be a negative effect if the access to microfinance increases both indirect or direct child labour rates since a household enterprise or land cultivation expansion increases the production activities, in turn increasing the school dropout rate for engaging in labour, taking care of younger siblings, and doing the domestic chores.

2.3 Empirical Review

In the context of Indonesia, no study has attempted to determine the effect of microcredit on cognitive outcomes. In order to enrich empirical evidence before defining the empirical strategy and specifying the estimation model, this study explores the evidence from the disciplines of psychology and economy, by examining two different research papers: the first one focuses on children's cognitive outcomes and the second one investigates credit assistance as the main variables affecting children's educational achievement. The discussion starts with general topics and goes on to IFLS-based research to provide related examples of existing studies.

2.3.1 Children's Cognitive Empirical Evidence

The first empirical evidence comes from USA produced by Dahl and Lochner (2005). They claimed to resolve two main issues on measuring the effect of family income induced by credit assistant on cognitive outcome by using the fixed effect instrumental variables (FEIV). They aimed to control permanent unobserved heterogeneity and unobserved transitory shocks during the observation period. This estimation method was applied to rectify the bias resulting by past literature both caused by measurement errors (attenuation bias) and endogeneity. It occurred if the OLS was used when temporary shock correlated with family income, particularly caused by shock in parental capacity or child development

(severe illness, loose job, or accident). The bias was even greater if a fixed-effects model was applied (Dahl and Lochner 2005).

They further used standardised cognitive assessment on Peabody Individual Achievement Tests (PIAT) that mainly consists of mathematics and reading ability test. Using the U.S. household's after tax total income as the main independent variable, they found that current income had a significant effect on children's achievement, and the family had a vision of future income triggered by the changes in exogeneous income from credit assistance that in turn affected the children's test scores (Dahl and Lochner 2005).

The second paper studied the association between SES, child health and nutrition, and parenting on cognitive scores of children aged 36–71 months in Ecuador (Paxson and Schady 2007). The researchers conducted a study in the context of Ecuador where they found a difference in the dominant predictors between developed countries such as the US and developing countries. While the studies in the US context suggest the most determinant factor is parenting style, the studies in developing countries show that malnutrition, lack of micronutrients and children's health are the crucial factors for children's cognitive achievement (Paxson and Schady 2007).

Paxson and Schady used OLS, maximum likelihood, and Censored Least Absolution Deviation (CLAD) techniques with a cross-section of their survey data and defined the international renowned Peabody Picture Vocabulary Test (PPVT) of Spanish version (*Test de Vocabulario en Ima´genes Peabody*/TVIP) as the main outcome. They found a robust significant gradient between higher household wealth (SES factor) and higher TVIP score and the magnitude increases when the age cohorts were included. Child's nutrition and parenting had a weak association with TVIP scores. This paper did not include the factor of children's home environment which was a crucial factor in US-based literature (Paxson and Schady 2007).

The third research implemented the CAPF model that focused on the effect of maternal employment on children's cognitive development. Bernal (2008) showed that the decision of a mother to work and use day-care after giving birth may affect her child's cognitive outcomes. Therefore, the centre of analysis is the mother and children that some characteristics are unobserved in past literatures. Bernal asserted that existing studies tackled the issue by using: (i) extensive use of control variables, (ii) fixed-effects models, and (iii) the IV method while that most previous studies failed to find an appropriate instrument. To address this concern, he produced the joint estimation model that incorporated the mother's decision on working, day-care use, and the CAPF model using the data of married mothers and children up to five years old on NLSY. Using the child-effect estimation model, this research showed that full-time working mothers who paid for day-care had a negative

association with cognitive test scores (Bernal 2008).

Concerning IFLS-based research, Heilmann (2013) produced a comprehensive work involving cohort analysis that associated children's health and cognitive achievement. Combining IFLS with the WHO index of children's height and weight growth standard, she analysed the children in 4 waves of IFLS which start from 1993 to 2007. In particular, she defined yearly child-height as a proxy for stunted children or malnutrition level, corresponding with the background of Paxson and Schady's (2007) research. The research did not use the level of household income since she claimed it was not directly associated with the parent's endeavour to stimulate a child's cognitive achievement. Therefore, she preferred using proxies for home characteristics such as per capita household consumption, water source, electricity, and household size, which was complemented by children's characteristics likes religion and ethnicity and parental level of education.

Heilmann's findings showed that older children had higher cognitive test scores. Moreover, the level of children's health and nutrition has a significant association with their cognitive achievement as well as the mother's level of education. The children who experience catch-up growth have 4% higher scores than stunted children.

2.3.2 Empirical Evidence on Microcredit Participation

Previous studies used microcredit as the main interest explanatory variable, Maldonado and Vega (2008) examined the difference between old borrower and new clients in Bolivia in terms of schooling gap and child labour. Using a random effects model, they found that an old borrower had a greater gradient than a new borrower. In contrast, it was found that microcredit increased the opportunities for a household in land farming, resulting in the children being pulled out from the school.

The second paper investigated the impact of microfinance in rural areas of the Philippines (Kondo et al. 2008). They examined the effect on comprehensive outcomes, starting from household wealth predictors to human capital investment. The research sample consisted of two types of data, the first addressed to the treatment area that consist of existing borrowers. The second was the control group area which the microcredit program have not launched yet even though it contains identified prospective clients. This type of data allowed them to apply the difference-in-difference (DiD) estimation method to capture counterfactual effects. Focusing on household wealth predictors, it was found that a higher loan had a slightly significant and positive association with higher Per Capita Income (PCI) and Per Capita Expenditure (PCE). However, there was no significant impact on human capital formation. The positive impact on income and consumption did not directly drive the investment in human capital. Finally, they indicated that microcredit programmes were not

appropriate for the poorest (least quantile of SES) since it led to additional burden in their lives (Kondo et al. 2008).

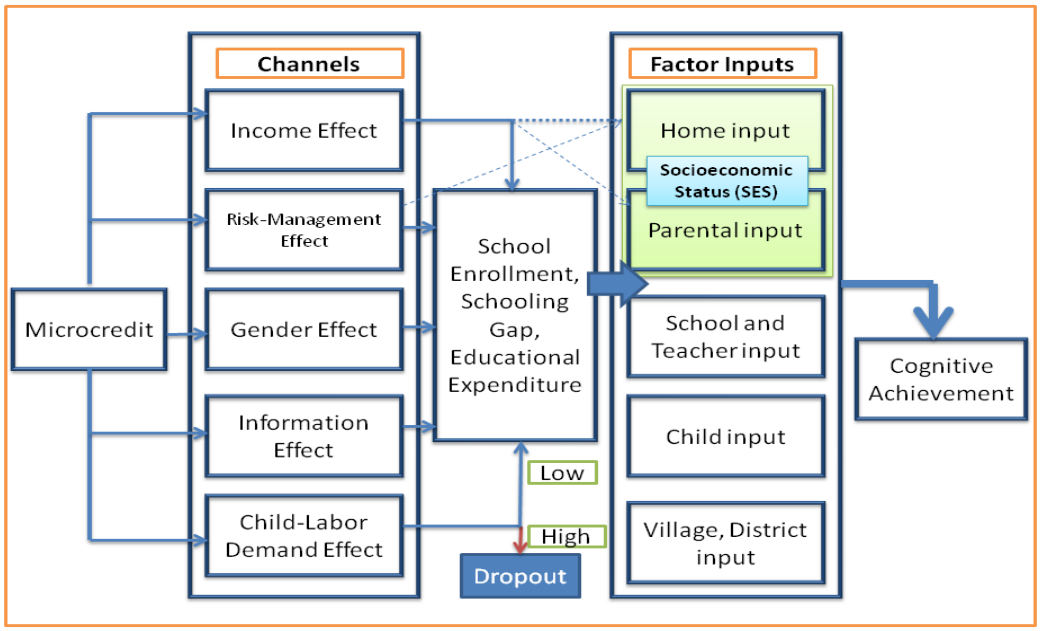
The research conducted by You and Annim (2014) on rural China had a similar output that can be followed to define the independent variables in the estimation model. They investigated microfinance's causal effect on the average Math and Chinese language test scores and used five groups of determinant variables representing the child's, parent's, household, teacher, and school's characteristics, controlled by village characteristics. They defined the benchmark as a criterion for an eligible borrower before using the regression-discontinuity design (RDD) estimator and then continued with the IV estimation method.

The result showed a positive but insignificant effect of microfinance. Microcredit seems to be efficient when it is combined with other important variables like children's age, capability to study, and father's years of education. Women's empowerment has a negative association with children's academic performance since it drives the children to work.

The last empirical evidence are from IFLS-based researches. Golan (2009) investigated the effect of microfinance access on the total expenditure on investment in children's education. Using a cross-section of data from IFLS 3 in 2000 and OLS estimation, he found that the MFI borrower spent significantly more money on education than a non-borrower while it only showed a slight difference compare to non-institutional borrower. Furthermore, Setyari (2012) examined the effect of microcredit participation on household well-being. She used panel data from IFLS 3 (2000) and 4 (2007) and defined the treatment group by the existence of MFI in a given area, which she claimed could capture the spill-over effect. Applying the IV method which chose loan size as the instrument, she suggested that access to microfinance gave the households an opportunity to expand their business which reduced the children's time in school as they had to focus on working in the family business. All the empirical results are provided in Table 1 (Appendix A).

2.2 Concluding Remarks

The theories of microfinance channels, CAPF, and empirical evidence underline the paper's initial assumption that microcredit access influences the children's cognitive achievement. The association between these fundamental frameworks is synthesised in Figure 1 given below:



* constructed by author

Figure1: Synthesis of the Research's Underlying Conceptual Frameworks

In the first stage, the five channels of microcredit were linked to the proxies of school attendance. The latter is the pre-requisite for measuring children's cognitive performance. However, the child-labour effect channel relies on its demand, i.e. if the demand for children working is high, the tendency of children attending school will be low and the children could be pulled out from school for work or other household activities. In conclusion, it is assumed that microcredit and other unobserved variables confirm the consistency of the children's attendance to school during the period of observation. Hence, in the following stage, the key factor inputs of educational achievement and microcredit determinants were incorporated from previous studies.

Furthermore, Figure 1 above shows the interrelationship between the theories and empirical evidence. The household income channel is linked to home and parental inputs. The determinant variables of these components can be defined as the integration of the notions of sociologist, psychologist, and economists in terms of SES. The direct links in SES are household income and parental assets (Zhan 2005), total non-farm business profit (Setyari 2012), consumption and educational expenditure (Golan 2009), and total expenditure (Case and Deaton 1999). The home input accommodates household wealth proxies such as sanitation, clean water, and electricity (Heilmann 2013). This also relates to indirect links supported by most researchers, suggesting that time allocation, parent-child interaction, parenting style and parent's level of education are important variables. These essential predictors are controlled by family structure, size of family and household head

gender (Davis-Kean 2005 and You & Annim 2014). The channel of risk-management effect is closely related to home input which is the household level of consumption and saving.

Moreover, the channel of women's empowerment and information effect could be associated with the parental input for the mother and father's years of education and mother-child interaction as well. Deaton and Case (1999), Rivkin et al. (2005), and Todd and Wolpin (2006) found that the most significant variables of school input were pupil-teacher ratio and years of teaching experience.

The child input represents their characteristics like age; birth order; number of siblings; and endowed ability such as the birthweight, nutrition, and health status. This input accommodates the evidence in developing countries which indicates health and nutrition as crucial factors. The remaining factors relate to neighbourhood, village, and district input. SES factors in the regional perspective refer to the wealth status and standard public facilitation and infrastructure such as sanitation, electricity, clean water, well-structured roads, transportation access, healthcare and education facilities.

Chapter 3 The Indonesian Context of Microcredit and Children's Cognitive Achievement

3.1 Microcredit in Indonesia

Indonesia, along with India and Bolivia, has long been considered one of the most successful examples of microcredit implementation. Indonesian microcredit is quite different from the original Grameen Bank in Bangladesh. While it originally aimed to empower women and provide subsidised scheme, Indonesian microfinance is non-subsidised, is a commercial product, and has a wider range of borrowers that aims to finance micro (self-employed/survival-based) enterprises to medium-size enterprises (Martowijoyo 2007).

In Indonesia, microcredit is served by several types of formal microcredit institutions which can be divided into three forms: banks, cooperatives, and non-bank financial institutions[8] (Baskara 2013). It was started by the commercialised lending firm of Bank Dagang Bali in 1970 and its scheme was replicated by Bank Rakyat Indonesia (BRI) that established local banking units in 1984 (Robinson 2002). BRI is one of the world's largest MFIs that successfully served commercial microcredit (Charitonenko and Afwan 2003, Hamada 2010). Today, BRI is the largest microfinance lender in the developing world. In 2016, the microloans business unit served approximately 8.91 million customers and disbursed 211.49 trillion rupiah (1.32 billion euro/€1= ± Rp16.000) across Indonesia via 8563 branches and network units (BRI 2017).

The penetration of formal microcredit has pervaded to the district level even though it is mainly concentrated in Java and Bali provinces. There are many MFIs in Indonesia that correspond to the rich variety of Indonesian cultures and ethnic groups such as *Lembaga Perkreditan Desa* (Rural Credit Association) in Bali and *Lumbung Pitih Nagari* (farmer association) in West Sumatra (Baskara 2013). The remains of microcredit providers are state pawnshops and informal institutions such as money lenders, social capital entities such as farmer & neighbourhood associations, and Rotating Saving and Credit Associations (ROSCA) (Martowijoyo 2007).

3.2 Indonesian Children's Cognitive Achievement

There are no available official data on cognitive test results of children in Indonesia. The majority of Indonesian people's cognitive test data have been conducted for research specific to community and regional level. Almost all the researches used toddlers as the subject, so the intelligence quotient could not be measured comprehensively. For instance,

[8]See Martowijoyo (2007) for more detail of the types of microcredit providers and Robinson (2002) for the comprehensive history of Indonesian microfinance.

one study on pre-schoolers aged 3–5 years in West Java found "..about half of children in the sample (48.2%) were categorized in the moderate development (60–79%), while 31.2% of children were in the upper category (>80%)" (Warsito et al. 2012:454).

Another research examined 271 infants aged 6–9 months in West Sumatera using the Bayley Scale of Infant Development the Third Edition (BSID-III) for cognitive assessment (Helmizar et al., 2017). They found that at baseline, the cognitive score was normal, between 97.7 ± 11.2 and 100 ± 8.50 (normal cognitive score for Bayley III was ≥85) (Johnson et al. 2014).

The author then compared cognitive skill attainment between Indonesia and other countries. As cited in the Learning Curve, Indonesia ranked 37 out of 40 countries for cognitive skills in 2014 (Pearson PLC 2017). The cognitive skills category was based on reading, maths, and science ability measured by the grade 8 Program for International Student Assessment (PISA 2012) and grade 4 Trend in International Mathematics and Science Study (TIMSS 2011) global data sets (The Economist Intelligence Unit 2014). Moreover, Indonesia was ranked the worst country (40th out of 40 countries) in the educational attainment category based on literacy and graduation rates. The graduation rate for upper secondary and tertiary level in 2013 was 63.2% and 22.6%, respectively (OECD 2013 as cited in Pearson PLC 2017). However, Indonesia's Department of National Education claimed the literacy rate improved from 96.24% in 2014 to 97.93% in 2017 (Effendi 2017). From these data and research examples, it can be assumed that the cognitive skills of Indonesian children are not well-documented yet. The learning curve report showed that the cognitive skills of Indonesian children are still far behind those of children in other countries.

Chapter 4 Methodology

4.1 Data Source

This analysis in this research draws on the Indonesian Family Life Survey (IFLS) wave 4 (2007) and IFLS wave 5 (2014) data sets released by RAND's collaboration with SurveyMeter. They developed a large-scale longitudinal survey of Indonesia since 1993, covering socio-economy and health data. It was conducted in 13 provinces, representing 83% of Indonesia's population (Strauss et al. 2016).

The data set of the survey consisted of individual, family, household, and community level data as well as public facilitation and infrastructure. In 2007 and 2008, as many as 13,535 households and 44,103 individuals were interviewed by the IFLS 4 team where most of them were the same respondents since IFLS 1 (1993) (Strauss et al. 2009 as cited in Setyari 2012). IFLS 5 is expanding the coverage of family life with a focus on subjective well-being, quality of life (sleep quality and retirement), and human capital development (health and disease history and education history). The IFLS 5 conducted in 2014–2015 successfully interviewed 16,204 households and 50,148 individuals (Strauss et al. 2016).

4.2 Methods of Data Analysis

4.2.1 Impact Evaluation of the Microcredit Programme

The classic problem that should be addressed in microcredit impact evaluation is the existence of the two types of selection biases: placement bias and self-selection bias. Placement bias is the non-random presence of a microcredit institution while the latter is household participation in microcredit that is not naturally based on self-intention but strongly dependent on the availability and eligibility set and purposely selected by a microcredit institution (Pitt and Khandker 1998, Shimamura and Lastarria-Cornhiel 2010, Duflo et al. 2013).

The contemporary literature suggests the best comparison measure in impact evaluation is the counterfactual effect –this is the analysis of the difference between outcome intervention and what would have been the outcome if their parents had no access to the microcredit programme (Shimamura and Lastarria-Cornhiel 2010). The most celebrated approach is the randomised control trial (RCT) explained by Karlan and Goldberg (2007) and carried out by Duflo et al. (2013) in rural India. RCT resolves the endogeneity problem as well. It appears the observed explanatory variable (microcredit participation) has a correlation with the error terms (unobserved or omitted variables).

However, the RCT approach requires a large random sample of non-participants that has similar characteristics as the participant group, not being spilled-over during the period of observation. The requirement of this methodology seems difficult to be fulfilled, especially in the Indonesian context where the penetration of microcredit institutions has covered the rural and remote areas (Gertler et al. 2002, Setyari 2012). Based on these premises, an RCT is considered to be costly, requiring a longer time of field work research. Consequently, most IFLS-based studies opted to apply the fixed-effects model for microfinance presence and non-random participant selection while using panel data (see Gertler et al. 2002, Buttenheim 2006, Deloach and Lamanna 2011, Setyari 2012).

In addition, Wooldridge (2015) suggests using the instrumental variable (IV) method in order to solve the problem of omitted variables and error in measurements, and it could be completed using the two-stage least square (2SLS) method. For instance, Ervani (2014) used distance to microcredit institution, Setyari (2012) used total credit received, and Deloach & Lamanna (2011) used urban-rural and electricity as the IV for the 2SLS estimation method.

4.2.2 Empirical Strategy

4.2.2.1 The Outcomes and The Main Variables of Interest

The research observed children aged 7 to 22 years. The panel data set allowed to conduct both between- and within-individual analysis. The cognitive scores of 7–14-year-old children in IFLS 4 will be compared to their own scores 7 years later in the IFLS 5.

The main outcome of this research is children's cognitive test score. The IFLS surveyors asked the willingness of the respondents to undertake the cognitive test[9]. The 7–14-year-old respondents worked on 17 sets of questions from book EK1. For the 15-24-year-olds participated in the IFLS 4 and 15–59-year-olds in the IFLS 5, they took on 22 problems from book EK2[10]. The author generated the cognitive score by dividing the sum of correct answers with the number of questions so the range of the scores was 0 to 100.

The main independent variable was microcredit participation which was a binomial dummy. It used 1 to denote a household with at least one of its member receiving microcredit and 0 to denote a non-borrower family. The definition of microcredit was that given by Setyari (2012) per which the treatment group was the family that had a loan below 50 million rupiah or approximately €3,125 (€1=± Rp16.000 based on Indonesian Central

[9]The cognitive test has two components: the first is matching of similar shapes that replicated Raven's test and the second is numerical test. Each section of EK1 and EK2 had 5 questions for numerical testing. Raven's progressive matrices test,which is widely used in non-verbal testing for analytic intelligence, was developed by Raven in 1936 (Kaplan & Saccuzzo 1997 in Heilmann 2013). For detailed background of Raven's test, see Raven (1958, 2000) and Raven et al (1993)

[10]In fact, when the author checked the data set, only 13 questions were answered out of 22 questions in the IFLS book EK2, so the missing answers were not included in score calculation.

Bank regulation). The loans above the cut-off line were dropped from the data set. This research did not consider the purpose of borrowing, e.g. business, consumption, or saving as well as the credit source.

4.2.2.2 The Strategy

The paper's empirical strategy was conducting four analyses to satisfy the research objectives. The first analysis focused on the association of microcredit participation on welfare indicator outcomes. The first analysis partly replicated the model of Kondo et al. (2008). The second, third, and fourth investigated the effect of microcredit participation on children's cognitive outcomes with different approaches using the child-effect estimation model. This preferred model aligned with the previous theoretical framework of assumption and restriction that should be employed in fixed-effects estimation.

The second examined the sensitivity of inclusion to the covariates of microcredit that may affect cognitive score using the theory developed by Maldonado and Vega (2008) while the third analysis examined mother-child interaction as one of crucial determinants of cognitive achievement (Todd and Wolphin 2008) using the evidence in Bernal's (2008) paper. This determinant was tested as a channel/pathway by which microcredit may influence children's cognitive attainment. The fourth is the analysis of the heterogenous effect of different age cohorts. It investigates the theory of child cognitive development and existing empirical evidence (Paxson & Schady 2007, Heilmann 2013) that older children tend to attain higher cognitive scores.

4.2.2.3 The Explanatory Variables/Covariates

All four analyses were controlled by a series of covariates that consisted of children, home, parental, school, and district/village characteristics. The preferred variables accommodated the CAPF theory and the existing empirical evidence. The parent and children's characteristics are widely used predictors for measuring both microcredit and cognitive achievement. The household wealth proxies were those suggested by Heilmann (2013) while the school inputs aligned with those suggested by Todd and Wolpin (2006). The district/village control replicated the method of You and Annim (2014) with slight adjustment. The inclusion of these essential factors compensates for the fact that the IV method was not used by the author. This strategy also corresponds to the model of Paxson & Schady (2007) which incorporated the CAPF model, used extensive explanatory variables, and applied the fixed-effect estimation model. The details of all the variables use are provided in Table 2 (Appendix B).

4.2.3 Equation Model Specification and Construction of Variables

First Analysis: The Association between Microcredit Participation and Welfare Indicators of SES

This analysis was performed to capture the effect of participating in microcredit on a household's welfare indicators which reflect the monetary ability of parents to shape their children's cognitive development. It is imperative to be carried out before examining the association between cognitive outcomes and participation in microcredit because this analysis corresponds to the characteristics of the data set in which the treatment group had a higher significant difference in SES variables than the control group.

The proxies of welfare indicators were per capita income (PCI), per capita expenditure (PCE), and total educational expenditure. The indicators followed the model specification of Kondo et al. (2008). These outcomes were regressed by using household's fixed-effect model and applying two groups of covariates. The equation model is presented below:

$$LnWI_{hjt} = a_i + ß_1 Credit50_{hjt} + ß_2 CV_{hjt} + \gamma_i + \varepsilon_i \quad (2)$$

$Ln\,WI1_{1hjt}$: *Welfare Indicator 1, Ln* PCI (per capita income), *Ln* of total household income (parent's job and non-farm business profit) divided by number of household members, in household *h* and district *j* and time *t*

$Ln\,WI2_{hjt}$ *Welfare Indicator 2, Ln* PCE (per capita expenditure), *Ln* of total household expenditure divided by number of household members, in household *h* and district *j* and time *t*

$Ln\,WI3_{hjt}$ *Welfare Indicator 3, Ln* Total Educational Expenditure, *Ln* of total educational expenditure spent in household *h* and district *j* and time *t*

$Credit50_{hjt}$: Microcredit participation below the 50-million- rupiah limit; 1= borrower, 0 = dummy/non-borrower

CV_{ihjt} : Control variables/covariates, contains series of household welfare indicators and district/village variables

γ_i : Fixed-effects estimation at household level

ε_i : Error term

Second Analysis: The Association between Microcredit Participation and Sensitivity to Inclusion Group of Covariates

In the first stage, the model was regress on microcredit participation and covariates. Then, five different regressions were run one by one considering the sensitivity of the five effect groups. For the final stage, all the five effect variables were included in the regression.

These analysis procedures aimed to capture differences in the sensitivity, reflecting the changes in magnitude and significance of coefficients for microcredit participation between five different effect groups. The equation model used the fixed-effect model to test the sensitivity, as given below:

$$LnCog_{ijht} = a_i + ß_1 Credit50_{hjt} + ß_3 Z_{ihjt} + ß_4 CV_{ihjt} + \gamma_i + \varepsilon_i \quad (3)$$

$Ln\ Cog_{ijht}$	:	Cognitive test score in t1 and t2 The paper will apply *Ln* to control the range of test score; 0–100 points. The *Ln* takes into account children's scores *i*, in household *h* and district *j* and time *t*
$Credit50_{hjt}$	:	Microcredit participation below the limit of 50 million rupiah; 1= borrower, 0 = dummy/non-borrower
Z_{ihjt}	:	Represents the selection effect and its sensitivity will be tested
CV_{ihjt}	:	Control variables/covariates; contains a series of children, parental, household/home characteristics and district/village characteristics
γ_i	:	Fixed-effect at individual level of the children
ε_i	:	error term

The independent variables used to examine the sensitivity were the proxies for the five-effect theory as follows:

The Income Effect	: *Ln* parent's income, *Ln* total non-farm business profit
The Risk Management Effect	: *Ln* per capita income (PCE)
The Gender Effect	: Household head sex, interaction between gender and microcredit participation
The Information Effect	: Father's level of education and mother's level of education
The Child-Labour Demand	: Children's participation's in labour, 1= full schooling, 2= working while schooling, 3=full working, 4=not schooling nor working

The results of the second analysis play an essential role as the fundamental basis for the following third analysis in which the pathway should be the focus to reflect the effective mediation of microcredit on cognitive scores. Therefore, it was essential to carry out the third analysis for selecting the channels by incorporating the CAPF theory and SES-related variable groups of the microfinance channel theory. Out of the four determinants of CAPF, the interaction between parent-children and the cognitive ability of the mother are considered to have the strongest correlation with the level of household income and consumption.

The paper's assumption follows the CAPF theory where the parent-child interaction can be reflected by the proportion of mother's time to nurture and to take care her children. The proxy for this determinant is the working mother variable. The family, with the mother

who has a firm job, will, consequently, have less time to interact with the other household members. The other two determinants were treated differently, where the inputs of children's innate ability were tested in the additional analysis of the heterogeneous effects on different age cohorts while school quality was not included since it was less likely to be associated with microcredit participation.

Third Analysis: The Association between Microcredit Participation and Mother-Child Interaction as a Selection Pathway/Channel

This analysis examined the assumption that children's cognitive performance is dependent on the parent's dedicated time for nurturing the children. Furthermore, the paper decided to use these determinants as a selection pathway where microcredit may affect the cognitive score. The equation model used the child fixed-effect model to test the strength of the channel of microcredit affecting the scores, as written below:

$$LnCog_{ijht} = a_i + ß_1 Credit50_{hjt} + ß_3 WM_{hjt} + ß_4 Credit50_{hjt} \times WM_{hjt} + ß_5 CV_{ihjt} + \gamma_i + \varepsilon_i \quad (4)$$

$Ln\ Cog_{ijht}$	:	Cognitive test score in t1 and t2; the paper will apply *Ln* to control the range of test scores from 0–100 points. The *ln* takes into account children's scores *i*, in household *h* and district *j* and time *t*
$Credit50_{hjt}$	:	Microcredit participation below the limit of 50 million rupiah; 1 = borrower, 0 = dummy/non-borrower
WM_{hjt}	:	Working mother in household *h* and district *j* and time *t*. It represents the selection pathway that will be tested as the proxy of mother's time allocation for nurturing the children's cognitive development: Dummy of working mother household *h* and district *j* and time *t*; 1=working mother, 0=full-time housewife
$Credit50_{hjt} \times WM_{hjt}$	:	Interaction between microcredit participation and interest independent variables of working parent and working mother in household *h* and district *j* and time *t*
CV_{ihjt}	:	Control variables/covariates; contains series of children's, parents', household/home, and district/village characteristics
γ_i	:	Fixed-effects estimation at individual level of the children
ε_i	:	Error terms

Fourth Analysis: Heterogenous Effect of Different Age Cohorts

This analysis follows the third specification of the estimation models. The paper generated two dummy variables to define the children who were below or above the mean age. Each of dummy variables was regressed separately controlled by the same covariates of the previous analysis. The main objective was to analyse the different cognitive scores between two age groups with the specifications given below:

$$LnCog_{ijht} = a_i + ß_1 Credit50_{hjt} + ß_3 AC_{hjt} + ß_4 Credit50_{hjt} \times AC_{hjt} + ß_5 CV_{ihjt} + \gamma_i + \varepsilon_i \quad (5)$$

$LnCog_{ijht}$	:	Cognitive test score in t1 and t2; the paper will apply *Ln* to control the range of test score from 0–100 points. The *Ln* takes into account children's scores *i*, in household *h* and district *j* and time *t*
$Credit50_{hjt}$	:	Microcredit participation below the limit of 50 million rupiah; 1= borrower, 0 = dummy/non-borrower
AC_{ihjt}	:	Age Cohort1: below the mean; Age Cohort2: above the mean of children's *i*, in household *h* and district *j* and time *t*
$Credit50_{hjt} \times AC_{ihjt}$	:	Interaction between microcredit participation and the age cohort's household *h* and district *j* and time *t*
CV_{ihjt}	:	Control variables/covariates; contains a series of children's, parents', household/home, and district/village characteristics
γ_i	:	Fixed-effects estimation at individual (children) level
ε_i	:	Error term

4.3 Hypothesis

Building on the formulated estimation model and past literature, this paper proposed the following hypothesis:

H1: *Participation in microcredit will have a significant positive effect on children's cognitive outcomes*

H2: *The five determinants of effects will have a significant sensitivity on children's cognitive performance*

H3: *The determinants of mother-children interaction and children's age are the effective channels by which microcredit influences children's cognitive achievement*

These hypotheses will be tested by applying microfinance's channels theory and the CAPF theory.

Chapter 5 Descriptive Statistics

5.1. Introduction

This chapter explains the descriptive analysis, multicollinearity, and Hausman test. The descriptive analysis covers the data specification, attrition analysis, data management, and the distribution in the view of outcomes and main determinant variables. This chapter will explain the process of data preparation before it is tested using the regression model.

5.2 Descriptive Statistics

The descriptive statistics of the panel data are presented in the Table 3 (Appendix C). The table provides the total number of observations, distribution, mean, minimum, and maximum of each variables. Attempting to follow the theoretical frameworks and run the empirical strategies, the author managed to construct a total 4 outcomes and 31 explanatory variables. There were 4342 observations consisting of 2171 children and 1704 households. However, this research dropped the father-child and mother-child interaction variables owing to missing observations (703 and 399, respectively, out of 4342).

While the author meticulously looked at the data characteristics, there were at least two groups of variables that were given special consideration: father and mother's level of education. These variables are naturally time-invariant in within individual observations along with child's gender; however, most other variables changed both between and within individuals (cross-section and time-series observation).

The other variables were related to SES that reflected household characteristics such as household income, profit, PCI, and PCE as well as district welfare proxy such as average teacher salary. The standard deviation of each variable exceed edits mean. The differences between mean and standard deviation of SES-related variables are presented in Figure II (Appendix C).

5.2.1 Attrition Analysis

This analysis examined the attrition process of the data set starting with the raw IFLS. It aims to avoid attrition bias and increase the availability of the panel data so that the panel represents the population (Fitzgerald et al. 1997). This subsection presents the analysis in two parts where the first provides the attrition from the raw data of IFLS to the optimum panel data and the next part presents the attrition from the optimum to final panel data.

The aim of the research is to provide the two main attritions analyses. Firstly, the reduction of observation because of the missing of main outcomes and covariates. Secondly, the attraction because there is missing data in the second period of time. The paper will build one panel of data using 595 different data sets of the IFLS 4 and IFLS 5 surveys. The detailed configuration of the attrition analysis is presented in the following table:

Table 4: Attrition Analysis

PART A- Raw Data Analysis						
Type of Data Set	**Raw Data (Observation)**			**Attritors**		**Total Optimum of Individual Observation**
	Panel Observation	**New Entrance**	**Total**	**Duplicates Observations**	**Missing Cognitive Scores**	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
IFLS 4 (Children 7–14 years old)	15,556	2,876	18,432	2,691	11,319	4,422
IFLS 5 (Children 14–22 years old)	9,858	1,806	11,664	2,199	5,041	4,424
Total Optimum for Panel Data						**8,846**

PART B- Panel Data Analysis						
Type of Data Set	**Panel Observation**	**Reason of Attrition**				**Final Panel Data Set**
		Missing Covariates		**Not Matched**	**Outlier**	
		Child & Parent	**School & District**			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Optimum Panel Data	**8846**	1892	2588	2	22	**4342**
(Number of Children)	(4422)	(946)	(1294)	(2)	(11)	**(2171)**

Part A in the table above shows the attrition during the first stage of building the data set. The total raw data obtained from IFLS 4 data set was 18,432 (Column 4) of which 15,556 (Column 2) observations were from the previous wave of the IFLS survey and 2,876 (Column 3) were the new respondents for IFLS 4 survey. Then, it continued to drop the duplicate observations (2,691 in column 5). Finally, the data were merged with the cognitive scores table and the missing values are dropped (11,319 in column 6). The optimum of IFLS 4 data is presented in column 7 which has 4422 observations of children aged 7 to 14 years.

Coming to the IFLS 5 data set, the raw data for children ages 14–22 years old was 11,664 (Column 4) with 1,806 new respondents (Column 3) and the rest of the panel data from IFLS4 (9,858). In all, 2,199 observations (Column 5) were dropped because of duplicates and another 5,041 (Column 6) did not have cognitive scores. As a result, the optimum number of observations for IFLS 5 was 4,424 observations (Column 7). Therefore, the total optimum observations to produce the panel data for the research was 8,846 individual children in the 2 surveys.

Part B of the table shows the data reduction process at the second period of constructing the panel data, provided from Column 3 to Column 6. The process of incorporation between the main outcome of cognitive score and covariates required the author to drop as many as 2240 individuals (4480 observations) owing to the missing data in children & parental characteristics (1892) and school & district input (2588) (sum of Column 3 and 4). The study then eliminated two attrition factors. Firstly, two observations were not found in IFLS 5 and there were 11 children whose family had extremely outlier data of income and consumption (above 500 million rupiah).The final observation is a balanced panel data that contains 4342 observations (2171 individuals) in which 1086 observations are of borrowers (treatment group) and 3256 observations are of non-borrowers (control group).

5.2.2 Characteristics of All Variables

This subsection summarises the characteristics of all the variables of children's cognitive outcomes. It covers the total number of observations in panel, the mean and the standard deviation that compared in two groups of treatment group and control group which given in the Table 5 (Appendix C). The table also provides the *p*-value analysis for the two comparisons: The treatment-group analysis is given in column 9 and the period analysis is presented in column 10. The source of the loan of household, presented in Table 5A (Appendix C). From the Table 5A, it can be seen that the largest microcredit access is given by formal microfinance institution which are commercial banks, rural banks and other financial insitutions.

5.2.2.1 Treatment-Group (Mean and *p*-value Analysis)

The mean analysis is presented from column 3 to column 8 in Table 5 (Appendix C). However, the author prefers to provide a discussion for selected variables that have the most significant differences (at 1% significance level, p-value<0.01). These selected variables are given in Table 6 below:

Table 6: Selected Treatment and Control Group Analysis

Variables	Treatment Mean	Control Mean	Mean Difference (%)	*p*-value*
Children age	14.675	14.072	4.34	0.000
Children level of education, no school=1	2.104	1.948	8.01	0.000
Father level of education, no school=1	2.54	2.29	10.92	0.000
Mother level of education, no school=1	2.51	2.37	5.77	0.002
Total Parent's Income (Rp000)	17,355	13,668	26.98	0.000
Total non-farm business profit (Rp000)	6,994	5,080	37.68	0.000
PCI (Rp000)	3,971	3,108	27.77	0.000
PCE (Rp000)	2,281	1,903	19.86	0.005
Total Educational Expenditure (Rp000)	6,270	4,612	35.95	0.000
Residence, Urban=1:mean	0.599	0.504	18.85	0.000
Average teacher salary (Rp000)	2,658	2,338	13.69	0.003
% household using electricity	94.97	92.171	3.04	0.000
Region, Java Island=2	2.308	2.244	2.85	0.008

*Ha: diff= mean (treatment group) – mean (control) ≠ zero i.e., the larger the p-value the lower the significant difference between the two group.

The children's characteristics, reflecting their innate ability, show significant differences between the two groups, especially the children's age and level of education variables. Both proxies show a mean difference of 4.34% and 8.01%, respectively, and the *p*-value is significant at the 1% level. The difference of level of education would be an early indication of the borrower family having a higher SES than the non-borrower.

Coming to the next explanatory variables group, the parental characteristics show that most of the parents attended elementary school even though there are differences in the average points between the two groups. The children living in borrower families had a father and a mother with higher level of education than those in non-borrower families (2.54 vs. 2.29), with statistically significant *p*-value at 1% level.

The proxies of SES-related home factors, which are total parent's income, total profit, PCE, PCI, and residency, show the borrower families have greater income and expenditure than non-borrower families. This is reflected by the significance of *p*-value at the 1% level. This is considered normal since microfinance institutions tend to have specific requirements for prospective clients, some of them probably reflected by the level of education, credit reputation, or the ability to repay the debt. Hence, it resonates the differences in the children's level of education which strengthens the initial assumption that borrower families have a stronger economy.

The other proxies of SES in terms of regional welfare show similar significant differences between treatment and control group both for mean and *p*-value analysis, indicated by the average teacher salary, access to electricity, and region. Again, this reflects the children in borrower families have better education facilities and enjoy a better living environment than those in non-borrower families. These major differences in SES variables are depicted in Figure III (Appendix C).

Therefore, all the variables do not have significant differences between treatment and control groups except the variables related to the strength of economy at the household, community, and regional levels.

5.2.2.2 Period of Time Analysis

In contrast with the previous analysis, this part focuses on whether all the variables show significant differences in the two period of time within the variables (column 9 in Table 5, Appendix C). Most of variables show a significant difference, meaning there were changes over a period of time. Some of variables were time invariant, namely the loan characteristics, such as frequency of received loans and source of credit, and school inputs, such as pupil-teacher ratio. These three variables are given in the table below:

Table 7: Selected Period of Time Analysis

Variables	*p*-value*
Loan frequency	0.680
Credit source	0.491
Pupil-teacher ratio	0.249

*Ha: diff= mean (treatment group) – mean (control) ≠ zero i.e., the larger of p-value the lesser significant difference between the two group.

5.3 Correlation Test

The paper provides the correlation test to ensure there is no significant correlation between the independent variables by using Correlation Test. The most significant results are presented in Table 8 below:

Table 8: Summary of Correlation Test

	Cognitive scores	Credit50	Child Age	Childlabour	HHIncome	total profit
Cognitive scores	1	0.0266	0.1161*	-0.0425*	0.1001*	0.0427*
Credit50	0.0266	1	0.0665*	0.0274	0.0761*	0.0520*
AoC (Amount of credit)	0.0954*	.	0.0867*	-0.0356	0.3035*	0.2685*
Loan frequency	-0.0790*	.	-0.0422	-0.0236	-0.0336	-0.0123
Credit source	0.0883*	.	0.0059	-0.0221	0.0893*	0.0768
Outstanding credit	0.0379	.	0.0487	-0.0239	0.0893	0.0209
Children level of education	0.2005*	0.0717*	0.7771*	0.6090*	0.2482*	0.1365*
Per Capita Income (PCI)	0.0734*	0.0738*	0.1395*	0.0123	0.7733*	0.6264*

Note: the summary table are produced by own construction based on Correlation Test. The (*) sign means the correlation is statistically significant at 1% level.

It is clear that most variables were correlated with the loan characteristics such as amount of credit, loan frequency, outstanding loan, and source of loan. These variables had the strongest correlation with microfinance participation. Children's level of education also had a significant and strong correlation with children's age and child labour variables. The PCI variables were naturally associated with household/parent's income and business profit, so these variables were excluded as covariates. In conclusion, loan characteristics and children's level of education were dropped. The correlation test results for all the variables are presented in Table 8A (Appendix D).

5.4 Hausman Test

The results of the descriptive statistics indicate that the data characteristics may have a higher variance and time invariance in some particular explanatory variables. Some were omitted for bias due to collinearity or endogeneity problem. Therefore, this paper applied the Hausman test to determine whether the fixed-effects or random-effects model should be used for the regression analysis. The summary of the Hausman test results are presented in the table below:

Table 9: Summary of Hausman Test Results

Outcomes-Estimation Model	Chi^2	Prob > Chi^2	Decision, Accept Ho = p>0.05
Household Welfare Model			
a. Income per capita (PCI)	77.38	0.0000	Reject Ho, Fixed Effect
b. Expenditure per capita (PCE)	63.58	0.0000	Reject Ho, Fixed Effect
c. Educational Expenditure	91.50	0.0000	Reject Ho, Fixed Effect
Cognitive Score- Sensitivity Model	114.33	0.0000	Reject Ho, Fixed Effect
Cognitive Score- Pathway Model	109.28	0.0000	Reject Ho, Fixed Effect
Cognitive Score-Heterogeneous Age Cohort	101.73	0.0000	Reject Ho, Fixed Effect

From that table above, the paper will regress all the estimation models using the fixed-effects model. The complete version of the Hausman test is given in the Appendix E.

According to the results of the Hausman test, the children's level of education has similar results with the correlation test in a different point of view. The Hausman test shows it has the endogeneity problem with the main outcome of cognitive score. The other groups were omitted such as father's education level, mother's education level, and child's gender since these were time-invariant variables. Consequently, these variables should be dropped from the specification model.

Therefore, the author dropped the child's level of education and child's gender but kept the parent's level of education because the father and mother's level of education are fundamental variables in both microfinance and children's cognitive achievement theories. In order to accommodate the omitted father and mother's education level, the author generated interaction variables of father and mother's level of schooling with participation in microcredit. In addition, the paper also produced interaction of microcredit and child's gender to capture the effect of microcredit through women empowerment.

Chapter 6 Results and Discussion

6.1. Introduction

This chapter provides the regression results for the interpretation and discussion of the four research analyses. The results of the first model are presented in section 6.1. The sensitivity model results are given in 6.2. Finally, the results of the third and fourth analyses are provided in 6.3 and 6.4, respectively, to strengthen the results before drawing the conclusion and giving policy recommendations in Chapter 7.

6.2 Discussion

This subsection presents the result of the four regression models to answer the research questions. With the higher SES for borrowers in the research sample, the first analysis focused on whether participation in microcredit has a positive influence on a household's welfare proxies. It further examined the sensitivity of the model to the channel theory of Maldonado and Vega (2008).

The third segment investigated mother-children interaction as the channels for microcredit affecting the cognitive scores. This interaction is one of the essential determinants of children's cognitive achievement along with maternal cognitive ability, children's endowed ability, and school input (Todd & Wolpin 2008). The last part produced an additional analysis of the heterogenous effect of different age cohorts. (The completed version of all analysis results is given in the tables in Appendix F).

Result 1: Association between Microcredit Participation and the SES Variables

Table 10: Microcredit and Household Welfare Indicators

Variables	*Ln* Income Per Capita		*Ln* Expenditure Per Capita		*Ln* Educational Expenditure	
	OLS	Fixed-effect	OLS	Fixed-effect	OLS	Fixed-effect
	(1)	(2)	(3)	(4)	(5)	(6)
Microcredit Participation, Borrower=1	0.647***	0.436**	0.284***	0.116	0.552***	0.166
	(0.123)	(0.172)	(0.0604)	(0.0885)	(0.115)	(0.171)
Covariates	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Number of Observations:	**3408**	**3408**	**3408**	**3408**	**3408**	**3408**

Note: Controls included. Constant included and not shown. Robust Standard Errors clustered at household level in parenthesis. *** p<0.01,** p<0.05, * p<0.1.

As seen in the table above, there is a positive association between all the household welfare variables and microcredit participation even though only PCI has a strong magnitude at one (column 1, OLS) and five (column 2, household-fixed effect) percent levels of significance. Further, the borrower family was likely to earn higher income per capita by 43.6 (column 2) percentage-points than the non-borrower family. It also shows a significant magnitude by 64.7 percentage-points at 1% significance level even if we remove the household fixed effect (column 1, OLS).

The higher income of the borrower family does not generate higher consumption per capita compare to non-borrower. It also does not lead significant higher of educational expense for their children. The coefficients of fixed-effect regression showed insignificant magnitude for these consumption proxies at 11.6 (column 4) and 16.6 (column 6) percentage-points, respectively.

These three coefficients resonate the initial assumption that people who received the loan tended to earn more income since credit access gives them an opportunity to scale up their business or job. Consequently, the credit received is dominantly used for the business so that the incremental consumption and educational expenditure does not a have significant magnitude compared to that of non-borrowers.

Therefore, the household fixed-effects regression result shows that the participation in microcredit leads the borrower family to concentrate the money on generating higher income through disbursement for business growth so it does not directly spend on consumption and education purposes. This finding is coherent with the results of Kondo et al. (2010) who found that a positively significant increase in PCI was not directly related to higher consumption and household asset accumulation.

Result 2: Association between Microcredit Participation and sensitivity of Five Effects on Children's Cognitive Outcome

Table 11: Cognitive scores and Sensitivity to the Inclusion of Covariates

Variables	Children Fixed-Effect Model- *Ln* Cognitive Score						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Microcredit Participation (MCP)	-0.0297**	-0.0322**	-0.0221	-0.0263	-0.0320**	-0.0274	-0.0184
	(0.0145)	(0.0144)	(0.0193)	(0.0368)	(0.0143)	(0.0366)	(0.0381)
Covariates							
Income effect	#						#
Risk-management effect		#					#
Gender effect			#				#
Information effect				#			#
Child-labour demand effect					#		#
Information effect and Child-labour demand effect						#	
Number of Observations:	4342	4342	4342	4342	4342	4342	4342

Note: Covariates included. Constant and Period dummy included and not shown. Robust Standard Errors clustered at children level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Having discussed the effect of microcredit on household welfare indicators that may relate to a household's investment in children's cognitive development process, this second analysis goes a step further to examine the sensitivity of microcredit participation coefficient on the main research outcome. The analysis investigated the association between the inclusion of group variables and cognitive test score according to the microfinance channel theory of Maldonado and Vega (2008). It aimed to capture the changes in sensitivity of the coefficients that may give an indication of microcredit affecting the cognitive scores.

Generally, the sensitivity analysis showed a consistent negative association with the cognitive score. This finding is dramatically opposite to the theory and the hypothesis which assumed microcredit has a positive significant effect on cognitive scores. In column 1, the negative sensitivity of income effect (total parent's income and total business profit) shows a significant magnitude at the 95% significance level. This means living in borrower families is associated with the reduction of score by -2.97% percentage-points as compared to living in non-borrower families.

Concerning the SES proxy variables in column 2, the risk management effect (PCE) also had a similar sensitivity sign as income effect, which was associated with a reduction in the cognitive scores by 3.22 percentage-points compared to non-borrowers at the 5% significance level.

The gender effect (household head and interaction between children's sex and microcredit participation) became insignificant with the coefficient estimated at 2.21 percentage-points. This result corresponded to the Indonesian context of microcredit in which microcredit penetration did not focus on women's empowerment and the largest platform of credit was commercial loan, with individual clients.

The introduction of parental characteristics (information effect, column 4) produces the insignificant sensitivity with 2.63 percentage-points. This means the parental level of education does not lead to a significant association between micro-lending and cognitive scores.

The child labour demand effect in column 5 indicates significant negative sensitivity for microcredit participation on the cognitive attainment by -3.20 percentage-point at 5% significant level compared to non-borrower. This finding is correlated with the theory that microcredit leads the children to participate in the labour force and is associated with the reduction in children's cognitive score.

This paper attempts to incorporate the information and child-labour demand effect into one regression to capture the association between parent's level of education and demand for child labour in the context of receiving the micro-loan. The result shows a negative insignificant coefficient of participation in microcredit. Thus, the demand for child labour and the level of parent's education do not increase the sensitivity of the association between participation in microcredit and children's cognitive score.

All included covariates in column 7 showed insignificant sensitivity of microcredit participation on the children's achievement in the cognitive tests by -1.84 percentage-points. Therefore, it can be concluded that only the SES-related effect variables have a negative significant correlation with cognitive scores and it corresponds with the result of descriptive statistics and the first analysis. However, the all included variables did not show statistically significant correlation, which means there was an insignificant link between all five effect groups and children's cognitive score.

Result 3: Association between Microcredit Participation and Cognitive Scores through Mother-Children Interaction as the Selection Channel

Table 12: Microcredit on Cognitive Score and Mother-Children Interaction as the Selection Channel

Variables	*Ln* Cognitive Score Fixed Effect
Microcredit Participation (MCP)	-0.0232
	(0.135)
Working mother	-0.000753
	(0.0345)
Interaction Working mom & MCP	-0.0129
	(0.0473)
Covariates	**Yes**
Number of Observations:	4342

Note: Controls included. Constant and period dummy included but not shown. Robust standard errors clustered at children level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

This analysis conducted a further investigation using the three previous analysis results. It attempts to link the negative association of higher borrower family income and economic status on cognitive score with the important factor of parenting.

As seen in Table 12 above, the direction of correlation between microcredit participation and cognitive score is consistently negative with the previous analysis although it is not statistically significant at -2.32 percentage-points. The working mother variable and interaction variable as media also showed an insignificant and small magnitude at-0.075 and -1.29 percentage-points, respectively. The total coefficient for working mother and participation in microcredit was insignificant at -3.61 percentage-points (-2.32 microcredit and 1.29 interaction). Thus, the children in the borrower family and with working mother were not significantly different on cognitive scores compared to those in the non-borrower family.

Therefore, there is no significant effect of working mother and participation in microcredit on the children's cognitive performance. Therefore, regardless of the mother working or not and borrowing or not, these variables do not have a significant link with children's cognitive result. In other words, the presence of mother for nurturing the children is not an effective mediation for channelling the microcredit effect on cognitive attainment. In addition, this variable could not be considered the underlying factor causing higher economic status (of borrowers) to have a negative correlation with children's cognitive results.

This finding may correspond with the theory that older children have developed knowledge, resulting in a naturally higher likelihood of achieving better cognitive development (Piaget as cited in Smith 2002). This paper then constructs the assumption that adolescents are more independent and not constantly dependent on their mother. Thus, for this group of children, the factor of mother care was not significant in the third analysis. Hence, it was imperative to carry out the fourth analysis to investigate this assumption.

Result 4: Heterogeneous Effect of Age Cohort Analysis

Table 13: Heterogeneous Effect of Age Cohort

Variables	*Ln* Cognitive Score Fixed Effect	
	(1)	(2)
Microcredit Participation (MCP)	-0.0301**	-0.0309*
	(0.0145)	(0.0183)
Age Cohort below the mean	-0.0350***	-0.0354**
	(0.0135)	(0.0148)
Interaction of AC below the mean with MCP		0.00183
		(0.0247)
Covariates	**Yes**	**Yes**
Number of Observations:	4342	4342

Note: Controls included. Constant and period dummy included and not shown. Robust standard errors clustered at children level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

The table above depicts the comparison of the regression results for children in the age group below the mean (children<15 years) and the same individual on reaching the age above the mean. The first column shows the regression without interaction of the age cohort with microcredit participation while the second column captures the effect of interaction and age cohort.

Again, the result indicates a steady negative association between microcredit and children's cognitive scores. This first column indicates a negative significant magnitude and coefficient between microcredit and children below 15 years of -3.01 and -3.05 percentage-points at 5% and 1% statistical level, respectively. In addition, the significant and negative coefficient of the age-below-mean variable alludes to the theory that the younger age cohort is significantly associated with lower cognitive scores compared to the older groups by 3.5 and 3.54 percentage-points.

An interesting finding is given in the second column when the interaction variable is introduced. There was no significant correlation between age group and participation in microcredit on cognitive outcomes even though the main coefficient of microcredit

remained significantly negative at 3.09 percentage-points at the 10% level of significance. This means there is no age heterogeneity effect, which can be seen from the total coefficient for the children under the mean age cohort and the family participating in microcredit. It is insignificant at -3.27 percentage-points (3.09+0.18) compared to children living in non-borrower families.

This finding is consistent with the sensitivity and mother-child analysis results, which indicates the effect of microcredit participation on cognitive scores but not at the level of significance. Therefore, it can be asserted that the cognitive outcome of children with age classification is not affected by their family's participation in microcredit. It also suggests the presence of a weak link between mother-children interaction and age below the mean with borrowing micro-loan. Hence, It can be suggested that there are insignificant difference cognitive outcomes betwen children living in borrower family and the children with family of control group.

Chapter 7 Conclusion

Microcredit, one of the most celebrated policies for tackling poverty in developing countries, has been attracting the attention of various stakeholders, especially in terms of measuring its impact. Considering the fact that Indonesia has experienced the implementation of the microcredit intervention for more than two decades, studies on impact evaluation are no longer focusing on the direct monetary impact but on non-monetary impacts such as human capital formation in education and health.

Relevant to the premise above, this study attempted to investigate the association between children's cognitive development and participation in microcredit. Generally, this paper found that microcredit has a weak, negative correlation with children's cognitive test scores, although the association was not statistically significant when all the explanatory variables were included. The findings opposed the theories and hypotheses stating that microcredit has a positive effect through particular channels.

Microcredit generated an increase in household income although there was no significant effect on educational expenditure. This finding resonates the descriptive analysis result which indicates that a borrower has a stronger economic status than a non-borrower. This is in contrast with the existing data where most of the participants are poorer than the control group (Kandker 2003, Montgomery 2005 as cited in Kondo et al. 2008), but coherent with the findings of a study conducted in the Philippines (Kondo et al. 2008). This result raises the issue of the effectiveness of targeting microcredit clients since most of the lenders in those studies were formal microcredit institutions.

Concerning the main research outcome, the result of the sensitivity models reflected that participation in microcredit has a weak, significant correlation with the cognitive test scores with all the covariates included. However, the one-by-one effect regression results showed a significant association on income, consumption and child-labor demand. Further analysis to test the assumption that the parent's allocated time affects their children's cognitive development revealed that the parent, especially mother, was not the effective pathway mediating the negative effect of microcredit on children's score.

Thus, the heterogeneous effects by age cohort were analysed to investigate the hidden cause of the negative association. This final examination revealed that the participation in microcredit insignificantly decreased the younger children's score with the interaction variable included.

Therefore, the findings seem to lead to a solid conclusion that there is no significant link between microcredit participation and children's cognitive scores. The increment in household income because of credit did not significantly generate higher investment on children, which clearly has no significant effect on cognitive outcomes.

However, it is imperative to formulate policies on microcredit considering children's cognitive development. Firstly, the targeting procedures for prospective clients need to be reviewed considering the majority of microcredit lenders in Indonesia are formal financial institutions. Secondly, it should be clear that human capital investment cannot be achieved by one single policy of credit access relaxation for unskilled and non-bankable persons. This should be undertaken by the harmonisation of policies across interested parties.

Finally, further research could determine the cause of the negative association focusing on child endowment predictors such as nutrition and health and the mother's cognition and intellectual capacity.

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APPENDIX A- Empirical Evidence

Table 1: The Empirical Evidence

Authors	Tittle and Year	Motives and Core Arguments	Research Methodology	Results
Gordon Dahl and Lance Lochner	The Impact of Family Income on Children Achievement (2005) in USA	Complement the past literature that often omitted permanent unobserved heterogeneity and unobserved transitory shock	- Data source: NLSY - Unit of Analysis: children and mother (cohort) - Fixed Effect Instrumental Variables	Current income has significant effect on children achievement
Christina Paxson and Norbert Schady	Cognitive development among young children in Equador (2007)	- The different results of determined factors of cognitive development between developed countries and developing countries - Examine the most three determinant predictor for cognitive achievement: SES, child health and parenting	- Data source: 1999 *Encuesta de Condiciones de Vida (ECV),* and 2001 Population Census - Unit of Analysis: child age 36-71 months - Crossection data, - used OLS, maximum likelihood and CLAD	Robust significant effect of higher SES on cognitive scores. Ages is significant while child nutrition and parenting only has minor effect.
Raquel Bernal	The Effect of Maternal Employment and Child Care on Children's Cognitive Development in USA (2008)	- Attempted to apply joint CAPF and fixed effect model for analise the mother decision of working or taking daycare services on children cognitive. It aim to solve the problem of the past literature in dealing with unobserved mother and children characteristics	- Data source: NLSY - Unit of Analysis: Children age 0-5 years old of married women - Child fixed effect model	The full-time worker mother and use daycare service is signficantly associated with reduction in her children cognitive score.
Sarah Heilmann	Life-chances of children in Indonesia:The links between parental resources and children's outcomes in the areas of nutrition, cognition and health (2013)	Examine the link between the parent's SES, children nutritional status and the cognitive outcome, with the pathway of the brain and physical development and parenting.	- Data souce : of IFLS 1-4(1993-2007) - Unit of Analysis: Children (cohort analysis) - Use residual height-age (expected-actual height at different children's life stage) as a proxy of cath-up or stunted children (malnutrition), - Applied multivariate regression model	- Children who stunted in early childhood life is associated with lower cognitive score - School attendace and parent's education, in particular mother, are strongly associated with children scores.

Authors	Tittle and Year	Motives and Core Arguments	Research Methodology	Results
Jorge H. Maldonado & Claudio Gonzalez-Vega	Impact of Microfinance on Schooling: Evidence from Poor Rural Households in Bolivia (2008)	- Construced the theory that microfinance may affects on child education through 4 channels: income growth, risk management, child-labor demand, gender empowerment, parent information -evaluate the impact of microfinance on human capital formation by looking at children from rural households with access to credit are kept in school longer	- Data Source: Use MF's Batallas and CRECER clients - Unit of Analysis: household - They attempted avoid selection bias : using cohort group, old borrowers - Use household random effect	- the children of old clients have about half a year (in the case of Batallas) or a quarter of a year (in the case of CRECER) less schooling gap than children from new dient households. - There is no differrence between girls and boy on schooling achievement - birth order is significant for the oldest boy/girl to be sent to school longer than their sibling - significant effect land holding on school gap, it increases opportunity in farm (paradox) make children to be pulled out from school, a poverty trap.
Kondo, Orbeta Jr, Dingcong & Infantado	Impact of Microfinance on Rural Households in the Philippines(2010)	- To solve the problem of past literature: it could not find a valid counterfactual - Examined the effect of microfinance participation on comprehenive outcomes such as: household's SES proxies (PCI, health expenditure per capita, educational expenditure, savings, food expenditure) and human capital investment (children health and education)	- Data source: Two own surveys of a. treatment area contains existing borrowers b. Control area, the area for prospective clients - Unit of Analysis: household - Used three type of microcredit participation: borrower, non-borrower, graduated borrower - Used fixed effect for SES and DiD to capture the counterfactual effect - "..Replicate Coleman (1999)of quasi-experimental design to control for non-random programme participation and fixed-effects estimation to correct for non-random	- The PCI and PCE are positively associated with the participation in microcredit while the effect on saving percapita showed insignificant result - Not significant result for human capital investment (injured incidence, hunger incidence, school attendance and educational expenditure) - The microcredit was not designed for ultra poor clients. The additional loan lead their live even worse.

Authors	Tittle and Year	Motives and Core Arguments	Research Methodology	Results
			programme placement"..(Kondo et al, 2010: 67)	
Jeremy Golan	The Impact of Microfinance Use on HouseholdEducational Expenditure in Indonesia (2009)	Examined the effect of microfinance access on total educational expenditure. Robinson (2002) found some part of KUPEDES (MF program) of BRI disbursed for educational expense while Thomas's (1998) findings constrastly showed it was associated with reduction of total household spending for education	- Crossection, IFLS 3 (2000). Using OLS - Unit of Analysis: household - Compare MFI dients and non MFI dients - Net educational expenditure as main interest independent variable	- MFI increased the total HH expenditure for children education - microfinance send their children to school more (in number of child and longer)
Ni Putu Wiwin Setyari	*Evaluasi Dampak Kredit Mikro Terhadap Kesejahteraan RT di Indonesia : Analisis Data Panel* (2012) The Impact evaluation study of Microcredit on Indonesian Household's well-being : Panel Data Analysis	Investigated the hypothesis that household well-being outcomes that could be impacted by microfinance : consumption per capita (PCI), labor supply and children education.	- Data Source: IFLS 3 and 4 - Unit of Analysis: household - Used the presence of MFI in a village/area to capture spill-over effect - Used OLS, district fixed effect model, and IV & Two Stage-Least Square Model - Loan size as an instrument	- Higher household expenditure and labor supply were associated with microcredit participation compare to non-borrower. Labor supply did not differ between child and adult labor - The presence of MF generated the expansion of household business which is adversely reduce the children time in school

APPENDIX B – All Variable Use

Table 2. The All Variables Use in The Analysis

Variable Name and Description	Measure	Variables are used in which Analysis: 1st, 2nd, 3rd, 4th, All
Outcomes (Dependent Variables)		
Ln Per Capita Income	*Ln* total household income divided by number of household	
Ln Per Capita Expenditure	*Ln* total household expenditure divided by number of household	1st
Ln Total Educational Expenditure	Ln of total educational expenditure spent in a household	
*Ln*Cognitive Test Scores in two IFLS surveys for the children age 6-22	Score's range: 0-100	2nd, 3rd, 4th
Independent Variables		
Interest Independent Variables		
Microcredit participation (credit50)	1=Borrower , 0=Non-Borrower (one of household member experienced in received microcredit=1)	All
Working mother	Dummy of working mother in household *h* and district *j* and time *t*, 1=working mother, 0=full housewife	3rd
Child Age Below the average	Heterogenous effect of different age cohort, children <mean of age	4th
Child Age Above the average	Heterogenous effect of different age cohort, children >mean of age	4th
Control Variables		
Loan Characteristics		
Amount of Credit/Loan size	The amount of credit received (Indonesian Rupiah/IDR)	
Frequency of Loan	Number of loan received within 12 months before the survey conducted	
Outstanding of credit	The remaining amount of loan when the survey conducted (IDR)	
Source of Credit	The first party/place a household could access when they need a money, 1=NGO, Money Lender, Other: 2: Social Capital (Farmer group, ROSCA, neighborhood association); 3: Employer, Landlord ; 4: Microfinance and Financial Institution (MFI)	

Variable Name and Description	Measure	Variables are used in which Analysis: 1st, 2nd, 3rd, 4th, All
Children Characteristics		
Age group	6-9 (1), 10-12 (2), 13-15(3), 16-18(4), >19(5)	2nd, 3rd
Child labor	1= Full schooling, 2= working while schooling, 3=full working, 4=not schooling nor working	2nd, 3rd, 4th
Child nutrition	1=eat at least 3 times in a day, 2= 2 times a day, 3= 1 time a day, 4= 5-6 times a week, 5=3-4 times a week, 6= 2 and less times a week	2nd, 3rd, 4th
Parental Characteristics		
Father's education	1=no schooling, 2=elementary school , 3= Junior HS, 4= Senior HS, 5= College/ University	All
Mother's education	1=no schooling, 2=elementary school , 3= Junior HS, 4= Senior HS, 5= College/ University	All
Father's age	Age of father	All
Mother's age	Age of mother	All
Home and House Characteristics		
Household head	Female=1, it is expected negative if the mother become household head	All
Ln Parent's income	Total income from father's and mother's occupation (Indonesian Rupiah/IDR)	2nd, 4th
Ln total profit	Total profit from non-farm business (IDR)	2nd, 4th
Ln Per capita Expenditure (PCE)	Total household expenditure divided by number of family member (IDR)	2nd, 4th
Residence	Urban=1 Rural=0	All
Household size	The total number of member in a household	All
Household's source of water	Does the source of drinking water is also used for bathing and laundering? Yes=1, No=0	All
Household's food storage	Do you store your perishable food in refrigrator?, Yes=2, No=1, Do not have refiregrator=0	All
Household's toilet type	Type of toilet in house, Own=1, Public/Shared=2, sewage/ditch/ River/Other=3	All

Variable Name and Description	Measure	Variables are used in which Analysis: 1st, 2nd, 3rd, 4th, All
School Characteristics		
Pupil-teacher ratio[11]	Ratio of number of student compare to teacher from the sampled schools of IFLS survey in village level, lesser is better	2nd, 3rd, 4th
Average teacher's salary[12]	Average teacher's salary calculated from the average of sampled schools interviewed in IFLS suvey in the village level	2nd, 3rd, 4th
Village and District Characteristics		
Average time to school	Average one-trip time to school, as a proxy for the presence of school in a village, lesser time is better (minutes)	All
Access to nearest public transportation system	1=Inside the village, 2= Outside the village	All
Percentage of using electricity	Percent of household using the electricity in village level	All
Road	Type of Road; 1= Aspalt/paved, 2=dirt, 3=marshes,4=river/lake/sea/others	All
Sewage	Is there a sewage system in the village? Yes=1, No=0	All
Region	Sumatra Island=1, Java=2, Others=3	All

[11]This calculation is a slight difference to Todd and Wolpin (2006). It is not the actual pupil-teacher ratio in child attended school but the proxy derived from the ratio of IFLS's sampled schools in children's village level.
[12]It has the same condition as pupil-teacher ratio.

APPENDIX C : Descriptive Statistics

Table 3: Descriptive Statistics of All Variables

Variable		Mean	Std. Dev.	Min	Max	Observations
Cognitive	Overall	71.092	17.688	5.882	100	N = 4342
	Between		14.315	12.670	100	n = 2171
	Within		10.391	32.856	109.327	T = 2
Microcredit Participation	Overall	0.250	0.433	0	1	N = 4342
Borrower=1	Between		0.329	0	1	n = 2171
	Within		0.282	-0.250	0.750	T = 2
Amount of Credit/Loan Size	Overall	6,512,197	9,909,929	20,000	50,000,000	N = 1086
(IDR/Indonesian Rupiah)	Between		8,997,987	20,000	50,000,000	n = 888
	Within		3,878,286	(16,500,000)	29,500,000	T bar = 1.22297
Credit Source,	Overall	3.578	0.971	1	4	N = 1086
4= Microfinance Insitution	Between		0.931	1	4	n = 888
	Within		0.399	2.078	5.078	T bar = 1.22297
Loan Frequency (Within 12months before the survey)	Overall	1.827	2.774	0	52	N = 1086
	Between		2.414	0	46	n = 888
	Within		1.335	-23.673	27.327	T bar = 1.22297
Outstanding Credit (IDR)	Overall	9,798,175	57,600,000	-	1,000,000,000	N = 998
	Between		62,400,000	-	1,000,000,000	n = 836
	Within		5,515,482	(51,400,000)	71,000,000	T bar = 1.19378
Child's Age	Overall	14.22	3.97	7	22	N = 4342
	Between		1.98	11	18	n = 2171
	Within		3.44	9.218	19.218	T = 2
Child Gender, Female=1	Overall	0.503	0.500	0	1	N = 4342
	Between		0.500	0	1	n = 2171
	Within		0	0.003	1.003	T = 2
Child's Level of Education	Overall	1.987	0.942	0	6	N = 4342
	Between		0.469	0.5	3.5	n = 2171
	Within		0.817	-0.513	4.487	T = 2
Child Labor, 1= Full Schooling	Overall	0.5368494	0.972	0	3	N = 4342
	Between		0.602	0	2	n = 2171
	Within		0.763	-0.963	2.037	T = 2
Child Nutrition,	Overall	1.328	0.594	1	6	N = 4342
1= eat at least 3 times in a day	Between		0.437	1	4	n = 2171
	Within		0.402	-0.672	3.328	T = 2
Family Structure	Overall	0.116	0.395	0	2	N = 4342
1= Father and Mother (Complete)	Between		0.333	0	2	n = 2171
0=Not known	Within		0.214	-0.884	1.116	T = 2

Household Head, Female=1	Overall	0.127	0.333	0	1	N =	4342
	Between		0.269	0	1	n =	2171
	Within		0.196	-0.373	0.627	T =	2
Household Size	Overall	7.078	3.025	1	23	N =	4342
	Between		2.817	2	22	n =	2171
	Within		1.103	-1.922	16.078	T =	2
Age of Father	Overall	40.54	21.79	0	106	N =	4342
	Between		19.09	0	99.5	n =	2171
	Within		10.51	-4.96	86.04	T =	2
Age of Mother	Overall	39.82	17.25	0	101	N =	4342
	Between		15.21	0	97.5	n =	2171
	Within		8.15	-4.677	84.323	T =	2
Children-mother Interaction	Overall	3.130	1.526	1	5	N =	399
Meet every day =5	Between		1.463	1	5	n =	305
	Within		0.483	1.130	5.130	T bar =	1.3082
Children-father Interaction	Overall	2.898	1.396	1	5	N =	703
Meet every day =5	Between		1.369	1	5	n =	496
	Within		0.451	0.898	4.898	T bar =	1.41734
Father's level of education	Overall	2.352	1.277	1	5	N =	4342
No Schooling=1	Between		1.277	1	5	n =	2171
	Within		0	2.352	2.352	T =	2
Mother's level of education	Overall	2.409	1.198	1	5	N =	4342
No Schooling=1	Between		1.198	1	5	n =	2171
	Within		0	2.409	2.409	T =	2
Working mother	Overall	0.563	0.496	0	1	N =	4342
Mother who are working=1	Between		0.403	0	1	n =	2171
	Within		0.289	0.063	1.063	T =	2
Total Parent's Income (IDR)	Overall	14,600,000	21,000,000	100	216,000,000	N =	4342
	Between		16,700,000	100	150,000,000	n =	2171
	Within		12,700,000	(86,800,000)	116,000,000	T =	2
Total non-farm business profit	Overall	5,558,700	16,000,000	100	360,000,000	N =	4342
(IDR)	Between		12,600,000	100	222,000,000	n =	2171
	Within		9,752,368	(171,000,000)	183,000,000	T =	2
Per Capita Income (IDR)	Overall	3,323,165	5,063,958	9	72,800,000	N =	4342
	Between		4,106,095	12	44,700,000	n =	2171
	Within		2,964,377	(28,900,000)	35,600,000	T =	2
Per Capita Expenditure (IDR)	Overall	1,997,267	3,809,656	100	55,800,000	N =	4342
	Between		2,810,815	21,372	34,600,000	n =	2171
	Within		2,571,890	(25,600,000)	29,600,000	T =	2
Total Educational Expense (IDR)	Overall	5,026,449	10,500,000	100	300,000,000	N =	4342
	Between		7,620,446	100	160,000,000	n =	2171
	Within		7,245,089	(135,000,000)	145,000,000	T =	2

Household's Water Source	Overall	0.692	0.462	0	1	N = 4342
Same source Drinking and	Between		0.372	0	1	n = 2171
Bathing/Laundering =1	Within		0.273	0.192	1.192	T = 2
Household's Type of Toilet	Overall	1.383	0.730	1	3	N = 4342
Own toilet=1	Between		0.610	1	3	n = 2171
	Within		0.401	0.383	2.383	T = 2
Household's storage of food	Overall	0.837	0.894	0	2	N = 4342
Store in refrigerator=1	Between		0.732	0	2	n = 2171
	Within		0.514	-0.163	1.837	T = 2
Residency, Urban=1	Overall	0.528	0.499	0	1	N = 4342
	Between		0.470	0	1	n = 2171
	Within		0.167	0.028	1.028	T = 2
Average teacher's salary (IDR)	Overall	2,417,637	2,941,210	205,000	26,600,000	N = 4342
	Between		1,976,334	561,591	14,400,000	n = 2171
	Within		2,178,466	(9,904,650)	14,700,000	T = 2
Average number of student	Overall	31.748	17.070	1	800	N = 4336
	Between		12.742	6	410	n = 2171
	Within		11.360	-358.252	421.748	T bar = 1.99724
Pupil-teacher ratio	Overall	9.324	3.818	1.055	42.507	N = 4342
	Between		3.008	1.544	24.661	n = 2171
	Within		2.352	-8.522	27.170	T = 2
Time to school (minutes)	Overall	15.804	15.543	0	360	N = 4342
	Between		10.958	1	190	n = 2171
	Within		11.025	-154.20	185.80	T = 2
Road type, Asphalt/Paved=1	Overall	1.033	0.210	1	4	N = 4342
	Between		0.155	1	2.5	n = 2171
	Within		0.143	-0.467	2.533	T = 2
Public transportation system	Overall	0.678	0.467	0	1	N = 4342
Inside the village=1	Between		0.377	0	1	n = 2171
	Within		0.276	0.1783	1.1783	T = 2
Percent of hh using electricity	Overall	92.871	14.366	4	100	N = 4342
	Between		11.514	20.5	100	n = 2171
	Within		8.593	49.871	135.871	T = 2
Sewage system, Yes=1	Overall	0.673	0.469	0	1	N = 4342
	Between		0.369	0	1	n = 2171
	Within		0.289	0.173	1.173	T = 2
Region, Java Island=2	Overall	2.260	0.712	1	3	N = 4342
	Between		0.590	1	3	n = 2171
	Within		0.399	1.260	3.260	T = 2

***Source: Author own calculation using STATA**

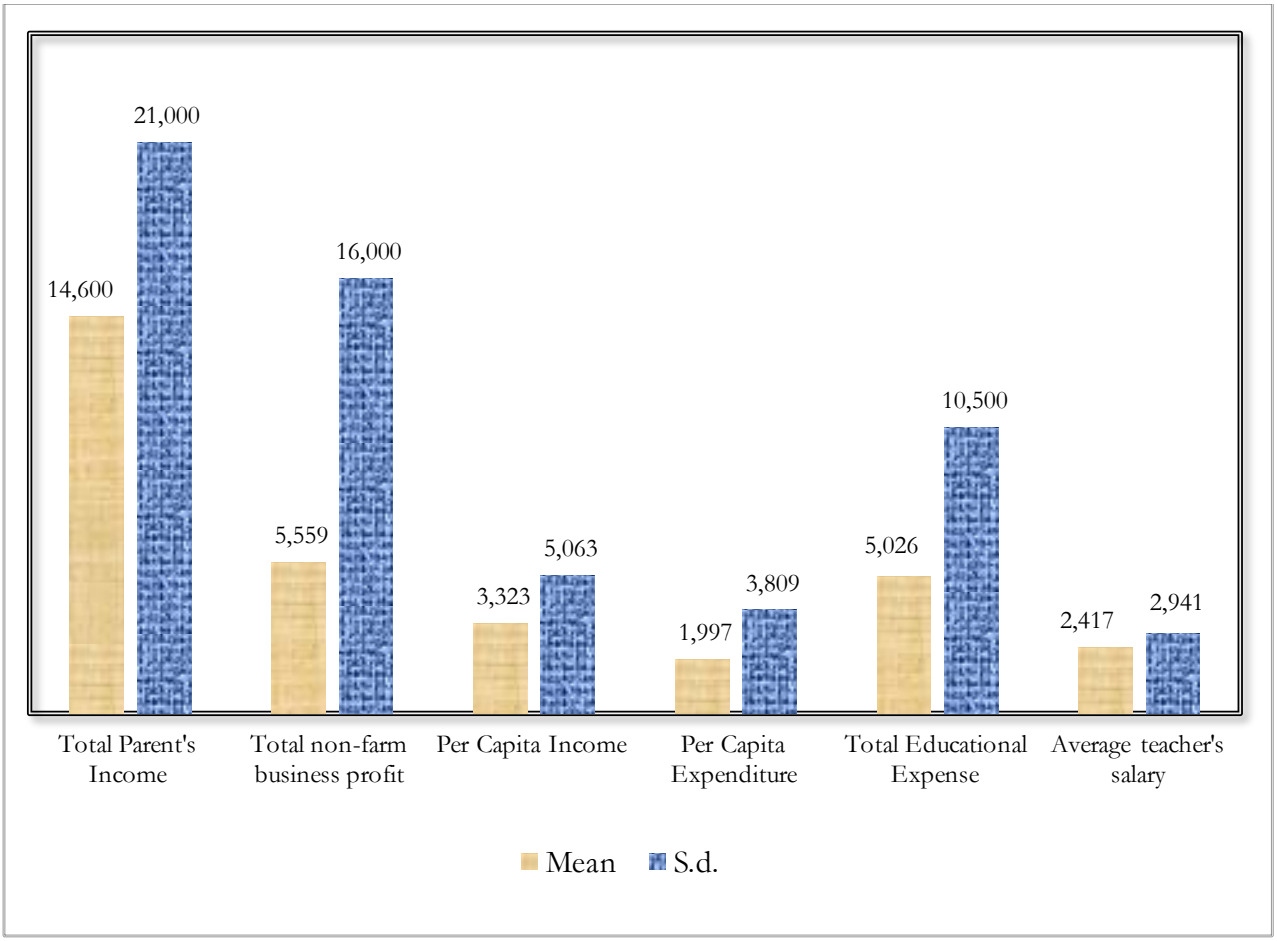


Figure II: The Mean and Standar Deviation of SES-related Variables (Rp000)

Table 5: Descriptive Statistics of Treatment-Control Group

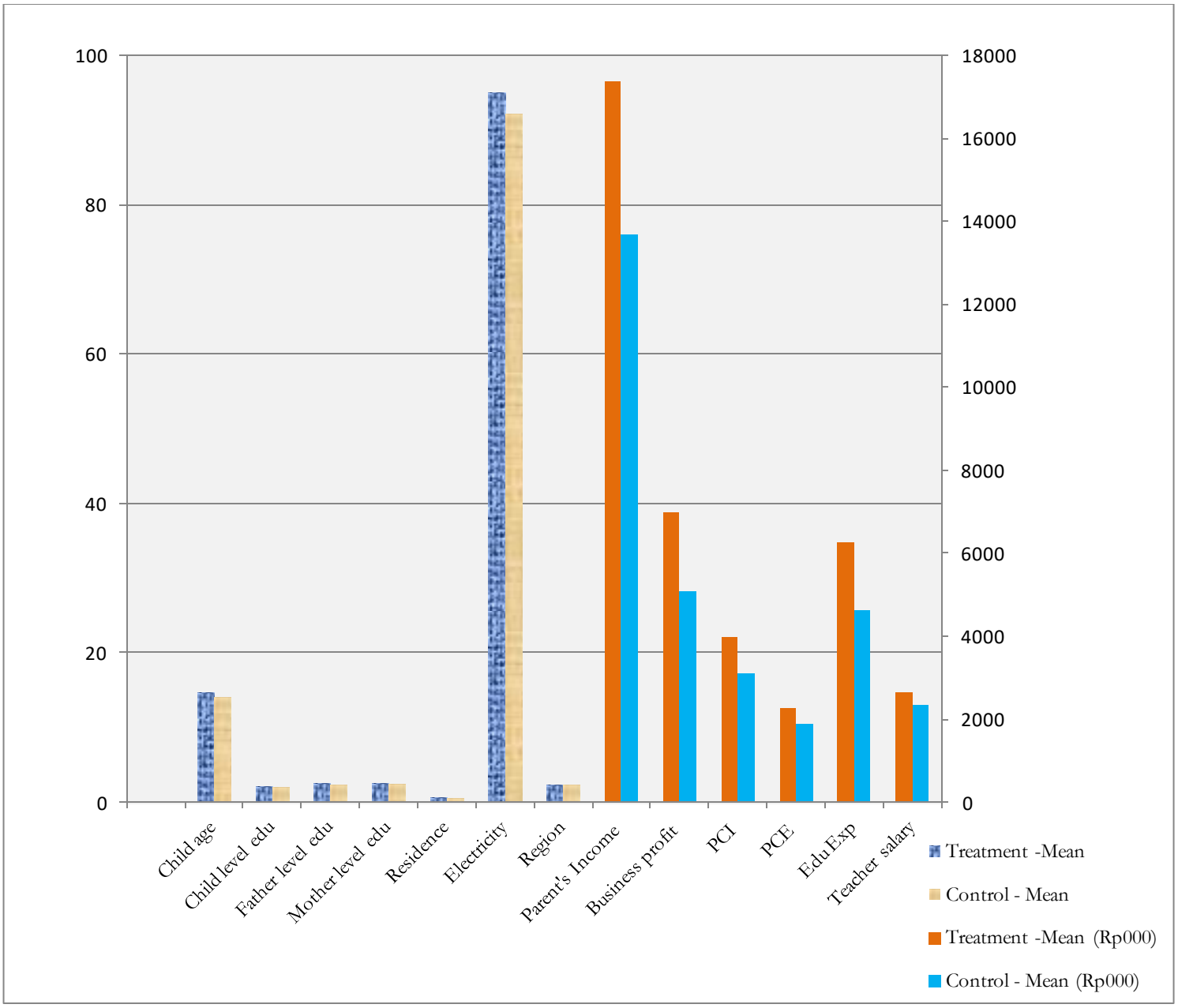
Variables	Obs	Borrower		Non-Borrower		Mean Diff	%	Treatment-Control *p*-value*	T1-T2 *p*-value
		Mean	S.d	Mean	S.d				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Cognitive test scores (0-100)	4342	71.907	0.56	70.82	0.348	1.087	1.53	0.086	0.000
Microcredit Participation	4342			0.25	0.433				0.000
Amount of Credit	1086			6,512	9,910				0.000
Frequency of received loan	1086			1.91	4.02				0.680
Source of credit	1086			3.58	0.97				0.491
Outstanding credit	1086			8,435	61,900				0.033
Child age (years old)	4342	14.675	0.106	14.065	0.054	0.61	4.34	0.000	0.000
Child gender (female=1)	4342	0.486	0.018	0.509	0.012	0.023	4.73	0.233	.
Child level of education (1= no schooling)	4342	2.104	0.026	1.948	0.013	0.156	8.01	0.000	0.000
Child labor (1=full schooling)	4342	0.583	0.029	0.521	0.015	0.062	11.90	0.068	0.000
Child nutrition (1=eat at least 3 times a day)	4342	1.334	0.02	1.326	0.011	0.008	0.60	0.692	0.000
Father's education (1=no schooling)	4342	2.54	0.047	2.29	0.029	0.25	10.92	0.000	.
Mother's education (1=no schooling)	4342	2.512	0.042	2.375	0.028	0.137	5.77	0.002	.
Father's age	4342	40.055	0.715	40.702	0.454	0.647	1.62	0.408	0.002
Mother's age	4342	39.243	0.573	40.017	0.366	0.774	1.97	0.225	0.000
Working mother, Yes=1	4342	0.604	0.016	0.549	0.01	0.055	10.02	0.002	0.088
Household head (female=1)	4342	0.143	0.012	0.122	0.006	0.021	17.21	0.102	0.000
Total parent's income (Rp000)	4342	17,355	761	13,668	391	3,687	26.98	0.000	0.000
Total non-farm business profit (Rp000)	4342	6,994	485	5,080	312	1,914	37.68	0.001	0.000
Per Capita Income (PCI) (Rp000)	4342	3,971	173	3,108	98	863	27.77	0.000	0.000
Per Capita Expenditure (PCE) (Rp000)	4342	2,281	114	1,903	71	378	19.86	0.005	0.000
Total educational expenditure (Rp000)	4342	6,270	378	4,612	176	1,658	35.95	0.000	0.000
Household's Water Source	4342	0.661	0.015	0.702	0.009	0.041	6.20	0.661	0.000
Household's Type of Toilet	4342	1.368	0.023	1.388	0.015	0.02	1.46	1.368	0.000
Household's food storage	4342	0.888	0.029	0.82	0.018	0.068	8.29	0.888	0.000
Residence (Urban=1)	4342	0.599	0.017	0.504	0.011	0.095	18.85	0.000	0.000
Household size	4342	7.07	0.101	7.08	0.067	0.01	0.14	0.925	0.002
Pupil-teacher ratio	4342	9.468	0.108	9.276	0.075	0.192	2.07	0.131	0.249
Average teacher's salary (Rp000)	4342	2,658	48	2,338	94	320	13.69	0.003	0.000
Average time to school (minutes)	4342	15.785	0.357	15.81	0.291	0.025	0.16	0.958	0.000
Nearest public transportation system (Inside village=1)	4342	0.665	0.015	0.683	0.009	0.018	2.71	0.286	0.000
Percentage of using electricity	4342	94.97	0.356	92.171	0.301	2.799	3.04	0.000	0.000
Type of road (aspalt/paved=1)	4342	1.012	0.003	1.04	0.004	0.028	2.77	0.000	0.000
Sewage system (Yes=1)	4342	0.669	0.015	0.674	0.009	0.005	0.75	0.792	0.000
Region, Java=2	4342	2.308	0.02	2.244	0.015	0.064	2.85	0.008	0.000

* Column 9: Ha: diff= mean (treatment group) – mean (control) ≠ zero i.e, the larger of p-value the lesser significant difference between the two groups.Source: Produced by author's calculation using orthout command in STATA

Table 5A: Source of Loan

The first place you apply credit	Frequency	Percent	Cummulative
Commercial Banks, Cooperatives and MFI	893	82.23	100
Employer/Landlord	42	3.87	17.77
Social Capital	37	3.41	13.9
Other	114	10.5	10.5
Total	**1,086**	**100**	

*Note: The composition of observation correspond to the population based on past literature that stated the largest microcredit lender is formal financial institutions. Source: Author own calculation using STATA



*All Variables are significant in one percent level of statistics (p-value<0.01)

Figure III Treatment and Control Group: *P*-Value Analysis for SES-related Variables

APPENDIX D- Correlation Test

Table 8A: Result of Correlation Test

	cognit~e	credit50	AoC	loanfreq	credit~e	outs_c~t	age
cognitive	1.0000						
credit50	0.0266	1.0000					
AoC	0.0954*	.	1.0000				
loanfreq	-0.0790*	.	-0.0495	1.0000			
credit_sou~e	0.0883*	.	0.1863*	-0.1346*	1.0000		
outs_credit	0.0379	.	0.1615*	0.0111	0.0321	1.0000	
age	0.1161*	0.0665*	0.0867*	-0.0422	0.0059	0.0487	1.0000
gender	0.0214	-0.0194	-0.0738	-0.0117	-0.0443	0.0192	0.0235
childedu	0.2005*	0.0717*	0.1952*	-0.0447	0.0355	0.0698	0.7771*
child_labor	-0.0425*	0.0274	-0.0356	-0.0236	-0.0221	-0.0239	0.6090*
Child_Nut	0.0147	0.0063	-0.0074	-0.0105	-0.0029	0.0041	0.1170*
hh_head	-0.0203	0.0270	-0.0719	0.0027	-0.0804*	-0.0213	0.1012*
Fam_size	0.0029	-0.0015	0.0069	0.0793*	-0.0277	-0.0141	0.0568*
fatherage	0.0363	-0.0129	-0.0079	0.0395	0.0600	0.0258	-0.0265
motherage	0.0515*	-0.0194	-0.0044	0.0362	0.0592	0.0030	0.0747*
f_lvedu	0.1475*	0.0847*	0.1800*	-0.0929*	0.1127*	0.0993*	-0.0486*
m_lvedu	0.1593*	0.0494*	0.2203*	-0.0653	0.1056*	0.0707	-0.0405*
working_mom	-0.0206	0.0479*	0.0879*	0.0398	0.1080*	-0.0578	-0.0226
HHIncome	0.1001*	0.0761*	0.3035*	-0.0336	0.0893*	0.0137	0.1580*
tot_profit	0.0427*	0.0520*	0.2685*	-0.0123	0.0768	0.0209	0.0722*
PCI	0.0734*	0.0738*	0.3252*	-0.0370	0.1086*	0.0167	0.1395*
PCE	0.0822*	0.0429*	0.2023*	-0.0437	0.0837*	0.0722	0.1013*
edu_exp	0.0932*	0.0683*	0.1549*	-0.0080	0.0443	0.1107*	0.1446*
hh_water	-0.0167	-0.0384	-0.0251	0.0051	0.0497	-0.0720	-0.1700*
hh_typetoi~t	-0.1339*	-0.0114	-0.1470*	0.0952*	-0.0945*	-0.0595	-0.1228*
hh_refrigr~r	0.1608*	0.0328	0.2771*	0.0225	0.0850*	0.1123*	0.1872*
Urban_Rural	0.1440*	0.0820*	0.0413	-0.0051	0.0138	0.0557	0.1018*
av_teach_s~y	0.0637*	0.0473*	0.0160	-0.0038	-0.0010	-0.0173	0.2173*
num_stud	0.0768*	-0.0130	0.1030*	-0.0060	0.0087	0.0535	0.0448*
p_t_ratio	0.0805*	0.0217	-0.0241	-0.0292	-0.0495	0.0690	0.0066
time_to_schl	0.0284	-0.0007	0.0878*	0.0019	0.0040	0.0831*	0.2589*
Road	-0.0120	-0.0575*	-0.0539	-0.0267	0.0217	-0.0159	-0.0869*
pub_trans	0.0603*	-0.0166	0.0534	-0.0120	-0.0050	-0.0536	-0.0353
electricity	0.1205*	0.0844*	0.0397	0.0026	0.0632	0.0282	0.2109*
sewage	0.0703*	-0.0041	0.0052	0.1030*	-0.0169	-0.0649	0.0515*
region	-0.0490*	0.0387	0.0266	-0.1111*	0.0324	-0.0210	0.3770*
female_em	0.0299	0.6442*	-0.0738	-0.0117	-0.0443	0.0192	0.0444*

	gender	childedu	child_~r	Child_~t	hh_head	Fam_size	fa~erage
gender	1.0000						
childedu	0.0534*	1.0000					
child_labor	0.0258	0.2290*	1.0000				
Child_Nut	0.0824*	0.1043*	0.0603*	1.0000			
hh_head	0.0115	0.0654*	0.0823*	0.0234	1.0000		
Fam_size	0.0509*	0.0296	0.0357	0.0200	0.0745*	1.0000	
fatherage	0.0170	-0.0033	-0.0443*	-0.0086	-0.2531*	0.0263	1.0000
motherage	-0.0133	0.0692*	0.0065	0.0104	-0.0167	0.2034*	0.1314*
f_lvedu	0.0005	0.1216*	-0.1374*	0.0090	-0.0788*	-0.0492*	-0.0126
m_lvedu	0.0018	0.1353*	-0.1372*	0.0069	0.0502*	-0.0314	-0.1239*
working_mom	0.0071	-0.0150	-0.0344	-0.0367	-0.2296*	-0.0119	0.1408*
HHIncome	-0.0072	0.2482*	0.0233	0.0416*	-0.0966*	0.0108	-0.0029
tot_profit	-0.0042	0.1365*	-0.0226	0.0291	-0.0435*	0.0478*	0.0353
PCI	-0.0228	0.2238*	0.0123	0.0445*	-0.1030*	-0.2202*	0.0094
PCE	-0.0027	0.1897*	-0.0360	0.0484*	-0.0070	-0.1256*	0.0152
edu_exp	-0.0027	0.2693*	-0.0848*	0.0326	-0.0040	0.0697*	0.0210
hh_water	-0.0199	-0.1643*	-0.0809*	-0.0365	-0.0193	-0.0219	0.0461*
hh_typetoi~t	-0.0088	-0.1956*	-0.0300	-0.0073	0.0139	0.0118	-0.0333
hh_refrigr~r	0.0212	0.2711*	0.0486*	0.0777*	0.0039	0.0608*	-0.0191
Urban_Rural	0.0264	0.1600*	0.0257	0.0716*	-0.0031	0.0256	0.0078
av_teach_s~y	0.0148	0.2160*	0.1041*	0.0503*	0.0068	0.0435*	-0.0192
num_stud	0.0407*	0.0892*	-0.0071	-0.0003	-0.0000	-0.0084	-0.0195
p_t_ratio	-0.0175	-0.0063	0.0236	0.0783*	0.0088	-0.0127	-0.0264
time_to_schl	0.0366	0.2916*	0.0618*	0.0355	0.0266	0.0014	-0.0114
Road	-0.0239	-0.1129*	-0.0561*	-0.0163	-0.0302	-0.0123	0.0052
pub_trans	0.0007	-0.0026	-0.0305	0.0538*	-0.0050	0.0397*	0.0123
electricity	-0.0019	0.2194*	0.0949*	0.0531*	0.0211	0.0148	-0.0029
sewage	-0.0022	0.1124*	-0.0248	0.0270	-0.0020	0.0382	-0.0076
region	-0.0035	0.1629*	0.5089*	0.0214	0.0569*	-0.0292	-0.0126
female_em	0.3699*	0.0507*	0.0251	0.0356	0.0230	0.0352	0.0144

	mo~erage	f_lvedu	m_lvedu	workin~m	HHIncome	tot_pr~t	PCI
motherage	1.0000						
f_lvedu	-0.0084	1.0000					
m_lvedu	-0.0256	0.4530*	1.0000				
working_mom	0.1084*	0.0137	-0.0410*	1.0000			
HHIncome	-0.0009	0.2577*	0.2380*	0.1817*	1.0000		
tot_profit	0.0433*	0.1104*	0.1108*	0.0724*	0.2918*	1.0000	
PCI	-0.0323	0.2408*	0.2112*	0.1448*	0.7733*	0.6264*	1.0000
PCE	-0.0111	0.1657*	0.1849*	-0.0204	0.2847*	0.1361*	0.3181*
edu_exp	0.0311	0.1927*	0.2143*	0.0246	0.2905*	0.1513*	0.2328*
hh_water	0.0598*	-0.0533*	-0.0521*	0.0474*	-0.1220*	-0.1001*	-0.1299*
hh_typetoi~t	-0.0346	-0.2066*	-0.2056*	0.0283	-0.1497*	-0.1061*	-0.1633*
hh_refrigr~r	0.0172	0.2352*	0.2488*	-0.0148	0.3068*	0.1861*	0.2889*
Urban_Rural	0.0146	0.2073*	0.1975*	-0.0777*	0.1658*	0.1031*	0.1611*
av_teach_s~y	0.0168	0.0623*	0.0634*	-0.0105	0.0793*	0.0657*	0.0638*
num_stud	-0.0266	0.0449*	0.0395*	-0.0506*	0.0486*	0.0289	0.0308
p_t_ratio	-0.0195	0.0346	0.0636*	-0.0945*	0.0407*	0.0325	0.0369
time_to_schl	0.0229	-0.0269	-0.0190	0.0039	0.0231	0.0178	0.0169
Road	0.0022	-0.0775*	-0.0745*	0.0497*	-0.0241	-0.0347	-0.0356
pub_trans	-0.0188	0.0831*	0.0864*	0.0053	0.0588*	0.0317	0.0535*
electricity	0.0083	0.1223*	0.1530*	-0.0738*	0.1138*	0.0652*	0.1081*
sewage	0.0234	0.1417*	0.1216*	-0.0249	0.1087*	0.0791*	0.1021*
region	0.0154	-0.0839*	-0.1060*	-0.0221	0.0114	0.0105	0.0303
female_em	0.0040	0.0375	0.0134	0.0438*	0.0470*	0.0333	0.0306

	PCE	edu_exp	hh_water	hh_typ~t	hh_ref~r	Urban_~l	av_tea~y
PCE	1.0000						
edu_exp	0.5018*	1.0000					
hh_water	-0.0951*	-0.0788*	1.0000				
hh_typetoi~t	-0.1152*	-0.1112*	-0.0491*	1.0000			
hh_refrigr~r	0.1902*	0.1895*	-0.1262*	-0.2698*	1.0000		
Urban_Rural	0.1065*	0.1092*	-0.1569*	-0.1694*	0.2166*	1.0000	
av_teach_s~y	0.0560*	0.0742*	-0.0592*	-0.0695*	0.0805*	0.0899*	1.0000
num_stud	0.0248	0.0314	-0.0675*	-0.0538*	0.0513*	0.0833*	0.0178
p_t_ratio	0.0360	0.0168	-0.0821*	-0.0290	0.0867*	0.2197*	0.0495*
time_to_schl	0.0489*	0.0900*	-0.0679*	0.0068	0.0535*	-0.0120	0.0391*
Road	-0.0455*	-0.0476*	0.0499*	-0.0011	-0.0963*	-0.1654*	-0.0699*
pub_trans	0.0376	0.0369	-0.0411*	-0.0549*	0.0740*	0.1937*	0.0409*
electricity	0.1036*	0.1042*	-0.0896*	-0.1434*	0.1854*	0.3650*	0.0416*
sewage	0.0450*	0.0831*	-0.1072*	-0.0929*	0.1204*	0.3390*	0.0592*
region	-0.0071	-0.0554*	-0.0927*	0.0169	0.0170	0.0543*	0.0708*
female_em	0.0114	0.0327	-0.0356	-0.0088	0.0277	0.0641*	0.0470*

	num_stud	p_t_ra~o	time_t~l	Road	pub_tr~s	electr~y	sewage
num_stud	1.0000						
p_t_ratio	0.0967*	1.0000					
time_to_schl	0.0406*	0.0060	1.0000				
Road	-0.0337	-0.1390*	-0.0058	1.0000			
pub_trans	-0.0036	0.0031	-0.0192	-0.1031*	1.0000		
electricity	0.0612*	0.1684*	0.0455*	-0.2304*	0.0947*	1.0000	
sewage	0.0276	0.1136*	0.0387	-0.1334*	0.1458*	0.2315*	1.0000
region	-0.0471*	0.0266	0.0074	-0.0986*	0.1072*	0.0482*	0.0042
female_em	-0.0039	0.0039	0.0062	-0.0348	-0.0107	0.0586*	0.0102

	region	female~m
region	1.0000	
female_em	0.0186	1.0000

APPENDIX E- Hausman Tests

Table 9A: Hausman Test: Outcome-Income per capita (PCI)

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
credit50	.4359603	.6178388	-.1818785	.1257562
Fam_size	-.0624664	-.2316231	.1691567	.0925127
hh_head	.0410153	-1.378326	1.419342	.1981491
hh_water	-.067255	.0037816	-.0710366	.1474856
hh_typetoi~t	.1169915	-.0992988	.2162903	.1013629
hh_refrigr~r	.1508379	.4066872	-.2558494	.0767557
Urban_Rural	-.219486	.4127149	-.6322009	.289136
time_to_schl	-.0010422	-.0058065	.0047643	.0027484
Road	.2799884	.3360045	-.0560161	.2516337
pub_trans	-.0742916	-.050721	-.0235706	.1316008
electricity	-.0028665	-.0002775	-.002589	.0044468
sewage	.257516	.2413791	.016137	.1192318
region	-.2766921	-.1264622	-.1502299	.1122883
2.hhperiod	.0721666	.0759433	-.0037768	.

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(14) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 77.38
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Table 9B: Hausman Test: Outcome-Expenditure per capita (PCE)

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
credit50	.1161573	.2686415	-.1524842	.0693762
Fam_size	-.008722	-.0893144	.0805923	.0474166
hh_head	-.1632824	-.2418927	.0786103	.1077254
hh_water	-.1788389	-.1736207	-.0052181	.0801344
hh_typetoi~t	-.2102245	-.2275514	.0173269	.0547516
hh_refrigr~r	.0759451	.2386115	-.1626664	.041755
Urban_Rural	.2482295	.138476	.1097535	.1508009
time_to_schl	.0034714	.0032415	.0002299	.001535
Road	-.2546798	-.1043848	-.150295	.1387349
pub_trans	-.0021272	.0003924	-.0025196	.0719266
electricity	.0210748	.0071075	.0139673	.0024337
sewage	.2011393	.0942219	.1069174	.0654689
region	-.1403196	-.1064188	-.0339008	.0600507
2.hhperiod	.0499474	.0641662	-.0142188	.

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(14) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 63.58
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Table 9C: Hausman Test: Outcome-Educational expenditure

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
credit50	.1663454	.5075698	-.3412244	.1293738
Fam_size	-.0049962	.0148587	-.0198549	.0896588
hh_head	-.2190007	-.444171	.2251702	.2015296
hh_water	-.0198849	-.0534929	.033608	.1499244
hh_typetoi~t	-.1170787	-.1813214	.0642427	.1025514
hh_refrigr~r	.0757485	.2961775	-.220429	.0780959
Urban_Rural	.248192	.2572005	-.0090085	.2842764
time_to_schl	.0147732	.0048737	.0098995	.0028528
Road	-.1487125	-.1287109	-.0200016	.2587586
pub_trans	.2565667	.4331621	-.1765954	.1343896
electricity	.0041736	-.0024363	.0066098	.0045455
sewage	.2701465	.3017641	-.0316176	.1221333
region	-1.79339	-1.072656	-.720734	.1126725
2.hhperiod	.0942875	.1348633	-.0405758	.

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(14) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 91.50
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Table 9D: Cognitive score Outcome- Sensitivity model

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
credit50	-.0412805	-.0748727	.0335922	.0352747
child_grage	.0264186	.0336032	-.0071846	.0049826
child_labor	-.0360013	-.0359645	-.0000369	.0071484
Child_Nut	.0061956	-.0055607	.0117563	.0076756
f_int	.018241	.0190361	-.0007951	.0114494
m_int	-.0047705	.007274	-.0120445	.0118155
fatherage	.0008885	.0005179	.0003707	.0004447
motherage	.0010081	.0008201	.0001879	.0006284
hh_head	.0006552	.0039103	-.0032552	.0194093
ln_HHIncome	-.0053925	-.0017236	-.003669	.0013831
ln_tot_pr~it	-.0007387	.001028	-.0017667	.0013223
ln_PCE	.0031056	.003246	-.0001404	.0030961
Fam_size	.0042135	-.0042271	.0084405	.0098426
hh_water	.0146596	.0166614	-.0020019	.014895
hh_typetoi~t	.0143974	-.0146938	.0290912	.0102566
hh_refrigr~r	.0112964	.0295046	-.0182082	.0078212
Urban_Rural	.0919625	.0504997	.0414628	.0292648
p_t_ratio	-.0025971	.0035818	-.0061789	.0015375
ln_av_teac~y	-.0084574	.0278881	-.0363454	.0088579
time_to_schl	.0000337	-.0004524	.0004861	.0002837
Road	.0080116	.0634735	-.055462	.0253006
pub_trans	.0226261	.0215272	.001099	.013039
electricity	.0000379	.0006372	-.0005992	.0004602
sewage	.0051228	.0020977	.0030251	.0119237
region	-.0049873	-.0263754	.0213881	.0159522
female_em	-.0217476	.021567	-.0433146	.0235582
2.period	.0267029	.0254177	.0012852	.001626

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(27) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 114.33
Prob>chi2 = 0.0000

Table 9E: Cognitive score outcome-pathway (mother-children) model

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
credit50	.0028266	-.0046949	.0075215	.0184452
working_mom	.008459	-.0081653	.0166243	.0142821
wokmom_int	-.0328161	.0131162	-.0459323	.0223584
child_grage	.0228665	.0227001	.0001665	.0052205
Child_Nut	.0055317	-.0052042	.0107359	.0076687
hh_water	.0144172	.0179647	-.0035475	.014915
hh_typetoi~t	.0163139	-.0167602	.0330741	.0102783
hh_refrigr~r	.0102867	.0299514	-.0196647	.0078279
Fam_size	-.0025714	-.0043655	.0017941	.0097424
ln_HHIncome	-.005346	-.0014964	-.0038496	.0014035
ln_tot_pr~it	-.000381	.0014505	-.0018315	.0013381
ln_PCE	.0036149	.0050221	-.0014072	.0031103
Urban_Rural	.0997668	.0545025	.0452643	.0293057
p_t_ratio	-.0025408	.0031225	-.0056633	.0015415
ln_av_teac~y	-.0069413	.0284223	-.0353636	.0088494
time_to_schl	.0001522	-.0003028	.000455	.0002826
Road	.0039281	.0625306	-.0586025	.0253142
pub_trans	.0254347	.0239657	.0014689	.013131
electricity	-.0000567	.0005805	-.0006373	.0004595
sewage	.0057885	.0049459	.0008426	.0119436
region	-.0464592	-.0456759	-.0007833	.0119234
2.period	.0260225	.0243574	.0016651	.0015711

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(22) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 109.28
Prob>chi2 = 0.0000

Table 9F: Cognitive score: Age cohort model (sample of the age below the mean variable)

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
credit50	-.0295639	-.0128724	-.0166915	.0115149
age_below	-.0352785	.0037687	-.0390472	.0093145
age_below_~t	.0002161	.0242367	-.0240206	.0138464
working_mom	.0025137	-.0040663	.00658	.010579
Child_Nut	.0056622	-.0016321	.0072943	.0066842
hh_water	.0022188	.00449	-.0022712	.0118861
hh_typetoi~t	.0179737	-.0203462	.0383199	.0082237
hh_refrigr~r	.0134337	.0327627	-.019329	.0064018
Fam_size	.0020373	-.0008934	.0029307	.0034207
ln_HHIncome	-.0033586	-.0012041	-.0021545	.0010513
ln_tot_pr~it	-.0004974	.0007579	-.0012552	.0010711
ln_PCE	.0036443	.0076188	-.0039745	.002644
Urban_Rural	.0735274	.0476665	.0258609	.0237989
p_t_ratio	-.0018415	.0026891	-.0045307	.0012189
ln_av_teac~y	-.0000712	.0385858	-.0386569	.006688
time_to_schl	.0003591	.000353	6.14e-06	.0002574
Road	.009234	.0516708	-.0424369	.0187698
pub_trans	.0144725	.0205781	-.0061056	.0109421
electricity	-.0003306	.0007443	-.0010749	.0003776
sewage	.0052456	.0067851	-.0015395	.0096428
region	-.0454395	-.030268	-.0151715	.0101194
2.period	.0225216	.0218442	.0006774	.

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(22) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 101.73
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

APPENDIX F – Result

Table 10A: Microcredit and Household Welfare Indicators- All Variables

Variables	*Ln* Income Per Capita		*Ln* Expenditure Per Capita		*Ln* Educational Expenditure	
	OLS	Fixed Effect	OLS	Fixed Effect	OLS	Fixed Effect
Microcredit Participation, Borrower=1	0.647***	0.436**	0.284***	0.116	0.552***	0.166
	(0.123)	(0.172)	(0.0604)	(0.0885)	(0.115)	(0.171)
Covariates						
Household Size	-0.231***	-0.0625	-0.0904***	-0.00872	0.0173	-0.00500
	(0.0221)	(0.0991)	(0.00839)	(0.0616)	(0.0170)	(0.100)
Household Head, Female=1	-1.683***	0.0410	-0.247***	-0.163	-0.461***	-0.219
	(0.218)	(0.337)	(0.0931)	(0.150)	(0.178)	(0.270)
Household's Water Source	0.0248	-0.0673	-0.171***	-0.179*	-0.0614	-0.0199
	(0.133)	(0.204)	(0.0635)	(0.100)	(0.119)	(0.194)
Household's Type of Toilet	-0.134	0.117	-0.226***	-0.210***	-0.193***	-0.117
	(0.0824)	(0.138)	(0.0356)	(0.0561)	(0.0715)	(0.136)
Household's food storage	0.458***	0.151	0.251***	0.0759	0.323***	0.0757
	(0.0674)	(0.106)	(0.0345)	(0.0543)	(0.0616)	(0.104)
Residence, Urban=1	0.442***	-0.219	0.146**	0.248	0.252**	0.248
	(0.131)	(0.356)	(0.0611)	(0.158)	(0.118)	(0.299)
Average time to school (minutes)	-0.00696*	-0.00104	0.00307*	0.00347*	0.00379	0.0148***
	(0.00381)	(0.00601)	(0.00174)	(0.00204)	(0.00379)	(0.00446)
Type of Road, Aspalth/Paved=1	0.334*	0.280	-0.0930	-0.255*	-0.139	-0.149
	(0.173)	(0.344)	(0.0675)	(0.136)	(0.175)	(0.381)
Nearest public transportation system (Inside village=1)	-0.0486	-0.0743	0.00540	-0.00213	0.439***	0.257
	(0.127)	(0.196)	(0.0581)	(0.0933)	(0.118)	(0.173)
Percent of using electricity	-0.000578	-0.00287	0.00576***	0.0211***	-0.00311	0.00417
	(0.00393)	(0.00755)	(0.00135)	(0.00262)	(0.00299)	(0.00592)
Sewage system, Yes=1	0.206	0.258	0.0888	0.201**	0.302**	0.270
	(0.133)	(0.179)	(0.0573)	(0.0816)	(0.119)	(0.177)
Region, Java Island=2	-0.0888	-0.277*	-0.108***	-0.140**	-1.001***	-1.793***
	(0.0839)	(0.152)	(0.0371)	(0.0715)	(0.0759)	(0.171)
2.hhperiod	0.0782	0.0722	0.0655	0.0499	0.139	0.0943
	(0.114)	(0.0966)	(0.0525)	(0.0492)	(0.101)	(0.0926)
Constant	14.50***	14.04***	14.08***	12.37***	15.66***	17.06***
	(0.550)	(1.149)	(0.214)	(0.502)	(0.453)	(1.029)
Observations	3,408	3,408	3,408	3,408	3,408	3,408
R-squared	0.100	0.012	0.102	0.059	0.088	0.114
Number of HH	1,704	1,704	1,704	1,704	1,704	1,704

Source: Authors own calculation using STATA. Robust Standard Errors clustered at household level in paratheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 11A: Cognitive Scores and The Sensitivity to the Inclusion of Covariates - All Variables

VARIABLES	Ln Cognitive score						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Microcredit Participation, Borrower=1	-0.0297**	-0.0322**	-0.0221	-0.0263	-0.0320**	-0.0274	-0.0184
	(0.0145)	(0.0144)	(0.0193)	(0.0368)	(0.0143)	(0.0366)	(0.0381)
Income Effect							
Ln Parent's Income	-0.00324**						-0.00323**
	(0.00164)						(0.00163)
Ln Total non-farm business profit	-0.000679						-0.000948
	(0.00138)						(0.00138)
Risk-Management Effect							
Ln PCE		0.00307					0.00277
		(0.00416)					(0.00408)
Gender Effect							
Household Head, female=1			-0.0128				-0.0144
			(0.0221)				(0.0219)
Interaction gender & MCP			-0.0190				-0.0156
			(0.0283)				(0.0280)
Information Effect							
Interaction father's edu & MCP				0.00676			0.00691
				(0.0111)			(0.0110)
Interaction mother's edu & MCP				-0.00914			-0.00833
				(0.0127)			(0.0126)
Child-labor Effect							
Child_labor, full schooling=1					-0.0392***	-0.0392***	-0.0392***
					(0.00905)	(0.00906)	(0.00906)
Information and Child Labor Effect							
Interaction father's edu & MCP						0.00739	
						(0.0109)	
Interaction mother's edu & MCP						-0.00935	
						(0.0126)	
Child_labor, full schooling=1						-0.0392***	
						(0.00906)	
Covariates							
Child group age	0.0148**	0.0151**	0.0156***	0.0156***	0.0242***	0.0242***	0.0227***
	(0.00583)	(0.00591)	(0.00588)	(0.00585)	(0.00624)	(0.00624)	(0.00629)
Child Nutrition	0.00537	0.00462	0.00506	0.00451	0.00408	0.00375	0.00442
	(0.00995)	(0.00992)	(0.00993)	(0.00995)	(0.0100)	(0.0100)	(0.0100)
Father age	0.000621	0.000625	0.000586	0.000621	0.000543	0.000537	0.000490
	(0.000428)	(0.000423)	(0.000436)	(0.000423)	(0.000422)	(0.000422)	(0.000437)
Mother age	0.00112	0.00111	0.00114*	0.00112*	0.00107	0.00107	0.00110
	(0.000687)	(0.000679)	(0.000678)	(0.000679)	(0.000674)	(0.000674)	(0.000684)
Household size	-0.00151	-0.000881	-0.00120	-0.00125	-0.00104	-0.00100	-0.000760
	(0.00396)	(0.00403)	(0.00393)	(0.00395)	(0.00389)	(0.00390)	(0.00397)
Household's water source	-0.000454	0.000182	-0.000295	7.84e-05	0.000450	0.000557	-3.46e-05
	(0.0169)	(0.0168)	(0.0169)	(0.0168)	(0.0168)	(0.0168)	(0.0169)
Household's type of toilet	0.0175	0.0181	0.0177	0.0173	0.0147	0.0144	0.0149
	(0.0122)	(0.0123)	(0.0123)	(0.0123)	(0.0123)	(0.0124)	(0.0124)
Household's food storage	0.0137*	0.0128*	0.0131*	0.0131*	0.0138*	0.0140*	0.0152**
	(0.00772)	(0.00773)	(0.00775)	(0.00775)	(0.00767)	(0.00768)	(0.00767)
Residence, Urban=1	0.0728***	0.0737***	0.0738***	0.0737***	0.0709***	0.0707***	0.0697***
	(0.0258)	(0.0256)	(0.0256)	(0.0257)	(0.0259)	(0.0259)	(0.0261)

Pupil-teacher Ratio	-0.00184	-0.00176	-0.00176	-0.00176	-0.00190	-0.00188	-0.00192
	(0.00171)	(0.00171)	(0.00171)	(0.00171)	(0.00172)	(0.00173)	(0.00173)
*Ln*average teacher salary	0.00172	0.00134	0.00176	0.00107	-4.63e-05	-0.000746	-0.000948
	(0.0101)	(0.0101)	(0.0101)	(0.0101)	(0.00998)	(0.0100)	(0.0100)
Average time to school (minutes)	0.000352	0.000344	0.000348	0.000346	0.000190	0.000189	0.000194
	(0.000404)	(0.000405)	(0.000406)	(0.000405)	(0.000397)	(0.000397)	(0.000397)
Road type, Aspalth/Paved=1	0.0142	0.0139	0.0138	0.0135	0.0116	0.0114	0.0123
	(0.0243)	(0.0242)	(0.0243)	(0.0243)	(0.0239)	(0.0239)	(0.0239)
Nearest access to public transportation	0.0136	0.0129	0.0126	0.0133	0.0104	0.0106	0.0103
	(0.0166)	(0.0166)	(0.0166)	(0.0165)	(0.0166)	(0.0166)	(0.0167)
Percent of household using electricity	-0.000177	-0.000215	-0.000158	-0.000164	-9.90e-05	-9.58e-05	-0.000135
	(0.000587)	(0.000587)	(0.000585)	(0.000588)	(0.000585)	(0.000588)	(0.000587)
Sewage system, Yes=1	0.00624	0.00493	0.00509	0.00517	0.00295	0.00294	0.00370
	(0.0152)	(0.0152)	(0.0153)	(0.0153)	(0.0153)	(0.0153)	(0.0153)
Region, Java Island=2	-0.0435***	-0.0421***	-0.0426***	-0.0429***	-8.94e-05	0.000153	0.000966
	(0.0123)	(0.0123)	(0.0123)	(0.0123)	(0.0157)	(0.0157)	(0.0157)
2.period	0.0220***	0.0221***	0.0221***	0.0222***	0.0223***	0.0224***	0.0222***
	(0.00823)	(0.00824)	(0.00824)	(0.00825)	(0.00820)	(0.00821)	(0.00819)
Constant	4.160***	4.067***	4.101***	4.111***	4.037***	4.047***	4.072***
	(0.172)	(0.176)	(0.168)	(0.168)	(0.167)	(0.167)	(0.179)
Observations	4,342	4,342	4,342	4,342	4,342	4,342	4,342
R-squared	0.029	0.027	0.028	0.027	0.036	0.036	0.039
Number of ID	2,171	2,171	2,171	2,171	2,171	2,171	2,171

Source: Author own calculation using STATA.Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 12A : Microcredit on Cognitive Score and Mother-Children Interaction as the Selection Channel- All Variables

VARIABLES	*Ln* Cognitive Test Score Fixed Effect Model
Microcredit Participation/ MCP, Borrower=1	-0.0232
	(0.0224)
Working mother, Yes=1	-0.000753
	(0.0160)
Interaction Working mother and MCP	-0.0129
	(0.0279)
Child group age	0.0165***
	(0.00582)
Child Nutrition	0.00522
	(0.00995)
Household's Water Source	0.00231
	(0.0168)
Household's type of toilet	0.0173
	(0.0123)
Household's food of strorage	0.0133*
	(0.00774)
Household size	0.00197
	(0.00360)
Residence, Urban=1	0.0739***
	(0.0257)
Pupil-teacher ratio	-0.00181
	(0.00171)
Ln average teacher salary	0.00104
	(0.0101)
Average time to school (minutes)	0.000371
	(0.000405)
Road type, Aspalth/Paved=1	0.00822
	(0.0242)
Access to nearest public transportation system, Inside Village=1	0.0151
	(0.0166)
Percent of household using electricity	-0.000258
	(0.000591)
Sewage system, Yes=1	0.00471
	(0.0153)
Region, Java Island=2	-0.0456***
	(0.0123)
2.period	0.0228***
	(0.00821)
Constant	4.172***
	(0.162)
Observations	4,342
R-squared	0.024
Number of ID	2,171

Source: Author own calculation using STATA. Robust Standard Errors clustered at household level in paratheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 13A: The Heterogeneous Effect of Age Cohort - All Variables Version

VARIABLES	*Ln* Cognitive Test Score (1)	(2)	(3)	(4)
MCP, Borrower=1	-0.0301**	-0.0309*	-0.0301**	-0.0291
	(0.0145)	(0.0183)	(0.0145)	(0.0198)
age_below	-0.0350***	-0.0354**		
	(0.0135)	(0.0148)		
age_below_int		0.00183		
		(0.0247)		
age_above			0.0350***	0.0354**
			(0.0135)	(0.0148)
age_above_int				-0.00183
				(0.0247)
Covariates				
working_mom	0.00106	0.00108	0.00106	0.00108
	(0.0154)	(0.0154)	(0.0154)	(0.0154)
Child Nutrition	0.00583	0.00582	0.00583	0.00582
	(0.00986)	(0.00985)	(0.00986)	(0.00985)
Household's water source	0.00143	0.00140	0.00143	0.00140
	(0.0168)	(0.0168)	(0.0168)	(0.0168)
Household's type of toilet	0.0167	0.0168	0.0167	0.0168
	(0.0123)	(0.0124)	(0.0123)	(0.0124)
Houehold's food storage	0.0134*	0.0134*	0.0134*	0.0134*
	(0.00769)	(0.00770)	(0.00769)	(0.00770)
Ln Parent's Income	-0.00344**	-0.00344**	-0.00344**	-0.00344**
	(0.00167)	(0.00167)	(0.00167)	(0.00167)
Ln PCE	0.000820	0.000834	0.000820	0.000834
	(0.00423)	(0.00424)	(0.00423)	(0.00424)
Ln non-farm business profit	-0.000674	-0.000670	-0.000674	-0.000670
	(0.00142)	(0.00143)	(0.00142)	(0.00143)
Ln Educational expenditure	0.00458**	0.00458**	0.00458**	0.00458**
	(0.00218)	(0.00218)	(0.00218)	(0.00218)
Household size	0.000765	0.000773	0.000765	0.000773
	(0.00375)	(0.00375)	(0.00375)	(0.00375)
Residence, Urban=1	0.0751***	0.0751***	0.0751***	0.0751***
	(0.0257)	(0.0257)	(0.0257)	(0.0257)
Pupil-teacher ratio	-0.00202	-0.00202	-0.00202	-0.00202
	(0.00172)	(0.00171)	(0.00172)	(0.00171)
Ln average teacher salary	-0.000551	-0.000533	-0.000551	-0.000533
	(0.0101)	(0.0101)	(0.0101)	(0.0101)
Time to school (minutes)	0.000299	0.000299	0.000299	0.000299
	(0.000401)	(0.000401)	(0.000401)	(0.000401)
Road type, Aspalth/Paved=1	0.00867	0.00878	0.00867	0.00878
	(0.0241)	(0.0241)	(0.0241)	(0.0241)
Access to nearest public transportation system, Inside village=1	0.0126 (0.0167)	0.0126 (0.0167)	0.0126 (0.0167)	0.0126 (0.0167)
Percent of household using electricity	-0.000260	-0.000263	-0.000260	-0.000263
	(0.000587)	(0.000587)	(0.000587)	(0.000587)
Sewage system, Yes=1	0.00523	0.00525	0.00523	0.00525

	(0.0152)	(0.0152)	(0.0152)	(0.0152)
Region, Java Island=2	-0.0375***	-0.0375***	-0.0375***	-0.0375***
	(0.0132)	(0.0131)	(0.0132)	(0.0131)
2.period	0.0224***	0.0224***	0.0224***	0.0224***
	(0.00819)	(0.00819)	(0.00819)	(0.00819)
Constant	4.238***	4.238***	4.203***	4.202***
	(0.186)	(0.186)	(0.179)	(0.180)
Observations	4,342	4,342	4,342	4,342
R-squared	0.028	0.028	0.028	0.028
Number of ID	2,171	2,171	2,171	2,171

Source: Author own calculation using STATA. Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1