



# Access to Credit and Quality of Education in Vietnam

HUR Yoon Sun



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INTERNATIONAL ECONOMIC POLICY (KIEP)**

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## EXECUTIVE SUMMARY

This paper tries to determine the relationship between two of growth engines in Vietnam: access to credit and education. To avoid potential bias due to the endogeneity of access to credit variable, this paper utilizes the propensity score matching. This paper takes advantage of the Young Lives Survey of Vietnam that collected information on children of various ages to observe the effect of credit access in different stage of childhood. The result of propensity score matching analysis shows that the quality of education, measured by test scores, is impacted significantly by access to credit when the child is young and household income is low. However, when the child is older, most of the input to enhance the quality of education comes from outside of household resources, such as school, friends, and teachers, and the access to credit status of the household does not have significant effects on the quality of education.

**Keywords:** Access to Credit, Education, Vietnam, Propensity Score Matching

**JEL Classification:** I24, I25, O15

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# Access to Credit and Quality of Education in Vietnam\*

HUR Yoon Sun\*\*

## I. Introduction

Vietnam achieved rapid economic growth and poverty reduction in the last few decades (World Bank 2015). The enhancements of credit access and education have been two of engines that drove the growth of Vietnam. Vietnam's government has a strong strategy to support credit for households and small firms; it implemented various credit programs in this regard, such as microcredit and preferential interest rates for the poor (Giang, Wang & Chien 2015). This policy increased overall access to credit in Vietnam (World Bank 2014). Similarly, the education sector in Vietnam has undergone dramatic development with financial support from the government and donor countries. Both the quantity and the quality of education have increased, and Vietnam has achieved comprehensive access to primary education (World Bank 2011).

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Problems remain, however. The development of the financial sector and education has not been equally beneficial to all people. The poor in rural and mountainous areas have yet to benefit from economic development. They often lack access to credit, as there are few branches of credit institutions in rural areas and/or the poor do not have knowledge required to obtain credit and manage loan repayment plans. Although comprehensive primary education exists, educational opportunities remain unequal: the quality of education for children from disadvantaged backgrounds is far lower than that of children from advantaged backgrounds (Rolleston, James, Pasquire-Doumer, & Tam 2013; World Bank 2011). In this paper, the researcher attempts to determine the relationship of the two growth engines that are unequal in terms of its benefits to Vietnam: access to credit and quality of education.

Despite the completion of numerous studies on the role of access to credit towards improving human resource accumulation in different countries (Kean & Wolpin 2001; Carneiro & Heckman 2002), most studies use data on college-level students in developed countries. The studies conducted by Jacoby and Skoufias (1997), Devicienti and Rossi (2013), and Hur (2015) are three of a few studies measuring the effect of credit in the context of developing countries. Nevertheless, these studies focus on measuring credit indirectly and/or utilize other estimation analysis such as randomized control experiment and instrumental variables.

The objective of this study is threefold: First, it involves defining access to credit in the context of Vietnam and directly measuring the effect of credit access using specific survey questions. The credit market in Vietnam has unique characteristics found in developing countries, with the formal and informal credit market coexisting. The researcher attempts to measure the effect of access to each credit market on educational achievements of children. Second, the researcher aims to establish whether access to credit at an early age influences the quality of children's education. This paper

takes advantage of the Young Lives Household Survey of Vietnam, which includes data about 3,000 children of various ages (4–5, 7–8, 11–12, and 14–15 years old), to observe the effect of credit access in the early stages of childhood on the quality of education. Third, the researcher utilizes propensity score matching to avoid potential bias due to the endogeneity of the access-to-credit variable. The key determining factors of the credit-status variable, such as socioeconomic factors and unobserved characteristics of individuals, may affect quality of education variables. For example, consider two types of parents, one with aggressive characteristics and one with less aggressive characteristics. The parents with aggressive characteristics may be more aggressive in obtaining credit (e.g., studying credit programs and moving to villages where credit institutions are nearby) compared to parents with less aggressive characteristics. In addition, it is possible that parents that are more aggressive are willing to invest more in their children's education. Propensity score matching measures the average treatment effect of access to credit in the context of a non-random selection problem.

The result of propensity score matching analysis indicates that access to credit has a positive and significant effect on a child's scholastic achievement when the child is in the early stage of childhood (under 7–8 years). The effect of credit access disappears when the child is older. Moreover, it shows that a child's scholastic achievement is affected by access to credit when the household is in the bottom 20% of income distribution. It means that the high income households' decision of investment in children's education is not affected by credit status, while low income households are significantly dependent on the credit status when deciding to invest to enhance the quality of education.

This paper proceeds as follows: Section II introduces previous studies related to access to credit and education, while Section III contains a review of the current status of Vietnam's credit market and education sys-

tem. In Section IV, the researcher describes data and methodology and presents empirical results about the effect of access to credit on the quality of education in Vietnam. Section V contains the conclusion.

## II. Literature Review

Enhancing the access to credit not only better households' welfare but also has been considered one of the driving forces of development. When a household has access to credit, it is better able to improve its welfare, as it can alleviate capital constraints with stable cash flow. In this case, the household can invest in production at the appropriate time. Additionally, access to credit enables the household, even if it is not borrowing, to adopt more risk-bearing and productive technology. For example, when households' incomes are vulnerable to shock, households with access to credit are more capable of choosing new, riskier but more profitable technology than households without access to credit, because credit cushions consumption against income shocks (Diagne, Zeller, & Sharma 2000). Furthermore, numerous scholars have theoretically and empirically proven that access to credit has a positive effect on economic behavior, such as saving (Rosenzweig & Wolpin 1993), crop choice and production (Diagne, Zeller, & Sharma 2000), and investment in education (Jacoby & Skoufias 1997). The World Bank (2015) indicates that the effects of access to credit go beyond individuals and that access to credit may positively affect the economic growth of developing countries.

Education is another key engine of economic growth. Schultz (1963) first introduced the value of education in economics, and a theoretical model emphasizing the role of education in economic growth has been developed by Lucas (1988) and Mankiw, Romer, and Weil (1992). Moreover, several empirical studies reveal the positive relationship between economic growth and education (Barro 1991; Hanushek & Woessmann 2008).

Glewwe and Jacoby (2004) found that educational development is the primary route for escaping poverty and achieving economic development.

The link between two growth engines, access to credit and education, has been an attractive research topic for many scholars. Both theoretically and empirically, it has been revealed that an individual's investment in education is affected by the credit status of that individual. Becker & Tomes (1986) theoretically show that if a household can borrow money and has access to credit in a complete financial market, income shocks may not affect its investment in education and overall consumption. The empirical results vary by study: Keane & Wolpin (2001) and Belley & Lochner (2007) investigate the positive relationship between credit access and decision on schooling, while Carneiro & Heckman (2002) find that the effect of credit on schooling disappears when one controls for household background.

The limitation of former studies related to access to credit is that there is no standard measurement of access to credit. Most studies measure access to credit indirectly by investigating the effect of money transfer and income shocks on economic behavior (Kean & Wolpin 2001; Jacoby & Skoufias 1997; Rosenzweig & Wolpin 1993). This is based on the simple life cycle/permanent income hypothesis (LC/PIH), which assumes transitory income and income shocks may not affect household consumption when there is access to credit. In the studies mentioned, the researchers examine whether the empirical results contradicts the LC/PIH and conclude that the contradiction may be due to the incomplete financial market. In many studies, access to credit and financial inclusion, credit constraints, and participation in formal credit are used interchangeably (Demirduc-Kunt, Klapper, Singer, & Van Oudheusden 2015; Zeller & Diagne 2001). The indirect measure of credit access and various definitions of it in studies also cause a biased estimation of the effect of access to credit and may be the main reason for conflicting empirical results across studies (Stinebrickner & Stinebrickner 2008).

Diagne, Zeller, and Sharma (2000) clearly explain the difference between the concept of access to credit, being credit constrained, and participation in a credit program. Suppose any potential borrowers face constraints in borrowing as

$$0 \leq b \leq b_{max}$$

where  $b_{max}$  is the maximum amount people can and are willing to borrow. The borrowers choose to borrow optimal loan size  $b^*$ . Access to credit occurs when the credit limit is strictly positive:  $b_{max} > 0$ . When the source is a formal financial institution (e.g., local bank or government-funded financial program), the household is defined as having access to formal credit. When the source is informal (e.g., relatives or friends), the household has access to informal credit. In contrast, a credit constrained household has binding credit constraints:  $b^* = b_{max}$ . The difference between credit constraints and access to credit is that credit constraints do not mean that a household cannot borrow as much as it wants. Instead, it means that “the optimal amount borrowed when borrowing under the credit constraints is strictly less than the optimal amount that would be borrowed if the credit constraints did not exist” (Diagne, Zeller, & Sharma 2000, p. 17). Similarly, some scholars use access to credit and participation in formal credit interchangeably (Briggeman, Towe, & Morehart 2009; Diagne, Zeller, & Sharma 2000). The household with access to credit can choose to borrow or not to borrow, but if the household chooses to borrow, it can be defined as participating in a credit program. Not participating in a credit program, in other words, means not borrowing any amount of money, not necessarily because the household is credit constrained or lacks access to credit (Diagne, Zeller, & Sharma 2000).

The World Bank (2014) confirms the difference between access to finance (including credit and savings) and financial inclusion. Financial in-

clusion focuses on the use of accounts, while access to finance focuses on the accessibility of finance. For example, some people may lack access to credit because of the prohibitive cost, burdensome paperwork, travel cost, difficulties in the legal process, and market failure. Other people may have access to finance, but this does not mean they are using the financial system, which is the focus of financial inclusion. Thus, financial inclusion is measured by the ownership and usage of accounts (e.g., saving, borrowing, transferring, and using mobile banking), while access to credit is measured by the accessibility of financial systems (e.g., distance to financial system and rigidity of regulations governing borrowing).

Another limitation of former studies on the effect of access to credit is the potential for bias due to the endogeneity of access to credit. Endogeneity can arise for various reasons, such as heterogeneity in unobservable variables, measurement error, and simultaneity.<sup>1</sup> Within the literature, some researchers have attempted to control selection bias using several statistical methodologies such as the Heckman estimator (e.g. Petrick (2004)), switching regression (e.g., Feder *et al.* (1990)), and propensity score matching (e.g., Briggeman *et al.* (2009)). Nevertheless, most used firm-level data in developed countries, and little is known about the effect of access to credit on education. Hur (2015) uses instrumental variables to control the endogeneity of liquidity constraints. Recently, some scholars utilized randomized control treatment to show the effect of credit on economic behavior in developing countries (e.g., Banerjee *et al.* (2013) and Dupas *et al.* (2015)), but the estimated effect of credit differs by experiment design and study sample.

In addition, although several studies emphasize the timing of investment, especially early investment, in human capital accumulation, most of studies relate to the effect of credit on education focus on the college-level

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<sup>1</sup> For more details about potential bias due to endogeneity and the reason for endogeneity, please see Section 4.1.

or high school–level student.<sup>2</sup> Little is revealed about the effect of access to credit in early childhood. However, human capital has characteristics of self-productivity that indicate that the early stock of human capital determines the later stock of human capital (Cunha & Heckman 2010, 2007). And a substantial body of evidence has revealed that early intervention in human capital has a high rate of return (Currie & Thomas 1995; Guralnick & Bricker 1987). Indeed, as Carneiro and Heckman (2002) note, the effect of credit may not have a great influence on college-level education, as a student’s abilities required for college admission may be decided in early childhood. The theoretical model from Caucutt and Lochner (2012) indicates that parents’ financial status in the early stages affects parents’ investment to enhance the quality of education, and ultimately affects human capital and labor market outcome in the long term.

This study attempts to fill the gaps in existing literature, first by reviewing the status of the credit market in Vietnam and endeavoring to define access to credit while reflecting the unique characteristics of Vietnam. Second, the researcher employs propensity score matching to overcome potential self-selection bias from the access-to-credit variable. Finally, taking advantage of the Young Lives Survey in Vietnam that includes data of children below 14-15 years of age, the effect of access to credit for young children is estimated.

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<sup>2</sup> It is based on the assumption that the cost of education is higher in secondary school than in primary school. In addition, many developed countries have comprehensive primary education systems, thus the cost of education is relatively low at primary school level. However, the cost of education at primary school level is still high, even for countries with comprehensive education: there are several informal costs for public education, and some parents spend money on private education such as extracurricular classes or hiring tutors (Tran 2014; ADB 2012).

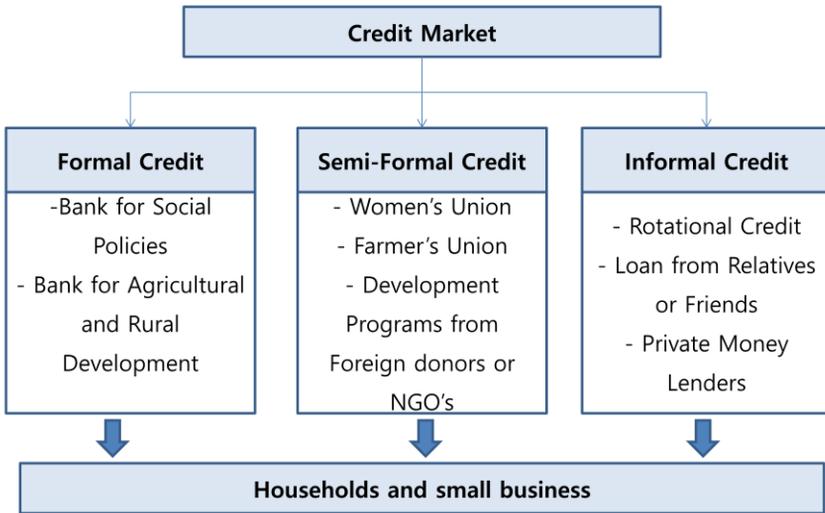
### **III. Access to Credit and the Educational System in Vietnam**

#### **1. Credit Market in Vietnam**

Since the economic reforms, or Doi-Moi, of the late 1980s, the Vietnamese economy has been transformed from a centrally planned economy to a market-oriented economy. As part of Doi-Moi, the banking sector changed dramatically: the Soviet-style mono-banking system changed to a two-tier system in which central banks and state-owned commercial banks coexist (Quach, Mulineoux, & Murinde 2005). Since the transformation of the banking sector, banks not owned by the state and private credit institutions have participated in the credit market in Vietnam, and the role of the private sector has become more prominent.

The unique characteristic of the credit market in Vietnam is that formal, semi-formal, and informal sectors exist side by side (Quach, Mulineoux, & Murinde 2005). As shown in Figure 1, the main credit providers in the formal market are state-owned banks, such as Vietnam Bank for Social Policies (VBSP) and Vietnam Bank for Agriculture and Rural Development (VBARD); commercial banks; and credit programs. The Vietnamese government realized the importance of credit market development for economic growth and thus launched various policies to enhance access to credit. These include offering products with lower interest rates to low-income households through budget-funded policy banks, the VBSP and VBARD, and expanding the number of bank branches in the country (World Bank 2014). In the semi-formal sector, organizations such as the Women's

**Figure 1. Credit Market in Vietnam**



Source: Revision of Figure 1 in Quach, Molineux & Murinde (2005).

Union and Farmers' Union, which sponsor programs such as microcredit, are the main credit providers.

However, the formal and semi-formal credit markets in Vietnam cannot meet the entire demand for credit in the country. As in several other developing countries, many households, especially in the rural and mountainous areas, do not have access to formal or semi-formal credit. Only a small number of bank branches have been established in the rural and mountainous areas: as of 2014, there are only 3.8 commercial bank branches per 100,000 adults in Vietnam (World Bank 2016), with most concentrated in urban areas. Additionally, the country contains fewer commercial bank branches per 100,00 adults than other lower-middle-income countries (8.2) and other developing countries in East Asia and the Pacific (8.4). As seen in Table 1, the percentage of people who have bank accounts with formal financial institutions are lower in Vietnam compared to other developing countries, and only 26% of people living in rural areas have accounts with

**Table 1. Key Indicator of Credit Market in Vietnam and Other Countries 2014**

	Vietnam	Low Middle Income	East Asia & Pacific	World
Commercial bank branches (per 100,000 adults)	3.8	8.2	8.4	13.4
Account at a financial institution (% age 15+)	30.8	41.7	60.7	68.7
Account at a financial institution (% age 15+), rural	26.9	39.1	55.7	64.2

Note: East Asia & Pacific includes only developing countries in EAP.

Source: World Development Indicators and Global Financial Inclusion Database (FINDEX). Retrieved at 2015. 12. 29.

formal institutions. Moreover, the complicated processes related to formal loans and payment plans hamper the poor in rural areas from obtaining formal credit. Many poor people in rural areas do not understand the complicated process of obtaining formal loans and managing payment plans (Quach, Mulineoux, & Murinde 2005), and people in rural areas may not have the collateral required for loans from the formal credit market (Barslund & Tarp 2008).

Thus, the informal credit sector plays a significant role in rural and poor areas in which formal and semi-formal credit providers are not accessible. The most common type of credit in the informal sector in Vietnam is called rotational credit, which involves forming community or family groups and pooling the resources available. The typical rotational credit program consists of a group of people who deposit some amount of money regularly. The sum of the deposits from all members is allocated to one of the group members. At regular intervals (mostly monthly or bi-weekly), the group members deposit money and allocate it to a member until every member has had a turn (Okae 2009). Another main source of credit for people in rural areas is relatives and friends, and some people use private lenders when they need money.

Scholars have discussed the background regarding the coexistence of formal and informal credit markets. Mohieldin and Wright (2000) cite Hoff and Stiglitz (1993), and note that formal and informal market coexist because government intervention in interest rates and collaterals create an informal market.<sup>3</sup> This may be the case in Vietnam, as many people turn to the informal credit market because they do not have access to formal credit. Other possible causes of the coexistence of formal and informal credit markets could be that the two credit markets are fulfilling different needs: the formal sector covers mostly the credit demand for expanding agricultural businesses, while the informal sector meets the credit demand for education and health expenses (Barslund & Tarp 2008). Thus, when measuring the effect of access to credit on the quality of education in Vietnam, it may be worthwhile to observe the effect of access to formal credit and the effect of access to informal credit separately.

## **2. Educational System in Vietnam**

Improving the educational system has been both a development goal and a strategy to achieve economic growth for Vietnam. After its first educational reforms in 1950, the Vietnamese government implemented several reforms and investments to enhance the school infrastructure and equipment as well as the quality of education. In 1991, Vietnam's government adopted the Law on Universal Primary Education, which requires 5 years of compulsory primary education for all children in Vietnam. Furthermore, the government dramatically increased financial support for education: the share of education in the national budget was 7% in 1986 but had increased by 20% in 2008 (World Bank 2011). Various reforms in education changed the education curriculum and examination system, reflecting the

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<sup>3</sup> An alternative and competing view introduced by Hoff and Stiglitz (1993) is that the difference in the cost of screening, monitoring, and contract enforcements raises segmentation in the credit market.

demand for high-quality education.

Due to this support from government, both the quality and quantity of education have improved. The level of educational in the population has increased dramatically, with the percentage of the total population with no education falling from 23% to almost 0% between 1992 and 2010 (Tran 2014). Currently, Vietnam provides universal primary education for both boys and girls. The enrollment rate in primary school has been stable at 100% since 2006.<sup>4</sup> Completing lower secondary school and upper secondary school is not yet compulsory but enrollment increased almost threefold between 1992 and 2012. The current primary to secondary education transition rate is 87% for female and 100% for male students (World Bank 2016). Pre-primary school is uncommon in Vietnam, but the enrollment rate for pre-primary school has been increasing due to the income growth of parents and the government's development strategy of encouraging pre-primary school education and women's participation in the labor market (World Bank 2016).

Nevertheless, the gap in educational learning opportunities and the outcome of education remains. Although the overall quality and quantity of education have improved in Vietnam, people from low income groups, living in rural areas, and ethnic minorities lag far behind those benefiting from improvements in national education (Rolleston, James, Pasquire-Doumer, & Tam 2013; World Bank 2011). The main obstacle causing this inequality in learning opportunities is the cost of education, which is high not only in non-compulsory secondary education but also in official comprehensive primary education. In primary education, the informal fees related to schooling are the main problem. Despite primary school tuition being free, there are various informal fees, such as construction and repairs, purchasing equipment, class funds, textbooks and stationery, uniforms,

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<sup>4</sup> Vietnam's formal school system includes 5 years of primary school, 4 years of lower secondary school (middle school), and 3 years of upper secondary school (high school).

meals, parking fees, supplementary classes at school, extra classes outside school, insurance, parents' association funds, and gifts and envelopes for teachers. (Tran 2014; ADB 2012). In addition, there are fees for full-day schools. Full-day schooling has been shown to be more efficient for learning, but many children can spend only a half day in school because of a lack of capacity in Vietnam. Thus, Vietnam has some of the lowest formal instruction hours compared to other developing countries (Rolleston, James, Pasquire-Doumer, & Tam 2013).

The cost barrier to learning opportunities is more severe in secondary education. Although the transition rate from primary to secondary school is high, the net participation rate in secondary education was 78% for male and 84% for female students in Vietnam from 2008 to 2012 (UNICEF 2016). Many students leave the education system due to the cost of education, such as tuition fees and other informal fees. The secondary school dropout rate is higher for children living in rural areas and ethnic minorities (Rolleston, James, Pasquire-Doumer, & Tam 2013).

The high cost of education leads to high household expenditure on education in Vietnam. Vietnam's culture is based on Confucianism, which emphasizes men as the center of the universe and the potential of education (Yee 2002). Hence, Vietnamese parents have a passion for education, and educational expenditure is higher in Vietnam than in other countries. According to the Vietnamese Household Living Standard Survey from 2006 and 2012, Vietnamese households spend around 10% of their total income on education. This is higher in relative terms than other countries such as Singapore and Australia, where around 5.4 to 5.5% of income is spent on education (Huy 2012; Singapore Department of Statistics 2014). In Vietnam, some households borrow money for expenditures related to education. In a survey conducted by FINDEX at 2014, when participants were asked to state the purpose for borrowing, it was found that the percentage of people who borrow for educational expenses is higher in Vi-

etnam than other countries. Additionally, when questioned about the reasons for borrowing, about 12% of the total respondents indicated that they borrowed for education and school fees, while only 7.7% borrowed for health and medical purposes. In contrast, borrowing for health and medical purposes was the most common reason in other East Asian developing countries and lower-middle-income countries.

In summary, the link between access to credit and the quality of education in Vietnam is expected to be significant for children in Vietnam. Although universal primary education is provided, costs related to various informal fees and private education is high. Parents who do not have access to credit may be forced to reduce their expenditure on education. Thus, access to credit is relevant to children's quality of education and human capital development.

## IV. Empirical Analysis

### 1. Data

#### 1) Child and Household Characteristics

This paper uses Young Lives Survey of Vietnam which is a household survey collected from 3,000 children. The survey includes in-depth information on children and their households, e.g. education level, living conditions, child's test scores and parent's credit status. The specifications in the following section includes individual and household characteristics such as child's gender, age in month, a dummy of first child,<sup>5</sup> mother's education level, father's education level, household income (or asset), rural or urban area, household size and the child's body mass index (BMI) at birth.

The original data have been collected over four rounds (Round 1 in 2002, Round 3 in 2006, Round 3 in 2009, and Round 4 in 2013). But because of many missing variables in Round 1 and non-public availability of Round 4 data, this paper only uses data from Round 2 and Round 3. Since this paper utilizes propensity score matching analysis, all of the analysis in the following section is cross-section by cohort and round even though the original data is panel.

The sampled 3,000 children are divided into two cohorts: older cohort children born in 1994-1995 and younger cohort children born in 2000-2001. The children are all in difference age groups: younger cohort was 4

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<sup>5</sup> This paper generate first child variable from the household survey, not the individual survey, asking about the year of born of first child in the household.

to 5 years in Round 2 and 7 to 8 years old in Round 3, older cohort was 11 to 12 years old in Round 2 and 14 to 15 years old in Round 3. This enables this study to see the effect of access to credit on differently-aged children. The analysis of the younger cohort in Round 2 will show the effect of access to credit for pre-primary school aged children. The sample of the younger cohort in Round 3 and older cohort in Round 2 will show us the effect of access to credit on children in universal primary school. The older cohort in Round 3 is already middle school age, which is not yet universal in Vietnam.

The original number of children is 1,000 for the older cohort and 2,000 for the younger cohort. But this paper dropped those missing in key variables such as test score and credit status of parents. The final numbers of observation in the analysis are 879 for the older cohort and 1,426 for the younger cohort.

## **2) Child Test Score**

To measure the quality of education, this paper uses test score of children.<sup>6</sup> The theoretical model from Caucutt and Lochner (2012) indicates that parents' financial status affects parents' investment in child's human capital accumulation. In the context of Vietnam, the investment includes sending the children to full-day programs, buying text books, hiring good tutors etc. Those investments improve the learning efficiency and quality of education which is directly revealed in child's test score.

The Young Lives Survey in Vietnam includes two types of test scores: the vocabulary test score and the math test score. Those scores are measure across all rounds for both cohorts. But the test format differs by cohort and round. In Round 2, younger cohort was only 4 to 5 years old and

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<sup>6</sup> Test scores are widely used by many studies as an indicator of the quality of education (e.g, Hanushek and Kimko (2000); Rosenzweig and Wolpin (1993)).

was too young to take an in-class math exam. In this case the mathematical ability is measured by quantity section of Cognitive Development Assessment (CDA), which is designed to have the child select pictures corresponding to the teacher's verbal statement such as few, more, nothing etc (Cueto & Leon 2012). The quantity sections have 15 questions in total, and the test score of younger cohorts in the sample ranges from 0 to 14. The older cohorts in Round 2 were 11 to 12 years old and took a basic math test with 10 questions on the number sense.

In Round 3, the younger cohort who was 7 to 8 years old took an original Mathematics Achievement test with a total of 30 questions: 10 questions measuring counting skills and numbers related knowledge, and 20 questions on basic calculation. For older cohorts who are 14 to 15 years old, the composition of questions is a bit different: 20 questions on basic calculations (including square root) and 10 questions on mathematics problem solving (Cueto & Leon 2012).

### **3) Measure of Access to Credit**

The measure of access to credit in previous literatures varies by the definition of access to credit as reviewed in Section 2. This paper follows the measurement method of credit access by World Bank (2015) and Diagne & Zeller (2001). As discussed in the previous Section, Diagne and Zeller (2001) defines access to credit as having positive amount of borrowing limits. In their paper on measuring the access to credit on households' welfare in Malawi, Diagne and Zeller (2001) directly asks about borrowing limits to the households. World Bank (2015) asks whether the individuals can come up with an amount of money around 1/20 of gross national income per capita within a month to measure the access to credit.

Following World Bank (2015) and Diagne and Zeller (2001), this paper define the access to credit as whether a household can borrow some

amount of money when it needs it. In other words, this paper defines that a household has access to credit when it answers “Yes” to following question: Can your household raise 300,000 VND in a week? The amount of money asked is about a weekly wage of Vietnam and about 1/110 of GNI per capita. Comparing with the question in World Bank (2015) that asks about 1/20 of GNI per capita within a month, the question seems to be compatible.

To differentiate the access to formal credit and access to informal credit, Young Lives Survey asks about the source from which they can raise the money. When a household answers that it can borrow the money from a formal credit institution, it is defined as having access to formal credit. When a household answers that it can borrow the money from informal sources such as private lenders, rotating credit, and relatives etc., it is defined as having access to informal credit. It does not necessarily mean that people who do not have access to formal credit have access to informal credit, or vice versa.

The access to credit variable may raise selection bias because of potential endogeneity. There are three ways that the access to credit is endogenous and may cause bias estimation. First of all, there may be unobserved heterogeneity that is also known as the omitted variable problem. Suppose parents with aggressive personalities are more eager to find sources of money when they face risks and have higher possibility of obtaining credit compare to other parents with relatively pacific personalities. Their personality also may have an effect on the decision of educational investment. In this case, the estimates of the effect of credit constraints on children’s education is biased because of the correlation between omitted personality in the error term and access to credit.

Also, there may also be some measurement error. Suppose that parents are not fully aware of their real credit status and misjudge their access to credit. Then the access to credit variable in the data is:  $AC = AC^* + u$ ,

where  $AC^*$  is the actual credit access status and  $u$  is the difference between the actual and observed credit status. If  $u$  is correlated with  $AC$ , the higher the probability for misjudging the credit status when there is greater possibility of lack of access to credit, then the estimates of  $AC$  variable is biased.

Lastly, there is also some possibility of reverse causality or simultaneity. For example there is possibility that the child's test score may affect the parent's effort to enhance its access to credit. When the child shows high educational achievement, parents may have greater expectations for the child's future and tend to invest more to maximize the potential of the child. In this case, the estimation will be biased.

To control the potential bias from endogeneity of access to credit, this paper uses Propensity Score Matching (PSM).

## 2. Propensity Score Matching

The basic concept of PSM is to estimate the unbiased effect of treatment from a pool of treated and non-treated individuals. In the context of access to credit, a parent who does have access to credit is referred to as the treatment group and those who do not have access to credit forms the control group. Rosenbaum and Rubin (1983) identify an outcome of interest, the effect of access to credit in this paper, by following equation:

$$E(Y_1 - Y_0|D = 1) = E(Y_1|D = 1) - E(Y_0|D = 1)$$

where  $Y$  is the outcome variable, the educational outcome in this paper, and  $D$  indicates the control or treatment group (access to credit =1, lack of access to credit=0). The household can be in one group but not both, thus the counterfactual  $E(Y_0|D = 1)$  is actually unobserved. In the ran-

domized control treatment case, we can expect that control groups have the same outcome level as treatment groups assuming they were in the treatment group:  $E(Y_0|D = 1) = E(Y_0|D = 0)$ . Then the average treatment effect can be calculated as  $E(Y_1|D = 1) - E(Y_0|D = 0)$ .

In this study, however, the treatment is not randomly assigned and the treatment can be determined by some covariates  $Z$  (e.g. education, gender, rural/urban etc.). Thus the treatment effect can be calculated as:

$$E(Y_1 - Y_0|Z, D = 1) = E(Y_1|Z, D = 1) - E(Y_0|Z, D = 1)$$

The propensity score describes the conditional probability of access to credit given equality in characteristics before the treatment between two groups. This can be expressed as:

$$p(Z) \equiv Pr(D = 1 | Z) = E(D|Z)$$

We assume that individuals with same characteristics,  $Z$ , have an equal chance of being treated. It can be expressed as:  $0 < Pr(D = 1 | Z) < 1$  (Becker & Ichino 2002; Caliendo & Kopeining 2008). Another key assumption for PSM is that if control groups are actually treated, the expected value of outcome conditioned on  $Z$  should be balanced with the treated group. The conditional mean independence is expressed as:  $E(Y_0|Z, D = 1) = E(Y_0|Z, D = 0)$ .

Equation (2) can be transformed to show the average treatment effect of the treated (ATT):

$$ATT = E(Y_1 - Y_0|P(Z), D = 1) = E(Y_1|P(Z), D = 1) - E(Y_0|P(Z), D = 0)$$

In practice, propensity score matching estimation proceed through two stages. Stage 1 involves the estimation of propensity for experiencing the

treatment, access to credit in this paper, using logistic regressions. The covariates, such as the parents' education level, household income, religion, size of households, and residence in rural or urban areas, are used to predict a household's propensity to have access to credit.

In Stage 2, the propensity score obtained in Stage 1 is used to match children in the treatment group with children in the control group. There are several matching methods, which use different functions from each other. The most straightforward matching method is the *nearest neighbor* method that simply matches one observation in the treatment group with twin cases in the control group based on the likelihood of experiencing the treatment. The cases that are not matched in the control group are dropped. This paper uses matching with replacement to overcome the problem of being without replacement that the matching is dependent on the order in which observations are matched. A second method is the *kernel-based matching* that is more flexible than the first one. The matched pair is identified as the weighted average of all observations in the opposite group within a certain propensity score distance. All observations in the control group contribute to the weighted mean of control groups and it improves the efficiency and estimation power.<sup>7</sup> However, since control observation contributes more than one match, the matches are not independent. It violates the ordinary assumption to calculate the standard error, so we are forced into using 100 repetitions to obtain standard error.<sup>8</sup>

The propensity score has been widely used to overcome the self-selection bias in the setting of non-experimental studies, yet there are still potential sources of bias such as the selection on unobservable, the failure

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<sup>7</sup> For more details about the mechanism of improving efficiency and estimation power, please see Caliendo & Kopeining (2005) and Frisco *et al.* (2007).

<sup>8</sup> This paper also employs other matching methods such as *radius matching* and *caliper matching* method which matches as many comparison units as are available within the caliper. It allows for usage of extra units when good matches are available, and also sometimes few unites are matched when there is no good matches available. The results of other matching methods are not presented in this paper but available upon request.

of the common support conditions, consideration of sufficient variables as determinants of treatment, and ignorance of local difference (geographic mismatch) (Heckman & Nazzaro-Lozano 2004; Mendola 2007). Besides ruling out the unobservable selection bias by conditional independence assumptions, this paper tries to overcome other sources of bias by using various variables such as covariates and checking for common support conditions, and analysis with sub-samples.

### **3. Results**

#### **1) Descriptive Statistics**

Table 2 provides descriptive statistics by parents' access to credit status. Some of these characteristics are the explanatory variables of the estimated models presented further on. It is shown that there are statistically significant difference between children from households with access to credit and children from households without the access. First of all, the measure of the quality of education, test score, shows statistically significant difference between children from households with access to credit and those from households without access to credit. Both the vocabulary test score and mathematical test scores are higher for children from households with access to credit than children from household with no access to credit. We can also see that family's total income, parents' education level, and residence in rural area produce statistical differences between household with and without access to credit, suggesting that those are main variables that affect access to credit status.

This paper includes the access to source of credit as one of the determinants of access to credit. As we have seen in the previous section, the informal credit is one of the most important credit sources in Vietnam,

**Table 2. Characteristics of Children with Access to Credit and Without Access to Credit**

	Treatment Group (Access to Credit)	Control Group (No Access to Credit)	Difference
<b>Test Score</b>			
Vocabulary	37.513	29.284	0.155***
Mathematics	10.045	8.674	0.575***
<b>Child characteristics</b>			
Age in month	63.759	63.564	0.195
First child dummy	0.462	0.411	0.051
Gender (1=female, 0=male)	0.519	0.553	-0.034
BMI	16.046	16.050	-0.003
<b>Household Characteristics</b>			
Mother's education (year)	7.200	4.312	2.887***
Father's education (year)	7.873	4.929	2.943***
Mother's religion is Catholic	0.011	0.028	-0.018*
Mother's religion is Bud- dhism	0.036	0.014	0.021
Mother's religion is protestant	0.007	0.021	-0.014*
Household size	4.665	4.645	0.020
Live in rural	0.834	0.922	-0.088***
Relatives in the community	0.950	0.986	-0.036*
Total income (mil VND)	0.020	0.006	0.013***
Remittance (mil VND)	0.005	0.021	-0.017**
Subsidies credit (1=Yes, 0=No)	0.771	0.695	0.076**
Savings cooperation in the Community (1=Yes, 0=No)	0.096	0.078	0.018

Notes: 1) \* significant at 10% level, \*\* significant at 5% level, \*\*\* significant at 1 % level. 2) Test scores are standardized. 3) This table only shows the characteristics of younger cohorts in Round 2. Other subsamples, such as younger cohorts in Round 3 and older cohort in Round 2 and 3, have similar characteristics as seen in Table A1 in Appendix.

especially in the rural area. In our sample, around 60 percent of households answered that they will borrow money from family or relatives when they face risk, while few households answer that they will use formal credit institutions such as a bank or other savings cooperatives. So we include a

dummy variable asking the existence of close relatives in the community and the existence of savings cooperatives in the vicinity as a determinants of access to credit. The existence of savings cooperatives does not lead to any meaningful difference between two groups, while possibility of existence of relatives in the community shows is slightly higher for groups without access to credit.

As in other developing countries, the remittance from household members and subsidies from the government are some of the more important income sources in Vietnam. Thus we add the variables indicating the income source outside of the household: the existence of remittance and subsidies from government.

## **2) Probability of access to credit**

Before viewing the propensity score matching result that measures the effect of access to credit on child's school achievement, we need to specify the propensity scores for the treatment variable. This paper uses the logit analysis to predict the probability of having access to credit and includes different ranges of households and child characteristics as regressors. Also, we impose "common support" condition that bounds propensity scores away from 0 and 1.

Results of three different specification of logit regression are presented in Table 3. Specification (1) and Specification (2) are using whole samples but different sets of control variables. By comparing the two specifications, (1) and (2), we can check for the consistency of the estimated causal effect, and avoid the bias raised from the exogenous variables used to estimate the propensity score and unobservables that remainders out the matching process.<sup>9</sup> Estimating p-score only for those living in the rural area (Specifica-

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<sup>9</sup> Comparing two or more specifications to check for the consistency and bias of causal effects is widely used by previous studies utilizing the propensity score matching analysis (e.g. Mendola (2007) and Smith & Todd (2003)).

**Table 3. Estimation of the Propensity Score Matching**

Logit Specification	Specif. (1)	Specif. (2)	Specif. (3) Rural only
Age in months		-0.0118 (0.0137)	-0.00781 (0.0143)
First child		0.113 (0.108)	0.0982 (0.112)
Female		-0.0444 (0.102)	-0.0553 (0.107)
BMI		-0.0143 (0.0377)	-0.0126 (0.0392)
Mother's education level(year)	0.0508*** (0.0182)	0.0538*** (0.0188)	0.0556*** (0.0197)
Father's education level(year)	0.0632*** (0.0180)	0.0658*** (0.0183)	0.0562*** (0.0191)
Mother's religion is catholic	-0.691* (0.356)	-0.729** (0.356)	-0.861** (0.381)
_ buddhism	-0.0406 (0.359)	0.0422 (0.384)	0.129 (0.569)
_ protestant	-0.316 (0.452)	-0.323 (0.459)	-0.337 (0.457)
Household size	0.0726* (0.0379)	0.0774* (0.0410)	0.0697* (0.0421)
Live in Rural	0.528** (0.211)	0.540** (0.220)	
D(Relatives in community)	-0.132 (0.386)	-0.0819 (0.388)	
Total income (mil. VND)	34.24*** (6.913)	34.25*** (7.137)	31.15*** (7.409)
Remittance		-1.249** (0.495)	-1.237** (0.496)
Existence of subsidized credit program		0.0841 (0.119)	0.0750 (0.125)
Existence of savings cooperation		-0.114 (0.183)	-0.0968 (0.183)
Observations	1,459	1,459	1,017

Notes: 1) Standard error in parenthesis. 2) \* significant at 10% level, \*\* at 5% level, \*\*\* at 1 % level.

tion (3)) is to check whether the estimation is sensitive to the choice of the sub-sample and increase the geographic mismatch (Smith & Todd 2003). We can observe that the estimates of propensity score in Table 3 are generally in line with expectations. Significant estimators from the households variables suggests that higher the parent's education and the higher the total income, the higher the probability of having access to credit. Living in the

rural area has a positive effect on the credit status of households, probably because of the preferential credit programs in rural areas of Vietnam. Measure of access to the source of credit, such as relatives, subsidized credit program, and savings cooperatives nearby does not have any significant effect on the credit status, while the existence of remittance reduces the probability of access to credit.

### 3) Effect of access to credit on child's school achievement

The effect of access to credit on children's school achievement is estimated through two different matching methods discussed above: the nearest neighbor and the kernel-based matching. Results are shown in Table 4 and 5.<sup>10</sup>

Overall, the matching estimates show that access to credit has a positive and robust effect on child school achievement when the child is in early childhood (under 7-8 years old). Moreover, we can observe that the potential bias from different specification of the propensity score estimation and geographical mismatch is not serious and was mostly eliminated.

More specifically, the results in Table 4 tells us that the access to credit increase a child's vocabulary test score by 0.06-0.16 standard deviation and math test score by 0.2-0.5 standard deviation for younger cohorts in Round 2, even though there are some statistically non-significant results across the specification and matching methodologies. The children here were 4-5 years old, and mostly of pre-primary school age. The difference in the test score between the group with access to credit and the group without tells us that there may be differences in educational investment depending on the credit

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<sup>10</sup> Figure A.1. in the Appendix shows that the p-score allows us to make treated and controlled groups more similar than before the matching. The figure shows the distribution of p-score before and after matching for younger cohorts in Round 2.

status of parents, and it affects the child's cognitive skills.

The positive effect of credit access is valid for children who are 7-8 years old and in the first to second grade of primary school. Table 4 indicates that access to credit increases children's vocabulary and math test scores by a range of 0.2-0.3 standard deviation. The effect is mostly statistically significant except for the math test score in Specification (2) using the nearest neighborhood matching methods.

For older cohorts in Round 2 and 3, however, the effect of credit access is not statistically significant. The older cohort was already 11-12 years old in Round 2, and 14-15 years old in Round 3. It tells us that the access to credit for children of that age is "out of date" and it does not affect children's cognitive skills. The result is consistent with Cunha & Heckman (2007), that the effect of credit is not valid to college enrollment when the household's background is controlled. It means that human capital is constructed at the early age of childhood and intervention in later periods may be not effective.

This paper divides the access to credit into two categories depending on the source of credit: access to formal credit and access to informal credit. Table 5 shows the effect of access to formal/informal credit on the child's test score. As we see in Table 5, the access to informal credit has positive and statistically significant effect on a child's vocabulary test score when the child is 7-8 years old. However, the access to formal credit does not have any effect on the score. This may be because of different income levels between the group of household who has access to formal credit and household who has access to informal credit. The review of Vietnamese credit market in Section 3 indicates that formal credit market requires collateral and payment plans, which are barriers of access to formal credit for low income households.

**Table 4. Effect of Access to Credit on Child School Achievement**

	Specification (1)		Specification (2)		Specification (3) Rural Only	
	NNM	KBM	NNM	KBM	NNM	KBM
<b>Younger Cohort Round 2 (4-5yrs)</b>						
Vocabulary	0.165*** (0.076)	0.0920*** (0.022)	0.0590* (0.027)	0.0915*** (0.0319)	0.0423 (0.060)	0.0618** (0.0292)
Math	0.208 (0.327)	0.295** (0.123)	0.502* (0.221)	0.300** (0.119)	0.438* (0.266)	0.299*** (0.108)
<b>Younger Cohort Round 3(7-8 yrs)</b>						
Vocabulary	0.274*** (0.0895)	0.276*** (0.0541)	0.206*** (0.0899)	0.289** (0.115)	0.223*** (0.101)	0.270** (0.112)
Math	0.152* (0.085)	0.286*** (0.0886)	0.108 (0.166)	0.269*** (0.0800)	0.0571 (0.301)	0.241* (0.128)
Observations	1,459	1,459	1,459	1,459	1,017	1,017
<b>Older Cohort Round 2 (11-12 yrs)</b>						
Vocabulary	-0.00786 (0.142)	0.0636 (0.0426)	0.0713 (0.136)	0.0752 (0.0474)	-0.0821 (0.105)	0.0252 (0.0455)
Math	-0.0658 (0.275)	0.109 (0.0936)	-0.0498 (0.237)	0.141 (0.108)	-0.198 (0.235)	-0.0262 (0.117)
<b>Older Cohort Round 3 (14-15 yrs)</b>						
Vocabulary	-0.135 (0.167)	-0.0583 (0.113)	-0.0901 (0.188)	-0.0364 (0.112)	-0.228 (0.203)	-0.0926 (0.121)
Math	-0.0299 (0.345)	0.171 (0.164)	0.116 (0.379)	0.235 (0.178)	-0.163 (0.394)	0.158 (0.234)
Observations	822	822	822	822	659	659
Balancing property satisfied	Yes	Yes	Yes	Yes	Yes	Yes
Common support imposed	Yes	Yes	Yes	Yes	Yes	Yes

Notes: 1) Standard error in parenthesis. 2) \* significant at 10% level, \*\* significant at 5% level, \*\*\* significant at 1 % level.

Table 5. Effect of Access to Formal and Informal Credit on Child School Achievement for Younger Cohort

	Specification (1)		Specification (2)		Specification (3) Rural Only	
	NNM	KBM	NNM	KBM	NNM	KBM
<b>Formal Credit</b>						
<b>Younger Cohort Round 2 (4-5yrs, n=183)</b>						
Vocabulary	0.0788 (0.0907)	0.0550 (0.0823)	0.0624 (0.106)	0.0345 (0.0755)	0.140 (0.0736)	0.0411 (0.0594)
Math	0.305 (0.401)	0.229 (0.270)	0.719* (0.412)	0.443 (0.437)	0.947*** (0.365)	0.657*** (0.243)
<b>Younger Cohort Round 3 (7-8 yrs, n=111)</b>						
Vocabulary	0.103 (0.148)	0.177 (0.137)	0.162 (0.151)	0.189 (0.129)	0.0827 (0.138)	0.123 (0.117)
Math	0.166 (0.259)	0.211 (0.201)	0.211 (0.303)	0.270 (0.227)	0.282 (0.238)	0.226 (0.174)
<b>Informal Credit</b>						
<b>Younger Cohort Round 2 (4-5yrs, n=958)</b>						
Vocabulary	0.123** (0.0576)	0.0511* (0.0285)	0.0759 (0.0632)	0.0437 (0.0310)	0.000666 (0.0531)	0.0220 (0.0304)
Math	0.296 (0.240)	0.231** (0.0971)	0.453** (0.249)	0.225* (0.148)	0.305* (0.224)	0.236** (0.112)
<b>Younger Cohort Round 3 (7-8 yrs, n=843)</b>						
Vocabulary	0.212*** (0.0828)	0.240*** (0.0562)	0.188*** (0.0956)	0.220*** (0.0534)	0.200*** (0.0977)	0.225*** (0.0513)
Math	0.157 (0.165)	0.215* (0.122)	0.234 (0.176)	0.212 (0.137)	0.111 (0.181)	0.187 (0.142)
Balancing property satisfied	Yes	Yes	Yes	Yes	Yes	Yes
Common support imposed	Yes	Yes	Yes	Yes	Yes	Yes

Notes: 1) Standard error in parenthesis. 2) \* significant at 10% level, \*\* significant at 5% level, \*\*\* significant at 1 % level

To differentiate the income effect from the access to credit effect, this study divides the sample by income quintile and measure the effect of access to credit on a child's test score with household incomes in top 20% and bottom 20% of the income distribution, separately. The result is shown in Table 6 and 7.<sup>11</sup> Both tables tell us that the effect of access to credit is only valid for children from households in bottom 20% of the income distribution. The result in Table 6 indicates that the access to credit affects vocabulary test score of children from household with income in the bottom 20% by 0.2-0.4 standard deviations. Among children from households in the top 20%, only the children in rural areas are affected by credit status of households. Table 7 shows the similar results: only children's test score in the bottom 20% of household income distribution is affected by access to informal credit, while children in the top 20% of the household income distribution are not affected by informal credit status.<sup>12</sup>

It indicates that the positive effect of overall credit access and access to informal credit for all samples in Table 4 and 5 is mostly from the income level in the bottom 20%. It can be interpreted that the high income households are not affected significantly by their credit status when they are deciding to invest in children's education while the decision of households with low income depends on the households' credit status

As we reviewed in Section 2, there are two ways that the credit access affects the quality of education: direct and indirect ways. First, the direct effect means that the households increase the educational expenditure by borrowing money from credit institutions. For example, most of the informal fees for primary schools are charged at the beginning of the school

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<sup>11</sup> We also estimates the effect of access to credit for other cohorts and rounds by income quintile using OLS. The results are not presented in the paper since there is no difference in Table 4 and 5 for other cohorts and rounds. The results are available upon request.

<sup>12</sup> This study cannot measure the effect of formal credit by income quintile, since there is a small number of household in the bottom 20% of the income distribution that has access to formal credit.

**Table 6. Effect of Access to Credit on Child School Achievement for Younger Cohort Round 3 by Income Quintile**

	Specification (1)		Specification (2)		Specification (3) Rural Only	
	NNM	KBM	NNM	KBM	NNM	KBM
<b>Income top 20% (n=166)</b>						
Vocabulary	0.134 (0.225)	0.167 (0.148)	0.261 (0.201)	0.125 (0.158)	0.223*** (0.101)	0.264 (0.0522)
Math	0.625** (0.324)	0.334 (0.207)	0.221 (0.311)	0.314 (0.227)	0.0571 (0.190)	0.270*** (0.0953)
<b>Income bottom 20% (n=130)</b>						
Vocabulary	0.362*** (0.177)	0.378*** (0.135)	0.410*** (0.192)	0.375*** (0.103)	0.223*** (0.101)	0.264*** (0.0593)
Math	0.494 (0.587)	0.512 (0.386)	0.547 (0.702)	0.658 (0.401)	0.0571 (0.190)	0.270** (0.111)

Notes: 1) Standard error in parenthesis. 2) \* significant at 10% level, \*\* significant at 5% level, \*\*\* significant at 1 % level. 3 Balancing properties and common support conditions satisfied for all specifications.

**Table 7. Effect of Access to Informal Credit on Child School Achievement for Younger Cohort Round 3 by Income Quintile**

	Specification (1)		Specification (2)		Specification (3) Rural Only	
	NNM	KBM	NNM	KBM	NNM	KBM
<b><i>Income top 20% (n=166)</i></b>						
Vocabulary	0.0976	0.186*	0.119	0.241	0.104	0.235*
	0.154	(0.106)	0.168	(0.125)	0.173	(0.140)
Math	0.159	-0.0157	-0.0417	-0.229	-0.174	-0.293
	0.303	(0.168)	0.353	(0.176)	0.319	(0.164)
<b><i>Income bottom 20% (n=130)</i></b>						
Vocabulary	0.292**	0.242*	0.225	0.223*	0.232**	0.221**
	0.154	(0.133)	(0.278)	(0.114)	(0.130)	(0.0967)
Math	0.991***	0.987***	1.244***	1.234***	1.130***	1.135***
	(0.232)	(0.143)	(0.314)	(0.205)	(0.346)	(0.186)

Notes: 1) Standard error in parenthesis. 2) \* significant at 10% level, \*\* significant at 5% level, \*\*\* significant at 1 % level. 3 Balancing properties and common support conditions satisfied for all specifications.

year. Households with access to credit can pay the informal fees by borrowing money at the beginning of the school year and it may affect the quality of education for its children. Second, the indirect effect is that the household with access to credit adopt more risk-bearing and expensive but high effective investment in child education even though it does not really borrow. This provides the basis for positive effect of access to credit for low income households. But this study can not reveal the exact mechanism about how access to credit affects the quality of education.

To check the robustness of estimates from propensity score matching, this study conducts ordinary least squares (OLS) estimation. Table 8 and Table A2 present the effect of access to credit on child's school achievement

**Table 8. OLS Effect of Access to Credit on Child School Achievement for Younger Cohort Round 3 by Income Quintile**

	(1) Voca	(2) Voca	(3) Math	(4) Math
<b>Access to Credit</b>				
<i>All Sample (n=1,459)</i>	0.313*** (0.0687)	0.0921** (0.0362)	0.673*** (0.202)	0.147** (0.0709)
<i>Income top 20% (n=293)</i>	0.269* (0.156)	0.0482 (0.146)	0.300** (0.149)	0.0337 (0.153)
<i>Income bottom 20% (n=290)</i>	0.434*** (0.102)	0.156** (0.0680)	0.996*** (0.389)	0.609** (0.251)
<b>Access to Informal Credit</b>				
<i>All Sample (n=843)</i>	0.299*** (0.0613)	0.0996** (0.0444)	0.555*** (0.274)	0.142 (0.0964)
<i>Income top 20% (n=166)</i>	0.387** (0.155)	0.109 (0.153)	0.643*** (0.312)	0.159 (0.175)
<i>Income bottom 20% (n=130)</i>	0.315*** (0.0951)	0.0646* (0.0462)	0.705** (1.987)	0.595* (0.319)
<b>Individual Covariates</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>

Notes: 1) Standard error in parenthesis. 2) \* significant at 10% level, \*\* significant at 5% level, \*\*\* significant at 1 % level. 3) For more details about the individual covariates included in the specification, please see Table A2.

estimated by OLS. The first and third column of Table 8 and Table A2 is a simple regression of test scores on access to credit and it shows that there is large impact from access to credit on children's test scores in both subjects. The size of the effect eliminates when covariates are controlled in column 2 and 4 of each table. Comparing the results in column 2 and 4 in Table 8 and Table A2 with the result of propensity score matching in Table 4, 6, and 7 shows how the selection bias is eliminated by using propensity score matching and how robust are the estimates

Overall the significance and signs of estimators are robust when comparing the results of propensity score matching with that of OLS for younger cohorts in Round 3. But the size of the effect is either eliminated or enlarged for some specification: the effect on vocabulary test scores is larger for propensity score matching, while the effect access to credit on math test score is eliminated by using propensity score matching for the bottom 20% of income distribution. In addition, the effect of informal credit on children's math test scores with income of bottom 20% is larger from propensity score matching than that from the OLS.

Table A2 shows the OLS estimation of the effect of access to credit on children's test scores for older cohorts in Round 2 (11-12 years old). The results indicate that there is positive and statistically significant effect of access to credit on children's vocabulary test scores by 0.08 standard deviation. But the effect is eliminated when we use propensity score matching, as we see in Table 4.

## V. Concluding Remarks

The main contribution of this paper is that it presents estimates of the effects of access to credit derived from non-experimental settings using propensity score matching analysis that are more precise than previous estimates. The propensity score matching estimation enables the estimator to avoid potential bias arising from the endogeneity of access to credit. In addition, the effect of access to credit on young children's scholastic achievement is estimated, and an attempt is made to fill the gap left by previous studies to increase knowledge of the effect of credit status on the human capital accumulation of children in early childhood. As discussed in Section 2, most studies on the effects of access to credit on human capital use data related to college-age students. However, human capital begins to develop at an early age (Cunha & Heckman 2010; Caucutt & Lochner 2012), and many studies reveal that early intervention has a high rate of return (Currie & Thomas 1995; Campbell *et al.* 2008; Heckman, Moon, Pinto, Savelyez, & Yavitz 2010). In this study, the researcher estimates the effect of access to credit on young children's scholastic achievement.

The estimation results indicate that access to credit has a positive effect on children's test scores when children are in the early stage of childhood (under 7–8 years old) and household income is low. The effect of access to credit is not significant for older children (11–12 and 14–15 years old). Hence, the results indicate that the quality of education is vulnerable to access to credit when the child is young, as parents make numerous investment decisions at this age, and the household income is low. However, when the child is older, most of the input for the quality of education comes from outside of household resources, such as school, friends, and

teachers, and the access to credit status of household does not have significant effect on the quality of education.

The evidence found in this paper has several implications to Vietnam's credit market and educational policy. Although Vietnam has achieved comprehensive primary education nationwide, a gap remains between the scholastic achievement of children from households with credit access and those without. The gap is mostly significant for younger children in early childhood. Nevertheless, most current policies to enhance credit access and human capital accumulation in Vietnam target college-level students. To increase the effectiveness of policy related to education and the credit market, policies targeting young children's human capital development are needed. Especially the credit program should target low income households with young children, as its quality of education is vulnerable to credit status. In addition, the result reveals that parents' investment depending on the credit status remains an important determinant of a child's human capital accumulation. To minimize inequality in quality of education due to parents' credit status, reforms should be implemented to ensure that the educational system provides efficient and fee-free education.

The limitation of this study is that it could not reveal the exact mechanism of the effect of access to credit on quality of education. Further studies with more detailed data on the mechanism or randomized control studies should be conducted in the future.

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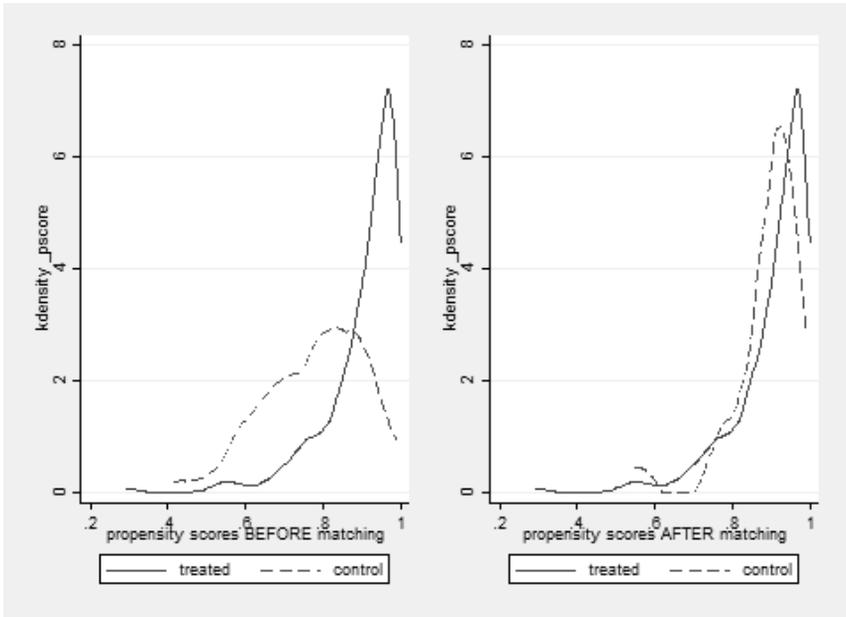
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# Appendix

Figure A.1. Density of the Propensity Scores Before and After Matching (Younger Cohort Round 2)



**Table A.1. Summary Statistics**

	All		Treatment Group (Access to Credit)		Control Group (No Access to Credit)	
	Mean	SD	Mean	SD	Mean	SD
<b>Younger Cohort Round 2</b>						
Vocabulary	36.718	17.593	37.513	17.709	29.284	14.544
Math	9.912	2.384	10.045	2.303	8.674	2.756
Age in months	63.740	3.684	63.759	3.630	63.564	4.170
First Child	0.457	0.498	0.462	0.499	0.411	0.494
Female	0.522	0.500	0.519	0.500	0.553	0.499
Mother's education	6.920	3.898	7.200	3.807	4.312	3.787
Father's education	7.588	3.865	7.873	3.803	4.929	3.409
Mother's religion catholic	0.012	0.110	0.011	0.103	0.028	0.167
_ buddhism	0.034	0.180	0.036	0.186	0.014	0.119
_ protestant	0.008	0.090	0.007	0.082	0.021	0.145
Household size	4.663	1.488	4.665	1.493	4.645	1.445
Live in Rural	0.842	0.365	0.834	0.372	0.922	0.269
BMI	16.047	1.387	16.046	1.392	16.050	1.351
D(Relatives in community)	0.953	0.211	0.950	0.218	0.986	0.119
Total income (mil. VND)	0.018	0.034	0.020	0.035	0.006	0.007
D(Remittance)	0.142	3.665	0.080	2.728	0.723	8.337
D(Subsidized program in the community)	0.764	0.425	0.771	0.420	0.695	0.462
D(Savings co. in the community)	0.095	0.293	0.096	0.295	0.078	0.269
<b>Younger Cohort Round 3</b>						
Vocabulary	94.090	27.300	94.770	27.440	80.750	20.280
Math	19.250	5.790	19.380	5.792	16.700	5.164
Age in months	97.220	3.727	97.240	3.717	96.830	3.936
First Child	0.457	0.498	0.455	0.498	0.507	0.504
Female	0.522	0.500	0.522	0.500	0.535	0.502
Mother's education	6.920	3.898	7.066	3.869	4.085	3.371
Father's education	7.588	3.865	7.707	3.839	5.254	3.632
Mother's religion catholic	0.012	0.110	0.012	0.110	0.014	0.119
_ buddhism	0.034	0.180	0.035	0.185	0.000	0.000
_ protestant	0.008	0.090	0.009	0.093	0.000	0.000
Household size	4.663	1.488	4.653	1.488	4.873	1.492
Live in Rural	0.842	0.365	0.841	0.365	0.859	0.350
BMI	16.050	1.387	16.050	1.392	15.890	1.291
D(Relatives in community)	0.947	0.224	0.948	0.222	0.930	0.258
Value of Asset	0.271	2.879	0.284	2.951	0.027	0.080
D(Remittance)	0.142	3.665	0.149	3.757	0.000	0.000
D(Subsidized program in the community)	0.600	0.490	0.598	0.490	0.634	0.485

Table A.1. Continued

**Older Cohort Round 3**

Vocabulary	138.972	23.939	140.423	22.662	127.538	30.064
Math	7.594	1.710	7.673	1.668	6.978	1.917
Age in months	147.576	3.972	147.717	3.945	146.462	4.029
First Child	0.374	0.484	0.377	0.485	0.355	0.481
Female	0.484	0.500	0.487	0.500	0.462	0.501
Mother's education	7.064	3.869	7.355	3.856	4.774	3.149
Father's education	7.966	3.913	8.322	3.819	5.161	3.509
Mother's religion catholic	0.018	0.134	0.019	0.137	0.011	0.104
_ buddhism	0.038	0.190	0.038	0.192	0.032	0.178
_ protestant	0.007	0.085	0.007	0.082	0.011	0.104
Household size	4.909	1.344	4.872	1.331	5.204	1.419
Live in Rural	0.804	0.397	0.801	0.400	0.828	0.379
BMI	14.206	1.349	14.213	1.359	14.149	1.271
D(Relatives in community)	0.927	0.260	0.925	0.264	0.946	0.227
Total income (mil.VND)	0.017	0.021	0.018	0.022	0.009	0.008
D(Remittance)	0.122	3.445	0.138	3.657	0.000	0.000
D(Subsidized program in the community)	0.737	0.440	0.761	0.427	0.548	0.500
D(Savings co. in the community)	0.085	0.279	0.089	0.284	0.054	0.227

**Older Cohort Round3**

Vocabulary	139.000	23.940	139.100	24.050	137.000	22.280
Math	7.594	1.710	7.622	1.690	7.146	1.978
Age in months	181.100	3.816	181.200	3.813	179.800	3.630
First Child	0.374	0.484	0.369	0.483	0.458	0.504
Female	0.484	0.500	0.487	0.500	0.438	0.501
Mother's education	7.064	3.869	7.177	3.894	5.229	2.897
Father's education	7.966	3.913	8.085	3.923	6.042	3.222
Mother's religion catholic	0.018	0.134	0.019	0.138	0.000	0.000
_ buddhism	0.038	0.190	0.040	0.196	0.000	0.000
_ protestant	0.007	0.085	0.008	0.088	0.000	0.000
Household size	4.909	1.344	4.922	1.344	4.708	1.336
Live in Rural	0.804	0.397	0.808	0.394	0.729	0.449
BMI	14.210	1.349	14.220	1.368	13.950	0.958
D(Relatives in community)	0.935	0.247	0.936	0.245	0.917	0.279
Value of Asset	0.449	4.277	0.476	4.406	0.018	0.035
D(Remittance)	0.122	3.445	0.130	3.550	0.000	0.000
D(Subsidized program in the community)	0.630	0.483	0.627	0.484	0.667	0.476

**Table A.2. OLS Effect of Access to Credit on Test Scores for Older Cohort Round 2**

VARIABLES	(1) Voca	(2) Voca	(4) Math	(5) Math
Access to Credit	0.452*** (0.0991)	0.0780* (0.0454)	0.285*** (0.0791)	0.0235 (0.0847)
Age in Month		0.0153*** (0.00356)		0.00853 (0.00565)
First Child		0.0152 (0.0247)		-0.0223 (0.0552)
Female		0.0108 (0.0275)		-0.0787* (0.0453)
Mother's education		0.0263*** (0.00614)		0.0379*** (0.00920)
Father's education		0.0222*** (0.00676)		0.0346*** (0.00959)
Mother's religion is catholic		0.0458 (0.0506)		0.0908 (0.0897)
_buddhism		-0.0839 (0.0826)		0.0358 (0.0791)
_protestant		-0.405* (0.237)		-0.773 (0.471)
Household size		-0.0490*** (0.0168)		-0.0592** (0.0257)
Rural		-0.136*** (0.0429)		-0.102 (0.0608)
BMI		-0.0321 (0.0223)		-0.0146 (0.0267)
D(Relatives)		0.0168 (0.0421)		0.0111 (0.0788)
Total Income		1.090* (0.616)		1.495 (1.002)
Remittance		-0.126** (0.0492)		0.168** (0.0707)
Subsidized credit program		-0.0616 (0.0501)		0.0460 (0.0669)
Savings Cooperatives		-0.269** (0.117)		-0.110 (0.0687)
Observations	826	826	826	826
R-squared	0.029	0.345	0.016	0.228

Notes: 1) Standard error in parenthesis. 2) \* significant at 10% level, \*\* significant at 5% level, \*\*\* significant at 1 % level.

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## 국문요약

이 연구는 성향점수매칭(Propensity score matching)을 이용하여 베트남 부모의 금융접근성이 자녀 교육의 질에 미치는 영향을 추정하였다. 이 연구는 다양한 연령대의 어린이들을 대상으로 한 가계설문인 Young Lives Survey in Vietnam을 사용하여 금융접근성의 영향력이 나이대별로 어떻게 달라지는지를 분석하였다. 분석 결과에 따르면 부모의 금융접근성은 아이들의 교육의 질에 부정적인 영향을 미치는 것으로 나타났다. 금융접근성이 교육의 질에 미치는 영향은 아이가 어리고 부모의 소득수준이 낮을수록 크게 나타났다. 반면 아이들이 11세 이상일 경우에는 부모의 금융접근성이 교육의 질에 미치는 영향은 미미한 것으로 나타났는데, 이는 11세 이상 아이들의 교육의 질은 부모의 금융접근성보다 학교, 선생님, 또래 친구들에게서 더 큰 영향을 받기 때문인 것으로 추측된다.

**핵심용어:** 금융접근성, 교육의 질, 성향점수매칭, 베트남

## 허윤선(許允鮮)

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## Access to Credit and Quality of Education in Vietnam

HUR Yoon Sun

This paper tries to determine the relationship between two of growth engines in Vietnam: access to credit and education. To avoid potential bias due to the endogeneity of access to credit variable, this paper utilizes the propensity score matching. This paper takes advantage of the Young Lives Survey of Vietnam that collected information on children of various ages to observe the effect of credit access in different stage of childhood. The result of propensity score matching analysis shows that the quality of education, measured by test scores, is impacted significantly by access to credit when the child is young and household income is low. However, when the child is older, most of the input to enhance the quality of education comes from outside of household resources, such as school, friends, and teachers, and the access to credit status of the household does not have significant effects on the quality of education.

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