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Equitable Access to Higher Education in Cambodia: Effects of Financial Aid for Low-Income Students

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Equitable Access to Higher Education in Cambodia: Effects of Financial Aid for Low-Income Students

（カンボジアの高等教育における就学の公平性 －低所得の学生に対する財政支援の効果－）

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Executive Summary

Human capital accumulation plays a crucial role in the development and advancement of our modern economies around the world. More recent studies on the rate of return to education reveal that investments in tertiary education, not primary education, yield the highest private rates of return. In the last two decades or so, we have witnessed the rapid rise in enrollment in higher education globally, especially among developing countries in response to the increase in demand and shift in labor markets that require highly skilled workers.

The Cambodian economy and education system were once wholly destroyed during the brutal genocide regime in the late 1970s. Nevertheless, not many countries have experienced an increase in enrollment in higher education, as sharp as the upward trend in Cambodia in the past 20 years. The surge in higher education participation in Cambodia is the result of success in expansion education service in basic education, stable macroeconomic growth, and more importantly two important education reforms in higher education sub-sector. In 1997, the Royal Government of Cambodia (RGC) allowed the establishment of the first private university and in the early 2000s adopted the cost-sharing strategies by introducing an additional fee-paying track system in public universities. The strategy to shift the burden of educational expenses from the government to private sector has certainly facilitated the expansion of higher education service delivery; however, it also impedes the enrollment opportunities of competent students who wish to pursue their higher education but find it unaffordable. To ensure more equitable access to higher education, the government has created scholarship schemes, mainly tuition exemptions, targeting students from disadvantaged backgrounds. Nevertheless, about half of students from low-income families cannot persist in completing a four-year university program even after receiving tuition waivers. To lessen this high dropout rate, MoEYS launched a Special Priority Scholarship (SPS) as a pilot program, supported by the World Bank in 2011. The program was to provide additional stipends on top of the regular tuition waivers to 1,000 poor students.

Against the backdrop of this rapid higher education expansion and the government demand-side scholarship intervention, this study aims to investigate three major research questions. Firstly, this study examines how the demand-side factors, including student and family characteristics, predict the probability of individuals' enrollment in post-secondary education, and how these predictors have changed during the rapid higher education expansion in the last decade. Secondly, it assesses the impact of the new MoEYS' Special Priority Scholarship (SPS) on university enrollment, retention, and completion among targeted low-income students. Last but not least, this study further evaluate the impact of the SPS program on the early career earnings of students after their graduation.

To answer the first research question, in Chapter 3 this study utilizes the nationally representative Cambodia Socio-Economic Survey (CSES) conducted in 2004, 2009, and 2014 with a multinomial logistic regression approach. In line with the findings from previous literature, the study confirms the positive effects of household head's education, household expenditure level, and urban residency. However, these factors are much less significant in terms of both statistical level and magnitudes when the samples are restricted to high school graduates. When the analysis is performed separately by year, our findings suggest that students of disadvantaged backgrounds (female students, students with low-education household head, students of lower consumption quintiles, students of remote areas) benefit less from the higher education expansion. In other words, higher education expansion has made access to higher education more unequal. Nevertheless, if those disadvantaged students can finish high school, they have much better odds of enrolling in universities and the disparities are much less pronounced. For instance, the results of predicted probabilities from the high school graduate sub-sample indicate that in 2014 individuals from remote and rural area have similar odds of being enrolled in higher education. Young adults in the second top quintile seem to benefit the most from the higher education expansion. Analyses with both unrestricted and high school graduate sub-samples reveal that in 2014 the predicted probabilities of enrolling in universities among this group are as high as those from the top quintile.

To evaluate the financial aid impact on university enrollment, retention, and on-time completion, the study, in Chapter 4, employs the inverse-probability weighted regression adjustment (IPWRA) to address the non-random assignment of the treatment. It is a two-stage regression that first estimates regression coefficients using inverse-probability weights, and then runs the regression adjustment to predict the outcome means. The results from the impact evaluation of stipends scholarship (SPS) program targeting high school graduates from low-income families reveals strong and positive impact of both scholarship eligibility on university enrollment, and the financial aid on retention and on-time completion. The results are also confirmed by the Propensity Score Matching (PSM) method with several matching algorithms, as well as by the Regression Discontinuity Design (RDD) approach. The results from the sub-sample estimations show that the impact of scholarship eligibility is relatively strong among students admitted to public universities and universities located outside Phnom Penh. The difference in impact between males and females is much less noticeable. After enrollment, the study finds that financial aid provides the highest impact on retention and on-time completion among students from students enrolled in private universities and universities located outside the capital.

The last empirical part in Chapter 5 further investigates the impact of the SPS program on students' earnings during the first 12 months after graduation using a similar approach to that employed in Chapter 4. The topic of financial aid on early career earnings is still less explored, even in developed countries. To obtain information on employment status and earnings, 600 individuals (300 from each group) were randomly selected and located for interviews through telephone and household visits in 2017. The government's financial aid is found to have a positive impact on early career earnings in both the OLS and IPWRA estimates. The impact is more favorable among the graduates, and negative but statistically insignificant among those who withdraw from their enrolled programs. The estimations by gender suggest that the impact on earnings is in favor of male students. Although the OLS estimates show some positive correlations between the program participation and female earnings, this study

cannot confirm the positive effect of the program with the IPWRA approach among female recipients both with aggregate sample and graduate sub-sample.

In a nutshell, the expansion of higher education has enabled individuals from disadvantaged backgrounds better opportunities to attend universities, although disparities still persist. The inequality is less pronounced among high school graduates; however, students from remote and low-income families appear less likely to finish high school. This suggests that interventions at lower education levels remain crucial in Cambodia. Based on the results of the impact evaluation of the SPS program, there is evidence that financial aid is effective in increasing university's enrollment, retention, and completion rate. The strong and robust impact on the academic outcomes, coupled with the high rate of return to university education, suggest that this stipend scholarships can be an effective public intervention in increasing intergenerational social and economic mobility among low-income families. Our findings also suggest that targeting students from remote areas enrolling in universities outside the capital yields the most favorable academic outcomes. Assessment of the program impact on student earnings and program cost-benefit analysis estimates that the investment costs can be recovered in about six years after students' graduations.

Acknowledgments

First and foremost, I would like to express my most profound appreciation to my academic supervisor, Prof. Keiichi Ogawa, for his continuous guidance, advice, and motivation during my five academic years from the beginning of my master's program. Without his assistance, I could not have successfully completed this doctoral dissertation. Furthermore, I am very grateful to him for encouraging me to participate in academic seminars and to present my papers at several academic conferences in Japan and abroad. I also greatly benefited from the opportunities to participate in several field researches and consultation workshops in Cambodia.

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Kobe, 20 June 2018

Chea Phal

Abbreviations

- ADB Asian Development Bank
- AEC ASEAN Economic Community
- ATE Average Treatment Effect
- AY Academic Year
- CNCC Cambodia National Council for Children
- CPI Consumer Price Index
- CSES Cambodia Socio-Economic Survey
- DEO District Education Office
- DHE Department of Higher Education
- DID Difference-in-Difference
- EFA Education for All
- EGRA Early Grade Reading Assessment
- ESP Education Strategic Plan
- GDP Gross Domestic Product
- GNI Gross National Income
- HE Higher Education
- HEI Higher Education Institute
- HEQCIP Higher Education Quality and Capacity Improvement Project
- ICL Income-Contingent Loans
- IDA International Development Agency
- IPWRA Inverse Probability Weighted Regression Adjustment
- ISIC International Standard Industrial Classification
- MDG Millennium Development Goals (MDG)
- MEF Ministry of Economy and Finance
- MoEYS Ministry of Education Youth and Sports
- MoLVT Ministry of Labour and Vocational Training
- NGO Non-Government Organization
- NIS National Institute of Statistics
- OECD The Organisation for Economic Co-operation and Development
- PEO Provincial Education Office
- PMT Proxy Means Tests

- PSM Propensity Score Matching
- RCT Randomized Control Trail
- RDD Regression Discontinuity Design
- RGC Royal Government of Cambodia
- SIDA Swedish International Development Cooperation Agency
- SPS Special Priority Scholarship
- TVET Technical and Vocational Education and Training
- UIS UNESCO Institute of Statistics
- UNESCO The United Nations Educational, Scientific and Cultural Organisation

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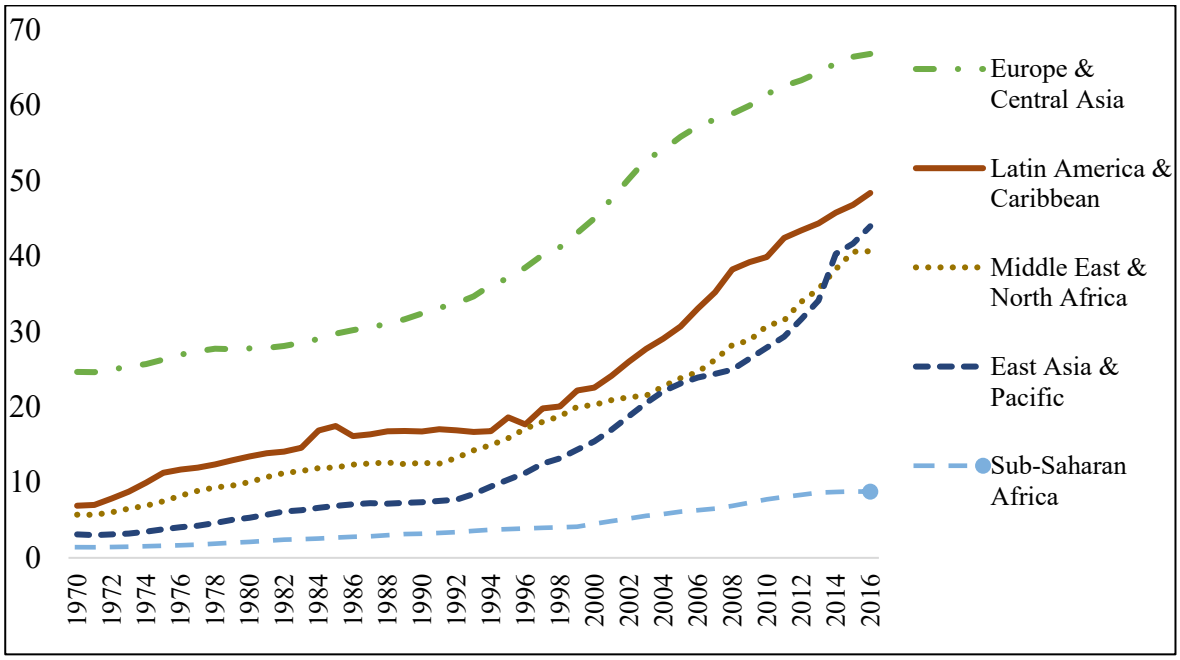
Chapter 1. Introduction

1.1. Background of the Study

It is universally recognized that human capital plays a critical role in building and developing a country's economy as well as an individual's lifetime career success. Globally, both government and local and international development communities tended to put a much higher priority on basic education, which was, and still is, a critical and rational public intervention. Higher education was not included in the major international development agendas, such as the Millennium Development Goals (MDG) and Education for All (EFA). However, a recent rigorous literature review on studies related to impacts of higher education on development indicates that higher education has strong positive influence on individual earnings, and moderate positive impact on economic growth, individuals' self-actualization and strengthening of institutions (Oketch, McCowan, & Schendel, 2014).

Although higher education is not a national education priority in most countries, there have been rapid rises in enrollment in higher education around the world, including Asia, in particular among emerging economies, over the last two or three decades. This is due to the increasing demand for highly skilled workers in service industries and individuals' perceptions that higher education can provide good returns to investments (UNESCO, 2014; World Bank, 2012). According to UNESCO's statistics, the average gross tertiary enrollment in East Asia & Pacific region increased around fourfold in the last 20 years from 11.26% in 1996 to 43.96% in 2016. The private sector has played a key role in driving the expansion of access to higher education, because the public sector's financial resources are far from sufficient to answer the increasing demand of the costly higher education service (Armstrong & Chapman, 2011). The shift in expansion to higher education is partly a by-product of success in expanding access at primary and later secondary education levels. The change in employment landscape that requires a higher level of knowledge and skills in the workplace is also a driving factor behind the rising demands for higher education.

Figure 1-1 Gross Tertiary Enrollment Ratio by Region



Source: Based on Unesco Institute of Statistics (UIS)'s Statistics. Retrieved from http://data.uis.unesco.org/ on May 20, 2018

In the meantime, the expansion of higher education also causes a number of concerns and challenges. The issues include the high cost of the expansion, inequality in access to higher education among groups of population, and decline in education quality (Asian Development Bank, 2012). The definition of equity in higher education can be loosely defined as "no barriers, for those who have the ability, to access university, or simply, all people have the same opportunity to develop their talents" (James, 2007, p. 1). Public budgets for higher education are limited and sometimes decline in many Asian countries, and are far from adequate to meet the ever-increasing enrollment demands (IIEP & UNESCO, 2017; UNESCO, 2003).

As demand for higher education has risen, many governments have no choice but to put more cost burden onto the private sector. Since the mid-1990s, more and more countries have introduced cost-sharing policies. It can be done by imposing or increasing tuition fees, generally at public universities, to generate extra income for the public schools, so that the

state budget can be reduced. The government can also provide incentives for the private sector to expand the delivery of higher education services instead of the government.

The Cambodian education system was once completely destroyed during the brutal genocide regime in the late 1970s. Nevertheless, not many countries have experienced the same increase in enrollment in higher education, the sharp upward trend, as Cambodia in the past 20 years or so (Williams, Kitamura, & Keng, 2014). In response to the increasing demand of higher education, the Royal Government of Cambodia (RGC) has also adopted the cost-sharing strategies by allowing the establishment of the first private university in 1997 and introducing the dual-track system in public universities in the early 2000s. The dual-track system allows the public High Education Institutes (HEIs) to continue offering programs for free (for scholarship students) and, at the same time, collect tuition fees from fee-paying track students.

1.2. Objectives of the Study

This study is further divided into three parts and attempts to provide empirical evidence on the determinants of enrollment in post-secondary education in Cambodia, and to assess the impact of the government's financial aid program targeting students from low-income families. First, this study examines how the demand-side factors, including student and family characteristics, predict the probability of individuals' enrollment in the post-secondary education. Since higher education in Cambodia has rapidly expanded in the last decade, the study also investigates the trends of those predictors in the last decade by using household datasets conducted in three different years between 2004 and 2014.

In the second part, the study assesses the new pilot stipend scholarship scheme implemented by the Ministry of Education Youth and Sports (MoEYS) aimed at improving access to higher education of students from disadvantaged backgrounds. It is to measure the effectiveness of financial assistance provided through the Special Priority Scholarship (SPS) program in increasing the university enrollment, retention, and completion of the targeted

poor students. Also, the study further examines whether the impact of the scholarship program is heterogonous between different groups.

The third and last objective of this study is to assess the impact of the above scholarship program on the early career earnings after students' graduation. By tracking the students one year after their expected graduation, the study intends to examine if the financial assistance from the government can help students shorten the period of finding decent jobs and/or increase their earnings after graduation. Again, this study also checks the heterogeneity in program impact on the earnings by different groups as well.

1.3. Structure of the Study

This dissertation is divided into five chapters structured as follows. Before going to the empirical chapters, Chapter 2 presents a review of the education system in Cambodia in general from basic education to higher education. This chapter also provides information about the current situation related to higher education financing as well as students' financial support in Cambodia. In response to the three objectives, three chapters are devoted to the empirical study, beginning with Chapter 3. Using three sets of Cambodia Socio-Economic Survey (CSES) data conducted in the last decade, Chapter 3 examines whether the expansion of higher education in Cambodia makes access to higher education more accessible among the disadvantaged groups. Chapter 4 investigates the impact of students' financial aid in higher education on the university enrollment retention and completion, and Chapter 5 looks into the effect of the students' financial support during undergraduate programs on students' early career earnings after their expected graduation. Lastly, in Chapter 6 the study summarizes and discusses the findings and limitations of the empirical study, followed by the conclusions. Appendixes for the three empirical chapters are provided at the end of the study to show detailed estimation in full results as well as some additional information and analysis related to the findings and discussions.

Chapter 2. Overview of Education System in Cambodia

The Cambodian education system consists of 12-year general education and higher education. The former is further organized into three levels: (i) six-year primary education, (ii) three-year lower secondary education and (iii) three-year upper secondary. Higher education covers undergraduate and post-graduate studies. In addition, similar to many countries, in parallel to general education, students can start the Technical and Vocational Education and Training (TVET) stream after either completing lower secondary education or upper secondary education. In general education, all public schools are entirely under the supervision of MoEYS. In addition, MoEYS is also responsible for pre-school education, non-formal education, and teacher training for all levels from pre-school to upper-secondary (MoEYS 2014a). However, Higher Education Institutions (HEIs) across the country are jointly supervised by 15 ministries and institutions, and most of the TVET schools are under the supervision of Ministry of Labour and Vocational Training (MoLVT) (MoEYS, 2017a; Sen & Soveacha, 2013).

Table 2-1 Formal Education System in Cambodia by Age, Level and Grade

Age	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21+
Education Level	Primary School						Lower Secondary			Upper Secondary			Higher Education			
Grade	1	2	3	4	5	6	7	8	9	10	11	12	University			
										TVET						

Source: Created by the author based on MoEYS's Education Strategic Plan 2014-2018

According to the MoEYS's Education Management Information System (EMIS)'s statistics, as of the academic year 2014-2015 there are 7,051 primary schools, 1,674 lower secondary schools and 455 upper secondary schools across Cambodia (MoEYS, 2015b). Most of the general education in Cambodia occurs in public schools regulated by MoEYS. Under MoEYS, at the national level, there are 25 Provincial Education Offices (PEOs) and

165 District Education Offices (DEOs) functioning as education service providers at the sub-national level.

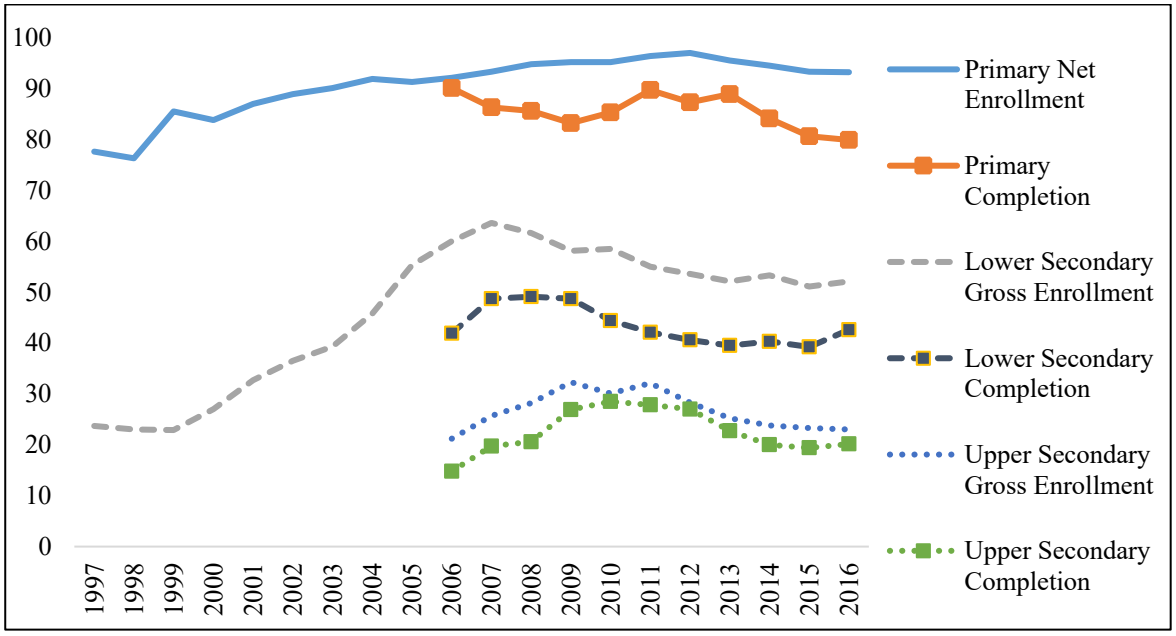
2.1. General Education

The official age for primary school admission in Cambodia is six years old. According to the constitution and the Education Law, all children regardless of their backgrounds are entitled to nine years of basic education. Pushed by the global EFA movement, as seen in Figure 2-1, Cambodia had no doubt made good progress in expanding basic education in the last decades, after prioritizing education access expansion at both primary and lower secondary education. The Royal Government of Cambodia (RGC) has introduced several demand-side interventions to ensure equitable access to education targeting children of disadvantaged groups. Those interventions include the school breakfast supported by World Food Program (WFP) and the provision of school operational budget in the form of school grants that try to eliminate school fees to reduce the financial burden of education on poor households. As a result, basic education has become accessible to more children. The gross enrollment rate at the lower secondary level rapidly surged during the decade between 1997 and 2007 (Figure 2-1). Nevertheless, the latest MoEYS's statistics indicate that the gross enrollment rate in lower and upper secondary schools in 2016 is still at 52.1% and 23% respectively (MoEYS, 2017b). Furthermore, Figure 2-1indicates that the completion rate at primary school is slightly declining in recent years, while the enrollment and completion rates at lower and upper secondary school are also stagnant. It is found that opportunity cost and family economic status appears to be strongly associated with dropout in Cambodia (CNCC, 2015).

Exacerbating the low enrollment and completion rates at lower and upper secondary school is the challenging issue of poor quality of education. Inequality has also drawn more attention of the government and international communities. In addition to high repetition and dropout rates at both primary and secondary levels, the results from the Early Grade

Reading Assessment (EGRA) are also very worrying. EGRA, conducted in 2010 on 24,000 students from grade one to six, found that about a third of grade two students could not read even a single word, and among children who could read, about half of them could not comprehend the contents (Tandon & Fukao, 2014). Although gender disparity issues have improved in recent years[1], children of low social-economic status and children in rural areas remain less likely to be able to access quality education than their affluent counterparts in urban areas. Empirical evidence suggests that financial support, in the form of conditional cash transfer, can help increase the enrollment of children from low-income families in Cambodia (Ferreira, Filmer, & Schady, 2009).

Figure 2-1 Gross Tertiary Enrollment Ratio by Region



Source: MoEYS's Education Management Information System Reports (1997-2016)

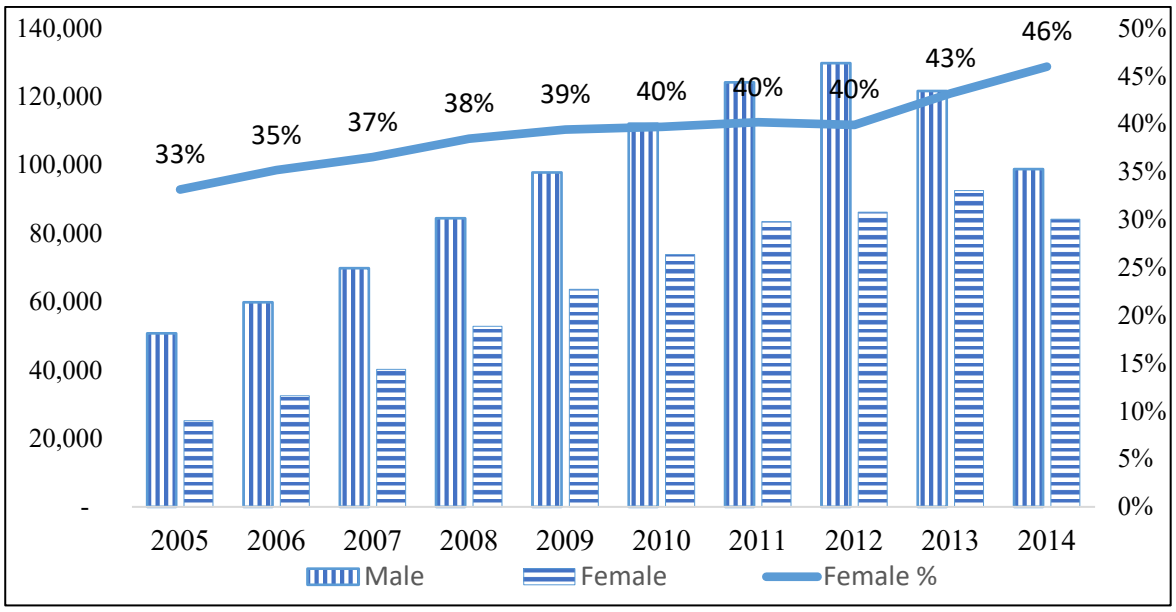
2.2. Higher Education in Cambodia

The Cambodian post-secondary education can be further separated into two streams, academic and vocational, supervised by the Ministry of Education Youth and Sport

[1] As of AY 2016-2017, the gross female enrollment rates in primary (91.4%), lower secondary (57.1%) and upper secondary schools (39.3%) are slightly higher than the overall enrollment rates (MoEYS's EMIS, 2017).

(MoEYS) and Ministry of Labor Vocational Training (MoLVT) respectively (Chet, 2009). As of the academic year 2014-2015, among the 118 HEIs across Cambodia, 71 HEIs are under the supervision of MoEYS, and 25 HEIs are under MoLVT, while the remaining 22 HEIs are under 13 other ministries or institutions (MoEYS, 2015a). Although MoEYS, precisely the Department of Higher Education (DHE), supervises more than half of all total HEIs, it does not have much authority to control or coordinate other HEIs supervised by other ministries or institutions, especially those in the TVET stream (Sen & Soveacha, 2013).

Figure 2-2 Number of Bachelor Degree Students from 2005-2015 by Year and Gender



Source: MoEYS's Education Congress Report (2016)

For the last 20 years, Cambodian higher education has made significant progress in both public and private sectors. With the Education Law, adopted in 2007, which provided direction for the future development of the higher education sub-sector, there has been a remarkable increase in the number of students enrolled in HEIs as well as the number of universities in Cambodia. The first private university was established in 1997 in response to high demand for higher education, and as of 2015, there are 72 private universities, while the number of public universities has also increased from eight in 1997 to 46 in 2015.[2] There

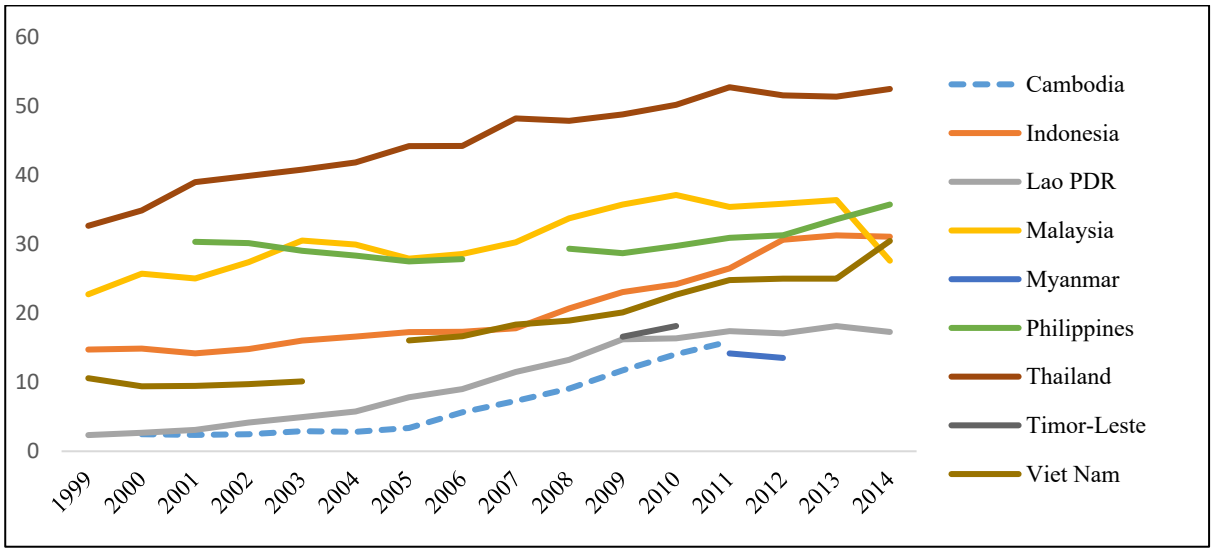
[2] Twelve out of the 46 public HEIs are under MoEYS.

were 182,987 undergraduate students enrolled in HEIs in 2015, an increase of about 20 times in two decades (MoEYS, 2015a); although, the enrollment in absolute terms reached its peak in 2012. The higher education enrollment ratio in Cambodia of 16% in 2011 was still low in comparison with other countries in the region such as Thailand (51%), Vietnam (25%), and the Philippines (28%) (UNESCO, 2014).

2.2.1. Higher Education Reforms and Expansion

Growth in higher education is a global and regional trend in recent years. However, very few countries have witnessed growth at the speed of Cambodia. Between the period of 2000 and 2011, the higher education enrollment rate increased about 6.42 times, while global and regional increases are less than two times in the same period (UNESCO Institute for Statistics, 2017). The growth was even more abrupt in the early 1980s when there was only one HEI in the whole country, and the enrollment rate was as low as 0.1%. Two significant reforms described below are the driving forces behind the rapid expansion of the Cambodian higher education system in the past two decades.

Figure 2-3 Higher Education Enrollment in Southeast Asia



Source: Based on Unesco Institute of Statistics (UIS)'s Statistics. Retrieved from http://data.uis.unesco.org/ on December 10, 2017

The first important reform was the introduction of private Higher Education Institutes in 1997, in which the first private HEI, Norton University, was established. Before that, traditionally, Cambodia's higher education was offered free of charge, and sometimes with additional scholarships. This reform was the first attempt to shift from a fee-free to the fee-paying system (Minxuan, 1998). Since the growth in demand for higher education surpassed government capacity to supply the service due to the public budget constraints, many more private HEIs have been authorized to address the increasing needs for higher education. In 1996, there were only eight public HEIs in the country with a total enrollment of around 10,000, but as of 2016, there are 219,069 students enrolled in 121 HEIs, of which 73 are private (Chet, 2009; MoEYS, 2017a; Un & Say, 2014). Without involving the private sector in higher education, Cambodia would not have been able to achieve such a rapid expansion in higher education, as the majority of the increase in enrollment is from the private HEIs — students enrolled in private institutions in 2011 accounted for about 60% of total students (UNESCO, 2014).

The second major higher education reform was the introduction of a fee-paying system into public HEIs, creating a new privatized track. The Circular issued in 2000 by the Prime Minister to authorize public HEIs to collect tuition fees from students also regulated the proportion of fee-paying students. Based on the Circular, public HEIs can receive fee-paying students up to a third of the total students, meaning two-thirds of the students should be tuition waiver (scholarship) students (World Bank, 2010). However, in reality, public HEIs started to offer some sort of fee-paying programs as early as 1996, even before the introduction of private HEIs, and by 2000 the number of fee-paying students (at private and public HEIs combined) already exceeded the number of scholarship students (Chet, 2009; UNESCO, 2014; Williams et al., 2014). The fee-paying reform enabled public HEIs to absorb more students generating extra income to supplement the limited budgets from the government. At the beginning of the reform, the fee-paying students were apparently already over the imposed one-third threshold. A decade after the introduction of the reform, around

70-80% of students at public HEIs were fee-paying. From the public budget perspective, using tuition fees to finance the higher education sub-sector can relieve the state budget; however, this approach makes the inclusiveness issue in higher education more challenging.

2.2.2. Financing Higher Education in Cambodia

Since Cambodia is still allocating a significant proportion of its education budget to primary and lower secondary schools, the share of higher education expenditure is relatively small in comparison to other countries in the region. Although in the Education Strategic Plan (ESP) 2014-2018, MoEYS allocates more than 10% of its budget to the higher education sub-sector, the higher education expenditure share of the total education expenditure is less than 5%, while it is around 15% in Lao PDR, Viet Nam, Thailand and Indonesia (MoEYS, 2014a; UNESCO Institute for Statistics, 2017). Cambodia's expenditure on tertiary education, as a share of total government expenditure and as of GDP, is also the lowest in the region at 0.06% and 0.12% respectively (see Table 2-2). The relatively low public expenditure on higher education has created opportunities for the private sector to enter the higher education sub-sector by opening private HEIs and introducing fee-paying tracks at public institutes.

Table 2-2 Expenditure on Tertiary Education (Latest Year Available)

Country	Total Education Expenditure	Total Government Expenditure	GDP
Cambodia	6.10%	0.60%	0.12%
Myanmar	11.28%	1.03%	0.24%
Philippines	11.96%	1.58%	0.32%
Lao PDR	13.81%	1.68%	0.41%
Viet Nam	15.01%	2.78%	0.85%
Thailand	15.55%	2.98%	0.64%
Indonesia	15.80%	3.26%	0.57%
Brunei Darussalam	18.89%	2.16%	0.84%
Malaysia	23.39%	4.83%	1.13%
Singapore	35.28%	7.04%	1.03%

Source: Based on Unesco Institute of Statistics (UIS)'s Statistics. Retrieved on March 20, 2018

In the 1980s and early 1990s, most of the costs of higher education were the sole burden of the government. However, in order to expand the higher education sub-sector, the government started to involve the private sector by allowing the establishment of private HEIs in 1997 and encouraged public HEIs to generate extra income by offering additional programs targeting students who were able to pay tuition fees. By 2000, the number of scholarship students was outnumbered by fee-paying students, and by 2005 more than 50% of HEIs were private. The combined expenditure for higher education in Cambodia in 2010 was US$ 42.36 million or 0.58% of the Gross Domestic Product (GDP), but the expenditure from the private sector accounted for more than 80% of the financial resources (World Bank, 2010).

Cambodian public HEIs' financial resources are mainly from the central government budget and tuition fees collected from students. For the former financial resource, public HEIs have a limited role in deciding how to utilize the budget as most of the government budget is for the salaries of full-time staff (Asian Development Bank, 2011). With limited government budget to support programs or activities to improve the quality of learning and teaching in general, public HEIs mainly rely on revenue generated from fee-paying students to support their institutional operations and development (Rany, Zain, & Jamil, 2012; Un, 2014).

2.2.3. Student Financing in Higher Education

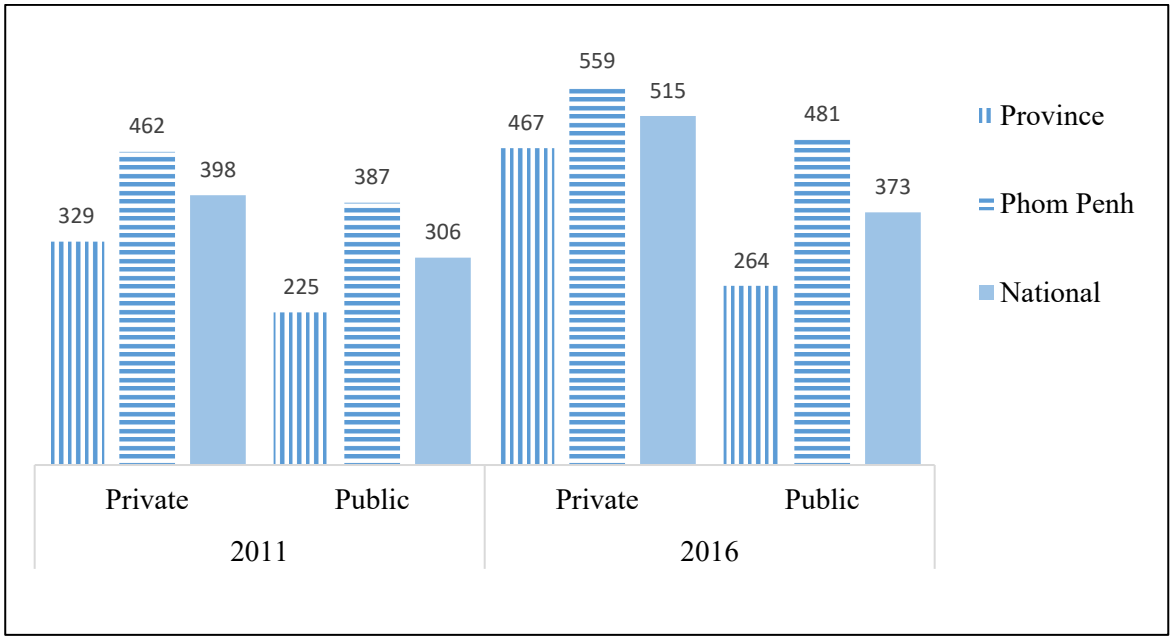
Financing the expansion of higher education has been debated not only in developed countries but also developing countries around the world. Although several factors influence the policy discussion, the debates often center around the economic concepts and thinking, in particular, the private and social rates of return to investment (Woodhall, 2007). In most economies, an optimal approach to funding higher education can be a mixture of public and private investment, since both sectors can benefit from the investment. Eicher & Chevaillier (2002) recommend that public finance should be channeled to both HEIs and students

through scholarship grants and/or student loans, and the private financial sources can be collected through tuition fees, interests, and repayments from the student loans. Correspondingly, an increasing number of countries has shifted to this kind of financing approach to overcome the lack of public budget for higher education. Governments finance higher education by either transferring resources directly to higher education institutions, or supporting students from low-income households through scholarship programs or loan subsidies for academic and living expenses, or through tax benefits (Chapman, 2006; Fahmi, 2007; Woodhall, 2007). The rising share of private financing sources can pose a concern about equal opportunities in accessing higher education of some groups of students with financial barriers. It impedes the enrolment opportunities of talented students who cannot afford high-cost post-secondary education. In this situation, government interventions are necessary to reduce this inequality and to create more opportunities for the poor and disadvantaged who basically cannot afford to make investments in higher education.

In Cambodia by the early 1990s, when the higher education enrollment rate was still low, the state was the sole provider of the higher education service. Tuition was then free and fully covered by the government's budget. However, the burgeoning demand for higher education steadily rose against the limited public budget for the higher education sub-sector. The increase in number of students has created a significant surge in demand for private Higher Education Institutes (HEIs). In 2000, in response to the massive demand for access to higher education, the government introduced a fee-charging track within public HEIs. In other words, public HEIs were allowed to collect tuition fees from students, which supplement insufficient funds from the government and reduce the government's burden. Even so, the government in cooperation with both public and private HEIs still continues to offer free higher education to particular groups of students in the form of either merit-based or need-based scholarships (tuition waivers only). Currently, students, except those with tuition waiver scholarships, in both public and private HEIs are expected to pay tuition fees. According to a survey collected from 29 private HEIs and 12 public HEIs in 2017, the

average annual tuition fee was around US$ 350 in 2011 and US$ 450 in 2016. Public HEIs outside Phnom Penh, tend to charge relatively lower fees, while the fees at private HEIs in the capital are the highest on average.

Figure 2-4 Tuition Fees at Public and Private HEIs in 2011 and 2016 (in US$)



Source: HEI Survey conducted through telephone during the Labour Outcome Survey in 2017

Cambodia's national scholarship scheme is administered and regulated by the MoEYS's Department of Higher Education (DHE). In principle, it only provides the tuition waivers to eligible students who are enrolled in the participating HEIs. The DHE offers both merit-based scholarships to high-performance students and need-based scholarships to students from prioritized groups, namely poverty priority, female priority and remote priority. In absolute terms, the number of students receiving tuition waivers from the DHE increased more than double between 2002 and 2011. This number, however, was much smaller than incremental number of fee-paying students. MoEYS estimated that freshmen enrollment with the tuition waiver program was at 10.55% in Academic Year 2015-2016 (MoEYS, 2015a).

Table 2-3 Number of Scholarships (Tuition Waivers) Awarded by the DHE

Year	Registered for G12 Exam	Passing G12 Exam	Scholarship Applicants	Scholarships Awarded	Enrolled Students
2002	47,122	18,767	-	-	-
2003	35,391	14,360	-	-	-
2004	38,552	18,883	-	-	-
2005	47,372	34,174	30,491	2,181	1,611
2006	55,921	43,064	39,325	2,432	1,929
2007	58,040	41,964	39,319	2,404	2,015
2008	78,560	55,178	46,716	3,091	2,467
2009	87,185	67,377	49,759	3,141	2,578
2010	106,908	87,561	57,451	3,768	3,116
2011	111,959	92,236	75,717	5,619	-

Source: Peter & Heang (2011)'s Report on the Process of Selecting SPS
Note: - : Data is not available

One of Cambodia's higher education sub-sector policy objectives is to provide opportunities for students from disadvantaged backgrounds to access higher education through scholarship programs. However, these regular scholarships offered by the DHE are only tuition exemptions. Every year, around 20% to 35% of scholarship awardees decline the scholarship offers[3] (Leth & Heang, 2011). Recognizing this challenge, in addition to the regular existing MoEYS's national scholarship scheme, the Special Priority Scholarship (SPS) program with additional stipends targeting poor students was launched as a pilot program in 2011 as the third component of the Higher Education Quality and Capacity Improvement Project (HEQCIP). The program is implemented by the MoEYS's Department of Higher Education (DHE). Because it is a pilot program, the SPS is provided to only one cohort of students starting from AY 2011-12 for the complete four-year university cycle. Similar to regular poverty priority scholarships (tuition waivers only), this stipend scholarship is available to those who are considered poor, passed the Grade 12 examination

[3] These are the aggregated statistics of both merit-based and need-based tuition weavers. The declining rate of the need-based group from poor households is almost 30% in 2010-2011.

and are enrolled in one of the participating HEIs in the national scholarship scheme. In addition, the SPS with additional quarterly stipends is provided to eligible students based on poverty ranking to cover their living costs.

Chapter 3. Does Higher Education Expansion in Cambodia Make Access to Education More Equal?

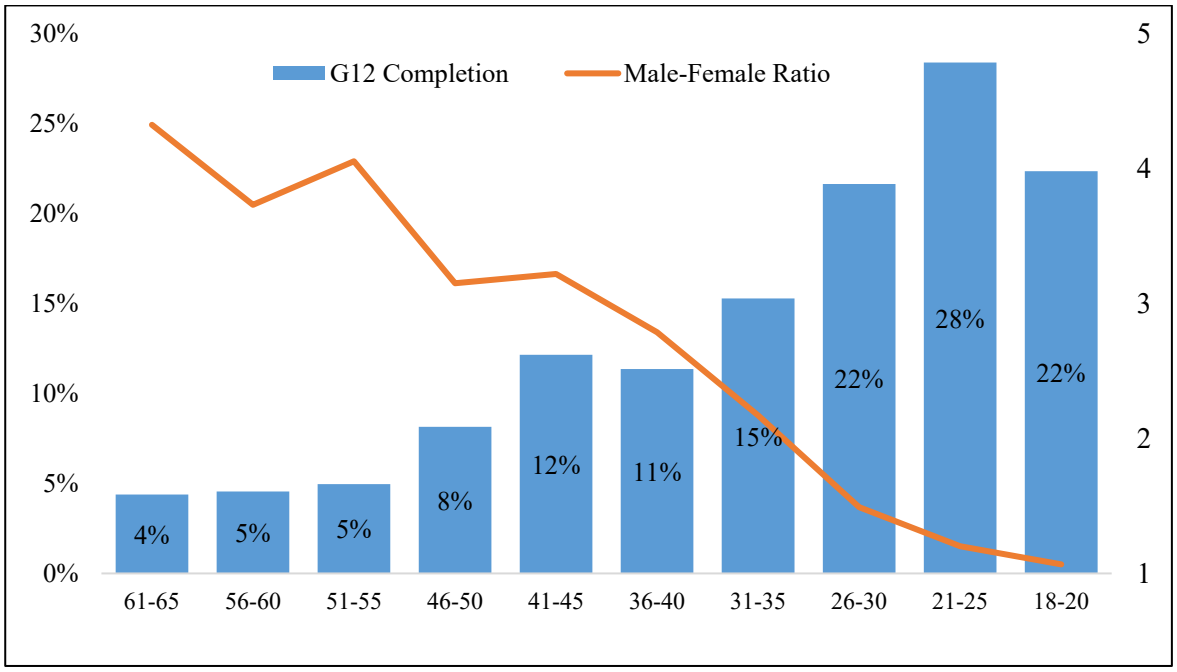
3.1. Introduction

3.1.1. Background

Higher education plays a vital role in developing human resources which are indispensable for the socio-economic development of a nation. Many countries across the Asia Pacific region including Cambodia have witnessed massive growth in higher education enrollment during the last decade or two. The remarkable increase in secondary school participation and the completion rate in the region as a result of EFA efforts is one of the reasons behind this higher education expansion (Asian Development Bank, 2012). ADB predicts that the demand for higher education in Asia is likely to continue growing at the same rate or even higher until 2025 before the demand starts to decline. However, despite the transformation from "elite" to "mass" higher education systems, the low and unequal access to higher education among disadvantaged groups such as low-income households, female students, and rural populations, remains a challenge (Asian Development Bank, 2011, 2012; UNESCO, 2003).

A simple estimation of upper secondary completion rates by age group using the latest household survey reveals a much higher proportion of completion rate among young adults, in particular females (Figure 3-1). Only around 4% of the population aged 60-65 are high school graduates in 2014, but the graduation rate rises to nearly 30% among young adults aged between 20 and 25 years old. The increase in high school completion among females is even more dramatic, because the male-female completion ratio among the 18-20 age group nearly reaches 1 in 2014. The male-female ratio for the 61-65 age group is as high as 4.32.

Figure 3-1 Percentage and Gender Ratio of G12 Completion by Age Group



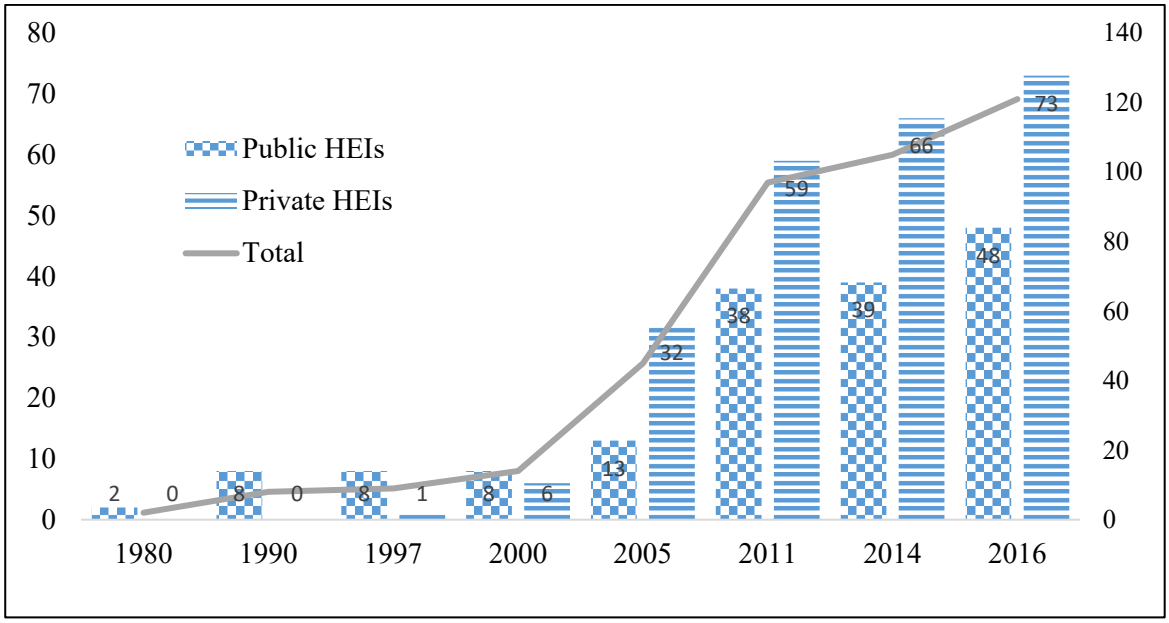
Source: Estimated by the author using CSES 2014

Cambodia became a lower-middle income country in 2013; and to achieve the goal of becoming an upper-middle income country by 2030, the RGC has placed the higher education sub-sector as one of its priorities as reflected in the Rectangle Strategy Phases III. The RGC also envisages at least one university or its branch in each province expanding the higher education system in the nation further. Thanks to the higher education reforms of introducing private HEIs in 1997 and allowing public HEIs to collect tuition fees in the early 2000s, the number of HEIs has increased dramatically from 2000, and as of 2016, there were 219,069 students enrolled in 121 HEIs (MoEYS, 2017a; Un & Say, 2014).

The ASEAN Economic Community (AEC) was established in 2015, attempting to integrate the ten-country members into a single market. Because of this, it is critical for Cambodia to advance its competitiveness by investing more in building qualified human resources in order to achieve sustainable economic growth and alleviate poverty. Given the fact that enrollment at the primary and secondary levels has improved, there is an additional pressure for expansion of the higher education system, with particular attention to disadvantaged groups to ensure inclusive economic growth. With this background, the

Cambodian higher education sub-sector has made a considerable contribution to national economic development, improvement of quality education, health, governance, environmental outcomes, and the ongoing debate on major social and cultural issues.

Figure 3-2 Number of HEIs in Cambodia 1980-2016



Source: Created by the author based on MoEYS (2017a); Un & Say (2014)

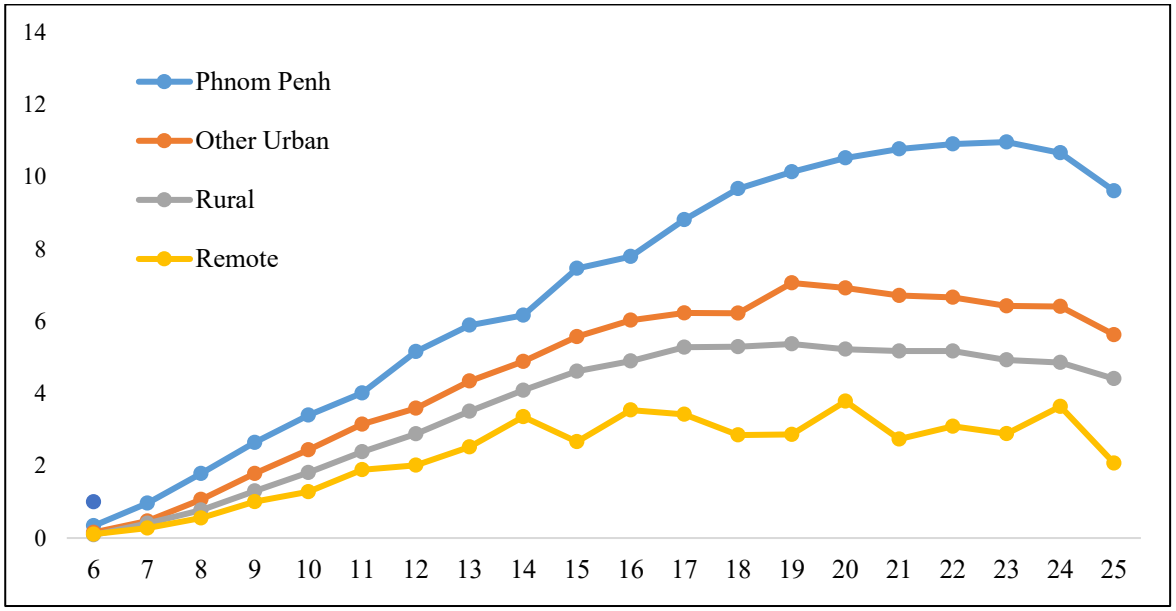
3.1.2. Problem Statement

Trow (2006) argues that global higher education expansion provides individuals of less privileged backgrounds a better opportunity for higher education. Increasing enrollment makes higher education accessible to a larger population. This change is a shift from education as a privilege to education as a right. However, there is less evidence from the empirical literature to support this argument. A growing body of literature from various countries, to be discussed in the literature section, suggests family wealth remains a key to educational attainment.

Cambodia has enjoyed the benefits of high economic growth and is considered one of the fast-growing economies in Asia and the world. However, the education gap between the rich and the poor, and to some extent gender disparity, remain concerns. For the growth to be inclusive, the government needs to ensure equal opportunity in accessing public

education for all regardless of individuals' backgrounds. As mentioned in the previous chapter, with the global efforts of achieving the EFA goals, Cambodia has been successful in expanding basic education access and, to some extent, narrowing the inequity in the access to primary and lower secondary sub-sectors over the last two decades. In a period of ten years, the transitional rate from lower secondary to upper secondary education increased from 59.2% in 2001 to 74.0% in 2011 (MoEYS, 2014b). The average completed grade of schooling of secondary-school-aged children increased by about 2.5 years between 2004 and 2014.[4] The average years of education of 13-year-old children increased from 4.06 in 2004 years to 6.48 years in 2014.

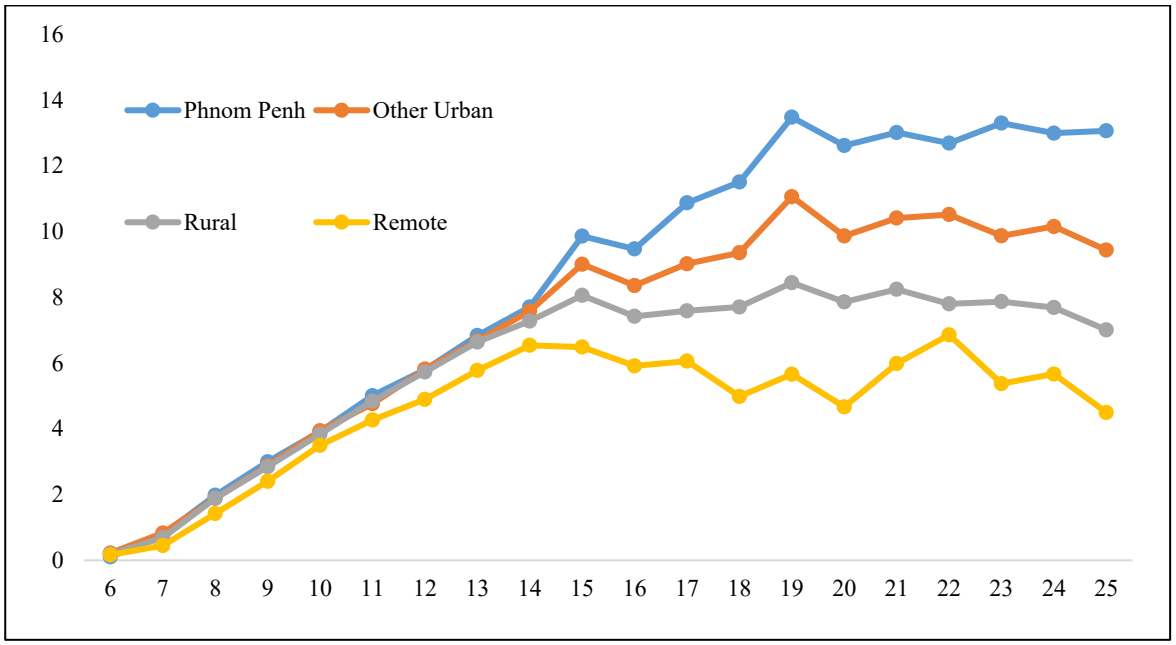
Figure 3-3 Average Completed Years of Schooling by Age in 2004



Source: Created by the author based on CSES 2004

[4] Based on the author's estimates using CSES 2004 and 2014.

Figure 3-4 Average Completed Years of Schooling by Age in 2014



Source: Created by the author based on CSES 2014

The completed years of schooling in 2004 and 2014 are illustrated in Figure 3-3 and Figure 3-4 respectively. A simple comparison between the two figures suggests that among children under age 14, differences in the average completed years of schooling by geographical areas have converged. The gaps between children in Phnom Penh and those in remote areas used to be large in 2004, but this gap becomes much smaller ten years later.[5] Notwithstanding the improvements of completed years of education by location, Figure 3-4 also indicates that the gap among the upper secondary aged children is still huge and there has been a persistent lack of improvement in the past decade.

With more secondary graduates and an increase in the demand and supply of higher education, the Cambodian higher education system is transforming from an elite system toward a mass system and probably has become more inclusive.[6] Higher education is now

[5] The CSES's residence sector is divided only into urban and rural. The remote area, referring to some provinces located in mountainous area in the northern part of Cambodia, is added using the MoEYS definition.

[6] Based on Trow (2006)'s classification, higher education systems with enrollment of between 16% and 50% are considered mass systems. Cambodia's higher education enrollment as of 2015 stands at 12% (MoEYS, 2015a).

more widely accessible. Two major reforms are responsible for this change: by introducing private HEIs in 1997 and allowing public HEIs to collect tuition fees in the early 2000s. In order to reduce the state financial burden, public universities are allowed to collect tuition fees from students. This has allowed the public higher education institutes to increase student quotas making higher education more accessible to the masses. In the meantime, however, it also poses financial barriers for students from low-income families, rendering capable and talented students from disadvantaged groups unable to benefit from the expansion of the higher education sub-sector. MoEYS strove to mitigate the problem around the time of the 2000 reform by creating scholarship scheme targeting disadvantaged groups such as poor students, female students, and students from remote areas in the form of tuition fee waivers. However, the disparity in access to higher education[7], as discussed in Chapter 1, is seen as a continuing challenge in Cambodia. Although Cambodia has experienced a rapid expansion of higher education along with the government interventions, little is known about whether young people from less privileged social groups have better odds of enrolling in post-secondary education. To fill this gap, this study intends to examine the trends of the demand-side factors, in particular social economic status, gender, and region, that influence the access to higher education in the last ten years. Furthermore, this study investigates if these disadvantaged groups are favorably or adversely affected by the expansion.

3.1.3. Research Questions

The two main research questions of the study are as follows:

1. How do the demand-side factors influence the likelihood of enrollment in higher education in Cambodia in the decade between 2004 and 2014?
2. How have students from disadvantaged groups benefited from the higher education expansion in Cambodia? Who has benefited the most from the expansion?

[7] Before the reform, tuition at public HEIs was free. After the reform students who were admitted to HEIs with merit-based or need-based scholarships were eligible for the free tuition; otherwise students need to enroll in the fee-paying track.

3.1.4. Significance of the Study

There is a handful of qualitative research on the topic of higher education in Cambodia such as Chet (2009), Sen & Soveacha, (2013), Williams, Kitamura, & Keng (2014) and Un & Say (2014); however, the topic is not well explored empirically. A couple of studies (Humphreys, 2015b; Lall & Sakellariou, 2010) tried to evaluate the rates of return to higher education in Cambodia, yet to the best knowledge of the author, this is the first attempt to examine the factors that influence access to higher education in Cambodia.

Outside of Cambodia, there are also a number of empirical studies on the determinants of higher education enrollment in other developing countries (Buckner, 2013; Chakrabarti, 2009; Nakata, 2015; Ogawa & Iimura, 2010; Psacharopoulos, Soumelis, & Costas, 1979; Sánchez & Singh, 2018; Vu, Le, & Muhajarine, 2013). Findings from these studies yield relatively consistent results on some determinants such as parental education and household incomes, but at the same time produce mixed findings on factors such as individual gender, household size, and household head gender. Also, all these studies except Nakata (2015) and Ogawa & Iimura (2010) use probit or logistic regression by treating schooling decisions as binary outcomes. This study categorizes school choice outcomes of the young adult aged 18-22 into three groups: i) Individuals who are not enrolling in any post-secondary education programs; ii) Individuals enrolling in vocational training programs; and iii) Those enrolling in undergraduate programs. The study then employs the multinomial logistic regression approach for the analysis.

Furthermore, while all the studies mentioned above use only one-time cross-sectional data to predict the enrollment in tertiary education, this study utilizes datasets collected in three different years with five-year intervals between 2004 and 2014 to examine the trend of the predictors of post-secondary education. This is capture how the predictors have changed during the ten-year higher education expansion. Both aggregate university official age cohort samples and sub-samples restricted to high school graduates are used for in our models, a unique feature of this study. Most of the prior literature use only the

restricted sample, but it is more appreciate to include the non-graduates if we want to examine the change in disparities. It is likely that a significant proportion of individuals from less privileged family backgrounds are unable to complete upper secondary education.

3.2. Literature Review

Human capital, pioneered by Becker (1965), refers to knowledge, skill and attributes accumulated by lifelong learning through either formal or informal education. Investment in education is considered to be long-term, yielding lifelong returns. Pursuing higher education is viewed as an excellent form of human capital investment, which affects both individuals' present consumption and earnings in the future. Therefore, one fundamental assumption is that an individual decides to pursue higher education only if he/she perceives that the lifetime private returns from higher productivity are higher than the foregone opportunity costs associated with the investment in extra years of education (Becker, 1962; Schultz, 1961). The benefits of attending college or university can also be non-monetary and short-term. These include enjoying school life and extracurricular activities, and enhancement of social status (Leslie & Brinkman, 1988). This section discusses the rates of return to education and determinants of enrolling in higher education.

Existing empirical studies suggest some key demand-side factors that are commonly found to be associated with the higher education enrollment. At the individual level, ability generally measured by test scores or IQ, age, and gender, are frequently found to affect the enrollment decision. Although students' test scores and motivation are not commonly available on household surveys, Menon's (1998) study in Ireland concludes that occupational motivation is one of the most important reasons behind students' decisions to further their education, while Psacgaropoulos & Soumelis (1979) find that ability measured by average grade in secondary school is a strong predictor of going to university in Greece.

Gender appears to be less conclusive, probably due to different social and economic contexts of the countries, as previous studies yield inconsistent results. While some studies

suggest that males have higher chances of enrolling in university (Chakrabarti, 2009; Sánchez & Singh, 2018), results from some studies indicate the opposite conclusion (Mora, 1997; Vu et al., 2013). In India, in both urban and rural areas, females have a significantly lower probability of entering university in comparison to their male peers (Chakrabarti, 2009). However, in contrast, Vietnamese females appear to have higher opportunities to take part in post-secondary programs (Sánchez & Singh, 2018; Vu et al., 2013). Ogawa & Iimura (2010) assess the determinants of tertiary enrollment in using multinomial logit approach with Indonesia Family Life Survey (IFLS4) and find insignificant relationships between being male and enrollment in university regardless of whether individuals reside in urban or rural areas. In the same study, they find that females are much more likely to enroll in diploma programs. Nakata's (2015) study in Vietnam indicates a similar finding that gender is not an essential factor in determining university enrollment, but females are more likely to enroll in college programs. The difference in findings in the case of Vietnam between Nakata (2015) and Vu et al. (2013) can be partly explained by the different estimation methods. While the former applied multinomial logistic approach, the latter treats college and university enrollment equally and uses binary schooling decisions as the dependent outcome variable. This inconsistency in findings on this topic is also confirmed by cross-country studies using panel datasets from India, Peru, and Vietnam (Sánchez & Singh, 2018) and in the Middle East and North Africa (Krafft & Alawode, 2018).

Family characteristics, such as the number of the household members, parent or household head's education, and household wealth, are found to be good predictors of higher education attendance in developing countries. The findings on the effect of household size on university enrollment are relatively consistent. Also, households with a smaller number of children and a larger number of working-age members are more likely to send their members to higher education program after high school (Chakrabarti, 2009; Krafft & Alawode, 2018; Ogawa & Iimura, 2010). The education level of parents or household head is found be one of the most robust predictors of university enrollment (Buckner, 2013;

Nakata, 2015; Sánchez & Singh, 2018). Parent education remains significantly important even after samples are further separated by regions (Ogawa & Iimura, 2010) or the type of higher education institute (Buckner, 2013).

Another critical factor in determining the likelihood of university enrollment, particularly in developing economies, is family welfare measured by family incomes, expenditure, or household assets. It is especially true in a system defined by Trow (2006) as "elite higher education" which is mainly accessible by those from wealthy families. The positive relationship between university participation and family income or consumption have been confirmed by a good number of studies (Buckner, 2013; Krafft & Alawode, 2018; Sánchez & Singh, 2018). James (2007) argues that even in Australia, low social-economic status is one of the most persistent barriers to higher education. However, in advanced economies, Carneiro & Heckman (2002) argue that the positive effect of family incomes is potentially overestimated. Using student ability to capture long-run financial constraints, they find that family income has no impact on college enrollment in the United States.

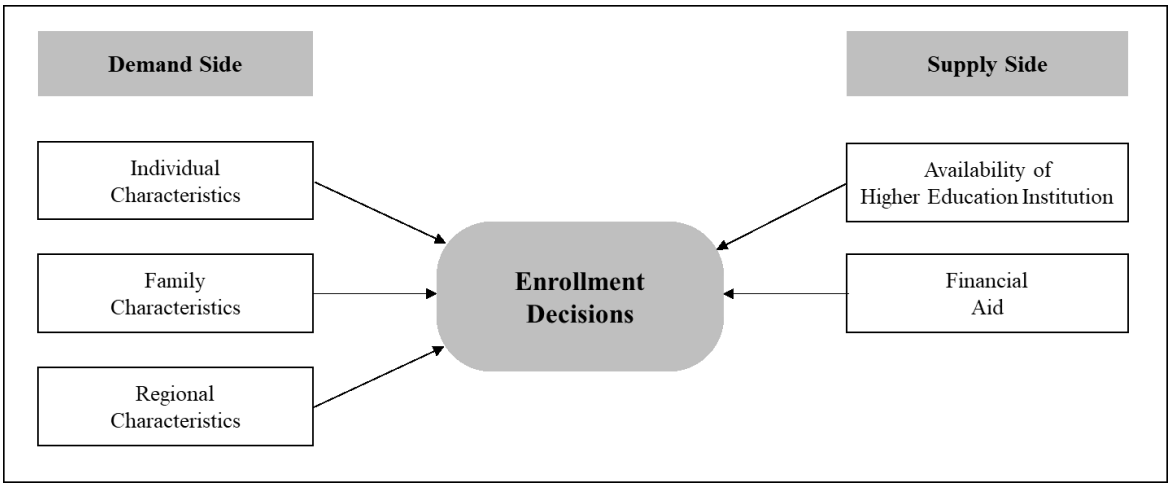
Regional characteristics are another factor commonly considered as a predictor influencing the likelihood of higher education attendance. Students living in urban areas are expected to have better opportunities to be enrolled, as HEIs usually are concentrated in cities (Buckner, 2013; Nakata, 2015). Furthermore, the surrounding environment or peer effect in urban areas can push motivation for students to spend extra years after completing secondary education (Psacharopoulos et al., 1979). However, not all studies share the same findings. The three-country study of Sánchez & Singh (2018) suggests a weak positive association between being in urban areas and university enrollment in India and Vietnam, but insignificant relationship in the case of Peru. Ogawa & Iimura's (2010) study also argues that living in an urban area is not correlated with access to higher education in Indonesia, although they find a strong association between regional income and tertiary enrollment in the country.

3.3. Methodologies

3.3.1. Analytical Framework

Most of the previous literature on this topic is based on a concept that individuals need to decide whether to pursue higher education or terminate study after high school graduation. However, since a significant proportion of high school graduates enrolled in the TVET program in 2004, this study adds the TVET as another option to whether high school graduates continue their study at the post-secondary education level. This study assumes that individuals select optimal schooling alternatives that are most suitable to their preferences to maximize their expected utilities. Figure 3-5 illustrates the factors that are found to influence schooling decisions made by individuals or their families from both the demand side and the supply side.

Figure 3-5 Conceptual Framework of Factors Affecting Enrollment Decisions



Source: Created by the author based on Jimenez & Salas-Velasco (2010) Ogawa & Iimura (2010); Psacharopoulos & Soumelis (1979) and others

3.3.2. Hypotheses

The hypotheses for research question 1 are made based on the previous literature on higher education enrollment and education statistics from MoEYS.

- **Hypothesis 1**: *Gender and residency, being male and living in urban areas, as well as parental education and household expenditure are positively associated with high*

school completion and enrollment in higher education. In Cambodia, there is no empirical study on this topic. There is no empirical evidence to support this hypothesis, although there are many similar studies in other developing countries such as in Vietnam, Indonesia, India, and Turkey. Existing literature provides mixed results of the gender predictor on university enrollment. We posit that males are more likely to continue going to university in Cambodia, because historically enrollment rate is higher among males. The positive relationships between parents' education, household wealth and residency and university attendance have been confirmed in many earlier studies (Chakrabarti, 2009; Nakata, 2015; Ogawa & Iimura, 2010; Sánchez & Singh, 2018; Vu et al., 2013)

- ***Hypothesis 2:*** *There is less disparity in gender, location and social-economic status in terms of higher education enrollment in Cambodia*. There is no doubt that in general students across different groups benefit (higher access) from the expansion of higher education. MoEYS reports that the Gender Parity Index (GPI) of gross enrollment in upper secondary school has dramatically improved in ten years from 0.50 point in 2002 to 0.93 point in 2012. The expansion of higher education institutes beyond Phnom Penh should also provide better access to students in rural areas, as the number of HEIs located outside the capital has increased in the last decade.

3.3.3. Models

A majority of prior study on the access in higher education enrollment treats the enrollment decision as binary outcomes, whether individuals of the target population choose to enroll in higher education or not. However, due to the fact that in 2004 a relatively high proportion of young adults choose to enroll in the TVET program, it is more justifiable to add the TVET alternative to the schooling decisions. Therefore, this study assumes that individual i aged between 18 and 22 has a set of non-ordered multiple decisions (j=1,2,…,M), one of which

is the most suitable utility for that individual *i*. The dependent variable is categorized into three: 1) individuals who are neither enrolled in HEIs nor TVET program, 2) individuals who are enrolling or had enrolled in TVET program, and 3) individuals who are enrolling or had enrolled in HEIs. In this study there are three outcome alternatives, therefore there are two equations and two probability distributions. Let y denotes the dependent alternative $j = \{1,\ldots,M\}$, x is a vector of K conditioning variables. If the first category is the reference group, the probability that individual *i* chooses the alternative $j=m$ can be expressed as:

$$\Pr(y_i = m|x_i) = \frac{\exp(x_i \beta_m)}{1+\sum_{j=2}^{M} \exp(x_i \beta_j)} \quad , m=2, \ldots, M \quad (3.1)$$

For the reference category where $j=1$, the probability is:

$$\Pr(y_i = 1|x_i) = \frac{1}{1+\sum_{j=2}^{M} \exp(x_i \beta_j)} \quad (3.2)$$

In the multinomial logistic regression model, we assume the independence from irrelevant alternatives (IIA), which means all else being equal, the odd between the two alternative outcomes of the dependent variable are not influenced by adding another alternative or changing the third alternative (Wooldridge, 2010).

Table 3-1 List of Independent Variable Definitions

Variables	Definitions
Male	Gender of the individual taking the value 1 for male and 0 for female.
Adult Member	A number of adult members in the household.
Child Member	A number of children aged under 18 in the household.
No Parent	Dummy variable taking the value 1 if both parents of the individual are not in the household, otherwise 0.
HH Head Gender	Gender of household head taking the value 1 for male and 0 for female.
Head Education	
- No Education	Dummy variable taking the value 1 if the household head has no education, otherwise 0.
- Primary	Dummy variable taking the value 1 if the household head has primary education, otherwise 0.
- Lower Secondary	Dummy variable taking the value 1 if the household head has lower secondary education, otherwise 0.
- Upper Secondary	Dummy variable taking the value 1 if the household head has upper secondary education, otherwise 0.
- Post-secondary	Dummy variable taking the value 1 if the household head has post-secondary education, otherwise 0.
Consumption Quintile	
- Q 1 (Poorest)	Dummy variable taking the value 1 if the individual is living in the household of lowest consumption quintile, otherwise 0.
- Q 2 (Poor)	Dummy variable taking the value 1 if the individual is living in the household of second lowest consumption quintile, otherwise 0.
- Q 3 (Middle)	Dummy variable taking the value 1 if the individual is living in the household of middle consumption quintile, otherwise 0.
- Q 4 (Rich)	Dummy variable taking the value 1 if the individual is living in the household of second highest consumption quintile, otherwise 0.
- Q 5 (Richest)	Dummy variable taking the value 1 if the individual is living in the household of highest consumption quintile, otherwise 0.
Region	
- Rural	Dummy variable taking value 1 if the individual resides in rural area, otherwise 0.
- Other Urban	Dummy variable taking value 1 if the individual resides in urban area outside Phnom Penh capital, otherwise 0.
- PNH Urban	Dummy variable taking value 1 if the individual resides in Phnom Penh Capital, otherwise 0.
Distance to Province	Distance to Provincial town in Kilometer.

Source: Created by the author

3.3.4. Data and Summary Statistics

To answer the research questions in this Chapter, this study uses the national representative Cambodian Socio-Economic Survey (CSES)'s datasets of various years. The National Institute of Statistics (NIS) is in charge of collecting this household survey data under technical assistance from the Swedish International Development Cooperation Agency (SIDA). CSES was first conducted in 1993, but NIS only started conducting the survey annually after 2007. Every five years, in 2004, 2009 and 2014, NIS conducted large-scale surveys with the sample size of approximately 12,000 households, more than three times larger than normal samples of about 3,600 households. Focusing on poverty issues, CSES contains rich information on demographic characteristics, housing, agriculture, education, labor force, health and nutrition, victimization and household income and consumption.

Three datasets of the large-scale CSES conducted in 2004, 2009 and 2014 are utilized for the analysis. The study restricts the samples to individuals who are in the range of the official university ages, between 18 and 22 years old. Later on, the study also further restricts this sub-sample to those who complete grade 12 for the sequential analysis. The sample size by year is shown in Table 3-2. The increase in observations of the high school graduate sub-sample between 2004 and 2014 is a clear evidence of the rise in high school completion rate during this period. Girls also experience increasing ratios of high school completion, and as of 2014 almost half of those who complete high school are females.

Table 3-2 Sample Size of CSES by Year

Year	Total		Age 18-22		Age 18-22 HS Graduates	
	Obs.	Female %	Obs.	Female %	Obs.	Female %
2004	74,719	51.90%	8,375	50.70%	506	38.98%
2009	57,105	51.48%	6,270	50.43%	726	46.63%
2014	53,968	51.98%	5,570	51.26%	1,413	49.19%

Source: Calculated by the author based on CSES 2004, 2009 and 2014

Note *: Excluding individuals who did not complete grade 12.

Table 3-3 presents the numbers and percentages of the university-age individuals with and without high school completion by year, and the post-secondary enrollment decisions (the outcome variable of interest in the study) of those high school graduates. In the last decade, the high school completion rate among this age group increases more than fourfold from 6.11% in 2004 to 25.39% in 2014. Among those who complete the upper secondary education, there is a drastic decline in young individuals enrolling in TVET programs. The ratio plummets from 29.25% in 2004 to just 5.92% in 2009, and further drops to 1.56% in 2014. Enrollment in university not only increases in absolute numbers but also as the share of total grade 12 graduates.

Table 3-3 School Choices of Individuals Aged 18-22

Outcomes	2004		2009		2014	
	Obs.	%	Obs.	%	Obs.	%
Grade 12 Completion						
- No	7,773	93.89%	5,533	88.40%	4,152	74.61%
- Yes	506	6.11%	726	11.60%	1,413	25.39%
Post-secondary Choice Among High School Graduates						
- None	148	29.25%	267	36.78%	445	31.49%
- TVET	113	22.33%	43	5.92%	22	1.56%
- University	245	48.42%	416	57.30%	946	66.95%

Source: Calculated by the author based on CSES 2004, 2009 and 2014

Grade 12 completion rates of young adults aged 18-22 are shown in the column (1) of Table 3-4. There is a general decline in disparities in high school completion in the last decade. The male-female completion ratio drops from 1.61 in 2004 to 1.09 in 2014. There has been a remarkable improvement in social economic and regional disparities in term of high school completion, yet the gaps also remain noticeable. During the same period, Phnom Penh-rural graduation ratio declines more than five times from 18.91 in 2004 to 3.49.

Columns (2) and (3) of Table 3-4 show the percentage of schooling decisions of young adults after high school completion. Among the graduates, the inequality issues in access to higher education seem less pronounced. Interestingly, in 2004 female high school graduation rate (4.69%) is much lower than males' (7.57%), but females are more likely to further their post-secondary study once they can complete upper secondary school. Female enrollment rates in university and vocational training programs are higher than males in 2014. The gaps in university enrollment between the rich and the poor as well as between those living in rural areas and the capital do exist, but these gaps are much smaller in comparison to the high school completion rates.

Table 3-4 Percentage of High School Graduates and Their School Choices by Year

	(1) HS Graduates			(2) University			(3) TVET		
	2004	2009	2014	2004	2009	2014	2004	2009	2014
Sex									
- Female	4.69	10.73	24.37	50.76	54.87	63.31	25.38	6.49	2.01
- Male	7.57	12.48	26.47	46.93	59.43	70.47	20.39	5.43	1.11
Consumption Quintile									
- Q 1 (Poorest)	0.69	1.63	6.89	45.45	31.58	51.85	9.09	5.26	1.23
- Q 2	1.26	4.32	13.83	42.11	18.52	51.32	15.79	5.56	1.32
- Q 3	1.93	6.82	24.79	25.00	38.37	64.81	21.88	5.81	1.11
- Q 4	5.53	15.00	42.07	42.39	53.30	71.90	25.00	4.57	1.17
- Q 5 (Richest)	18.93	29.18	40.73	52.56	70.81	71.22	22.44	6.76	2.28
Region									
- Rural	2.08	6.33	16.19	36.36	43.83	62.56	21.97	6.17	2.11
- Other Urban	7.26	21.46	34.06	43.18	51.57	63.51	11.36	8.18	1.69
- Phnom Penh Urban	39.34	39.60	56.50	55.59	76.83	74.40	25.87	4.25	0.80

Source: Calculated by the author based on CSES 2004, 2009 and 2014

Summary statistics of the variables used in this study are reported in Table 3-5 by year for both the unrestricted sample of the 18-22 age cohort and the sub-sample restricted

to those who successfully completed upper secondary education. The statistics from the unrestricted samples indicate that university enrollment jumps from 3% in 2004 to 17% in 2014. Among the restricted sub-samples, university enrollment only increases from 48% to 67% during the same period. By comparing the unrestricted and restricted samples, we also notice that the number of females who can finish upper secondary education has increased gradually, and by 2014, the numbers of male and female observations in the sub-sample are roughly the same.

Table 3-5 Summary Statistics

Variables	2004		2009		2014	
	All	HS Graduates	All	HS Graduates	All	HS Graduates
School Choice						
- Not Enrolled	0.96	0.29	0.93	0.37	0.83	0.31
- TVET	0.01	0.22	0.01	0.06	0.00	0.02
- University	0.03	0.48	0.07	0.57	0.17	0.67
Male	0.49	0.61	0.50	0.53	0.49	0.51
Adult Member	3.68	4.31	3.78	4.41	3.80	4.11
Child Member	2.39	1.65	2.10	1.56	1.67	1.25
No Parent	0.20	0.15	0.20	0.10	0.15	0.07
HH Head Gender	0.79	0.77	0.80	0.83	0.79	0.82
Head Education						
- No Education	0.27	0.05	0.24	0.07	0.22	0.07
- Primary	0.45	0.24	0.47	0.35	0.42	0.32
- Lower Secondary	0.18	0.29	0.20	0.30	0.21	0.26
- Upper Secondary	0.06	0.21	0.06	0.15	0.07	0.14
- Post-secondary	0.04	0.22	0.03	0.12	0.07	0.20
Consumption Quintile						
- Q 1 (Poorest)	0.19	0.02	0.19	0.03	0.21	0.06
- Q 2	0.18	0.04	0.20	0.07	0.20	0.11

Variables	2004		2009		2014	
	All	HS Graduates	All	HS Graduates	All	HS Graduates
- Q 3	0.20	0.06	0.20	0.12	0.20	0.19
- Q 4	0.20	0.18	0.21	0.27	0.18	0.30
- Q 5 (Richest)	0.22	0.70	0.20	0.51	0.21	0.34
Poverty Line						
- Poverty Line	0.49	0.63	0.69	0.51	0.61	0.46
- Poverty Line (3x)	0.04	0.15	0.17	0.33	0.17	0.27
- Poverty Line (5x)	0.02	0.06	0.06	0.14	0.19	0.26
Region						
- Rural	0.77	0.26	0.78	0.42	0.68	0.44
- Other Urban	0.15	0.17	0.12	0.22	0.16	0.21
- PNH Urban	0.09	0.57	0.10	0.36	0.16	0.35
Distance to Province	32.84	10.86	35.53	18.81	30.48	20.14
Observation	8,279	506	6,259	726	5,565	1,413

Source: Calculated by the author based on CSES 2004, 2009 and 2014

Household head's education is likely to be associated with upper secondary education completion. Even in 2014 household heads with post-secondary education accounted for only about 7% of the total observations; yet, among the 2014 graduate sub-sample observations, 20% of the household heads have education higher than upper secondary education. Similarly, family welfare measured by household consumption seems to matter. The disparities in upper secondary school completion between the richest and the poorest are still noticeable. Nevertheless, we also see improvement: many more individuals from the lowest consumption quintile can complete upper secondary education. Only 6% of those from the two lowest quintiles could finish upper secondary school in 2004, but the proportion rises to 10% in 2009 and 17% in 2014.

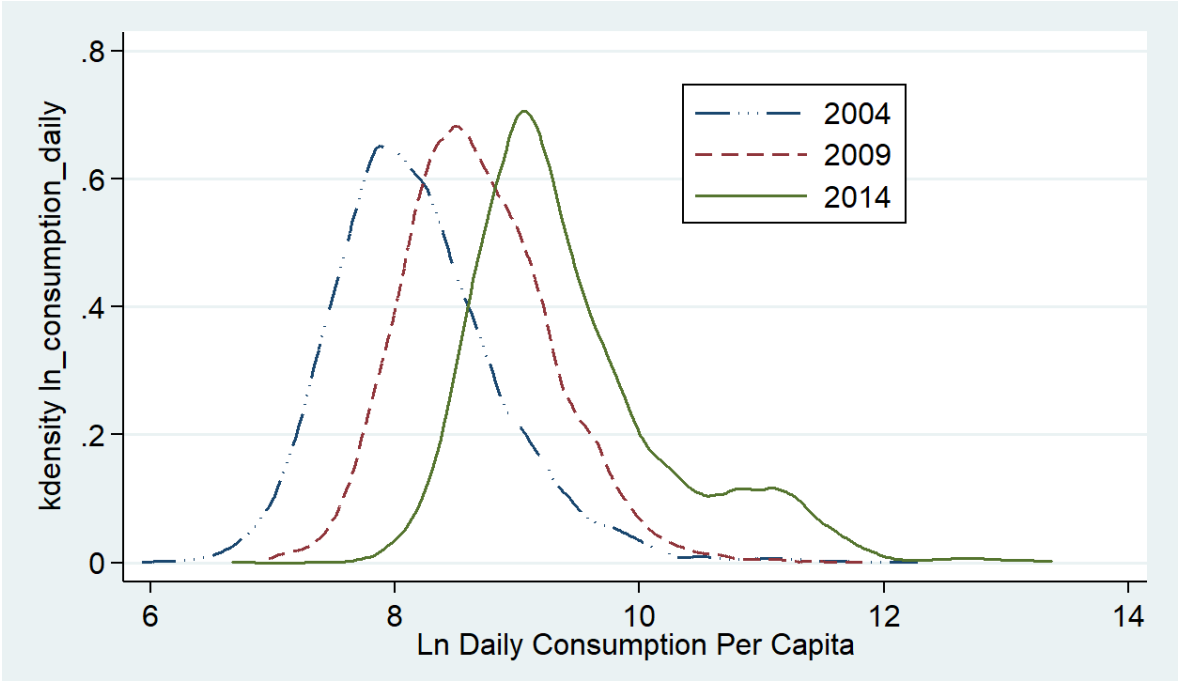
Public service expansion has made upper secondary education more accessible. The ratio of rural young adults with upper secondary education almost doubles, from 26% in 2004 to 44% in 2014. The average distance of student residences from the provincial towns of the high school graduate sub-sample in 2004 is 10.86 km, but ten years later in 2014, the average distance is up to 20.14 km. This means that more students living far away from central areas can now have access to and complete upper secondary education.

Notes on Data Processing

The dependent variable is the post-secondary education enrollment status of individuals aged between 18 and 22 years old. They are categorized into three groups: i) individuals who completed high school but did not enroll in any HEIs or TVET programs, ii) individuals who are enrolling or have enrolled in TVET programs, and iii) individuals who are enrolling or have enrolled in HEIs. Observations with missing values are dropped from the samples.

Consumption or expenditure in this study is the sum of food consumption, non-food consumption, utility consumption, and durable goods consumption. Expenditure on housing is excluded in the calculation since in 2004 information on the estimated rental prices at market price (in cases where the house is not rented) are not available. The study uses the poverty line of the Ministry of Planning, set at Riel 6,347, Riel 4,352 and Riel 3,503 for Phnom Penh, other urban areas and rural areas respectively. Consumption values in 2004 and 2014 are deflated using GDP deflators with 2009 as the base year so that the same poverty line can be used. Consumption per capita was divided by the raw number of household size without adjusting with the OECD's adult equivalence scale. Figure 3-6 presents the distribution of daily log consumption per capita by year. The right shift of the consumption distribution clearly shows that consumption level in Cambodia has increased, even after deflated, in the last ten years.

Figure 3-6 Histogram of Ln-consumption Per Capita by Year



Source: Created by the author based on CSES 2004, 2009 and 2014

3.4. Results

3.4.1. Factors Influencing Likelihoods of Enrollment in Higher Education

This sub-section examines the likelihood of post-secondary pathways among young adults aged between 18 and 22 and the high school graduate sub-samples. First, we begin with the multinomial logistic regressions of the pooled cross-section data obtained from the CSES 2004, 2009 and 2014 of the unrestricted sample. The results from the multinomial logistic regressions can be found in the Appendix A.1, and the marginal effects are reported in Table 3-6. Although the findings related to TVET program enrollment are included in the estimation results, the discussion mainly focuses on the university enrollment.

By holding household and regional factors constant, male students appear to have a higher likelihood of enrolling in university in both the unrestricted and restricted sub-samples. Young male high school graduates are 7% more likely to be enrolled in university, provided they can complete upper secondary school.

The results from the unrestricted sample analysis reveal that family structure also influences university attendance. Having a smaller number of children and a larger number of adult members are found to be associated with increased odds of sending young adult members to universities. Similarly, individuals in households headed by males are predicted to have higher probabilities of attending universities. Students whose parents are not in the household – either orphans or those living separately from their parents – are less likely to enroll either in undergraduate or vocational programs. However, when the sample is restricted to high school graduates, only the number of adult members and parental cohabitation factors remain statistically significant. Number of children and the gender of household heads are no longer important.

Most of the findings from the earlier literature indicate parental, or household head education is a good predictor of enrollment in higher education. This study categorizes household head education level into five groups and uses the middle group, lower secondary education, as the base group. In our unrestricted sample's empirical analysis, the study confirms that household head education plays an essential role in determining the probabilities of individuals enrolling in universities. In comparison to households where the heads have lower secondary education, those with primary education and no education have lower probabilities of enrolling their children in higher education; and those with upper secondary, and post-secondary education are more likely to send their children to universities after their high school completion. All of the education dummy factors are statistically significant at the 1% level. However, when the sample is restricted to those who complete upper secondary school, the household head education factor becomes less important. In comparison to the base group, individuals whose household heads hold upper secondary and post-secondary education have the likelihood of being enrolled in universities by 5% and 13% respectively. However, the comparisons with the primary school and no education groups do not indicate any significant correlations.

Table 3-6 Results of Multinomial Logistic Marginal Effects

VARIABLES	(1)	(2)	(3)	(4)
	All		High School Graduates	
	TVET	University	TVET	University
Male	0.000	0.009***	-0.012	0.065***
Adult Member	0.000*	0.005***	-0.003	0.014*
Child Member	-0.001***	-0.006***	-0.001	-0.006
No Parent	-0.003	-0.028***	0.002	-0.097***
Head Gender	-0.001	-0.006***	0.005	-0.027
Head Education (Base: Lower Secondary)				
- No Education	-0.004***	-0.022***	-0.003	0.043
- Primary	-0.003***	-0.014***	-0.007	0.012
- Upper Secondary	0.004**	0.025***	0.005	0.054*
- Post-secondary	0.006***	0.076***	-0.005	0.137***
Consumption Quintile (Base: Q3)				
- Q 1 (Poorest)	-0.002*	-0.016***	-0.012	-0.072
- Q 2	-0.001	-0.012***	-0.003	-0.115***
- Q 4	0.002*	0.02***	0.002	0.056*
- Q 5 (Richest)	0.007***	0.041***	0.006	0.125***
Region (Base: Rural)				
Other Urban	0.001	0.012***	-0.012	0.008
PNH Urban	0.007***	0.051***	-0.005	0.147***
Distance to Province	0.000	0.000**	0.000	0.000
Year (Base: 2004)				
- 2009	-0.002***	0.017***	-0.165***	0.144
- 2014	-0.003***	0.062***	-0.210***	0.265***
Observations	19,965	19,965	2,623	2,623

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

In this study, we use the consumption per capita quintile to capture the social economic status of individual households. Households are divided into five quintiles from Quintile 1, the poorest, to Quintile 5, the richest. The middle Quintile 3 is used as the base group in the analyses, because the consumption quintile distribution is skewed to the left in the high school graduate sub-sample, meaning there are much fewer observations from the low quintiles. Family wealth is found to have a strong positive effect on higher education enrollment, particularly in the unrestricted model. Individuals of the middle consumption households are more likely to invest some extra years in higher education than their peers from lower consumption quintiles, but they have fewer chances in doing so when compared to those from the upper consumption quintiles.

In line with many other studies, this study also finds that regional factor is a strong predictor of enrolling in higher education. Young adults living in Phnom Penh capital and other urban areas are more likely to finish upper secondary school and continue on to undergraduate programs. The results from the restricted high school graduate sub-sample suggest that if young adults of rural areas can complete high school, their chances of enrolling in higher education are not significantly different from their other-urban peers. However, high school graduates residing in Phnom Penh clearly have better opportunities to access higher education. Similar to the other urban (not Phnom Penh) variable, the remoteness of the region, measured by the distances from the villages to the provincial towns, has a similar positive effect on higher education attendance. It is statistically significant only in the unrestricted sample, but not in the restricted graduate sub-sample.

After performing the multinomial logistic regressions, the study conducts the post-estimation of the predicted probabilities that individuals either enroll in TVET programs or university courses in 2004, 2009 and 2014 while holding other factors constant at mean values (see Table 3-7). In 2004, enrolling in vocational training programs seems to be a popular alternative among young adults. After completing upper secondary education, around one-fourth of individuals choose to continue to the TVET programs. The difference

in enrollment between the vocational training programs (22.5%) and undergraduate courses (43.8%) is less than half in 2004. However, it seems higher education expansion makes the vocational training programs less and less attractive among young high school graduates. The predicted probabilities of enrolling in TVET programs drops to 6% in 2009, and in 2014 less than 2% of high school graduates opt for the vocational training schools. In other words, the TVET enrollment ratio plummets by 14 times over the ten-year period.

Table 3-7 Predicted Probabilities of Post-secondary Enrollment Outcomes

VARIABLES	(1)	(2)	(3)	(4)
	TVET		University	
	All	HS Graduates	All	HS Graduates
Year 2004	0.005***	0.225***	0.012***	0.438***
	(0.001)	(0.022)	(0.001)	(0.024)
Year 2009	0.003***	0.061***	0.028***	0.582***
	(0.001)	(0.009)	(0.002)	(0.020)
Year 2014	0.002***	0.016***	0.074***	0.703***
	(0.000)	(0.003)	(0.004)	(0.013)
Observations	19,965	2,623	19,965	2,623

Standard errors in parentheses

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

In contrast, undergraduate programs are more accessible to a larger population, and more high school graduates choose to pursue their education at HEIs. The predicted probabilities indicate that, among young adults aged 18-22, university enrollment rates exploded more than six times from 1.2% in 2004 to 7.4% in 2014. We also see a boost in university enrollment among the high school graduates. Between 2004 and 2014 the enrollment rate increases about 26 percentage points from 43.8% to 60.3%.

3.4.2. Do Disadvantaged Groups Benefit from the Higher Education Expansion?

Thanks to higher education expansion in the last decade, it is clear that a larger proportion of Cambodia youths, in particular those who can finish upper secondary school, are able to access higher education. To assess how this expansion can provide individuals of disadvantaged backgrounds better opportunities to access higher education, this study examines the trends of demand-side factors in determining the likelihood of university enrollment. The study also estimates the post-secondary enrollment alternatives' predicted probabilities of individuals from different groups. Using the multinomial logistic regression with the same covariates, this sub-section presents results from both unrestricted samples and high school graduate sub-samples by year. The full estimation results by year are presented in the Appendix A.1's Table A-2 and Table A-3 respectively. The marginal effects for the university enrollment outcome by year are reported in Table 3-8.

By examining the results by year, there are some noticeable trends in the changes of how individual, household, and regional factors affect the enrollment in higher education in the last decade. The results from the unrestricted sample analysis, that includes individuals without upper secondary education, suggest that in general young adults from disadvantaged groups are less likely to reap the benefits from the higher education expansion. For instance, the magnitude of gender (being male) the marginal effect rises from 0.003 in 2004 to 0.028 in 2014 over the ten-year period. When we restrict the samples to those who can complete high schools, the results suggest that the disparity issues are less pronounced. Among the high school graduates, gender factor is not statistically significant in 2004, and its magnitude slightly declines from 0.10 in 2009 to 0.08 in 2014. This suggests that as a whole, gender inequality is in favor of males, but when female students can finish upper secondary education, female students have better odds to enroll in university programs in 2014, than they did in 2009.

Table 3-8 Marginal Effects of University Enrollment Outcome by Year

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	All			HS Graduates		
	2004	2009	2014	2004	2009	2014
Male	0.003***	0.008***	0.028***	-0.045	0.101**	0.085***
Adult Member	0.001***	0.004***	0.018***	0.033	0.024*	0.007
Child Member	-0.001***	-0.004***	-0.023***	-0.009	-0.002	-0.001
No Parent	-0.004***	-0.026***	-0.117***	0.052	-0.053***	-0.159***
Head Gender	-0.002*	-0.006*	-0.021**	0.073	-0.089	-0.034
Head Education (Base: Lower Secondary)						
- No Education	-0.007***	-0.023***	-0.062***	0.036	-0.102	0.118**
- Primary	-0.003***	-0.015***	-0.04***	0.104	-0.06	0.037
- Upper Secondary	0.011***	0.011*	0.081***	0.084***	-0.022	0.073
- Post-secondary	0.024***	0.062***	0.201***	0.143*	0.151**	0.142***
Consumption Quintile (Base: Q3)						
- Q 1 (Poorest)	0.000	-0.014***	-0.084***	0.167	-0.08	-0.138**
- Q 2	0.001	-0.011***	-0.061***	0.21	-0.23**	-0.127**
- Q 4	0.006**	0.021***	0.078***	0.167	0.082	0.06
- Q 5 (Richest)	0.015***	0.057***	0.073***	0.238**	0.255***	0.062*
Region (Base: Rural)						
- Other Urban	0.003**	0.009***	0.044***	0.02	0.002	0.01
- PNH Urban	0.03***	0.034***	0.105***	0.123***	0.193***	0.099***
Distance to Province	0.000**	0.000**	0.000	-0.001	0.000	0.001*
Observations	8,279	6,212	5,474	506	716	1,401

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Young adults without parents or those living with household heads having low education levels have lower odds of attending higher education programs in the analysis of

the unrestricted samples. The increasing marginal effect magnitudes indicate that, as time passes, household heads' education becomes more influential in determining the access to higher education of young adults. In 2004, individuals whose household heads have post-secondary education have 2.4% higher odds to enroll in university in comparison to those with lower-secondary education household heads. Yet, the odds increase around ten times to 20% in 2014. However, household head's education predictor is less significant in the analysis of the restricted samples of high school graduates. In 2004 and 2009, there is no statistical difference in higher education enrollment between high school graduates whose heads have lower secondary education and those whose heads have primary school education or no education. Nevertheless, post-secondary education of household heads has consistent and positive effects on high education enrollments across the years.

As found in many other previous studies, the results from this study indicate a significant positive association between the social-economic status when measured by consumption level and the probability of higher education participation. In the 2004 unrestricted sample estimate, there are no statistical differences in higher education enrollment between individuals of middle consumption quintile and their peers of lower income quintiles. However, young adults from middle-consumption quintile have better chances of enrolling in higher education in comparison to the two lower consumption quintiles in 2009 and 2014. The top two quintiles consistently have higher odds of going to universities in all three years. The increasing marginal effects of consumption level in the unrestricted sample analysis by year indicate that the expansion of higher education provides students of wealthy families even greater opportunities to enroll in universities in comparison to their peers from poorer families. For example, the marginal effect of the second richest Q 4 (in comparison to the base group of Q 3) rises from 0.006 in 2004 to 0.021 in 2009 and 0.078 in 2014.

As reported in the summary statistics Table 3-5 in the methodology section, there are more students from the lowest quintile in the 2014 high school graduate sub-sample,

meaning more young adults can finish their upper secondary education in 2014. Nevertheless, the marginal effects in the unrestricted samples also suggest the social-economic disparity become worse, because the expansion of higher education is in favor of students from well-off families. Similar to household heads' education, household consumption level is also less influential in determining the university enrollment, provided students can complete high schools. The marginal effect magnitudes of the Quintile 2 and Quintile 5 significantly drop in 2014.

Furthermore, the predicted probabilities of enrolling in undergraduate programs by consumption quintiles are graphically presented in Figure 3-7 and Figure 3-8. Among the young population aged 18-22, the predicted university enrollment has increased for all consumption quintiles over the ten-year period (see Figure 3-7). By 2014, the university enrollment of second from top quintile has caught up with the top quintile, although the middle and lower quintiles still lag behind. Among the high school graduates, the social-economic disparity in access to higher education is less pronounced. In fact, in 2004, the high school graduates from the lowest two consumption quintiles have higher predicted probabilities of university enrollment than those from the middle consumption quintiles. This is partly explained by the fact that very few students from lower-income families can complete upper secondary education. The 2004 high school graduate sub-sample estimation results show that, in comparison to the base group of middle quintile, the positive effects on university enrollment probability of being in the poorest and the second poorest quintiles is not statistically significant (see Table 3-8, column (4)). In 2014, high school graduates from the poorest quintile have the odds of enrolling in university higher than 50%. The odds also gradually increase by consumption quintiles, although there is no significant difference among the top two quintiles (See Figure 3-8).

Figure 3-7 Predicted Probabilities of University Enrollment by Consumption Quintile (All Samples)

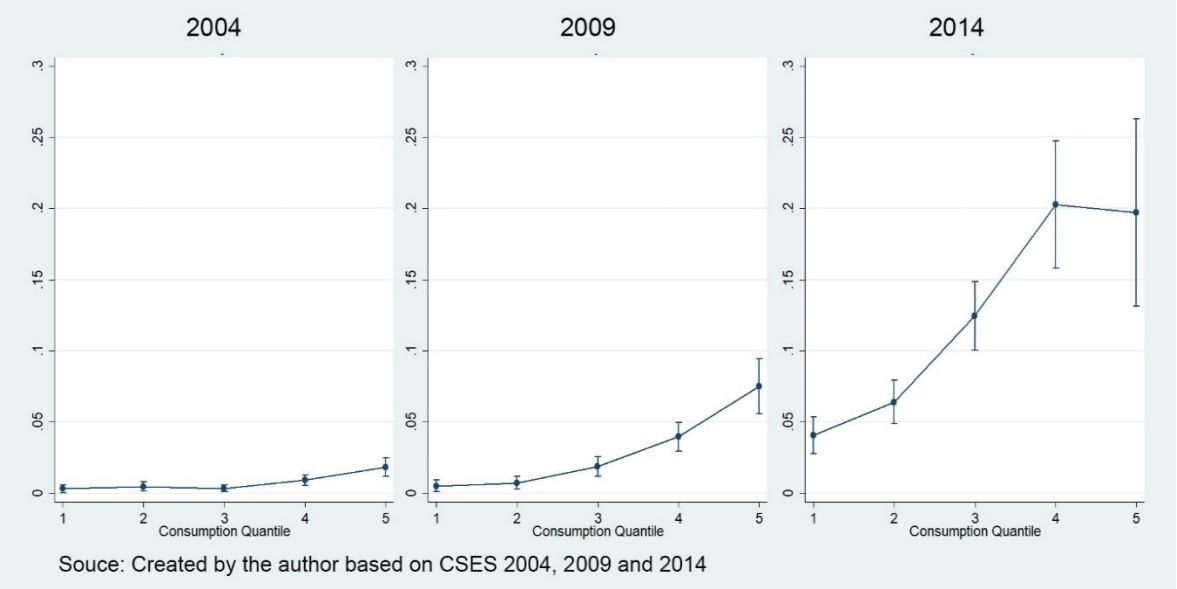
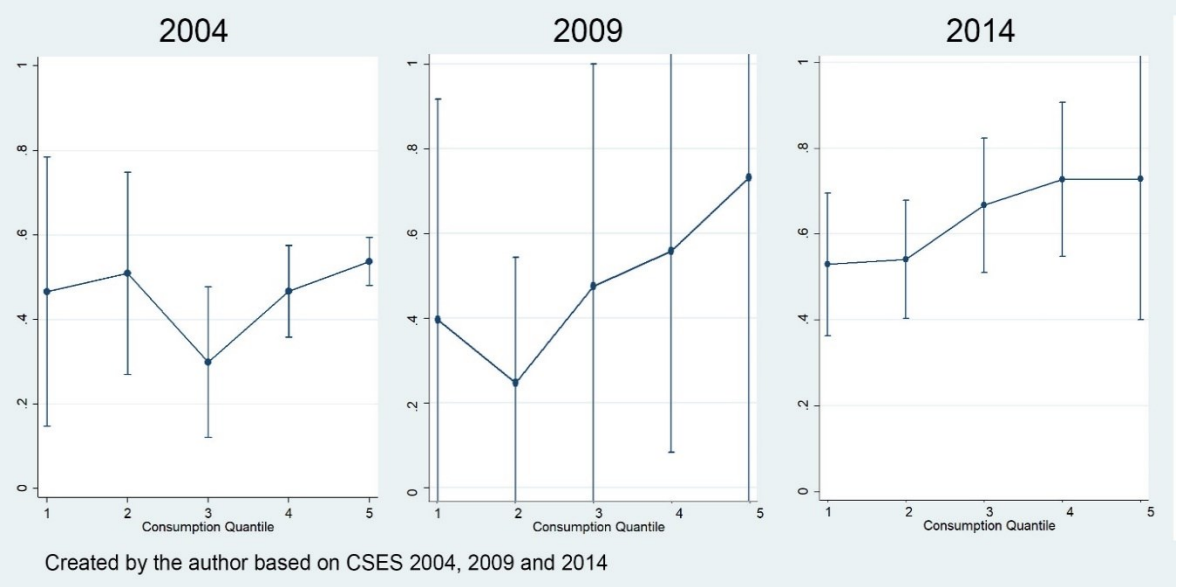


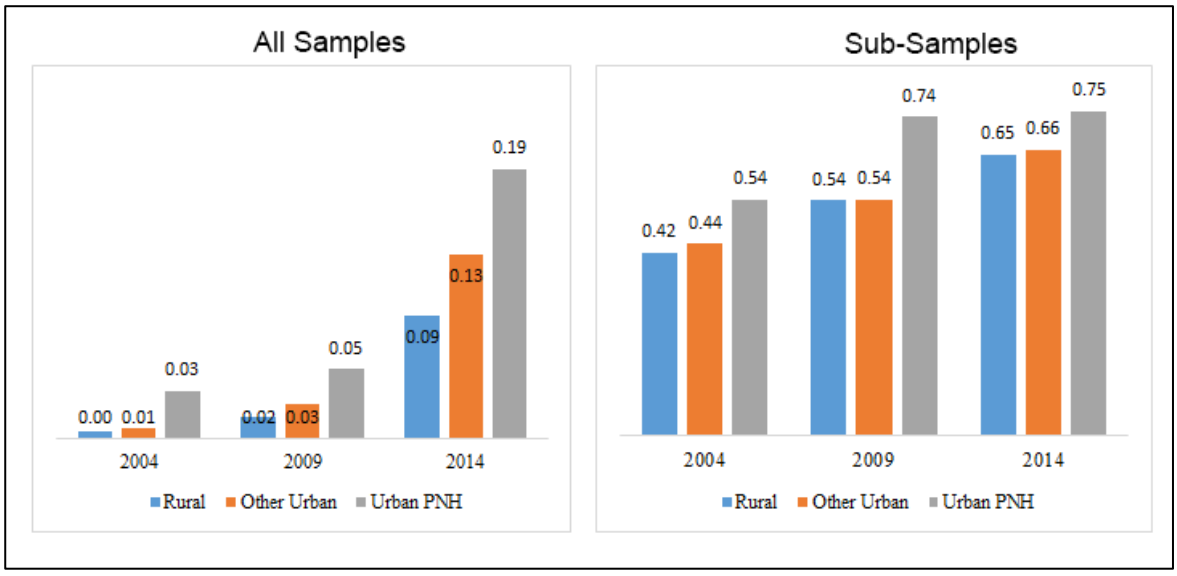
Figure 3-8 Predicted Probabilities of University Enrollment by Consumption Quintile (All Samples)



The predicted probabilities by regional areas shown in Figure 3-9 suggest that young adults from rural areas have much higher chance of enrolling in universities; however, the increasing marginal effect of Other Urban and PNH Urban (Rural is the base group) in the unrestricted samples shown in Table 3-8 reveal that, in relative terms, rural young adults have lower odds in attending university in 2009 and 2014. The regional disparities are much

less concerned among high school graduates. The results from the high school graduate sub-sample analysis indicate more favorable results: there is no significant difference in enrollment likelihoods between high school graduates in rural areas and urban areas outside the capital. However, as expected, residents of Phnom Penh, where the majority of HEIs are located, continue to enjoy greater opportunities in accessing higher education.

Figure 3-9 Predicted Probabilities of University Enrollment by Consumption Quintile (All Samples)



Source: Created by the author based on CSES 2004, 2009 and 2014

The predicted probabilities of university enrollment by regional areas produce similar results. It is true that individuals from rural areas have increasing opportunities to enter universities, but the enrollment gaps are still huge. The regional disparities among the high school graduates are much less evident in comparison to the disparities among the general population. Holding other covariates constant, the predicted university enrollment probabilities of young adults in rural areas and other urban areas are around 65%, only slightly lower than their Phnom Penh counterparts at 75%. Even in 2004 and 2009, it is predicted that rural individuals have similar probabilities to enroll in university in comparison to their peers in other urban areas, provided they can complete upper secondary school.

3.5. Conclusion

This Chapter 3 intends to examine the determinants of higher education enrollment in Cambodia and to assess the disparity trends in the last ten years by looking at the changes in the predictors of university enrollment and the predicted probabilities among groups. To answer these research questions, the study utilizes the multinomial logistic regression model to predict the influences of the demand-side independent variables on the schooling decisions of young adults in 2004, 2009 and 2014.

Our empirical analysis confirms the associations between higher education enrollment and some demand-side factors that are commonly found in previous literature. Males are more likely to enroll in undergraduate programs, although the effect is less noticeable when the samples are restricted to high school graduates. By 2014, more female youths are able to complete upper secondary school, and among those graduates the predicted probability of university participation also increases.

Regarding the family characteristics, household consumption and household head education are found to have substantial and positive influence on the university enrollment decisions in Cambodia. Apparently, many young adults from impoverished households have difficulties even to complete upper secondary education. However, once they are able to graduate from high schools, their odds of enrolling in universities greatly improve. In 2014, young adults from the poorest quintile have around a 50% chance of enrolling in universities, provided they can finish high schools. That is more than a 10% increase from 2009. Household head education remains a predictor affecting the university attendance of young adult members. However, the education level of household heads appears to play an even more important role in the enrollment decisions at lower education levels. Although the regional disparity in accessing higher education is declining in general, Phnom Penh residents continue to have a higher chance of furthering their education at universities. Surprisingly, there is no significant difference in university enrollment between high school graduates living in rural areas and urban areas outside the capital.

By examining the determinants of university enrollment and the predicted probabilities of university enrollment in Cambodia, the study concludes that even after substantial higher education expansion in the past ten years, family backgrounds remain strongly influential to accessing higher education. Although in absolute terms more children of disadvantaged backgrounds are able to access higher education, the results from the unrestricted sample clearly reveal that the situation has become worse as the higher education expansion is in favor of children from well-educated household heads and affluent families in urban areas. On the positive side, the inequality is much less pronounced among those who can finish upper secondary schools. The university enrollment opportunities for high school graduates from low-income families in rural areas are now catching up with those from more affluent families in urban areas.

Chapter 4. Impact of Financial Aid on University Enrollment, Retention and Completion in Cambodia

4.1. Introduction

4.1.1. Background

Increased globalization has undoubtedly contributed to high education massification and changing the educational landscape. The Asian Development Bank (ADB) foresees that the demand for higher education in Asia is likely to continue growing at the same or even at a higher rate until 2025 before the demand will start to decline. However, despite the transformation from "elite" to "mass" higher education systems, the low access to higher education among disadvantaged groups including low-income households, female students, and rural populations, remains a challenge (Asian Development Bank, 2011, 2012; IIEP & UNESCO, 2017; UNESCO, 2003). With the establishment of the ASEAN Economic Community (AEC) in 2015, a major milestone of the economic integration in the region, the role of the higher education sub-sector becomes even more vital in developing human resources which are indispensable for collaboration and competitiveness among nations across the region. Higher education is also an essential mechanism for national economic development as well as a critical driving force for individuals' socioeconomic mobility.

Similar to many countries across the Asia Pacific Region, Cambodia has also witnessed significant progress in terms of access in the higher education sub-sector as a result of the Education for All (EFA)'s efforts to increase access and completion rates in basic education (Asian Development Bank, 2012). The Education Law enacted in 2007 gave directions to Cambodian Higher Education sub-sector development, and subsequently, the number of enrolled students in undergraduate programs grew rapidly over the past decade from 56,810 in AY 2005-2006 to 174,142 in AY 2015-16. As of 2016, there are 121 higher

education institutions (HEIs), of which more than 60% are private, spread over the capital and 19 other provinces (MoEYS, 2017a; Williams et al., 2014).

According to the Organisation for Economic Co-operation and Development (OECD), around 70% of expenditure on tertiary education is subsidized by public expenditure, although the level of subsidization is substantially different, from 32% in Korea to 99% in Argentina (Organisation for Economic Co-operation and Development, 2016). The theory behind higher education subsidization is that it reduces inequality by providing opportunities to students from poorer family backgrounds to access university education; and that higher education generates positive externalities. The provision of student financial aid in this study is justified mainly by the first argument; however there is also evidence showing that investments in higher education can result in positive externalities, meaning that the social benefits from better-educated people—such as economic growth, productivity growth, reduction in crime rates and social cohesion—are higher than the private benefits.

4.1.2. Problem Statement

Students from disadvantaged backgrounds are more likely to quit schooling during primary or secondary school before being able to complete high school—the minimal requirement for entering higher education. Hence, one might argue that the intervention to promote access to higher education for the poor is rather late, and intervention at a lower education level is much more important to narrow the disparities. This idea is supported by the study of Cameron & Heckman (2001), which investigates the schooling outcomes of American male students born between 1908 and 1964. It found that long-run financial constraints have a greater influence on college enrollment than short-run financial constraints. In other words, the financial difficulty after high school graduation is not a major barrier to prevent students from continuing to an undergraduate program. There is no doubt that disparity in access to education between the affluent and poor is likely to happen even during lower secondary school. However, it is also true that many interventions at the lower levels have been made

to tackle this challenge, while there is little attention focused on addressing the inequality issues at the higher education level. While 45% and 37% of the Ministry of Education Youth and Sports (MoEYS) budget in 2016 were allocated to the primary education and secondary education sub-sectors respectively, only 5% of the budget went to the higher education sub-sector in the same year. It is less than half of the figure initially proposed in the Education Strategy Plan (ESP) (MoEYS, 2016).

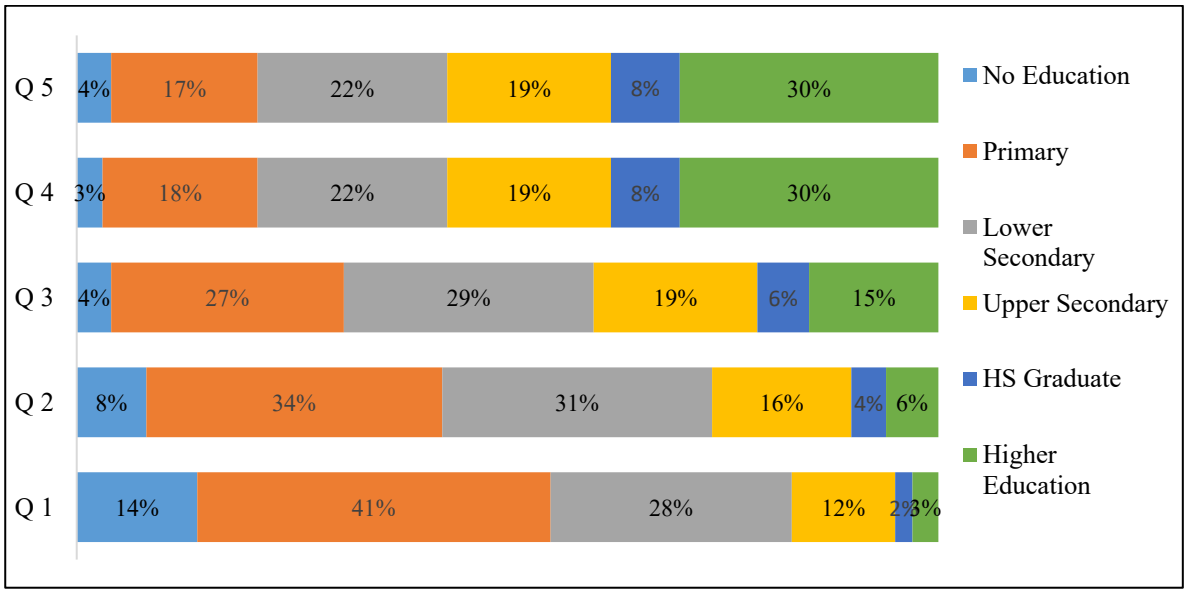
After graduating high school, students need to decide either to further their education at a higher level or to start working or in the case of Cambodia, to combine both. The factors influencing the decision to pursue higher education can be monetary and nonmonetary. The monetary barriers usually are determined by the students' family incomes can be further classified as cost-benefit barrier, cash-constraint barrier, and debt aversion barrier (World Bank, 2012). Students with cash-constraint barrier think the returns to higher education are higher than costs, but cannot find sufficient resources to afford the extra four years of education at university. Without financial support, these students miss the opportunities to expand their potentials due to liquidity constraints. Furthermore, even for those who are not debt averse and wish to borrow money from banks, institutions, or informal money lenders to cover tuition fees and living costs, find student loan options in Cambodia are very limited. Neither the government nor the private sector is willing to take risks to provide loans to students most of whom have no collateral. This kind of market failure is not uncommon in low-income countries (Chapman, 2006). Without access to aid in the form of scholarships, there is little choice but finding work after completing their upper secondary school, often in low wage jobs.

Recent international and national evidence has indicated that the returns to higher education are much higher than those to primary and secondary, and higher education can help increase opportunities for the poor to expand their potential. There is strong evidence that children from poor households have higher chances of climbing to the top two quintiles if they earn a bachelor's degree (Haskins, Holzer, & Lerman, 2009). Similar to other

countries, Cambodian studies on rates of return to education indicate that the rate of return to higher education is much higher than the rates of return to primary and secondary (Humphreys, 2015a; Lall & Sakellariou, 2010).

Despite rapid expansion of higher education and the provision of scholarships (tuition waiver programs) to the poor over the past decade, attendance of students from the lowest consumption quintile or/and remote areas in undergraduate programs continue to lag behind that of their peers from urban, middle and upper consumption quintiles. Based on the CSES 2014, only 3% of young people aged between 18 and 24 from the lowest quintile are enrolled in or have completed undergraduate programs. This is ten times lower than of the enrollment rate among the richest quintile (See Figure 4-1). The difference in higher education enrollment between those residing in remote areas and Phnom Penh is also around ten times, according to the same data. Historically, higher education enrollment of female students has always been lower than their male counterparts; however, the situation has greatly improved, and the gender disparity is much less pronounced.

Figure 4-1 Education Level of Young Adults (18-24) by Consumption Quintile



Source: Created by the author based on CSES 2014

The regular scholarships (tuition waivers) have not been very effective to encourage or enable talented students with financial barriers to continue their studies since, without stipend support, they cannot afford the living costs for another four years. Even though the tuition is free, the costs incurred during university life are a tremendous financial burden for students from poor households and their families, and many students decide not to enroll in university or drop out in the middle of the programs. As shown in Table 4-1, around 30% of the students decline the university admission offers and tuition waivers scholarship. Even after the enrollment, many students cannot survive until the final year to complete their enrolled program. Only around 40% to 50% of them can finish their study with degrees.

Table 4-1 Retention Rate of Poor Priority Scholarship Recipients

Academic Year	Obs.	2009	2010	2011	2012	2013	2014	2015
2009-2010	394	78%	62%	59%	57%	-	-	-
2010-2011	540	-	71%	49%	46%	45%	-	-
2011-2012	593	-	-	50%	39%	36%	34%	-
2012-2013	763	-	-	-	74%	57%	50%	44%
2013-2014	531	-	-	-	-	71%	61%	50%

Source: DHE's HEQCIP Semi Annual Progress Report, 2016

4.1.3. Research Questions

The main purpose of this study is to find the answers to the questions: i) How much can financial aid (Special Priority Scholarship) targeting disadvantaged groups increase university enrollment, retention, and completion?; and ii) Does the SPS have different impacts in scale on those outcomes among different groups of students?

4.1.4. Significance of the Study

First, to the best knowledge of the author, this is the first study on the impact of financial aid on schooling outcomes in higher education in Cambodia. The literature on the topic in developing countries is still very scarce. Furthermore, although there are a larger number of

studies on the issue in developed counties, in particular in the United States, the findings on the effects of financial aid on schooling outcomes are still very inconclusive to date due to the mixed results. This study intends to contribute to a better understanding of the impact of financial aid on university enrollment, retention and completion in Cambodia especially, as well as in the context of developing counties generally. Another unique feature of the study is the incorporation of student ability, measured by Grade 12 examination scores, into the outcome models. Some critics believe that scholarship intervention at higher education can be too late (S. V Cameron & Heckman, 2001); therefore, the study also tests if schooling outcomes are associated with student prior performance by controlling student ability, assuming that student ability is accumulated year by year and affected by long-run financial constraints.

Secondly, the findings from this study are an important reference for the policy-makers in Cambodia when considering the future expansion of the national scholarship scheme. The Special Priority Scholarship (SPS) with additional stipends provided to disadvantaged students was initiated as a pilot program to complement the government's existing national scholarship scheme (tuition waivers only) to improve the enrollment, retention, and graduation of poor students in higher education. It was a pilot program, and it is the first time that MoEYS provides stipends directly to needy students. Therefore, the findings from this impact evaluation are critical for the future discussion on whether it is worthwhile to include this new scholarship option in the national scholarship scheme. As a part of the impact evaluation of the program, this study assesses the effects of the program on student enrollment, retention, and on-time completion.

4.2. Description of Program Intervention

The Higher Education Quality and Capacity Improvement Project (HEQCIP) was financially supported by the World Bank's International Development Agency (IDA) through the Ministry of Economy and Finance (MEF). The project agreement between the

Royal Government of Cambodia and IDA was made on September 7, 2010 and became effective on December 31, 2010. Overall responsibility for project management and implementation lies with the Department of Higher Education in the Ministry of Education, Youth and Sport (MoEYS). MoEYS implemented the project with supervision by the World Bank. The objectives of the project are twofold: 1) to improve the quality of teaching, management and research in project supported entities; and 2) to improve the targeting of disadvantaged students for enhanced access and retention. The project is divided into the four following components. The project was officially closed on September 30, 2017

To ensure equity in access to higher education, as a part of the project component, the provision of the Special Priority Scholarship (SPS) targeting disadvantaged students from poor households was initiated to address the high decline rate mentioned earlier. It is very likely that many more students drop out before being able to complete their courses. In AY 2011-2012, the DHE offered merit-based tuition waivers to 2,740 students and need-based tuition waivers to 1,862 students (713 for female priority, 663 for poor priority and 486 for remote priority). In the same year, the DHE also provided the SPS to 1,000 poor students with the additional quarterly stipends of US$ 175 or US$ 125 for students studying in Phnom Penh or provinces outside the capital respectively[8]. The quarterly stipends are transferred directly to student bank accounts registered at commercial banks. However, to maintain this stipend scholarship, students are required to pass annual examinations, have at least an 80% attendance rate for registered courses and stay in the same program[9] (Department of Higher Education, 2010). The tuition fees for the SPS awardees are also covered by the program and paid directly to the HEIs through bank transfers.

[8] Students were asked to select the HEIs they intended to enroll in when they filled the application forms before the National Examination. The difference in amount of stipends is unlikely to affect their selection of HEIs as they were unaware of the difference in stipends amount.

[9] In reality, repeating students were also able to continue receiving the stipend as long as they did not drop out of school.

The SPS scholarship process started with the distribution of scholarship applications (both merit-based and need-based) to all Grade 12 students nationwide in April about three months prior to the national examination in July. For those who wished to apply for the SPS, they were required to fill in a poverty questionnaire based on which their poverty ranking is determined. The World Bank developed the new poverty questionnaire to include more detailed information based on the analysis of Cambodia Socio-Economic Survey (CSES) 2009 data. Different from previous years, the poverty questionnaire provided many more comprehensive variables to construct students' poverty scores with the proxy means tests (PMT) method. By June, a total of 75,717 applications were collected by the DHE, and among them, 8,138 were the need-based poverty priority scholarships.

After obtaining the examination result database from the Secondary Education Department, the DHE combined it with the information from application forms to screen for students eligible for scholarships. Among the 8,138 applicants, 5,958 had completed poverty questionnaires and passed the National Examination. The 5,968 were then ranked by poverty scores, and the 1,300 poorest (lowest poverty scores) were shortlisted for verification through household visits to re-evaluate all of the self-reported responses to the 29 questions on the poverty questionnaire. The household verification survey revealed that there was a considerable tendency for candidates to over-report themselves as being poor. After the poverty scores were revised based on the verification visits, the average poverty score became higher, that is students were, in reality, less poor than reported[10].

The 1,300 students were again re-ranked with the verified poverty scores, and the poorest 1,000 (lowest scores) were selected for the Special Priority Scholarship (SPS) and extracted from the main database. In the initial research design, the remaining 300 students ranked from 1,001 to 1,300 were supposed to receive the poverty priority scholarships (tuition waivers only) and to be used as the control group. With the poverty scores' cut-off

[10] Lower scores indicate poorer welfare.

line at 1,000, the regression discontinuity design (RDD) method can be applied to estimate the impact of the SPS program (additional stipends) on the outcomes of interests. However, when the DHE ran the allocation algorithm to generate 663 students for the poverty priority scholarships, it used the revised poverty scores of those initial 300 control students making them less poor compared to others. For this reason, many of the initial 300 control students were not selected for the poverty priority scholarships.

Table 4-2 Numbers of Scholarships Awarded in 2011-12 and 2012-13

Academic Year	SPS	Need-based			Merit-based
		Poor Priority	Female Priority	Remote Priority	
2011-2012	1,000	663	713	486	2,740
2012-2013	0	764	651	264	2,743

Source: Peter & Heang (2011) and DHE's Statistics, MoEYS

Due to the non-compliance issues, a new method, propensity score matching (PSM), discussed later in the methodology section was applied to evaluate the impact of the program. The new approach uses the poverty priority scholarship (tuition waiver only) students in AY 2012-13 as the control group. Both 2011-12 SPS and 2012-13 poverty priority scholarship students were selected based on poverty scores measured by proxy means tests (PMT) using the same revised poverty questionnaire. The SPS is still in the pilot stage and is only available for the AY 2011-12 cohort, meaning in the AY 2011-12 the poorest students were offered SPS (with additional stipend), while in 2012-13 the poorest students were offered just regular poverty priority scholarship (tuition waiver only).[11] AY 2011-12 poverty priority scholarship students were not selected as the control group because they were less poor compared to the SPS groups, making it unsuitable for the matching approach.

[11] There are 764 students awarded poverty priority scholarship in 2012-13. However one observation of this new control group is missing, therefore there are only 763 in the analysis.

4.3. Literature Review

Need-based grants are common public interventions to reduce social disparity; however, the impact is not yet well established as some empirical studies suggest financial aid has positive effects on intended outcomes, while there are also studies that find no connection between financial aid and enrollment, retention and completion. A large number of studies scrutinizing the impact of financial aid on student enrollment, retention and completion were conducted in the United States with very few studies in developing countries. One of the most frequently studied financial aid programs is the Pell Grant, the largest federal financial aid program, established in 1973 to reduce the direct costs of higher education for students of low-income households in the United States. In 2010-2011, the US federal government spent more than $35 billion, providing some sort of financial assistance to almost half of all undergraduates, with an average award of $3,800 and a maximum amount of $5,550 (U.S. Department of Treasury, 2012).

4.3.1. Impact of Financial Aid Eligibility on Enrollment

By using 1973, the year when the Pell Grant program started, as the cut-off point, Hansen (1983) examined the enrollment of youth aged between 18 and 24 years old in 1972 and 1980, producing disappointing results that provided little evidence that the greater availability of scholarships impact the rise in enrollment of students of below-median-income families. There are some limitations in Hansen's study since he examined the enrollment patterns only in two year points, and the program eligibility was simply identified by those in the lowest income quintile. Seftor & Turner (2002) revisited the analysis utilizing the same DID method but with a more extended period from 1969 to 1977. They slightly modified the method to identify program eligibility by incorporating family size offset, assessment rate, and tax variables into their estimation, and focused their study on the grant impact among older students. By restricting their sample to household heads or spouses aged between 22 and 35 years old, they found that the eligibility for the Pell Grant

increased the probability of enrolling in college by 1.5 percentage points for males and 1.3 percentage points for females. In addition, in reviews of the literature on student responsiveness to changes in college costs, Leslie and Brinkman (1987) and Leslie and Brinkman (1988) reported a consensus estimate that a $1,000 change in college costs (1990 dollars) is associated with an approximately five percentage point difference in college enrollment rates.

Outsides the United States, Vergolini & Zanini (2015) examined the impact of financial aid conditional on merit and family incomes in Trento, Italy, using the regression discontinuity method with the grant eligibility as the cut-off line. From this study, they could not detect any significant impact of the grant on the enrollment of students who graduated from high schools in Trento Province and concluded that financial constraints are not the issue among academically high performing students. However, in the case of Columbian subsidized loan program for low-income students, Melguizo, Sanchez & Velasco (2016) found that the program had positive effects on university enrollment among low-income students.

4.3.2. Impact of Financial Aid on Retention and Completion

Once eligible students enroll in universities or colleges, it is important to know whether scholarships or financial aid can keep those students in the school system long enough to complete their courses. After finishing the first year of the program, students reevaluate the cost benefits of the program and decide whether to continue. The impact of financial aid on retention is also inconclusive as findings indicate both positive impact and little or no impact (Bettinger, 2004; Castleman & Long, 2013; Desjardins & McCall, 2007; Goldrick-Rab, Harris, Kelchen, & Benson, 2012; Santelices, Catala, Kruger, & Horn, 2016). By using students' individual data including information on their performance and financial aid status from all public colleges in the State of Ohio, Bettinger (2004) examined the impact of the Pell grants on retention of first-year students and found that the grants have a positive impact

on retention by reducing the dropout rate. More recent studies investigating the impact of financial aid on retention and completion using randomized controlled trial by Goldrick-Rab et al. (2012) on Wisconsin Scholars Grant and by Angrist, et al. (2014) on privately-funded scholarships in Nebraska also yielded similar positive results. The Nebraska's scholarship program was found to be effective in particular in increasing enrollment and retention rates of disadvantaged students.

However, when Desjardins & Mccall (2007) assessed the impact of the Gate and Millennium Scholar Program founded by the Bill & Melinda Gates Foundation using instrument variable approach, they suggested that the program had no impact on retention. Furthermore, the study previously mentioned in Wisconsin by Goldrick-Rab et al. (2012) only suggested the impact on retention among sophomore students with no evidence on retention after the second year. There are even more limited studies on the longer-term impact of financial aid on completion due to time and financial constraints in tracking students until the time of completion or graduation. Castleman & Long (2013) use the regression discontinuity approach to investigate the effects of the need-based Florida Student Access Grant. They found the grants helped increase the bachelor degree completion rate within five years 3.2 percentage points, yet the same grants had no effect among students taking associate degree programs.

The Chilean Government also provided subsidies through grant and loan programs to students from low-income households. A study on the impact of financial aid in Chile conducted by Santelices et al. (2016) showed that not all programs have positive impact on retention. With logistic regression and matching methods, they found that merit-based grants had positive but small impact on retention, while need-based grants seemed to have no effect at all on retention. Also in Chile, another study on student loan programs using longitudinal data indicated that the program had a moderate effect on dropout among five-year college students and a much stronger impact among students enrolled in two or four-year colleges (Rau, Rojas, & Urzúa, 2013).

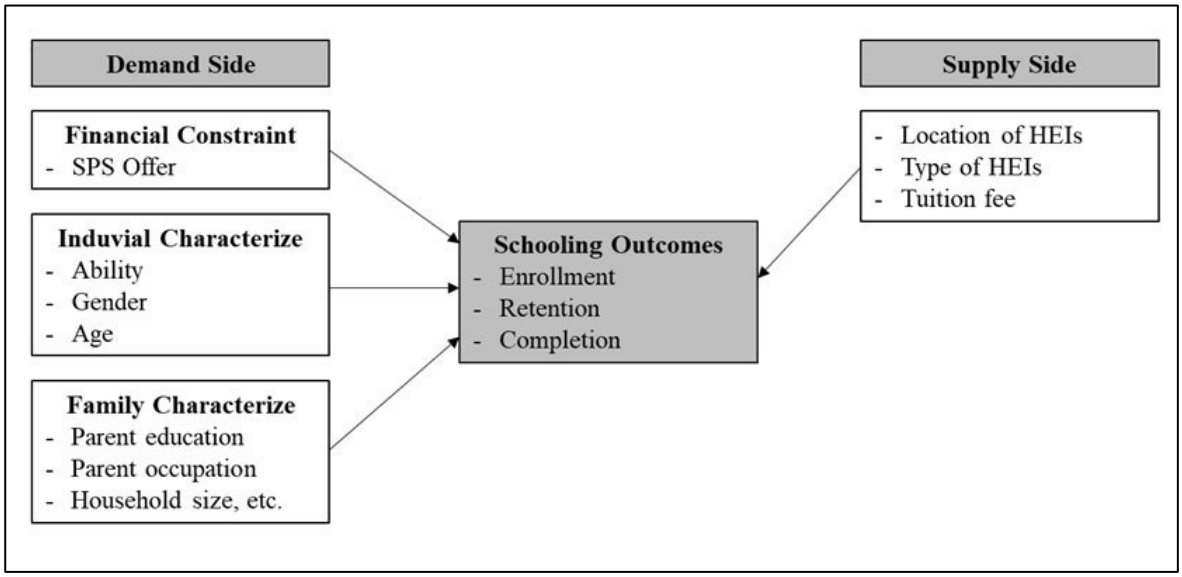
In short, even recent rigorous experimental studies using random assignment still produced inclusive results on the impact of financial aid programs. These findings suggest that the effect of financial aid greatly varies depending on program criteria designs as well as targeted students.

4.4. Methodologies

4.4.1. Analytical Framework

Once students successfully passed the national Grade 12 examination and were offered tuition waivers to enroll in HEIs, not all of them decided to accept the offers and enroll. Their decisions on whether to accept or decline the offers are influenced by both demand side and supply side factors as presented in Figure 4.1. Also even after the enrollment, these factors are considered to affect their retention and completion outcomes.

Figure 4-2 Conceptual Framework for factors affecting schooling outcomes



Source: Created by the author based on Cameron & Heckman (2001); Castleman & Long (2013)

4.4.2. Hypotheses

The hypotheses for the research questions are made based on previous studies on the effects of student financial aid on schooling outcomes in other countries, statistics from household

surveys and the author's understanding of the actual situation on the topic in the Cambodian context.

- **Hypothesis 1**: *This study posits that by proving additional financial assistance on the top of tuition waivers, students from poor households are much more likely to enroll in higher education and remain in the system until completion.* Since this is the first study on financial aid in the higher education sub-sector in Cambodia, this hypothesis is made based on the existing literature on the topic in other countries. Cameron & Heckman (2001) argue that post-secondary enrollment is much more influenced by long-run financial constraints rather than short-time financial difficulty families encounter during the college-going period. Some studies also indicate that financial aid to students from low-income families is ineffective in raising the enrollment and persistence in higher education. However, the majority of studies on the impact of financial aid on schooling outcomes suggest positive results. In addition, based on household surveys financial constraints are commonly found as one of the key reasons behind dropout decisions in Cambodia. Based on CSES 2014, more than half of teenagers aged between 15 and 17 years old were not in school because either they were too poor or needed to contribute to household income.

- **Hypothesis 2***: The hypothesis on the heterogeneity of the program impact is the SPS have a more substantial impact on schooling outcomes among students from remote areas and students enrolled in HEIS located outside Phnom Penh capital.* Since there is no similar study on this topic, and there is a difference in country context, this is hypothesized primarily based on the idea that (i) students from remote areas have fewer opportunities to enroll in higher education and more financial difficulties to remain in the school system after enrollment; hence they highly appreciate the financial aid and are more motivated to finish the program; and (ii) HEIs outside

Phnom Penh are less attractive, therefore without financial support, students are more likely to decline the offer and/or quit their courses even after enrollment. Furthermore, in addition to higher living costs in the capital, employment opportunities can also be a pull factor.

4.4.3. Models

Randomized controlled trial (RCT) is considered to be the most rigorous impact evaluation. However, it is much less frequent in social science as it is in medical studies because it is often unethical or impractical to conduct such experiments. When the eligible population cannot be randomly assigned, difference-in-difference (DID) or regression discontinuity design (RDD) are commonly used to assess the impact of financial aid on the intended outcomes. Initially, the SPS program was also designed with RDD approach in mind; however, due to non-compliance issue, this approach became unrealistic.

Instead of RDD, the propensity score matching (PSM) method is used to estimate the Average Treatment Effect (ATE) of the SPS program. Even though it is less rigorous compared to an experimental study using randomized controlled trial (RCT) and RDD, the PSM is a popular and frequently-used method to evaluate impacts of program interventions. Without the random assignment of treatment and control units, the covariates of the two groups are imbalanced. To address this challenge, the PSM method attempts to mimic randomization by matching program participants with statistically comparison group based on propensity scores estimated by the probability of participating in the program with observed characteristics unaffected by the program as independent variables (Khandker, Koolwal, & Samad, 2009). Treatments (program participants) are matched to nonparticipants based on the estimated propensity scores, with different matching methods to check its robustness. The mean difference in outcomes between the two groups is the average treatment on the treat of the program.

Two critical assumptions are required to yield suitable comparison groups. First, the conditional independence assumption that the outcomes Y are independent of treatment assignment D conditional on observable covariate X. This means that the outcome variables must be independent of the treatment conditional on the propensity scores. If Y_1 and Y_0 are the outcomes for treatment and control groups respectively, conditional independence can be expressed by $(Y_1, Y_0 \perp D_i \mid X_i)$. Secondly, we need a good balancing and strong common support to ensure that there are enough matches to make the comparison (Khandker et al., 2009). The average treatment effect, ATE= E [Y(1)-Y(0)], is the expected effect on the program on the outcome.

Propensity Score Estimation:

As the treatment is binary, a probit or logit model can be used for the propensity score estimation. Choosing variables to include in the estimation to ensure the conditional independence is a crucial part, as excluding important variables can increase the biased estimation of the scores. The SPS eligibility is measured by the proxy means tests (PMT) using the poverty questionnaire of 29 questions containing information such as students' parent education level and occupation, housing condition, household assets, and village characteristics. For this reason, information derived from the poverty questionnaire is used as observed factors to construct the propensity score, P(X) = Pr(D=1|X) for the matching to estimate the impacts of the SPS on the desirable outcomes, for these are the factors that influence the treatment status. Variables such as gender, age, student ability proxied by the Grade 12 national examination, HEI characteristics are not included into the estimation as these factors are not considered when students were selected for the scholarship. However, these factors are also likely to influence learning outcomes.

Matching Algorism Using Inverse-Probability Weighted Regression

There are several methods to match the participants to the non-participants on the basis of the propensity scores such as nearest neighbor matching (with or without replacement), radius matching and kernel matching. In this study, the inverse-probability weighted regression adjustment (IPWRA) is used for the estimation of program effects It is a two-stage regression that models both the outcome and the treatment, to account for the nonrandom treatment assignment, it is, therefore, more suitable for this study. The treatment model (inverse-probability weighted estimators) in the first stage, predicts the probability that students are likely to join the SPS program based on our observable covariates. The outcome model (regression adjustment estimators) compute the earnings.

An advantage of IPWRA estimators, unlike classical propensity score matching methods, is that the IPWRA can control for the factors that influence the outcomes, but not the treatment in the second stage regression adjustment. By evaluating the results of different types of the matching method using data from job training program and comparing them to the experimental data, Heckman, Ichimura, & Todd (1997) conclude that the regression-adjusted matching method shows the least bias because it provides the closest results to the experimental data. The estimates using inverse-probability weighting are also more efficient than the traditional propensity score matching in evaluating the average treatment effect of program participation (Hirano, Imbiens, & Geert, 2003).

Some observable individual and HEI characteristics do not influence the treatment assignment but are very likely to be associated with the academic outcomes. The standard matching estimators cannot partial out the effects of these factors on the outcomes as they merely estimate the means of both groups after matching. However, the IPWRA estimator can solve this problem, as the IPWRA estimator models both the treatment and the outcomes to account for the nonrandom treatment assignment. For the IPWRA estimator, weighted regression coefficients are used to estimate the averages of predicted outcomes of treatment and control groups. In the outcome model of this study, additional observable factors such

as gender, age, student ability proxied by the Grade 12 National Examination's scores, and HEI characteristics, such as its tuition fee levels, type, and locations, are added to the factors used in the treatment model. For the robust check, results from other matching methods will be reported in the Appendix.

4.4.4. Data

The treatment group in this study is the 1,000 students awarded the Special Priority Scholarship (with additional stipends) in the AY 2011-2012, and in the same year, another 633 students were also awarded the regular priority scholarships (tuition waivers only). However, the students from the normal priority scholarships in AY 2011-12 have higher poverty scores in comparison to those from the SPS group, since the SPS was provided to the neediest 1,000 students based on the PMT scores.[12] The same variables used for PMT estimation are used for the estimation of propensity scores. Therefore there would be very few matches between these two groups in the common support. For this reason, an additional 763 students awarded the regular priority scholarship in AY 2012-13 are also added as untreated students in the comparison group in this study. In AY 2012-13 there was no SPS program, so the poorest students measured by the PMT scores were awarded the regular priority scholarships. Considering that the SPS students and untreated students in AY 2012-13 are the most impoverished students, these two groups should share similar characteristics, making it ideal for the matchings using propensity scores. There is no noticeable economic changes or major educational reforms in the higher education sub-sector between the AY 2011-2012 and the AY 2012-2013. The Grade 12 National Examination's passing rates in AY 2011-12 and AY 2012-13 are 79.1% and 85.9% respectively.

The datasets employed in this empirical study come primarily from three sources, namely data collected from scholarship application forms, the Grade 12 National

[12] As discussed earlier this control group was initially designed for RDD analysis with the cut-off line at 1,000.

Examination results and students' academic records collected through the HEIs in 2016 and 2017. To collect the first set of data, the Department of Higher Education sends all Grade 12 students nationwide the scholarship application form containing 29 questions designed for poverty score estimation.[13] The application form was drastically revised in AY 2011-2012 when the Special Priority Scholarship was introduced. The questionnaire was slightly revised in the AY 2012-2013, but its contents are the same. The information from the questionnaire provides rich information on students' family characteristics and welfare, based on which proxy means tests (PMT) was calculated for the scholarship screening.

The second data sources come from national standardized Grade 12 examinations conducted in AY 2011-2012 and AY 2012-2013. The examination database from the Department of Secondary Education contains students' individual information, in particular, their academic performance during the national exams. It contains the percentile rank of students' total test scores as well as their grades categorized from Grade A to Grade F. To pass the national examination and be eligible for the scholarship program students are required to score at least 50% of the total scores or Grade E. None of the students from either SPS program or normal poverty scholarship program received Grade A, and only around 2% of them were able to obtain Grade B.

The last part of the data source was obtained from the end-line survey on enrollment and retention of the treatment and control groups collected by the Department of Higher Education in 2016 and 2017. It provides information on the HEI characteristics the students applied to or enrolled in, and their academic outcomes, namely enrollment, retention, and completion.

[13] The questionnaire is attached in the Appendix

Table 4-3 Summary Statistics

Variable	Treatment		Control		Min	Max	Mean Dif.
	Mean	Std. Dev.	Mean	Std. Dev.			
Outcomes of Interest							
Enroll	0.93	0.26	0.64	0.48	0	1	0.29***
Retain Year 1	0.86	0.35	0.49	0.50	0	1	0.37***
Retain Year 2	0.83	0.37	0.44	0.50	0	1	0.40***
Retain Year 3	0.80	0.40	0.39	0.49	0	1	0.41***
Retain Year 4	0.78	0.41	0.34	0.48	0	1	0.44***
Complete							
Household Characteristics Household Characteristics							
Parent alive	0.98	0.15	0.95	0.22	0	1	0.03***
Father education	2.77	3.22	3.09	3.51	0	14	-0.32***
Mother education	1.99	2.65	2.48	2.85	0	13	-0.49***
Farther Occupation (Farmer with Land is the Base Group)							
- Unemployed or Deceased	0.42	0.49	0.29	0.45	0	1	0.13***
- Employee	0.03	0.18	0.05	0.22	0	1	-0.02*
- Farmer without land	0.14	0.35	0.16	0.37	0	1	-0.02
- Others	0.12	0.32	0.11	0.31	0	1	0.01
Mother Occupation (Farmer with Land is the Base Group)							
- Unemployed or Deceased	0.42	0.49	0.24	0.42	0	1	0.18***
- Employee	0.34	0.47	0.44	0.50	0	1	-0.11***
- Farmer without land	0.13	0.34	0.18	0.39	0	1	-0.05
- Others	0.09	0.29	0.08	0.27	0	1	0.01***
HH member	8.26	1.83	7.04	2.25	4	17	1.21***
Children under 14	1.88	1.38	1.60	1.43	0	8	0.28***
Welfare (PMT scores)	831.56	15.13	844.14	33.09	819.11	940.37	-12.58***
Individual and HEI Characteristics							

Male	0.54	0.50	0.56	0.50	0	1	-0.02
Age	19.56	1.59	19.52	1.76	15	25	0.04
Area (Remote is the base group)							
- Rural	0.59	0.49	0.59	0.49	0	1	-0.01
- Urban	0.20	0.40	0.20	0.40	0	1	-7.05***
Percentile Rank	57.08	23.29	64.13	22.79	18.00	99.95	0.20***
HEI in Phnom Penh	0.82	0.38	0.62	0.48	0	1	0.09***
Public HEI	0.90	0.30	0.80	0.40	0	1	0.08***
Tuition Fee (Ln)	5.86	0.31	5.78	0.33	5.08	7.24	0.29***
Observation	1000		1351				

Source: Created by the author based on the poverty survey, Grade 12 examination database and end-line survey on academic outcomes
*** p<0.01, ** p<0.05, * p<0.10

Notes on Data Modification

For those students whose father and/or mother were deceased, the education level of the father and/or mother are treated as zero education. The household welfare variable is constructed using the PMT formula based on 20 variables, such as housing structures and possession of durable goods, obtained from the poverty survey. To estimate students' poverty level, the DHE and World Bank used CSES data to construct the weights of the 29 variables collected through the poverty survey. In this study, the same weights are applied, although only 20 variables are included in the estimation of the welfare scores.

4.5. Results

4.5.1. Overall Impact of SPS Program

The main results of the impact of the SPS program on university enrollment, retention, and on-time completion are based on the IPWRA estimates. The first-stage treatment model, with the logistic regression, predicts the probabilities that each individual student is likely

to be selected as treatments. In the first-stage model, only the 2011-2012 cohort sample is utilized for the estimation. The results of the first-stage logistic regression and its marginal effects are shown in Table 4-4. The high Pseudo R2 at 0.54 suggests that the variables used in the model can well predict the treatment probabilities. The results from the treatment model indicate that farther occupations (being unemployed or deceased) is positively associated with being SPS recipients. The base group for parents' occupations is farmer with land. It is reasonable because students with unemployed or deceased fathers are deemed poor and more likely to be selected as the stipend scholarship recipients. Household structures (household size and number of members age under 14) and welfare scores also appear to strongly affect the probabilities of being treatments.

Table 4-4 First-stage Treatment Model

Variables	Coef.	Std. Err.	dy/dx	Std. Err.
Parent Alive	-0.316	(0.478)	-0.072	(0.109)
Father Education	-0.011	(0.032)	-0.002	(0.007)
Mother Education	0.005	(0.036)	0.001	(0.008)
Father Occupation (Farmer with land is the base group)				
- Unemployed or deceased	0.880***	(0.296)	0.202***	(0.068)
- Employee	0.068	(0.520)	0.016	(0.119)
- Farmer without land	-0.046	(0.425)	-0.011	(0.097)
- Others	-0.300	(0.350)	-0.069	(0.080)
Mother Occupation (Farmer with land is the base group)				
- Unemployed or deceased	-0.54	(0.281)	-0.124	(0.064)
- Employee	-0.412	(0.512)	-0.094	(0.117)
- Farmer without land	-0.824*	(0.435)	-0.189	(0.100)
- Others	-0.398	(0.378)	-0.091	(0.087)
Total Members	1.281***	(0.081)	0.293***	(0.019)
Child under 14	0.608***	(0.078)	0.139***	(0.018)

Variables	Coef.	Std. Err.	dy/dx	Std. Err.
Welfare Score	-0.127***	(0.008)	-0.029***	(0.002)
Constant	97.554***	(6.268)		
Observations	1,588			
Prob > chi2	0.000			
Pseudo R2	0.542			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

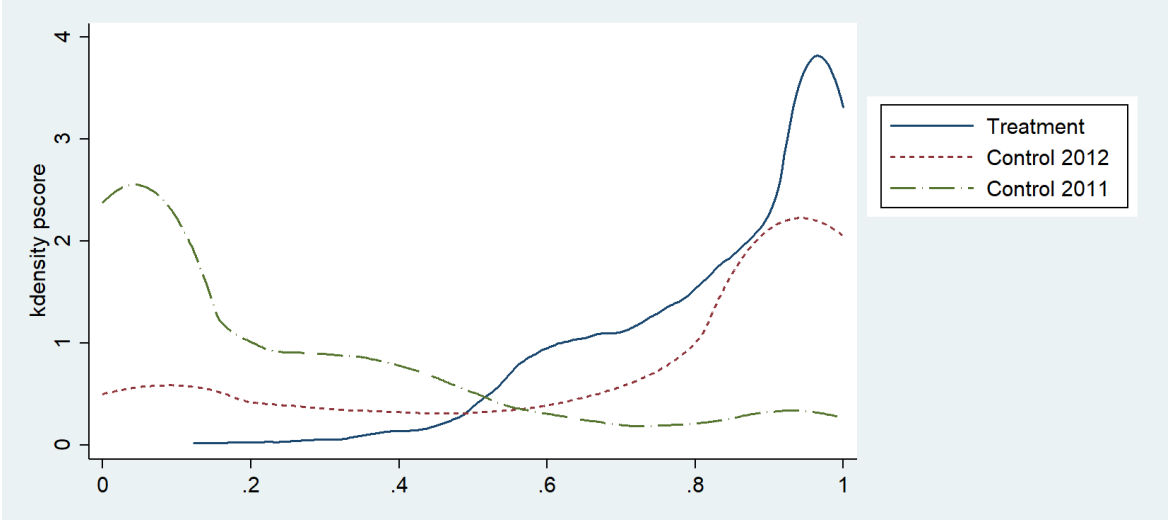
After performing the first-stage logistic regression, we estimate the predicted probabilities of being a treatment for both treatment and control groups including the 2012-2013 cohort untreated students that were not included in the first-stage model. Figure 4-3 illustrates the distribution of the predicted probabilities (propensity scores) by group of students. The propensity scores' distribution of the treatment group is skewed to the right, which means that students of this group are very likely to be assigned as treatments, while it is the opposite for the 2011-2012 cohort control group. The 2012-2013 cohort control group are more likely to be assigned as treatments in comparison to the 2011-2012 cohort control group. The SPS scholarships are not available in 2012-2013, therefore it is very reasonable that students of the 2011-2012 control group are less poor and less likely to be assigned as treatments in comparison to the control of 2012-2013 cohort.

Common Support and Trimming

A simple approach to determine the region of common support is using the minima and maxima of the propensity scores in both groups. The propensity scores of our treatments lie within the range [0.129, 0.999] and the propensity scores of the control are within [0.00, 0.99]. Therefore, the common support region of our sample is within the interval [0.129, 0.99]. First, observations whose propensity scores are not within this region are dropped. To improve balance on P(X) between the two groups, we further trim the sample within the

range of [0.1, 0.9] as recommended by (Crump, Hotz, Imbens, & Mitnik, 2009) for the estimation of average treatment effects.

Figure 4-3 Distributions of Predicted Probabilities (Propensity Scores)



The baseline characteristics of both the treatment and control groups, as shown in Table 4-3, indicates significant differences between the two groups. This suggests that the results from simple mean comparison of the outcomes are likely to be biased. To solve the selection bias issues, we apply the inverse-weighted regression proposed by (Hirano et al., 2003) to estimate the average treatment effect of the program impact on the outcomes of interest. The inverse-weights are $1/\hat{P}(X)$ for the treated individuals and $1/1-\hat{P}(X)$ for the untreated individuals.

Table 4-5 presents the basic statistics of the academic outcomes of the treatment and control groups. Both unrestricted sample and trimmed sub-sample provide similar results on the percentages of enrollment, retention and on-time completion. We notice that the enrollment rate of the 2011-2012 control group (50.51%) is much lower than the enrollment rate of the 2012-2013 control group (73.63%). This enrollment rate is also very low when compared to previous academic years (See Table 2-3). This means that students who failed to get the stipend scholarships are less likely to enroll in universities even they are offered

tuition waivers in AY 2011-2012. Nevertheless, by the fourth year, the retention rate of both control groups are very similar.

Table 4-5 Number and Percentage of Enrollment, Retention, and Completion

	Obs.	Enroll	Retain				Complete
			Year 1	Year 2	Year 3	Year 4	
A. Unrestricted Sample							
SPS	1000	92.80%	85.90%	83.30%	80.40%	79.90%	78.40%
Control (2011-12)	588	50.51%	39.12%	36.56%	34.69%	32.82%	32.65%
Control (2012-13)	763	73.66%	56.88%	48.89%	42.86%	36.44%	35.78%
B. Trimmed Sub-Sample							
SPS	809	92.46%	86.03%	83.31%	80.35%	79.98%	78.62%
Control (2011-12)	166	52.41%	39.16%	37.35%	36.14%	33.73%	33.73%
Control (2012-13)	452	73.45%	73.45%	50.66%	43.58%	36.28%	35.84%

Source: Created by the author based on the end-line survey on academic outcomes

The summarized results from the IPWRA's estimates are presented in Table 4-6. Since the untreated students are from two different academic years, the year dummy is also incorporated in the models. The study finds that the enrollment rate of students who are eligible for the additional stipends are 45.4 percentage points higher than students who are offered tuition waivers when the year dummy and other covariates are controlled for. The difference in enrollment rate is much higher than the unweighted mean difference between the two groups reported in Table 4-3. Academic year (2012) is found to be positively associated with enrollment, meaning tuition-waiver students are more likely to enroll in university in AY 2012-13. These results are in line with the summary statistics that the enrollment rate of the untreated students in 2011-12 is very low. The impact of the SPS eligibility found in this study is relatively huge compared to studies on financial aid eligibility in the United States and other countries.

Once students enroll in HEIs, the SPS students study in Phnom Penh or outside the capital receive the quarterly stipends of US$ 175 or US$ 125 respectively on top of the tuition waivers. In the estimation of the program impact on retention and on-time completion, we use both aggregate sample and sub-sample restricted to students who accept the scholarship offers and enroll in the participating HEIs[14].

In the unrestricted sample, the program impact on retention fluctuated between 39.5 percentage points and 35.8 percentage points. In the meantime, the coefficient of the year dummy decrease in term of both significant level and magnitude. After controlling for the program treatment and other covariates, there are no differences in retention rate between the two control groups in the third and fourth years. Due to the fact the enrollment rates between the two control groups are significantly different, we further perform an analysis on the program impact on the restricted sub-sample of enrolled students shown in Panel B of Table 4-6. In the restricted sub-sample, the program impact on retention is much weaker, that by the third year the effect of financial aid turns insignificant. In contrast, a significant and negative association between the academic year 2012 and retention is detected in the fourth year. The negative coefficient suggests that there are fewer students accepted the offers of tuition waivers in AY 2011-12, but these students are more likely to remain in their enrolled program until the fourth year in comparison to the control group in 2012-13.

[14] Most HEIs in Cambodia require students to repeat year if they cannot pass required credits or subjects. In this study, repeaters also treated as retaining as long as they do not drop out from their programs. Completion in this study refers to those students who were promoted to the next academic year for four years consecutively without having to repeat any year. In Cambodian HEIs, subjects are designed by academic year with little or no elective subjects for students to choose. Failing to pass the required subjects or to obtain credits, students are required to repeat the year. Another reason that graduation is not used as the final outcome in this study is that some students enrolled in programs that require more than four years to complete.

Table 4-6 Estimates of Program Impact Using IPWRA

	Enrollment	Retention				Completion
		Year 1	Year 2	Year 3	Year 4	
A. Unrestricted Sample						
SPS	0.454***	0.536***	0.538***	0.395***	0.420***	0.398***
	(0.072)	(0.079)	(0.081)	(0.077)	(0.077)	(0.077)
Year (2012)	0.340***	0.312***	0.251**	0.065	0.009	-0.007
	(0.086)	(0.094)	(0.099)	(0.092)	(0.091)	(0.092)
Percentile Rank	0.003**	0.003**	0.003**	0.002*	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
N	1,427	1,427	1,427	1,427	1,427	1,427
Adjusted R-square	0.144	0.132	0.122	0.155	0.140	0.131
B. Sub-sample Restricted to Enrolled Students						
SPS		0.183**	0.198**	0.093	0.092	0.054
		(0.088)	(0.090)	(0.114)	(0.113)	(0.113)
Year (2012)		0.031	-0.054	-0.211	-0.313**	-0.352***
		(0.110)	(0.109)	(0.132)	(0.131)	(0.131)
Percentile Rank		0.001	0.001	0.000	-0.000	-0.000
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
N		1,167	1,167	1,167	1,167	1,167
Adjusted R-square		0.116	0.109	0.176	0.174	0.167
Control Variables						
Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Family Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
HEI Characteristics	Yes	Yes	Yes	Yes	Yes	Yes

Source: Estimated by the author
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

This study also confirms that the impact of the SPS program on on-time completion is also strongly positive and significant in the unrestricted sample. Its effect (39.8 percentage points), slightly smaller than the retention rate by the fourth year (42.2 percentage points), suggests that more of the SPS students are likely to continue their study even though they had to repeat some years. In other word, students without the stipends are more likely to drop out if they fail to advance to the next academic year, although the percentage is very small.

In order to examine whether long-term financial constraints can be also obstacles for disadvantaged students in pursuing their higher education, this study follows Carneiro & Heckman (2002) and uses students' accumulated abilities measured by the Grade 12 examination scores' percentage rank as a proxy of long-term financial constraints. This study finds positive association between the students' prior abilities and university enrollment and retention in early years in the unrestricted sample. However, this positive relationship is not found in the restricted sub-sample of enrolled students.

4.5.2. Heterogeneity of Program Impact

To examine the heterogeneity of the program impact on the academic outcomes, the sample is disaggregated into sub-groups by gender and type and location of HEIs. Analysis using the same IPWRA approach is conducted separately by the sub-groups, and the results of the program impact on the intended outcomes are shown in Table 4-7.

When students are divided into gender sub-samples, the impact of the SPS program eligibility seems to be larger among the female group, although the difference is relatively small. Regarding the impact of the program eligibility on enrollment, the effect is 39.9 and 43.6 percentage points for males and females respectively. For the program impact on retention, female students seem to benefit more from the financial aid in the early years; yet in the third and fourth years, the impact on retention for males is slightly higher than females.

In stipend effect on on-time completion among males is 36.7 percentage points, slightly higher than females at 34 percentage points.

Table 4-7 Estimates of SPS Impact on Academic Outcomes by Sub-group Using IPWRA

	Enrollment	Retention				Completion
		Year 1	Year 2	Year 3	Year 4	
A. Gender						
Male	0.399***	0.444***	0.444***	0.361***	0.398***	0.367***
(N=763)	(0.090)	(0.102)	(0.102)	(0.098)	(0.099)	(0.099)
Female	0.436***	0.522***	0.522***	0.363***	0.347***	0.340***
(N=664)	(0.109)	(0.115)	(0.115)	(0.117)	(0.113)	(0.113)
B. Public and Private HEIs						
Phnom Penh	0.298***	0.464***	0.464***	0.365***	0.328***	0.277**
(N=1097)	(0.089)	(0.109)	(0.109)	(0.114)	(0.115)	(0.115)
Outside Phnom Penh	0.544***	0.576***	0.576***	0.392***	0.400***	0.400***
(N=330)	(0.096)	(0.114)	(0.114)	(0.117)	(0.118)	(0.118)
C. By Location of HEIs						
Public	0.498***	0.552***	0.552***	0.333***	0.353***	0.338***
(N=1253)	(0.077)	(0.093)	(0.093)	(0.085)	(0.083)	(0.083)
Private	0.326**	0.660***	0.660***	0.662***	0.684***	0.642***
(N=174)	(0.143)	(0.120)	(0.120)	(0.116)	(0.117)	(0.126)
Control Variables						
Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Family Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
HEI Characteristics	Yes	Yes	Yes	Yes	Yes	Yes

Source: Estimated by the author
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

Next students are categorized by the HEIs they are admitted or enrolled (i.e., public or private HEIs, and HEIs located in or outside of Phnom Penh capital). Most well-known

Cambodian HEIs are public and located in Phnom Penh, while private HEIs and HEIs outside the capital are relatively new and small. Public universities in Phnom Penh is more attractive among higher school graduates, although it is usually harder to be admitted due to the competitiveness. In the trimmed sub-sample, only 174 students (12.19%) are of private HEIs and 330 students (23.31%) are admitted or enrolled in HEIs located outside the capital. The results by type and location of HEIs on impact of financial aid eligibility on enrollment and impact of financial aid on retention and on-time completion are reported in Panel B and C of Table 4-7.

The effect of the program eligibility for the additional stipends on enrollment among students admitted to HEIs outside the capital is 54.4 percentage points, roughly two times higher than among those who are admitted to HEIs in Phnom Penh. The impact on retention is in declining trends for both groups of students. By the fourth year, the program impact on retention among Phnom Penh students is 32.8 percentage points, while the impact among students of HEIs outside the capital is higher at 40 percentage points. The effect on on-time completion among Phnom Penh students further declines to 27.7 percentage points. This implies that some SPS students in Phnom Penh fail to complete their program on-time even though they can manage to remain in their enrolled HEIs for four years.

By separating the sample into students of public and private HEIs, the study finds that the program eligibility impact on enrollment is stronger among students of public HEIs, but the impact of financial aid on retention and on-time completion is more favorable among private HEIs. The impact on retention by the fourth year and completion among students of public HEIs is 35.3 percentage points and 33.8 percentage points respectively, while the impact among students enrolled in private HEIs is even much higher at more than 60 percentage points.

4.6. Conclusion

In response to the first research question inquiring how the financial aid provided by the SPS program can improve the academic outcomes of students from poor households, the study finds that the SPS program eligibility strongly affect students' enrollment in higher education, and the program's additional stipends are effective in increasing both the retention and on-time completion rates after the enrollment. Compared to studies conducted in other countries, the impact of financial aid on enrollment, retention, and completion in Cambodia is very large in scale. The probabilities that students enroll in university is as high as 45.4 percentage points higher if they are eligible for the SPS program. However, the impact on enrollment can be upward biased, since the labor outcome survey conducted in 2017 finds that some control students decide to enroll in other HEIs after the declining the offers of tuition waivers by the DHE. After the enrollment, the program impact on retention and completion is also very high; by the fourth year, the retention rate of students with financial support is 42 percentage points higher than students receiving normal scholarships (tuition waivers only).

Assuming the student performance prior to university enrollment is influenced by long-term financial constraints in the past, the national examination scores' percentage rank is incorporated in the outcome models to test whether the SPS intervention is too late. We expect that performances of students are influenced by investment in education from early stages. Well-off families would invest more in their children's education, therefore their children performance should be higher on average in comparison to students from poorer families. The study finds that the percentage rank is positively associated with enrollment and retention in the early years. This means that in the case of Cambodia long-term financial constraints also remain a factor in determining students' enrollment and retention at higher education level.

The sub-sample analysis clearly shows the magnitudes of program impact varies by sub-groups. Students admitted to public HEIs and HEIs outside of Phnom Penh are the

groups that most benefit from the SPS eligibility. In other words, these groups of students are more likely to decline the regular scholarships (tuition waivers only) and decide not to enroll in the accepted HEIs without the stipend scholarship. With the additional stipends, the odds that they enroll in higher education is much higher. Program eligibility has the smallest effect among urban students, probably due to the fact that their financial situation is better than other groups. Nevertheless, even among the urban students, the enrollment rate increased by nearly 30 percentage points.

After enrollment, the stipend effect on retention and completion among students enrolled in private HEIs and HEIs located outside the capital are found to be the largest. In contrast to the relatively low eligibility effect, the impact on retention and completion among students studying in private universities are higher than students from public universities. Without the SPS offers, more than 60% of students admitted to private HEIs would not be able to graduate from the university programs. The sub-sample results also suggest a larger impact on retention and completion among students enrolled in HEIs located in provinces, although the stipends provided to students studying in provinces are lower than those studying in the capital. Therefore, targeting this group of students appears to be the most cost-effective in improving access to higher education. Furthermore, it would also help reduce the disparity in access to higher education between urban and rural areas as well. The high living cost and plenty of job opportunities in Phnom Penh can be reasons behind the lower impact on retention and completion among students enrolled in HEIs in the capital.

Chapter 5. Impact of Financial Aid on Early Career Earnings in Cambodia

5.1. Introduction

5.1.1. Background

In 2010, the Royal Government of Cambodia (RGC) signed an agreement with the International Development Agency (IDA) for US$ 23 million (50% of which was grants) to fund the five-year Higher Education Quality and Capacity Improvement Project (HEQCIP), implemented by MoEYS with supervision from the World Bank. The program aimed at improving the management and research capacity of the Cambodian Higher Education Institutes (HEIs) and piloted a new scholarship scheme targeting disadvantaged students from low-income households.

The third component of the project was to provide scholarships to the disadvantaged students from needy families. In the AY 2011-2012, 1,000 students identified as poor were awarded the stipend Special Priority Scholarship (SPS)[15]. Prior to that, MoEYS only offered scholarships in the form of tuition waivers. As it was a pilot project, the SPS was available only to students enrolled in AY 2011-2012. The following AY 2012-13, 763 poor students identified by the same method were offered the regular tuition waiver scholarships (without stipends). Due to similarities in characteristics, the latter group is used as the control group in this study. The project ended in 2017. However, the government is still undecided on whether to continue the stipend SPS. In the meantime, MoEYS is also considering adding student loans as another financing tool to support students from disadvantaged backgrounds. Although there is also financial assistance from the private sector and faith-based

[15] The poverty ranking was measured by proxy means test (PMT) using 29 variables from the self-reported poverty questionnaire.

organizations and NGOs, current financial support from MoEYS to poor students is limited to the tuition waivers.

With many educational priorities to focus on, and understanding that any intervention needs to be made based on its effectiveness or cost benefits, a question arises: *Is it sufficient to only look into the program impact on enrollment, retention and degree completion to justify the SPS intervention?* To examine to what extent the SPS program can affect students' early career path and earnings after graduation, this study uses the labor outcome survey data collected in 2017, one year after the expected graduation of the control group[16], as the main data source for the analysis.

5.1.2. Problem Statement

A bulk of the literature shows that education plays an important role in alleviating poverty and boosting economic growth. Empirical studies have proved that public investment in education, as well as health and infrastructure, is the key to sustainable economic growth and that the level of education has a causal impact on civic engagement such as going to vote and recognizing the importance of democracy (World Bank, 2018b). At the micro or individual level, as earnings are largely dependent on individuals' productivity, there is strong evidence indicating earnings are determined by the skills and knowledge acquired through schooling (Acemoglu & Autor, 2011; Valerio, Laura, Puerta, Tognatta, & Monroy-Taborda, 2016).

The average years of schooling in developing countries has increased more than three times over the past six decades between 1950 and 2010 (World Bank, 2018b). The trend of higher education enrollment has also increased around the globe, in particular in transforming economies (UNESCO, 2003; World Bank, 2012). The rise of people with higher education should result in decreasing rates of return to investment in higher education,

[16] The treatment students were expected to graduate one year earlier.

assuming that the increase in supply is higher than the increase in demand. Yet, the latest study on the rates of return to education by Montenegro & Patrinos (2014) reveals that rates of return to higher education investment in most countries, including Cambodia, have actually surged in recent years. In the case of Cambodia, this is also confirmed by Lall & Sakellariou (2010) and Humphreys (2015).

Unfortunately, the benefits from education expansion are not equally distributed. The higher the education level, the less likely that the disadvantaged groups are able to reap the benefits from the expansion (UNESCO, 2014). Inequality is inevitable when we try to incentivize people to put more effort to be more productive. However, when the level of intergenerational earning mobility —children of low-income families becoming high-income earners and vice versa — is too low, it is a social concern that needs to be addressed (Autor, 2014). Evidence across the world also shows a strong positive association between intergenerational mobility in education, and economic growth and poverty alleviation (World Bank, 2018a). Economic inequality is clearly a barrier of intergenerational income mobility around the world (Andrews & Leigh, 2009), and education that enables individuals to adopt new technologies is the key to reduce the inequality (Mankiw, 2013; World Bank, 2018a).

If access to higher education continues to be in favor of people from wealthier families, the high rates of return to higher education only make the income inequality more severe. To ensure inclusive economic growth and to narrow the social gaps, the government needs to make sure that all groups of people, including those from low social-economic status or rural areas, have more equal chances of benefitting from education expansion. As a public intervention, MoEYS has offered scholarships in the form of tuition waivers to the disadvantaged students, namely female students, poor students and students from remote areas. Additional student financial tools such as student loans and the stipend scholarships are also on the MoEYS's policy agenda for higher education, but they are yet to be realized as there are many priorities with a limited budget. The lessons learned from countries around

the world, both in developed and developing countries, is that student loan programs are not short of challenges. The problems include, but are not limited to, rising student debts, rent-seeking from private loan providers and difficulties in collecting the repayment (Armstrong & Chapman, 2011; Chapman, 2006; Dynarski, 2014; Johnstone, 2004; Lochner & Monge-Naranjo, 2016; Thaler & Sunstein, 1999). Inequality in education distribution is also closely linked to economic inefficiency: if some groups of people are excluded from the opportunities to enhance their human capital due to financial barriers, they are unable to make their full contribution to economic growth (Stiglitz, 2012).

5.1.3. Research Questions

The empirical study in this chapter intends to investigate the impact of the SPS program on the employment outcomes in the early career stage of the graduates. With this objective, the research questions in this study are as follows:

- How does the SPS program help students shorten the time in securing jobs with a reasonable level of earnings after their expected graduation?
- How does the SPS program impact the earnings of the graduated students?

5.1.4. Significance of the Study

From the latest World Bank's update on the rates of return to education and a growing body of empirical literature on the topic, the positive effect of post-secondary education on earnings is unarguable. However, there is extremely limited research on the impact of financial aid (grants), as a means to reduce the financial barrier among students from low-income families, on early career earnings after graduation. Even in the United States, where plenty of studies on financial aid can be found, Welch (2014) argues that there is no existing literature on the topic before her study on the impact of financial aid on earnings of college graduates. There is a small but growing body of literature on the impact of student loans on early career decisions and earnings, mainly in the United States, but its results are also

inconclusive (Altonji, Arcidiacono, & Maurel, 2016; Minicozzi, 2005; Monks, 2001; Rothstein & Rouse, 2011; Zhan, Xiang, & Elliott III, 2016; Zhang, 2010). Therefore, this study tries to enhance understanding of the impact of financial aid on early career after graduation. This study also contributes to a small but growing body of literature on the rate of return to higher education in Cambodia (Humphreys, 2015a; Lall & Sakellariou, 2010; Montenegro & Patrinos, 2014).

In addition to the academic contribution, the results from this study have important implications for future MoEYS's policy discussions on the scholarship scheme that is currently limited to the tuition waivers provided to the disadvantaged groups of students. Although the SPS's pilot program indicates a strong and positive impact on university enrollment, retention, and completion, the MoEYS also needs to examine its economic returns from this investment.

5.2. Labor Market and Education Premium in Cambodia

5.2.1. Labor Market in Cambodia

After more than two decades of economic growth, Cambodia rose through the ranks from a lower income country and became a lower-middle income country, after its Gross National Income (GNI) per capita in 2015 surpassed the World Bank's threshold of $1,025. Growing tourism industry and Foreign Direct Investment (FDI) in the garment manufacturing sector attracted by cheap labor costs and an abundant young labor force have helped contribute to the strong economic growth (ADB, 2015). The proportion of Cambodian people living under the national poverty line has steadily declined from 53.2% in 2004 to 20.5% in 2011 (World Bank, 2014). According to the same report, the decline in poverty headcount has stagnated from 2009 after the global financial crisis, and a large proportion of the non-poor who are just above the poverty line are at risk in the event of an unexpected negative shock.

The Royal Government of Cambodian (RGC) in 2015 adopted the Industry Development Policy 2015-2025, aimed at maintaining the high economic growth and provided a new strategy to strengthen regional competitiveness and to diversify and transform the economy. The policy clearly recognizes that economic transformation and diversification is substantially dependent on the quality of educational inputs to produce graduates with higher levels of productivity (Ministry of Commerce, 2015).

The Cambodian dependency ratio declined from 86.5% in 1998 to 52% in 2013, and this trend is predicted to continue for another 30 years (ADB, 2015). This means there will be a larger working-age population, and fewer children under 15 years old and aged people. Amongst the working-age population (15-64 years old), a large proportion of people were economically active in 2014, although the labor force participation rate dropped slightly from 84.4% in 2009 to 82.6% in 2014[17]. Nevertheless, women in Phnom Penh became much more active as the working female population increased more than 10% from 61.5% to 72.2% during the same period (NIS, 2015). The participation rates in Phnom Penh capital and other urban areas were lower than in rural areas, due to the high proportion of inactive working age population. The unemployment rate was very low at merely 0.1% both in 2009 and 2014; however, the majority of the workforce is involved in informal, vulnerable, unstable, and poorly rewarded jobs. Therefore, the main issues in the labor market include skills mix, working conditions, and earnings. As of 2014, although the workforce employed in the primary sector (agriculture, forestry, and fishing) declined, it was still almost half of the working population (NIS, 2015).

[17] Just as in many other developing countries, people much younger than 15 are also economically active; however in the CSES's official document, working age population is defined as those of 15 years and above.

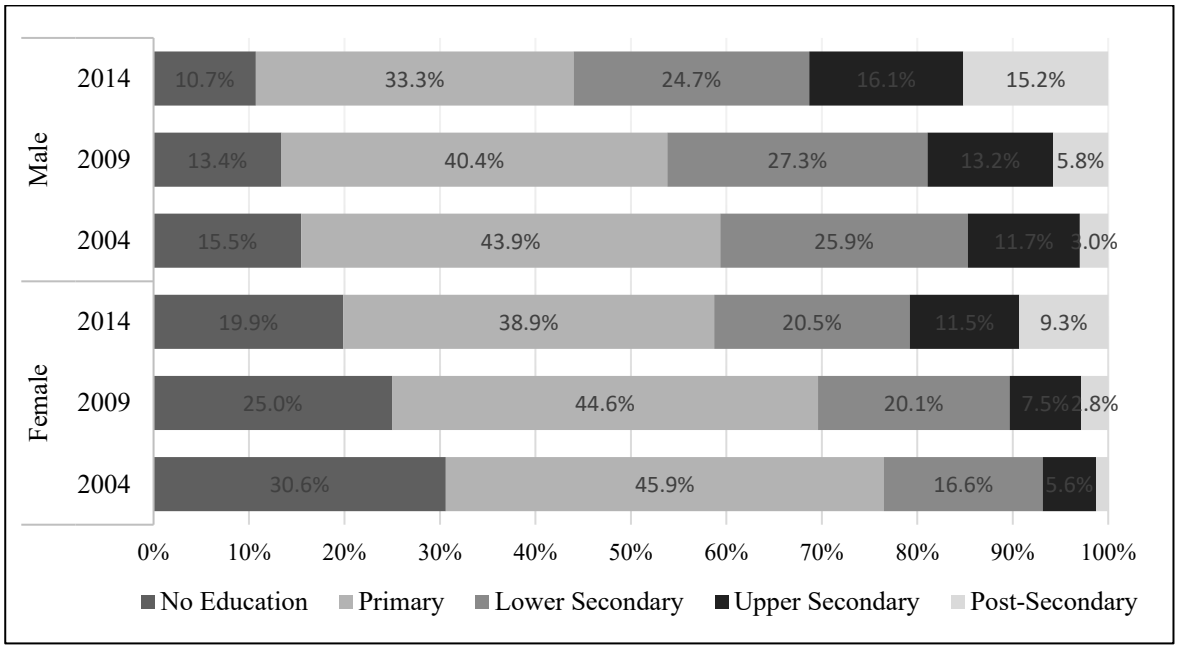
Table 5-1 Labor Force by Gender and Geographical Location (in Thousand and Percent)

Labor Force and Gender	2009				2014			
	Cambodia	Phnom Penh	Other Urban	Rural	Cambodia	Phnom Penh	Other Urban	Rural
Total Population	13,967	1,383	1,428	11,156	15,184	1,794	1,796	11,594
Working Age	8,865	1,001	956	6,907	10,001	1,361	1,219	7,421
Labor Force	7,480	688	737	6,055	8,259	1,060	961	6,238
Labor Force Participation Rate								
Women	80.4	61.5	72.7	84.3	77.5	72.2	71.1	79.6
Men	88.8	77.2	82.1	91.3	87.9	84.1	87.3	88.7
Both	84.4	68.7	77.2	87.7	82.6	77.9	78.8	84.1
Employment Rate								
Women	80.3	61.4	72.6	84.2	77.4	72	71	79.4
Men	88.6	76.9	81.7	91.2	87.8	84	86.9	88.6
Both	84.3	68.5	77	87.6	82.4	77.8	78.6	83.9
Unemployment Rate								
Women	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2
Men	0.2	0.3	0.4	0.1	0.1	0.1	0.4	0.1
Both	0.1	0.3	0.3	0.1	0.1	0.1	0.3	0.1

Source: Cambodia Social-Economic Survey (CSES) 2014's Report

Cambodia is benefiting from its demographic dividend, a significant proportion of the working-age population (between 15 and 65 years old); however, the majority of them still have an education level lower than upper secondary school. Over the past decade between 2004 and 2014, it is clear that the education level of the working-age population has increased for both men and women; nevertheless, gender disparities in educational attainment still exist. As presented in Figure 2.1 only about 40% of women aged 15-64 had an education level higher than primary school completion in 2014, a level that was achieved by men of the same age cohort ten years ago in 2004. During the same period, the workforce with post-secondary education increased drastically, more than five times among men from 3.0% in 2004 to 15.2% in 2004, and nearly seven times among women from 1.3% in 2004 to 9.3% in 2014.

Figure 5-1 Education Level of the Labor Force Aged (15-64) by Gender



Source: Created by the author based on CSES 2004, 2009 and 2014

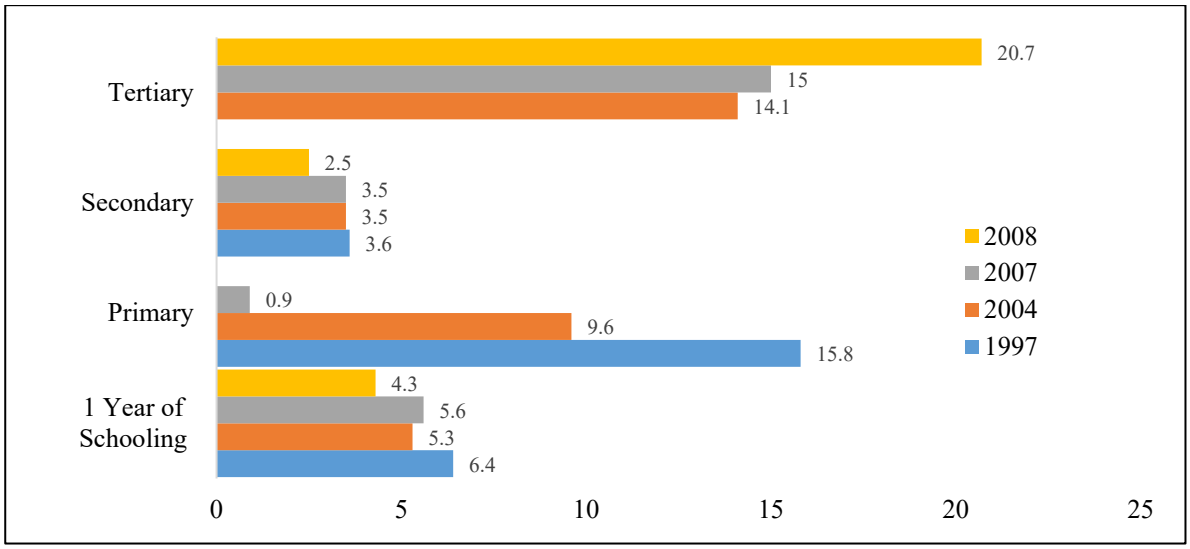
5.2.2. Trend in Rates of Return to Education in Cambodia

The theory of human capital and signaling theory suggest that higher education is associated with higher earnings (Peracchi, 2006). The former theory posits that the accumulation of skills and knowledge through schooling is associated with higher productivity and earnings, while the latter theory is based on the idea that having a good education is beneficial for individuals to signal out to potential employers that they have skills and knowledge needed for jobs. Supporting the first theory, recent studies argue that rather than years of schooling, skills or knowledge formulated during schooling do matter, because they found that among individuals with the same number of years of education, those with higher skills can earn more than the lower-skilled counterparts (Hanushek, et al., 2014; Valerio, et al., 2016).

Across the globe, education, measured by years of schooling, is consistently found to be positively associated with earnings; and among the three levels of education, investment in primary education exhibited the highest rates of return to schooling either socially or individually (Psacharopoulos, 1994; Psacharopoulos & Patrinos, 2004). However, the latest update from 139 economies around the world in 2014 by Montenegro

& Patrinos at the World Bank found that returns to tertiary education are now the highest. After more than four decades of study on the topic, it is clear that rates of return to education are positive and generally the returns are even higher in low- or middle-income countries. Studies on rates of return to education in Cambodia are still limited. Cambodia was not included in the global synthesized report compiled by the World Bank until the latest report in 2014. The latest update suggested that rates of return in Cambodia also share similar trends found across the globe, that from the late 2000s, the investment in higher education yields the highest private return (Figure 5-2).

Figure 5-2 Rate of Return to Education in Cambodia



Source: Created by the author based on Montenegro & Patrinos (2014)

The most comprehensive study on returns to schooling in Cambodia to date is by Lall & Sakellariou (2010). Using the Mincer earning function with household survey data sets between 1997 and 2007, they estimated the education premiums[18] in Cambodia in various years to see the trends. In addition to OLS, they also applied the instrument variable method to address the endogeneity issue of the schooling variable due to the ability bias and self-selection. Using early age smoking and spouse education as the instruments for the IV

[18] Education premiums are defined as the percentage difference between earnings of people with different education level. Different from the rates of return to education, direct and opportunity costs are not included in the estimation of education premiums.

estimations, the results on rates of return to education are similar to, but slightly higher than, the OLS estimates. They found that between 1997 and 2003, the education premiums to university education, particularly in the case of women, have drastically increased. Another study on the topic worth mentioning is by Humphreys (2015) using a set of primary data collected in 2012 from 530 respondents in two provinces in Cambodia. In addition to years of experience and years of experience squared, he also controlled for the individual and family characteristics such as gender, high school grade, incomes, and education level of parents, in his estimations. In comparison to the findings by Lall & Sakellariou (2010), Humphreys found a much higher premium for university education, putting the estimation of the return at 21%. In contrast, the premiums for primary and secondary education are much lower at 2% and 6% respectively.

5.3. Literature Review

Although little is known related to the impact of financial aid on earning or employment outcomes after graduation, there is a small but growing literature, mainly found in the United States, on the effects of debt or student loans on early career choices and earning after graduation (Ambrose, Cordell, & Ma, 2015; Field, 2009; Minicozzi, 2005; Rau et al., 2013; Rothstein & Rouse, 2011; Weidner, 2016; Zhang, 2010). The results from the literature on the impact of student loans on the early career decisions and earnings are still inconclusive. Some studies found that debts, incurred by student loans, make students opt for better-paid jobs, but some other studies suggested different results showing that student loans either have no impact on early career path and earnings or that students with loans to pay off are likely to earn less after graduation.

The studies on the effects of student debts in the United States that suggested the positive association between student debts and initial earnings included Field (2009), Minicozzi (2005) and Rothstein & Rouse (2011). The tendency to take high-paid jobs can be driven by the fact that they need to repay the debt accumulated during their study.

Minicozzi (2005) studied the impact of the state-funded student loans in the United States that male students used to finance their college study prior to 1987. He found that the amount of debt is positively associated with higher probability that students take jobs with high initial wages. In a natural experiment, Rothstein & Rouse (2011) utilized data collected from an unnamed college in the United States where students loans were replaced with grants for one cohort of students, and employed the DID approach as their estimation strategy by treating non-eligible students as the control group and separating the before and after effects using the year that the school started the no-loan policy. The findings from the study suggested that student with debts are likely to take higher-salary jobs rather than public-interest but low-paid jobs. A separate experiment[19] using a lottery to assign grants to the winners and interest-free loans to the losers in New York University's School of Law also produced similar findings (Field, 2009). She found, two years after their graduation, the chances that students with grants were employed in public interest law were about 20 percentage points higher than those who graduated with loans, who are more likely to go into corporate law. It is worth mentioning the studies by Field (2009), and Rothstein & Rouse (2011) were conducted in selected universities in the United States, making it rather difficult to generalize the impact of student loans. However, Minicozzi (2005) also found that high earnings in the first year are not associated with high-income growth rate over a more extended period.

There are also a few studies showing education loans have no effect or adverse effect on early career choices (Monks, 2001; Zhang, 2010), or wealth accumulation (Elliott, Grinstein-Weiss, & Nam, 2013; Zhan et al., 2016) of young adults in the United States. Zhang (2010) examined the impact of the total debt of target undergraduate students in the United States on graduate school enrollment and early career choices after their bachelor degree graduation by combining the Baccalaureate and Beyond 93/97 longitudinal study,

[19] Through lottery, 141 students out of 270 students was offered grants and the remaining students had to take interest-free loans.

the National Student Loan Data System (NSLDS) and self-reported debts from students. For the empirical strategy, she employed the IV model using financial aid policy as the instrument to address the endogeneity problem of the student debt and found that debts have a negative impact on graduate school enrollment but not early career choices such as earnings or employment sectors. Similarly, a study conducted in 27 colleges and universities in the United States also found that student loans appear not to influence students' occupational decisions after graduation (Monks, 2001).[20]

Outside the United States, Rau et al. (2013) examined the impact of State Guaranteed Loan (SGL)[21] program with longitudinal data in Chile. They also found that loan-recipient students earned less than those who did not benefit from the loan program. However, the results in Chile were less robust, as Rau, et al. (2013) found the impact statistically significant in the structural model, but not in the regression discontinuity model (even after restricting the sample to non-dropouts).

Slightly different from normal debt, Income-Contingent Loans (ICL) were introduced as an additional tool in students' financing mechanism. The resource providers can be public institutions or commercial banks, yet the unique characteristics of income-contingent loans are that the repayment is decided by the future income levels of the borrowers. Income-contingent loans are risk-pooling. They can help reduce loan default and smooth consumption by adjusting repayment obligation, as the future higher earners repay more while the lower earners repay less (Chapman, 2006; Woodhall, 2007). Since the 1980s, there are growing number of countries (including Australia, New Zealand, United States, United Kingdom, Indonesia, Namibia, Nepal, Mexico, and Rwanda) adopting the income-contingent loans scheme as an alternative financing option to support students. In Cambodia, the Human Capital Project, a small non-profit organization established in 2007, offers ICL

[20] The earnings in this study were measured by their career plans not actual earnings.

[21] SGL is a student loans with subsidized interest rate guaranteed by the Chilean government that the government will repay to the lenders if a student defaults.

to needy students in Battambang and Kampong Cham provinces with the condition that they pay back 10% of the earnings after their graduation and acquisition of a decent job for a number of years (Humphreys, 2015a). Since ICL is a less common type of student loans, the literature on this topic is also small.

Welch (2014), who claimed she could not find any prior study on the topic of the impact of financial aid on earnings after graduation, found that the HOPE scholarship program in Tennessee's 13 state community colleges does not have any impact on expected earnings or actual earnings after students completed their college programs.

5.4. Methodologies

Most of the empirical literature in labor economics on the link between education and individual earnings are influenced by the simple but hugely popular Mincerian earning function, that the log of wages is the function of years of schooling, years of experience and years of experience squares (Mincer, 1974).

5.4.1. Hypotheses

This study assumes the hypotheses as follows:

Hypothesis 1: *After completing their enrolled programs, students awarded the SPS on average are more likely to find jobs with decent salaries more quickly.*

Hypothesis 2: *The financial aid from the SPS program has a positive impact on the early career earnings during the first year after the expected graduation.*

There is little evidence from the previous literature to support the two hypotheses. As reviewed in the previous section, the literature on the impact of financial aid on earnings is scarce. The only study on the impact of financial aid on earnings we found is by Welch (2014). She could not find any significant impact of scholarship grants on the earnings of college graduates in her study. However, her study focuses on the community colleges in

the United States that are very different from university programs in Cambodia. In the study on the impact of student loans conducted in the Laws School by Field (2009), students with grants were used as the control group. From the study, she concluded that student loans have positive impact on earnings. In other words, grants have a negative impact on earnings. However, the sample is limited to only one laws school, and the earnings are measured by whether the graduates enter cooperate or public laws firms. In addition, apparently it is not that students awarded the grants cannot find jobs at private firms due to their performance, but it is just that they do not have pressure to repay the debts.

In the context of Cambodia, it is expected that the stipends from the SPS program help relieve the financial burden of the students, allowing them to concentrate more on their studies. Our study on the impact of financial aid on enrollment, retention, and completion also indicates strong and positive effect of the aid on the retention and completion. Moreover, in the questionnaire of the labor outcome survey conducted in 2017, students revealed the sources of incomes to cover their spending during their school life. Almost half of the students reported they worked part-time to supplement their incomes. Students of the control group depended more on part-time jobs: on average 43% of their income sources was from part-time jobs, while among the working SPS group the ratio is only about 24%. On another hand, there is also evidence that part-time experience, especially jobs related to the field of study, is positively associated with earnings (Geel & Backes-Gellner, 2012; Häkkinen, 2006). However, most of the jobs are low-paid in retails and food-service sectors. Therefore, the influences from those experience should be minimal if there is any.

5.4.2. Models

Following most of the studies on individual return to education, this study is an extension from the Mincerian earning function, which can be expressed as follows:

$$Y_i = \beta_0 + \beta_1 \text{Treatment}_i + \beta_2 \text{Graduate}_i + \beta_3 \text{X}_i + \mu_i$$

where Y_i is log hourly wage of individual i, Treatment_i is the dummy variable taking the value 1 if an individual is eligible for the SPS program, Graduate_i is the dummy variable taking the value 1 if individual i graduated from university otherwise 0, X_i is a vector of other covariates, such as sex, age, ability (examination score, language competency and computer literacy), marital status, employment sectors and locations of the workplace, and μ_i is the an error term.

A shortfall of the Mincerian earning function is the concern of endogeneity of education variable or ability bias, that individual ability is likely to positively correlate with both educational attainment and earnings (Heckman, Lochner, & Todd, 2006). Instrument variable approach can be an option to tackle this potential bias (Card, 2001). Another approach, which is also employed in this study, is to include factor(s) that can capture individuals' ability such as school grade or IQ score in the model. Furthermore, self-selection is less a problem in this study, as the stipends from the SPS program are only available for the AY 2011-2012, not the control group enrolled in 2012-2013. The two groups were identified as poor using the same PMT method and poverty questionnaires for the poverty ranking.

Another concern in the study is the year difference between enrollment and expected year of program completion of the two groups. Therefore, the data on wages of the treatment and control group is also one year different. Although the potential difference in labor market conditions cannot be controlled for, the study adjusts the nominal wage of the control group for inflation using monthly Consumer Price Index (CPI) reported by the National Institute of Statistics (NIS). Additionally, the study employed inverse-probability weighted approach to match individuals with similar characteristics before performing the Mincerian estimator in the second stage regression to tackle the non-random assignment issues.

Survival Analysis

To answer the first research question on the early carrier outcomes, the study utilizes survival analysis, also known as time-to-event analysis. This study tracks the employment status of the treatment and control group in the first 12 months after their expected graduation. The survival function is the probability that an individual survives or, in the context of this study, is unemployed beyond time *t* after the expected graduation time, and can be expressed as follows:

The time origin is July 2015 for the treatment and July 2016 for the control, due to the fact students of the control group were expected to complete their programs one year later, and the end point is 12 months after the origin time. The event of the survival analysis is not limited to death but can be any event of interests such as marriage, loan default or technology adoption (Cox & Oakes, 1984; Nikulin & Wu, 2016). The event of interest in this study is when an individual student gets a job with a monthly salary higher than the minimum wage of US$ 170 and US$255.

It is recommended to start the survival analysis from the nonparametric estimates to graphically describe the event with the survival curves (Hancock, Maher, Costa, & Williams, 2014). There are several methods, which yield similar results, to plot the curves of survival function or time-to-event. In this study, we employ the Kaplan-Meiser curve as the nonparametric estimator.

$$\mathrm{S}(t_j) = \prod_{j=1}^{t} \frac{n_j - d_j}{n_j}$$

where n_j is number of observations at risk (those who are still unemployed and in the sample) at time *t*; and d_j is the number of events at time *t*.

For the parametric estimation, with which we can control for variables that are likely to influence the outcomes, we utilize the widely used Cox proportional hazard model to assess the effect of predictors on time-to-event. It can be expressed as follows:

$$h_i(t|\, x_i) = h_0(t)\, \exp(x_i\, \beta)$$

where $h_i(t|\ x_i)$ is the hazard function of individual i conditional on covariate x_i, $h_0(t)$ is the baseline hazard function, and β is the vector of regression coefficients. The control variables used in this parametric estimates include students' abilities and skills measured by Grade 12 examination score, English language competency and frequency of computer uses, individual characteristics (gender, age, and marital status), HEI characteristics (location, type – private or public –, enrolled program disciplines and HEI fixed effect), internship and working experiences, as well as location and type of employments.

Inverse-Probability Weighted Regression Adjustment

Similar to Chapter 4, to investigate the impact of SPS program on earnings after graduation, this study employs the inverse-probability weighted regression adjustment (IPWRA) estimators to address the selection problem in nonexperimental data. The non-randomness of treatment assignment is confirmed by the significant differences in the covariates of most variables between the two groups shown in Table 5-2. The predicted probabilities and inverse-weights are calculated based on the estimation in Chapter 4. However, in this Chapter the 2011-2102 control group is not included in the second-stage estimation due to the data availability. The control group in this Chapter is the 2012-2013 cohort's tuition waiver students.

5.4.3. Data

The primary data for this study is the labor outcome survey conducted in 2017 when both treatment and control cohorts were supposed to graduate from their enrolled HEIs. Six hundred students (300 treatment students out of 1,000 and 300 control students out of 763) were randomly selected. After the samples were selected, two local consultants were hired for the period of six months to conduct the data collection. Before conducting the survey, a pre-test was conducted in February 2017 and based on the results, the questionnaire was slightly modified. One of the concerns in collecting the employment data was the treatment and control students graduated in different years. While most of the treatment students

completed their study by late 2015, the control group did so one year later. To obtain comparable information, we asked about the employment situation between July 2015 and June 2016 for the treatment group, and for the control group, we asked about their situation between July 2016 and June 2017. In addition to the employment status and monthly wage in the 12 month period, we collected more detailed earning information including the level of job satisfaction, working hours, and in-cash and in-kind incomes in the third and ninth months after the expected graduation. The in-kind incomes include benefits such as transportation fees, telephone fees, food, and accommodations.

Since after graduation, students were scattered across the country,[22] the survey was conducted through telephone interviews. We first started the survey with the treatment group from April 19, 2017, to June 10, 2017. Then we needed to collect the control group's employment status in the 12-month period by June 2017. Therefore, we started collecting the data from the control group in the second round between the period of June 25, 2017, and October 04, 2017. However, as expected we could not track not all students through telephone calls. As the results, the two consultants and staff at the Department of Higher Education were required to travel to the students' hometowns to conduct face-to-face interviews. Two missions were organized in attempt to gather the labor outcome information. When the team was not able to find the students at their hometowns, parents or siblings of the students were interviewed. In the end, we still could not find 32 students (5.33%) by any means, and needed to replace them with new students. To ensure the accuracy of the information, we also cross-checked the results by calling some interviewees after the completion of the data collection.

In addition to the labor outcome survey, two other separate sets of data—from the poverty questionnaire and the Grade 12 national examination result database—were also used for the analysis. The former data set, used to construct the poverty score based on

[22] The survey also found that 12 former students had moved to work or study in other countries. These students are not included in the earnings estimates.

which scholarships were offered, were collected before the Grade 12 National Examination in 2011 and 2012 for the 2011-12 and 2012-13 cohorts respectively. Variables from the poverty questionnaires, such as individual and family characteristics and household possessions, were used to predict the likelihood of being an SPS recipient in the treatment model, the first stage of the IPWRA. Since it is known that ability is very likely to affect the wage, the national examination scores of individual students are used as a proxy for individual ability in the outcome models.

Description of the Sample

Table 5-2 reports the summary statistics of key variables separately for the SPS and control groups alongside the difference in mean between the two groups. Simple t-tests of mean difference indicate that there is little difference in types of employer among the two groups. The simple t-tests show the gaps in earnings between the two groups are statistically different both in the third and ninth months. The box plots in Figure 4.2 indicate that female are likely to earn less than males, in particular among the non-graduate groups.

Table 5-2 Summary Statistics

Variables	SPS		Control		Min	Max	Difference
	Obs.	Mean	Obs.	Mean			
Male	300	0.49	300	0.48	0	1	0.01
Age	300	25.47	300	25.18	21	31	0.29 **
Single	300	0.76	300	0.78	0	1	-0.03
Grade 12 Examination (Grade E is the Base Group)							
- Grade C and B	300	0.34	300	0.50	0	1	-0.16 ***
- Grade D	300	0.18	300	0.21	0	1	-0.03
Father's Education	300	2.43	300	2.45	0	15	-0.02
Mother's Education	300	1.84	300	1.97	0	14	-0.13
Graduated Member	300	0.28	300	0.56	0	1	-0.28 ***
HEI in Phnom Penh	300	0.81	300	0.74	0	1	0.07 **
Private HEI	300	0.85	300	0.86	0	1	-0.01
Discipline (Humanities and Others is the Base Group)							
- Business Related	300	0.27	300	0.26	0	1	0.02

Variables	SPS		Control		Min	Max	Difference
	Obs.	Mean	Obs.	Mean			
- Science	300	0.28	300	0.21	0	1	0.07 *
- Social Science	300	0.26	300	0.22	0	1	0.03
English language	300	36.73	300	30.93	0	100	5.80 **
Computer Skill	300	0.63	300	0.61	0	1	0.02
Graduate	300	0.81	300	0.65	0	1	0.17 ***
Double Program	300	0.16	300	0.38	0	1	-0.22 ***
Experience	253	1.63	240	1.99	0.17	5.67	-0.35 ***
Experience Square	253	4.02	240	5.80	0.03	32.11	-1.78 ***
Intern or Volunteer							
- Private	253	0.19	240	0.13	0	1	0.06 *
- NGO	253	0.21	240	0.18	0	1	0.03
Work in Phnom Penh	253	0.66	240	0.57	0	1	0.09 ***
Employer Type (Self-employed and Others is the Base Group)							
- Private Enterprise	253	0.54	240	0.53	0	1	0.01
- Public Sector	253	0.11	240	0.17	0	1	-0.06 *
- NGO	253	0.08	240	0.13	0	1	-0.04
Ln Total Wage in the 9th Month	253	5.44	240	5.42	3.95	6.74	0.10 **
Ln Cash Wage in the 9th Month	253	5.37	240	5.35	3.91	6.74	0.10 ***
Job Match in the 9th Month	253	2.97	240	3.22	1	5	-0.25 *
Ln Total Wage in the 3rd Month	230	5.31	209	5.23	3.43	6.81	0.13 ***
Ln Cash Wage in the 3rd Month	230	5.24	209	5.17	3.43	6.71	0.12 ***
Job Match in the 3rd Month	230	2.98	209	3.25	1	5	0.27 *

Source: Created by the author based on the labor outcome survey 2017
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

The ratio of wage earners and non-wage earners is shown in Table 5-3. Overall the proportion of salaried worker in the treatment group is slightly higher than the control group. However, this gap is less obvious than the comparison between the graduates and non-graduates. In the ninth month after graduation, only 9% of the graduates from the treatment group is either non-wage earner or unemployed; however, among their non-graduate peers, the rate is nearly three-time higher standing at 26%.

Table 5-3 Percentage of Non-Wage and Wage Earners

	3rd Month			9th Month		
	Non-Wage	Wage Earner	Obs.	Non-Wage	Wage Earner	Obs.
Treatment	**18%**	**82%**	**290**	**12%**	**88%**	289
- Graduate	15%	85%	240	9%	91%	239
- Non-Graduate	28%	72%	50	26%	74%	50
Control	**23%**	**77%**	**290**	**14%**	**86%**	290
- Graduate	24%	76%	190	11%	89%	190
- Non-Graduate	20%	80%	100	21%	79%	100
Grand Total	**28%**	**72%**	**580**	**16%**	**84%**	**579**

Source: Created by the author based on the labor outcome survey 2017
* Students and those are not looking for jobs also included the non-wage earner category.
** Those who earn US$ 1,000 or higher per month are excluded from the sample.

Figure 5-3 Kdensity Plots of Incomes by Treatment Status

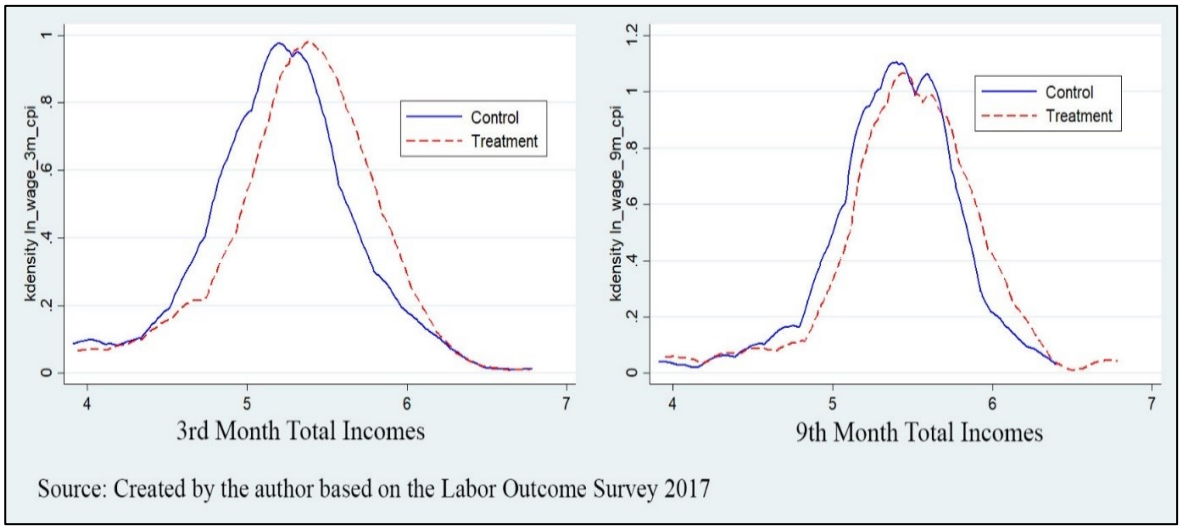
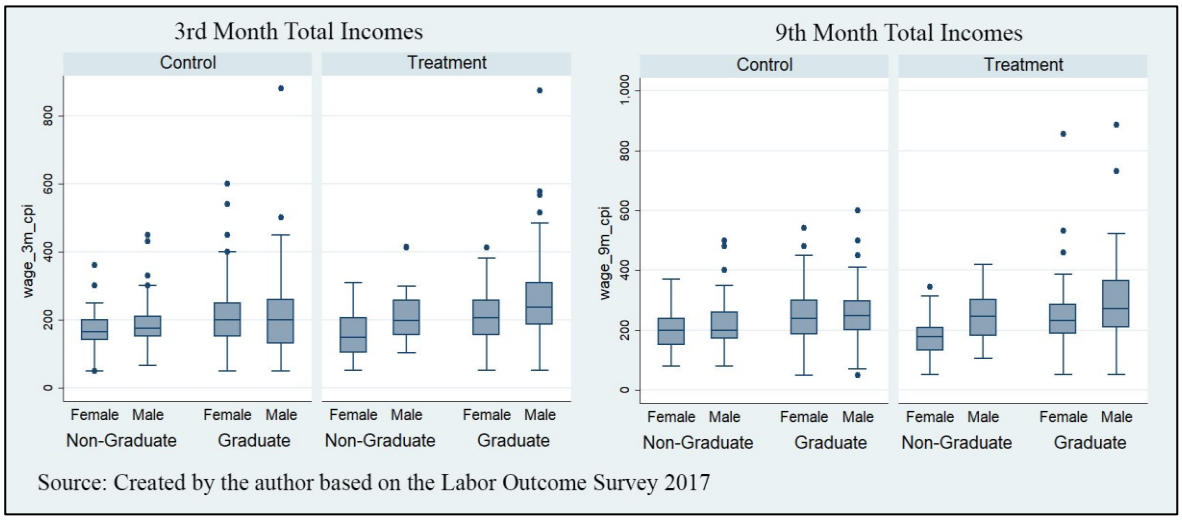


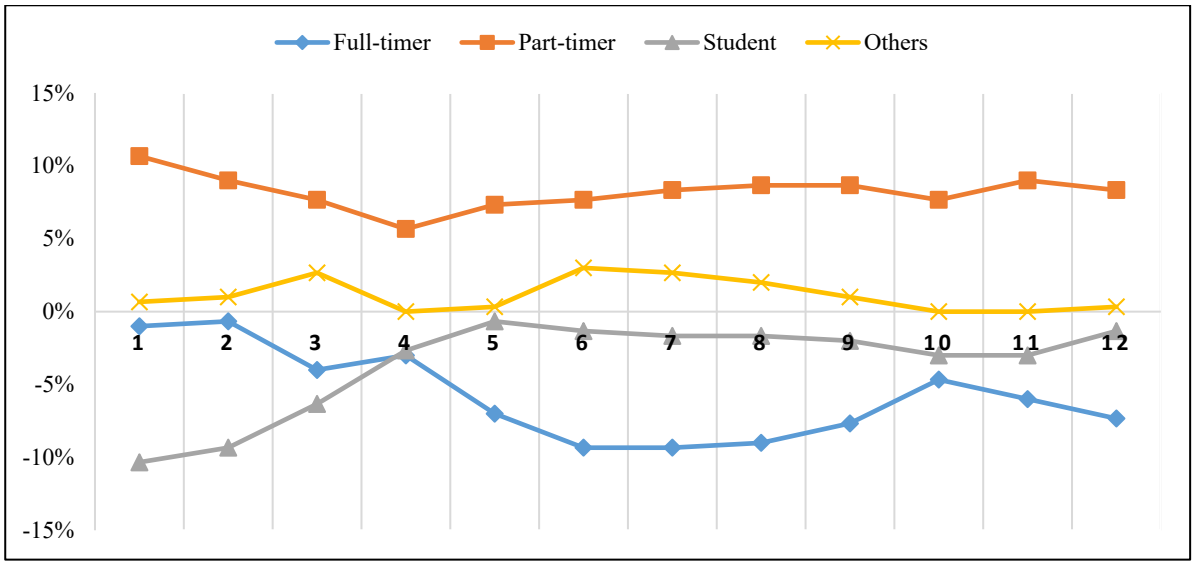
Figure 5-4 Box Plots of Incomes by Treatment Status, Gender and Graduation Status



Source: Created by the author based on the Labor Outcome Survey 2017

Employment status is categorized as full-timer, part-timer, student, and others (for those who are unemployed, not looking for a job, and other occupations that are unable to be classified under the first three categories). Overall, during the 12-month period, the SPS group has higher rates of being employed as a part-timer, and fewer of them are employed as full-timers. Figure 5-5 also suggests that more students of the control group cannot finish their program in four years and are still enrolled university during the period.

Figure 5-5 Difference in Employment Status between the SPS and Control Group

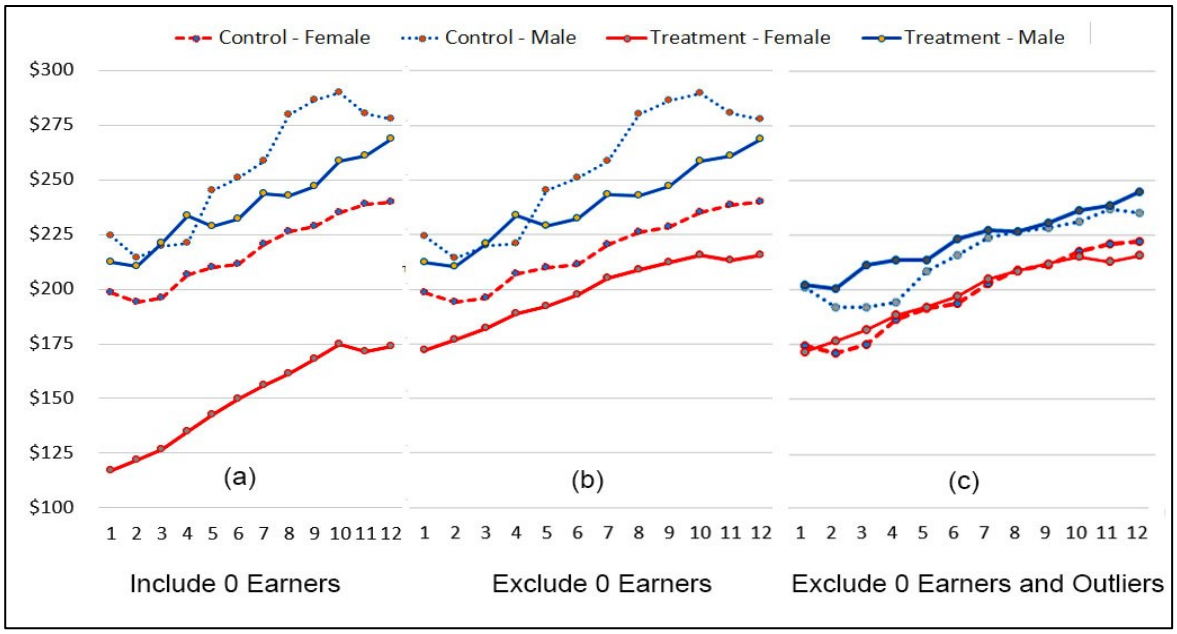


Source: Created by the author based on the Labor Outcome Survey 2017

Figure 5-6 shows the increasing trend in average monthly in-cash earnings for both groups and genders. However, as seen in column (a) and (b) of Figure 5-6, the control group, on average, seems to have higher monthly incomes than the treatment group. During the tracking period, there are a small number of former students working overseas such as in Korea, Thailand, and Japan whose incomes are very high. After excluding those who earn more than US$ 1,000 and zero earners from the sample, the treatment group, on average, appears to earn slightly more than the control group. In this study, the zero earners and outliers (>=1000 earners) are excluded from the estimations.

The result from the labor outcome survey as seen in Table 5-4 indicates that the control groups have a higher rate of unemployment or economic inactivity. This can be partially explained by the Figure 5-5 that students of the control are more likely to be still enrolled in HEIs during the period. Although the majority of both groups work as employees, we notice that students of SPS program are more likely to be self-employed or employed by their household members. Out of 300, 68% of SPS and 58% of control students work for private enterprises.

Figure 5-6 Average In-cash Monthly Earnings in the First 12 months (Unadjusted)



Source: Created by the author based on the Labor Outcome Survey 2017

Table 5-4 Employment by Type of Employer after Graduation

	SPS			Control		
	Male	Female	All	Male	Female	All
Employee	**88%**	**87%**	**88%**	**82%**	**84%**	**83%**
- Private Enterprise	70%	66%	68%	60%	57%	58%
- Government Sector	11%	14%	13%	14%	15%	14%
- NGO and Others	8%	6%	7%	8%	13%	10%
Self-employed or Work for Families	**8%**	**8%**	**8%**	**3%**	**4%**	**4%**
Unemployed or Economically Inactive	**3%**	**5%**	**4%**	**15%**	**12%**	**13%**
Observations	146	154	300	143	157	300

Source: Created by the author based on the labor outcome survey 2017

Table 5-5 further classifies the economic activities by sector and sub-sector using the International Standard Industrial Classification (ISIC) and also restricts the sample to graduate and non-graduate sub-samples. In the service sector, working in education and financial sub-sectors as well as with Non-Government Organizations (NGOs) (Q. Human health and social work activities) seems to be the most popular among students of both groups. The control group has a higher proportion of individuals employed in the manufacturing sector, in particular for those who fail to graduate from their enrolled programs.

Table 5-5 Economic Activities of the Sample by ISIC Classification

Economic Activities	SPS			Control		
	Non Grad.	Grad.	Sub-Total	Non Grad.	Grad.	Sub-Total
Agriculture Sector (Primary)						
A- Agriculture, forestry and fishing	9%	5%	6%	1%	2%	1%
Industrial Sector (Secondary)						
C- Manufacturing	11%	4%	5%	13%	5%	8%
D- Electricity, gas, steam and air conditioning supply	4%	2%	2%	1%	1%	1%
F- Construction	9%	2%	3%	3%	2%	2%

Economic Activities	SPS			Control		
	Non Grad.	Grad.	Sub-Total	Non Grad.	Grad.	Sub-Total
Service Sector (Tertiary)						
G- Wholesale and retail trade, repair of motor vehicles, etc.	4%	4%	4%	2%	3%	3%
H- Transportation and storage	2%	0%	1%	1%	2%	1%
I- Accommodation and food service activities	5%	7%	7%	10%	7%	8%
J- Information and communication	0%	2%	2%	1%	4%	3%
K- Financial and insurance activities	9%	12%	12%	11%	11%	11%
L- Real estate activities	0%	1%	1%	0%	2%	1%
M- Professional, scientific and technical activities	2%	11%	9%	5%	8%	7%
N- Administrative and support service activities	2%	7%	6%	2%	6%	5%
O- Public administration and defense	4%	5%	5%	4%	6%	5%
P- Education	5%	20%	17%	12%	20%	17%
Q- Human health and social work activities	13%	11%	11%	6%	16%	13%
T- Activities of households as employers	5%	6%	6%	2%	0%	1%
Students, unemployed or economically inactive	18%	0%	4%	26%	7%	14%
Obs.	56	244	300	106	194	300

Source: Created by the author based on the labor outcome survey 2017

5.5. Results

5.5.1. Impact of SPS on Early Career Paths

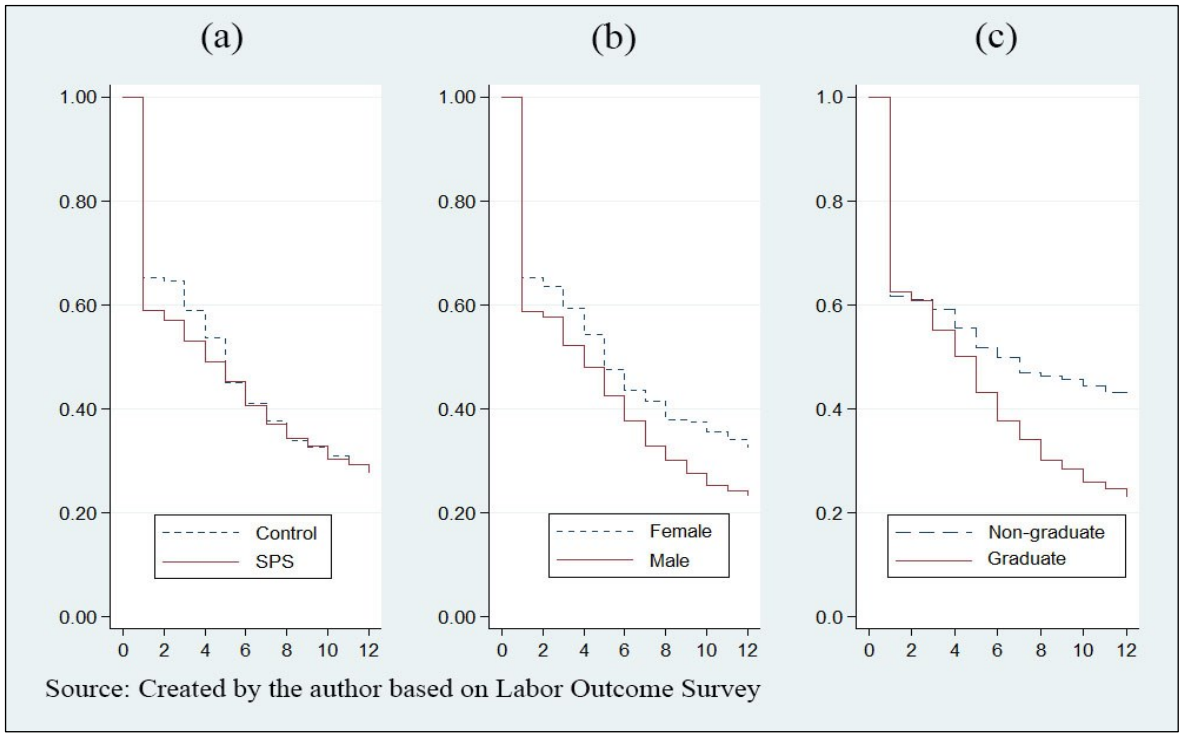
Before going to the main analysis on the impacts of SPS on early career paths and earnings, this section first presents some graphical descriptive analysis to provide a broad understanding of the labor outcomes during the 12-month period after the expected graduation time. Figure 5-7 presents the estimated results of the nonparametric survival function by treatment and control cohorts, gender, as well as by graduates and non-graduates in column (a), (b) and (c) respectively. The event of interest in this study is when an individual student gets a job with a monthly salary higher than the threshold of the minimum wage (US$ 170). The survival rate in the study is the rate that individuals of particular

groups failing to earn more than the threshold earnings. Therefore, the lower survival rate indicates the higher ratio of high earners.

The Kaplan-Meier survival probability estimator results in column (a) indicate that in the first five months, the control group has a higher survival ratio or, in other words, has a higher ratio of individuals without decent jobs (earning monthly income of US$ 170 or more). However, from the sixth month, both groups are able to secure decently paid jobs roughly at the same ratio. When the sample is separated by gender, the results in column (b) of Figure 5-7 show higher survival rate among females, meaning females are less likely to get jobs with decent salaries and the gap becomes even larger by the endpoint at the 12th month of the tracking period. The comparison of the graduate and non-graduate groups in column (c) provides a different pattern. In the beginning, the survival rates of both groups are very similar; however, as time passes the graduates have a much higher chance of earning decent salaries. By the 12th month, the difference in survival rate between the two groups is around 20 percentage points. In addition, even after the samples are restricted to those who successfully graduated from their enrolled program, the comparison results between the treatment and control and between males and females provide very similar results.

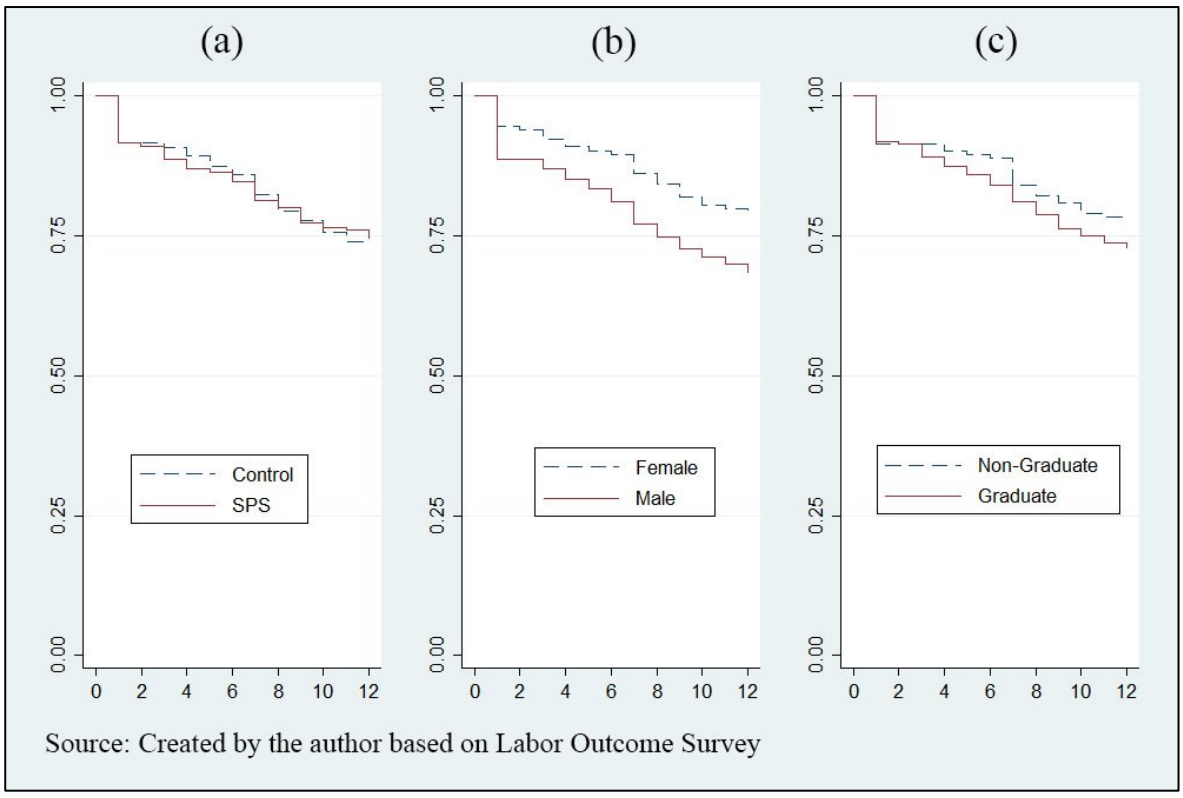
To check the robustness or sensitivity of the earning threshold, we also test the Kaplan-Meiser survival estimates with time-to-event set at US$ 255 (1.5 times the minimum wage). As expected, the survival rates increase dramatically for all groups of students. The comparison results in the columns (a) and (b) show similar trends when the threshold is set at US$ 170. However, the difference in survival rates between the graduates and non-graduates becomes much smaller when the threshold of the monthly in-cash income is increased to US$ 255.

Figure 5-7 Kaplan-Meier Survival Estimates (Probability of not getting jobs with salaries higher than US$ 170)



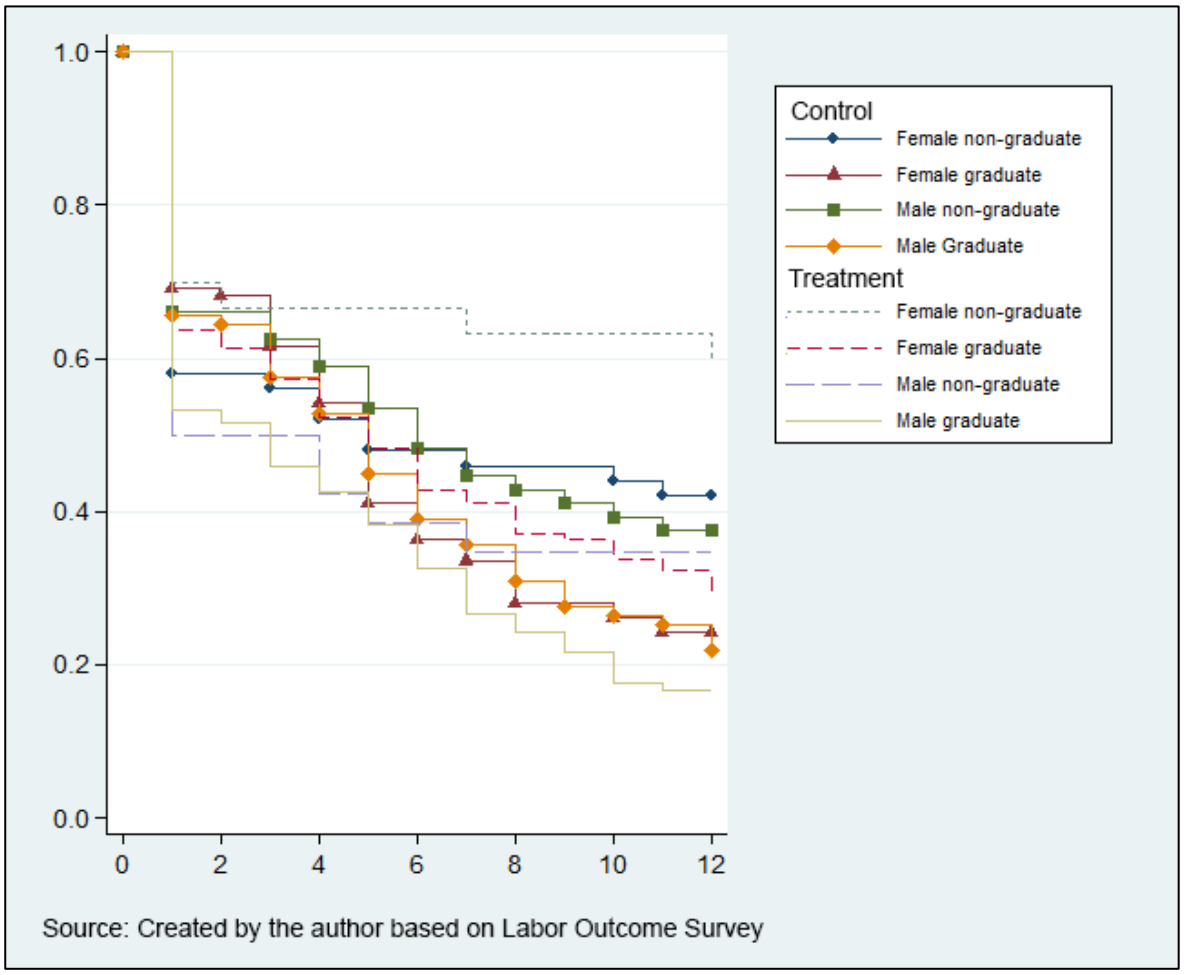
Source: Created by the author based on Labor Outcome Survey

Figure 5-8 Kaplan-Meier Survival Estimates (Probability of not getting jobs with salaries higher than US$ 255)



Source: Created by the author based on Labor Outcome Survey

Figure 5-9 Kaplan-Meier Survival Estimates in Detailed Sub-Groups (Event=US$170)



When the samples are further divided into specific sub-groups as seen in Figure 5-9, the Kaplan-Meier survival estimates reveal that female non-graduates of the SPS cohort have the highest survival rate, or lowest rate of individuals earning higher than the threshold amount, while male graduates of the SPS cohort have the highest chances of being employed with decently paid jobs. The difference in survival rate between the two groups is more than 40 percentage points, or around double. The group with the second lowest rate in obtaining good employment is female non-graduates from the control group, although the gap with female non-graduates and male graduates of the control cohort is much smaller.

Cox proportional hazard results are reported in Table 5-6 for both the unrestricted sample and graduate sub-sample, as well as graduate sub-samples by gender. After controlling for other factors, overall, it shows that financial aid appears not to be associated

with the time-to-event. In other words, financial aid does not help students get jobs with decent salaries within a shorter time. In the graduate sub-sample, the correlation is positive and significant at 10% level, but it turns insignificant when the sub-sample is further divided into male and female groups. In line with the graphical analysis, being male and graduated with a degree are found to be helpful for students to obtain decent-salary jobs in a shorter time. Those working as self-employed or employed by household members, the reference group for the types of employer, seem to have more difficulty in getting well-paid jobs in comparison to those hired in private and NGO sectors. When the event is set at US$ 255, the Cox proportional hazard yield similar results (see Appendix C.2).

Table 5-6 Cox Proportional Hazard Results (Event=US$ 170)

VARIABLES	(1) All	(2) All	(3) Graduates	(4) Graduates Male	(5) Female
SPS	0.096	0.157	0.223*	0.182	0.169
	(0.112)	(0.116)	(0.132)	(0.192)	(0.206)
Male	0.241**	0.271**	0.282**		
	(0.101)	(0.108)	(0.118)		
Age	-0.020	-0.002	-0.011	0.067	-0.102*
	(0.033)	(0.035)	(0.039)	(0.059)	(0.057)
Single	-0.150	-0.089	-0.008	-0.103	0.086
	(0.121)	(0.136)	(0.157)	(0.244)	(0.227)
Grade C and B	0.358***	0.315***	0.293**	0.272	0.234
	(0.116)	(0.122)	(0.135)	(0.202)	(0.203)
Grade D	0.182	0.318*	0.324*	0.597**	0.019
	(0.160)	(0.166)	(0.183)	(0.262)	(0.267)
Rural	-0.133	-0.158	-0.184	-0.031	-0.267
	(0.120)	(0.132)	(0.149)	(0.240)	(0.217)
Urban	-0.379**	-0.374**	-0.300	-0.208	-0.263
	(0.168)	(0.177)	(0.195)	(0.308)	(0.278)
Father Education	-0.013	-0.012	-0.007	0.005	-0.028
	(0.019)	(0.020)	(0.022)	(0.035)	(0.032)
Mother Education	-0.003	0.014	0.005	0.030	0.017
	(0.022)	(0.023)	(0.025)	(0.043)	(0.038)

VARIABLES	(1) All	(2) All	(3) Graduates	(4) Graduates Male	(5) Female
HH Member Graduate	-0.048	0.198*	0.164	-0.027	0.278
	(0.108)	(0.114)	(0.128)	(0.195)	(0.189)
HEIs in Phnom Penh	0.037	0.134	0.057	0.020	0.144
	(0.127)	(0.153)	(0.181)	(0.280)	(0.261)
Private HEIs	-0.190	-0.160	-0.073	0.216	-0.555*
	(0.148)	(0.163)	(0.195)	(0.297)	(0.297)
Major Discipline					
- Business Related	-0.029	-0.055	-0.092	0.219	-0.364
	(0.139)	(0.150)	(0.167)	(0.247)	(0.244)
- Science	-0.166	-0.052	-0.107	-0.206	0.188
	(0.143)	(0.152)	(0.172)	(0.269)	(0.248)
- Social Science	-0.204	-0.133	-0.225	-0.169	-0.203
	(0.143)	(0.151)	(0.168)	(0.253)	(0.244)
English	0.002	0.005**	0.002	0.002	0.002
	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)
Computer Skill	0.087	0.074	0.161	0.150	0.268
	(0.110)	(0.120)	(0.139)	(0.212)	(0.209)
Graduate	0.411***	0.307*			
	(0.129)	(0.157)			
Double Degree	0.265**	0.250*	0.292**	0.235	0.308
	(0.115)	(0.128)	(0.148)	(0.244)	(0.214)
Experience		0.752***	0.793***	0.784**	0.707**
		(0.173)	(0.213)	(0.332)	(0.291)
Experience Square		-0.121***	-0.128***	-0.119*	-0.102*
		(0.033)	(0.044)	(0.068)	(0.061)
Intern or Volunteer (Private)		0.079	-0.031	0.073	-0.134
		(0.145)	(0.157)	(0.218)	(0.240)
Intern or Volunteer (NGO)		-0.148	-0.232	-0.014	-0.360
		(0.143)	(0.156)	(0.227)	(0.251)
Work in Phnom Penh		-0.175	-0.218	-0.245	-0.250
		(0.135)	(0.154)	(0.233)	(0.226)
Employer Type					
- Private Sector		0.556***	0.513***	0.603**	0.469*
		(0.147)	(0.165)	(0.246)	(0.241)

VARIABLES	(1) All	(2) All	(3) Graduates	(4) Graduates Male	(5) Female
- Public Sector		0.363*	0.140	-0.095	0.216
		(0.203)	(0.240)	(0.397)	(0.322)
- NGO		0.490**	0.497**	0.782**	0.499
		(0.217)	(0.238)	(0.355)	(0.352)
Observations	600	493	388	185	203

Source: Created by the author based on the labor outcome survey 2017
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

5.5.2. Impact of SPS on Early Career Earnings

To estimate the effect of the SPS program on early career earnings, first, we begin with simple OLS estimates as shown in Table 5-7. In column (1), individual, family and HEI characteristics are controlled for in the estimation. Later working experience and graduation are added in the estimates reported in column (2) and (3)[23]. We use the third and ninth month wages to capture the earnings outcomes for the earning analysis in this study because we have more detailed earning information including in-cash and in-kind incomes as well as the level of their job satisfaction in these two months.

Holding other factors constant, experience and graduation appear not to have any relationships with earnings. A plausible explanation of the insignificant relationship between experience and earnings can be explained by the short working experiences in the early career stage. The strong association between being SPS recipients and graduation can be a reason behind the insignificant correlation between graduation and earnings. The Estimates in column (1), (2) and (3) provide similar results, although, in column (3) where experience and graduation factors are included, the magnitudes of the SPS coefficients are slightly smaller. We further separate the sample into non-graduate and graduate samples,

[23] Working experience calculated by number of working months divided by 12. The average working experience is less than two years.

and the estimation results are shown in the column (4) and (5) respectively. In all the four earning outcomes, the financial aid is found to have no significant relationship with earnings in the non-graduate sub-sample estimates. However, in the graduate sub-sample analysis, the effect of the financial aid is even larger than in the whole sample's analysis.

Table 5-7 OLS Results of SPS Effects on Earnings

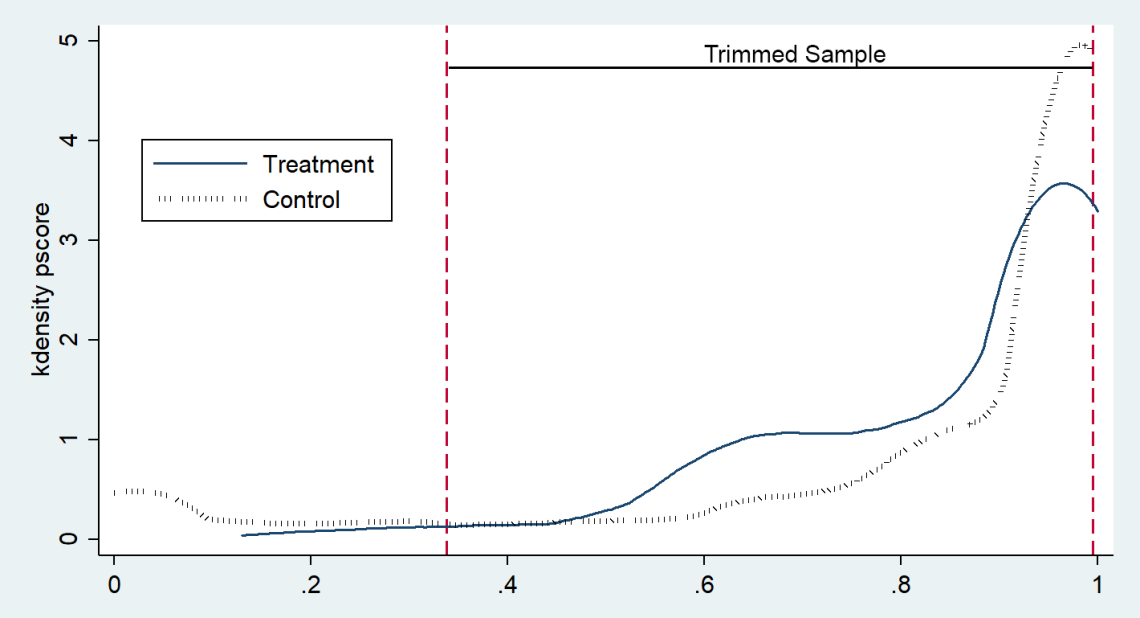
Earnings	(1) All	(2) All	(3) All	(4) Non-Grad.	(5) Grad.
Third Month (Total)	0.163***	0.166***	0.159***	0.009	0.167***
	(0.049)	(0.050)	(0.051)	(0.104)	(0.064)
Third Month (In-cash)	0.160***	0.163***	0.154***	-0.009	0.161***
	(0.048)	(0.049)	(0.050)	(0.109)	(0.062)
Ninth Month (Total)	0.148***	0.148***	0.141***	0.009	0.170***
	(0.042)	(0.043)	(0.043)	(0.091)	(0.052)
Ninth Month (In-Cash)	0.163***	0.162***	0.153***	0.034	0.169***
	(0.040)	(0.041)	(0.041)	(0.094)	(0.049)
Control Variables					
Graduate	-	-	Yes	-	-
Experience	-	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes
Family Characteristics	Yes	Yes	Yes	Yes	Yes
HEI Characteristics	Yes	Yes	Yes	Yes	Yes
HEI Fixed Effect	Yes	Yes	Yes	Yes	Yes
Obs.					
Third Month	440	440	440	99	341
Ninth Month	493	493	493	105	388

Source: Created by the author based on the labor outcome survey 2017
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

For the main analysis, the IPWRA approach discussed in the methodology section is employed. In the first stage (treatment model) of the IPWRA, the probabilities of program participation are estimated with the logistic regression model. Details of the first-stage estimation can be found in Section 4.5. Results of Chapter 4. However, unlike Chapter 4, only the untreated students from the 2012-2013 cohort are used as the control group. Figure

5-10 illustrates the distributions of predicted probabilities of being treatments for the SPS and control groups. The vertical dash lines indicate the trimmed region (0.1, 0.9) used in the weighted regressions.

Figure 5-10 Distributions of Predicted Probabilities of Treatment



The same covariates used in the OLS estimates are incorporated in the outcome models. IPWRA results from the unrestricted sample in column (1) show positive impact of the program on all earnings, except the 9th-month total income. When experience and graduation are added into the models, the program impact turns insignificant (see column (2) and (3)), although the coefficients remain positive. Similar to the OLS results, the program impact is insignificant among non-graduates and stronger among graduates. The program impact on in-cash earnings for graduates also become larger as time progresses, increasing from 15.2 percentage points in the third month to more than 25.4 percentage points in the ninth month.

Table 5-8 IPWRA Results of SPS Effects on Earnings

Earnings	(1) All	(2) All	(3) All	(4) Non-Grad.	(5) Grad.
Third Month (Total)	0.136*	0.109	0.119	-0.186	0.169*
	(0.074)	(0.076)	(0.078)	(0.169)	(0.096)
Third Month (In-cash)	0.117*	0.089	0.103	-0.148	0.152*
	(0.071)	(0.073)	(0.074)	(0.168)	(0.092)
Ninth Month (Total)	0.078	0.054	0.100	-0.057	0.223**
	(0.062)	(0.066)	(0.070)	(0.145)	(0.095)
Ninth Month (In-Cash)	0.108**	0.086	0.133**	-0.024	0.254***
	(0.053)	(0.056)	(0.061)	(0.143)	(0.085)
Control Variables					
Graduate	-	-	Yes	-	-
Experience	-	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes
Family Characteristics	Yes	Yes	Yes	Yes	Yes
HEI Characteristics	Yes	Yes	Yes	Yes	Yes
HEI Fixed Effect	Yes	Yes	Yes	Yes	Yes
Obs.					
Third Month	312	306	306	64	242
Ninth Month	340	335	335	65	270

Source: Created by the author based on the labor outcome survey 2017
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

To explore the heterogeneous effect of the SPS program, OLS and IPWRA estimates by gender are performed and reported in Table 5-9 and Table 5-10 respectively. Among males, positive program effect on earnings is found in both unrestricted samples and graduate sub-sample in the four earning outcomes recorded in the third month and ninth month. The significant and positive effect is confirmed in both the OLS and IPWRA estimates. In all models in the male sub-sample, IPWRA estimates consistently show larger magnitude of coefficients in comparison to the OLS estimates. When females are excluded from the graduate sub-sample, the impact of financial aid on earnings among male graduates

is roughly the same as in the third month and ninth month at around 33 to 37 percentage points.

The results of program impact among females are rather disappointing. Although the OLS results indicate positive associations between the SPS program and all earning outcomes among females in the ninth month, the IPWRA results show insignificant effect of the program on earnings among females in both whole and graduate samples.

Table 5-9 OLS Results of SPS Effects on Earnings by Gender

Earnings	(1)	(2)	(3)	(4)
	All		Graduates	
	Male	Female	Male	Female
Third Month (Total)	0.267***	0.089	0.241**	0.125
	(0.076)	(0.072)	(0.099)	(0.087)
Third Month (In-cash)	0.263***	0.077	0.245**	0.104
	(0.072)	(0.071)	(0.094)	(0.084)
Ninth Month (Total)	0.162**	0.113*	0.166**	0.179**
	(0.063)	(0.060)	(0.080)	(0.069)
Ninth Month (In-Cash)	0.176***	0.118**	0.184**	0.168**
	(0.060)	(0.058)	(0.077)	(0.067)
Control Variables				
Graduate	Yes	Yes	-	-
Experience	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes
Family Characteristics	Yes	Yes	Yes	Yes
HEI Characteristics	Yes	Yes	Yes	Yes
HEI Fixed Effect	Yes	Yes	Yes	Yes
Obs.				
Third Month	214	226	165	176
Ninth Month	239	254	185	203

Source: Created by the author based on the labor outcome survey 2017
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 5-10 IPWRA Results of SPS Effects on Earnings by Gender

Earnings	(1)	(2)	(3)	(4)
	All		Graduates	
	Male	Female	Male	Female
Third Month (Total)	0.363***	-0.063	0.375***	0.068
	(0.099)	(0.109)	(0.115)	(0.141)
Third Month (In-cash)	0.315***	-0.065	0.337***	0.046
	(0.100)	(0.107)	(0.112)	(0.142)
Ninth Month (Total)	0.260***	-0.030	0.369***	0.041
	(0.083)	(0.098)	(0.090)	(0.127)
Ninth Month (In-Cash)	0.221***	0.044	0.331***	0.138
	(0.079)	(0.087)	(0.083)	(0.110)
Control Variables				
Graduate	Yes	Yes	-	-
Experience	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes
Family Characteristics	Yes	Yes	Yes	Yes
HEI Characteristics	Yes	Yes	Yes	Yes
HEI Fixed Effect	Yes	Yes	Yes	Yes
Obs.				
Third Month	150	156	121	121
Ninth Month	164	171	132	138

Source: Created by the author based on the labor outcome survey 2017
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

5.6. Conclusion

The rates of return to higher education are high in developing countries; nevertheless, the rising private costs in higher education is a major constraint for students from lower-income families. There is a large literature documenting the impact of financial aid on university enrollment, retention, and completion; yet remarkably little is known about its impact on early career earnings. This paper investigates the impact of the MoEYS's Special Priority Scholarship (SPS) program on earnings of students after their expected graduation.

As discussed in the literature, only one study on the impact of student grants on earnings was found, and the results from studies on impact of student loans are inclusive. The inconsistent findings can be due to the fact that the nature of the financial aid (both grants and loans), as well as the targets (students), are different. For instance, the positive impacts of student loans in the United States found by Field (2009) and Rothstein & Rouse (2011) are from studies conducted in very selective universities. In addition, students in Field's (2009) study is limited to those majoring laws and the earning outcome is simply the binary variable whether students are employed in public or private law firms. In contrast, although it is in the same country, Monks (2001) and Zhan (2010) do not find any significant associations between student loans and earnings. They use the national dataset collected by the Federal Government with a much larger sample size.

Empirical findings from this chapter suggest that the stipend support not only increases the likelihood of university graduation but also has positive impact on earnings in the first year after the expected time of graduation. Although the survival analysis shows no clear evidence that financial aid can shorten the period in getting well-paid jobs, it indicates that being graduates is a key in securing decently paid jobs in a shorter time period. The second analysis of the impact on monthly earnings finds that financial aid has some positive effect on earnings in general, and the impact of the program effect is even clear and larger among the graduates. Also, being males are also strongly associated with higher earnings; and the sub-sample analysis by gender discovers some evidence that suggests the program affect the earnings differently by gender. The program seems to have a stronger effect on earnings among males, especially among the graduates. The impact on earnings among females is rather disappointing. Although the OLS estimates detect some positive association between the program and earnings among females, this study cannot confirm the impact of the program with the IPWRA approach. The IPWRA results show insignificant impact in all the four earning outcomes in both the whole and graduate samples.

Chapter 6. Discussion and Conclusion

6.1. Discussion

This section summarizes and discusses the findings from the empirical study in Chapter 3, Chapter 4 and Chapter 5, followed by the discussion on limitations of the empirical analysis in this study and conclusion.

6.1.1 Disparities in Access to Higher Education

The analysis in Chapter 3 reveals that disparities in accessing higher education are less noticeable when the samples are restricted to high school graduates. This suggests that the benefits from higher education expansion are relatively distributed fairly across different groups, provided they can finish upper secondary school. Household characteristics such as education level of household head and household consumption level have little influence on the university enrollment decisions among high school graduates. However, unlike most of the earlier studies on this topic, we also perform separate analysis using the unrestricted samples that include those who did not finish high schools. The results from the unrestricted sample analysis reveal more pronounced educational gaps between regions and households' characteristics. Our findings indicate that, although the university enrollment among disadvantaged groups has increased, disparities in access to higher education also become worse. This implies that students with disadvantaged backgrounds still have difficulties in finishing upper secondary schools.

Future studies can identify the education level from which children of disadvantaged backgrounds are likely to drop out their study, as well as the causes of dropping out. Appropriate public interventions need to be taken to narrow these gaps effectively. The current scholarship programs targeting students from low-income families, starting from primary to upper secondary schools, are perhaps not effective enough. There is empirical evidence showing that the need-based conditional cash transfers targeting children of low-

income families in Cambodia are ineffective in improving student learning, although it can increase school attendance (Barrera-Osorio & Filmer, 2013).

Education at public schools up to upper secondary school is free in Cambodia. However, due to the high unit cost of higher education, since the early 2000s, the Royal Government of Cambodia has allowed public universities to charge fees as a means of generating additional income to support university operational expenditures. The shift of the financial burden from the government to households is clearly an obstacle for high school graduates from low-income families who wish to further their study at universities. Statistics from the Department of Higher Education, MoEYS also show a large proportion of students from low-income families cannot finish their enrolled programs at HEIs, even after receiving tuition waiver scholarships.

6.1.2 Impact of Financial Aid on Academic Outcomes

As mentioned earlier, after being admitted to HEIs, students from poor families appear to have difficulty in surviving the four-year programs at HEIs due to financial barriers. The government introduced the SPS program in 2011 as a pilot project in an attempt to mitigate the gaps in access to higher education between the rich and the poor. In the meantime, it raises questions about how much this demand-side intervention can help high school graduates from disadvantaged backgrounds to persist and complete their enrolled programs. The literature on the impact of financial aid on academic outcomes in developing countries is scarce and studies in developed countries, in particular in the United States, provide mixed and inconsistent results. The inconsistency in findings is possibly due to the difference in targeted populations and quality of higher education institutes. In the case of the SPS program in Cambodia, our findings in Chapter 4 indicate positive and strong impact of financial support on university enrollment, retention, and on-time completion. For instance, by the fourth year, almost half of the students receiving the regular scholarships (tuition waivers only) have dropped out from their enrolled programs without a degree. However,

with the stipend support from the SPS program, the completion rate of students from low-income families rises by almost 40 percentage points.

The findings in Chapter 3 show that disparities in access to higher education among high school graduates are negligible, but the findings from Chapter 4 shows strong impact of the SPS program on enrollment, retention and university completion. This suggests that short-term financial constraints can be an obstacle for students of disadvantaged backgrounds to finish their enrolled programs. Moreover, the study also confirms the positive association between long-term financial constraints (proxied by the Grade 12 examination scores) and the enrollment and retention in early years. As reviewed in the literature section, the rate of return to higher education in Cambodia is relatively high. Therefore, the SPS program can help low-income families break the intergenerational poverty cycle.

By assessing the effects of the program by sub-group, the study finds noticeable differences in impact on enrollment, retention and on-time completion. The SPS eligibility has the highest impact on enrollment among students admitted to HEIs outside Phnom Penh, followed by students of public HEIs. After the enrollment, the stipends' impact is found to be the most effective among those attending private HEIs and HEIs located outside the capital. Only 25% of the 249 control students, awarded the tuition waiver scholarships to study in universities located outside the capital, are able to survive to the fourth year. However, with the additional stipends, the survival rate jumps to 75%. In Phnom Penh, the survival rate to the fourth year of the control group is relatively high, at 45%. The opportunities to generate extra income from part-time jobs in the capital and better quality of HEIs are possibly the reasons for higher retention rates. Moreover, the size of stipends for students enrolled in HEIs outside the capital is also smaller in comparison to those studying in Phnom Penh. Therefore, it is wiser and more cost-effective to invest in poor students enrolling in provincial areas.

6.1.3 Impact of Financial Aid on Earnings

To understand the economic impact of the SPS program intervention, this study in Chapter 5 assesses the effect of the SPS program on the duration of finding well-paid jobs and individuals' earnings during the first 12 months after graduation. Both nonparametric and parametric survival analysis fail to shed evidence that financial aid can help students shorten the period of obtaining decent salaried jobs. However, being males and having bachelor degrees seem to be keys in determining the period of finding well-paid jobs. The findings in Chapter 4 suggests that financial aid has strong impact on graduation, therefore, it is arguable that financial aid can indirectly shorten the period of getting decent jobs.

The study uses individuals' earnings (both with and without in-kind incomes) in the third and nine months to capture the early career earnings. Overall, both the OLS and IPWRA estimates yield similar results that financial aid has positive impact on earnings. The impact is more favorable among the graduates, and negative but statistically insignificant among those who withdraw from their enrolled programs. As found in Chapter 4, financial aid has a significant impact on graduation, and the summary statistics indicate that graduates are more likely to be wage earners. Therefore, the positive impact of financial aid on earnings can be partly explained by the academic benefits the SPS students gained through the stipend supports. In the graduate sub-sample analysis, the IPWRA estimates show larger coefficients in comparison to the OLS approach. It is possible that financial aid can also help less talented students finish their undergraduate programs on time, and less talented students are likely to earn less on average. In such a case, our IPWRA estimates in the graduate sub-sample can be downward bias because those less talented students are added to the treatment group.

When we further divide the sample by gender, our results indicate that the impact on earnings remains strong and statistically significant among males in both the unrestricted sample and graduate sub-sample. However, the impact on earnings among females is rather disappointing. Although the OLS results show some positive correlation between the

program treatment and earnings reported in the ninth month among females, the IPWRA estimates fail to confirm the positive impact on earnings among females. Also found in the survival analysis, female non-graduates of the treatment group seem to encounter the most difficulties in finding jobs with salaries higher than the minimum wage.

6.2. Limitation of the Study

All studies including this study contain limitations. In Chapter 3, to identify the determinants of post-secondary enrollment decisions, this study utilizes cross-sectional data with multinomial logistic regression. It is known that the supply-side factors as well cast associated with access to higher education are also very likely to influence the enrollment in higher education; however, the household survey used in this study does not provide information about these factors. Although information on distances from villages to the nearest lower and upper secondary schools are included in the village questionnaire in 2004 and 2009, this information is missing in the 2014 datasets. Another shortfall of this study is that, like many other studies on this topic, education outcome is treated as a flow variable. However, to be precise, education is rather a stock accumulated year on year. To be eligible for university enrollment, individuals need to complete upper secondary education; and lower secondary school completion is required for the transition to upper secondary school and so forth. The sequential schooling decision model can address this issue; however, a more comprehensive schooling dataset is needed for the conditional probability estimations (Cameron & Heckman, 1998; Cameron & Heckman, 2001; Sawada & Lokshin, 2009).

In Chapter 4, to assess the impact of the SPS program on university enrollment, retention, and completion, this study uses the base-line poverty survey, reported by students before taking the Grade 12 examination, to match the treatment and control. However, the verification survey conducted in 2011 indicates the tendency of students to self-report themselves as being poorer than they actually are. These measurement errors can be a source of bias in our estimation. In addition, the SPS impact estimates on the academic outcomes

are likely to be upwardly biased. According to the information obtained from the labor outcome survey in 2017, some students from the control group were uninformed about the offers of tuition waivers, and some were not able to travel from their hometowns to submit their applications on time. From the same survey, we also learned that some students decided to withdraw from their enrolled programs and change to new HEIs. In our analysis, we treat these individuals as dropout students.

There are some technical challenges in estimating the impact of the SPS program on earnings after the expected graduation in Chapter 5. Two potential biases need to be addressed: the non-randomness of the treatment assignment and sample selection issue (about 20% of the observations has no wage information). The IPWRA method used in this study can only address the first bias, but not the latter sample selection bias. Furthermore, the information on employment status and earnings of the treatment and control groups are one year different. If there are any significant differences in labor market conditions, our data cannot control for these factors. Furthermore, there is a lack of prior literature on the impact of financial aid on earnings to support our hypothesis argument, in particular for the duration of job acquisition.

6.3. Conclusion

There is a growing body of literature on access to higher education in developing countries; however, to the limits of the author's knowledge, this is the first empirical study on this topic in Cambodia. In the Cambodian context, we confirm some commonly found predictors in university enrollment, and in the meantime find some interesting patterns in Cambodia. The education level of household heads, household consumption level, and regional factors are found to be highly associated with the university enrollment of young household members in Cambodia. However, these factors play much less important role in the higher education attendance once they can finish upper secondary school.

By examining the trends in the past ten years, the expansion of higher education has allowed more people from disadvantaged backgrounds the opportunity to attend universities. However, although the enrollment rate does rise among students of disadvantaged backgrounds, inequalities in accessing higher education actually has widened in the past decade. Disparities appear to be not a major issue, provided students from disadvantaged can complete upper secondary schools. Unfortunately, students of low-income families in remote areas are more unlikely to persist and complete the 12-year general education. There are still needs for the government to continue improving the disparities in access to secondary education, such as through introducing more effective public interventions targeting those who are susceptible to dropout from the education system. Moreover, the study also finds that long-term financial constraints can be also a barrier to access to higher education and persistence after enrollments at universities.

Meanwhile, many students from low-income families also face short-term financial constraints and are unable to pursue their higher education after being admitted to universities and offered tuition waivers. To narrow the disparities in access to higher education, the government introduces the SPS as a pilot program. This study finds that the additional stipends from the SPS program are very effective in helping students with short-term financial constraints to complete their four-year undergraduate programs on time. Although the amount of stipends is smaller for those enrolled in HEIs located outside Phnom Penh capital, the study finds that the program impact is higher among students who enroll in HEIs outside the capital. Therefore targeting this group of student would be much more cost-effective. It is worthwhile to mention that the control group in this study is the students with tuition-waiver scholarships. Therefore, the results from this study cannot conclude whether the SPS is more cost-effective or efficient than the regular tuition-waiver scholarships. Assessing the impact or effectiveness of the tuition-waiver scholarships is beyond the scope of this study.

The analysis of the SPS impact shows positive effect of the program on individuals' earnings after the expected graduation, especially among the graduates. Using the private returns to education as the benefits from the investment, the cost-benefit analysis suggests that it takes less than seven years to recover the investment costs. In addition, it is also known that higher education investment is associated with positive externalities which are not included in the benefit estimation. The positive return on investment found in this study provides some thoughts for the policy discussions on public interventions to reduce the disparities in educational attainment. However, there are many alternatives or interventions that can alleviate the disparities. Therefore, in order to make well-informed decisions, it is important to assess other alternatives that share similar objectives. Furthermore, as found in Chapter 3, children from disadvantaged backgrounds still have difficulties in finishing high schools. Coupled with the problem, without the SPS program, many talented students from low-income families would not be able to fully exert their potentials and bring their families out of poverty cycles.

If the program is to be continued and expanded, the government should place a higher priority on students who intend to enroll in HEIs outside the capital. In addition to the favorable impact of the SPS program on academic outcomes among this group of students, it also costs less. The strong impact of the program on enrollment and completion is probably due to fewer opportunities for students outside the capital to find part-time jobs to generate additional incomes to support their livings.

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Appendix A.1. Results of Multinomial Logistic Regression Coefficients

Table C-1. Results of Multinomial Logistic Regression Coefficients

VARIABLES	(1)	(2)	(3)	(4)
	All		Sub-Sample	
	TVET	University	TVET	University
Male	0.168	0.356***	-0.140	0.267***
	(0.156)	(0.062)	(0.178)	(0.090)
Adult Member	0.088*	0.189***	-0.040	0.056*
	(0.052)	(0.021)	(0.063)	(0.032)
Child Member	-0.241***	-0.242***	-0.044	-0.030
	(0.064)	(0.025)	(0.073)	(0.036)
No Parent	-0.946***	-1.115***	-0.246	-0.444***
	(0.238)	(0.106)	(0.280)	(0.157)
Head Gender	-0.259	-0.251***	0.054	-0.113
	(0.206)	(0.083)	(0.236)	(0.122)
Head Education (Base: Lower Secondary)				
- No Education	-1.283***	-0.946***	0.049	0.189
	(0.364)	(0.124)	(0.404)	(0.187)
- Primary	-0.727***	-0.488***	-0.160	0.036
	(0.212)	(0.080)	(0.234)	(0.113)
- Upper Secondary	0.538**	0.545***	0.293	0.263*
	(0.222)	(0.100)	(0.255)	(0.143)
- Post-secondary	0.863***	1.215***	0.322	0.656***
	(0.239)	(0.103)	(0.274)	(0.147)
Consumption Quintile (Base: Q3)				
- Q 1 (Poorest)	-1.238*	-1.015***	-0.579	-0.327
	(0.636)	(0.166)	(0.674)	(0.230)
- Q 2	-0.420	-0.631***	-0.350	-0.490***
	(0.440)	(0.134)	(0.470)	(0.178)
- Q 4	0.586*	0.598***	0.206	0.255*
	(0.311)	(0.098)	(0.338)	(0.139)
- Q 5 (Richest)	1.232***	1.019***	0.562*	0.606***
	(0.291)	(0.093)	(0.320)	(0.136)
Region (Base: Rural)				
- Other Urban	0.228	0.466***	-0.345	0.002
	(0.262)	(0.094)	(0.282)	(0.135)
- PNH Urban	1.310***	1.284***	0.336	0.690***
	(0.223)	(0.088)	(0.239)	(0.131)
- Distance to Province	-0.004	-0.004**	0.004	0.002
	(0.004)	(0.002)	(0.004)	(0.002)
Year (Base: 2004)				
- 2009	-0.569***	0.902***	-1.375***	0.224
	(0.185)	(0.091)	(0.216)	(0.140)
- 2014	-1.053***	1.905***	-2.496***	0.651***
	(0.242)	(0.085)	(0.270)	(0.133)
Constant	-4.352***	-4.137***	-0.570	-0.724***
	(0.452)	(0.180)	(0.513)	(0.268)
Observations	19,965	19,965	2,623	2,623

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table C-2. Results of Multinomial Logistic Coefficients by Year (Total Sample)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	2004		2009		2014	
	TVET	University	TVET	University	TVET	University
Male	0.379*	0.485***	0.029	0.410***	-0.415	0.296***
	(0.204)	(0.150)	(0.312)	(0.119)	(0.451)	(0.082)
Adult Member	-0.010	0.150***	0.196*	0.192***	0.269*	0.188***
	(0.071)	(0.048)	(0.102)	(0.037)	(0.157)	(0.031)
Child Member	-0.248***	-0.236***	-0.179	-0.200***	-0.188	-0.242***
	(0.085)	(0.059)	(0.124)	(0.047)	(0.189)	(0.035)
No Parent	-0.580**	-0.618***	-15.704	-1.420***	-0.407	-1.223***
	(0.277)	(0.206)	(680.834)	(0.199)	(0.660)	(0.160)
Head Gender	-0.721***	-0.320*	1.913*	-0.318*	1.126	-0.222**
	(0.240)	(0.191)	(1.028)	(0.164)	(1.050)	(0.111)
Head Education (Base: Lower Secondary)						
- No Education	-1.376***	-1.331***	-1.193	-1.304***	-0.986	-0.737***
	(0.479)	(0.384)	(0.775)	(0.263)	(0.831)	(0.155)
- Primary	-0.790***	-0.417**	-0.551	-0.621***	-1.178**	-0.422***
	(0.290)	(0.206)	(0.377)	(0.148)	(0.600)	(0.107)
- Upper Secondary	0.908***	0.773***	0.276	0.308*	-14.847	0.583***
	(0.277)	(0.216)	(0.474)	(0.186)	(1,101)	(0.142)
- Post-secondary	0.767**	1.273***	0.544	1.131***	1.483***	1.219***
	(0.317)	(0.222)	(0.588)	(0.208)	(0.551)	(0.139)
Consumption Quintile (Base: Q3)						
- Q 1 (Poorest)	-1.640	-0.095	-1.223	-1.309***	-1.061	-1.210***
	(1.074)	(0.578)	(1.101)	(0.451)	(1.170)	(0.191)
- Q 2	-0.699	0.299	-0.307	-0.968***	-0.545	-0.732***
	(0.698)	(0.508)	(0.736)	(0.368)	(0.924)	(0.152)
- Q 4	0.542	0.988**	0.374	0.773***	0.600	0.581***
	(0.446)	(0.399)	(0.567)	(0.213)	(0.742)	(0.118)
- Q 5 (Richest)	0.984**	1.703***	1.355***	1.453***	1.150*	0.548***
	(0.429)	(0.381)	(0.518)	(0.205)	(0.668)	(0.115)
Region (Base: Rural)						
- Other Urban	-0.323	0.511**	0.628	0.459**	0.558	0.451***
	(0.410)	(0.257)	(0.439)	(0.184)	(0.643)	(0.125)
- PNH Urban	1.879***	1.994***	0.377	1.174***	0.155	0.906***
	(0.302)	(0.224)	(0.491)	(0.179)	(0.696)	(0.118)
	-0.011*	-0.011**	-0.011	-0.008**	0.015**	-0.001
	(0.006)	(0.005)	(0.009)	(0.003)	(0.008)	(0.002)
Constant	-3.690***	-4.961***	-6.876***	-3.267***	-7.384***	-2.029***
	(0.610)	(0.512)	(1.263)	(0.327)	(1.423)	(0.215)
Observations	8,279	8,279	6,212	6,212	5,474	5,474
Pseudo R2	0.333	0.333	0.296	0.296	0.222	0.222

Standard errors in parentheses

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

Table C-3. Results of Multinomial Logistic Coefficients by Year (Sub-Sample)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	2004		2009		2014	
	TVET	University	TVET	University	TVET	University
Male	-0.467*	-0.385	0.110	0.432**	-0.443	0.394***
	(0.281)	(0.239)	(0.350)	(0.182)	(0.467)	(0.121)
Adult Member	-0.156	0.061	0.107	0.108*	0.133	0.033
	(0.099)	(0.079)	(0.117)	(0.060)	(0.172)	(0.048)
Child Member	-0.093	-0.078	-0.008	-0.010	0.073	-0.006
	(0.113)	(0.091)	(0.132)	(0.069)	(0.184)	(0.052)
No Parent	0.567	0.461	-13.713	-0.825***	0.355	-0.740***
	(0.414)	(0.364)	(382.485)	(0.307)	(0.703)	(0.226)
Head Gender	-0.140	0.230	1.871*	-0.296	1.318	-0.154
	(0.332)	(0.292)	(1.051)	(0.251)	(1.065)	(0.166)
Head Education (Base: Lower Secondary)						
- No Education	0.061	0.170	-0.174	-0.428	0.312	0.561**
	(0.627)	(0.547)	(0.832)	(0.372)	(0.875)	(0.254)
- Primary	-0.016	0.414	-0.256	-0.259	-0.651	0.142
	(0.367)	(0.300)	(0.407)	(0.215)	(0.618)	(0.155)
- Upper Secondary	1.077***	0.897***	-0.108	-0.096	-14.240	0.285
	(0.389)	(0.341)	(0.518)	(0.279)	(680.273)	(0.198)
- Post-secondary	0.052	0.595*	0.191	0.742**	0.856	0.722***
	(0.406)	(0.330)	(0.656)	(0.350)	(0.579)	(0.194)
Consumption Quintile (Base: Q3)						
- Q 1 (Poorest)	-1.229	0.356	-0.067	-0.327	-0.342	-0.579**
	(1.214)	(0.822)	(1.167)	(0.572)	(1.192)	(0.275)
- Q 2	-0.550	0.690	-0.372	-1.030**	-0.395	-0.534**
	(0.856)	(0.697)	(0.777)	(0.430)	(0.944)	(0.215)
- Q 4	0.149	0.784	-0.073	0.328	0.297	0.287
	(0.562)	(0.517)	(0.603)	(0.284)	(0.761)	(0.176)
- Q 5 (Richest)	0.115	1.053**	1.017*	1.143***	0.930	0.300*
	(0.524)	(0.479)	(0.574)	(0.290)	(0.686)	(0.172)
Region (Base: Rural)						
- Other Urban	-1.211***	-0.251	0.058	0.010	0.253	0.046
	(0.463)	(0.338)	(0.495)	(0.265)	(0.677)	(0.188)
- PNH Urban	0.653*	0.810***	0.102	0.859***	-0.307	0.472***
	(0.339)	(0.289)	(0.554)	(0.283)	(0.720)	(0.180)
Distance to Province	-0.004	-0.006	-0.002	-0.000	0.022***	0.006*
	(0.005)	(0.004)	(0.010)	(0.005)	(0.008)	(0.003)
Constant	0.494	-1.218*	-4.213***	-0.690	-5.525***	-0.012
	(0.786)	(0.703)	(1.312)	(0.471)	(1.467)	(0.327)
Observations	506	506	716	716	1,401	1,401
LR chi2 1106.78	83.35	83.35	158.53	158.53	110.54	110.54
Prob > chi2 <0.0001	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo	0.079	0.079	1.129	1.129	0.057	0.057

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix B.1. Poverty Questionnaire

1. Father Deceased Alive Age

2. Mother Deceased Alive Age

3. Father's education

4. Mother's education

Education code:

90. No education	*0. Pre-school*	*1 to 12 (Grade 1 to Grade 12)*
13. LLS graduate	*14. USS graduate*	*15. TVET (Lower)*
16. TVET (Upper)	*17. Associate degree*	*18. Bachelor's degree*
19. Master	*20. Ph.D.*	

5. Father's occupation

6. Mother's occupation

Occupation code:

1. Civil Servant	*2. State Company Employee.*	*3. Private Company*
4. Seller	*5.International NGO*	*6. Local NGO*
7. Farmer	*8. Farmer without land*	*9. Domestic worker*
10. Others	*90. Jobless*	*91. Retiree*

7. Number of Household members

8. Number of children age under 14

9. Drinking water Source

1. Water tank	*2. Piped water*	*3. Pumped well*
4. Hand well	*5. Hand well (without protection)*	*6. Pond, lake, river*
7. Rain water	*8. Purchased water*	*9. Others*

10. Source of light

1. Electricity	*2. Generator*	*3. Battery*
4. Lamp	*5. Kindle*	*6. Others*

11. Number of rooms

12. Wall of the house

1. Bamboo *2. Wood block* *3. Plywood* *4. Cement, brick*

5. Zinc *6. Fiber Cement* *7. Recycled materials* *8. Others*

13. Roof of the house

1. Thatching *2. Tile* *3. Fiber Cement*

4. Zinc *5. Recycled materials* *6. Mixed but the majority is zinc, tile and fiber cement*

7. Mixed but the majority is recycled material and thatch

8. Cement *9. PVC plastic* *10. Others*

14. Floor of the house

1. Dirt *2. Wood, bamboo* *3. Cement* *4. Luxurious wood*

5. Marble tile *6. Plastic* *7. Ceramic tile* *8. Others*

15. Toilet

1. Toilet connected to sewage *2. Flush toilet* *3. No-flush toilet*

4. Manual flush toilet *5. Public toilet* *6. Shared toilet*

7. Others *8. No toilet*

16 Cooking Fuel

1. Firewood *2. Charcoal* *3. Firewood and charcoal* *4. Gas*

5. Kerosene. *6. Public electricity* *7. Gas and electricity*

8. Generator *9. Don't cook* *10. Others*

17. Does your house have cell phone? Yes No

18. Does your house have TV? Yes No

19. Does your house have VCD? Yes No

20. Does your house have motorcycle? Yes No

21. Does your house have car, van, truck? Yes No

22. Does your house have pig or cow? Yes No

23. Does your house have cart? Yes No

24. Is there Upper Secondary School in the village Yes No

25. Is there food shop in the village Yes No

26. How far is the communal Health Center from the house Km

27. How far is the public phone from house Km

28. Is there access to GAS as energy source in the village Yes No

29. Does your HH receive any remittance? Yes No

Appendix B.2. SPS Impact on Academic Outcomes (IPWRA Full Results)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	enroll	retain11	retain22	retain33	retain44	complete2
SPS	0.454***	0.536***	0.538***	0.395***	0.420***	0.398***
	(0.072)	(0.079)	(0.081)	(0.077)	(0.077)	(0.077)
AY 2012	0.340***	0.312***	0.251**	0.065	0.009	-0.007
	(0.086)	(0.094)	(0.099)	(0.092)	(0.091)	(0.092)
Male	-0.008	-0.004	-0.055	-0.002	-0.003	-0.013
	(0.060)	(0.066)	(0.066)	(0.065)	(0.065)	(0.065)
Age	0.034**	0.016	0.006	-0.021	-0.017	-0.019
	(0.015)	(0.018)	(0.018)	(0.017)	(0.018)	(0.018)
Region						
- Rural	0.032	-0.003	-0.057	-0.115*	-0.131*	-0.132*
	(0.067)	(0.072)	(0.072)	(0.069)	(0.068)	(0.069)
- Urban	0.025	0.112	-0.002	-0.040	-0.046	-0.078
	(0.096)	(0.095)	(0.105)	(0.101)	(0.099)	(0.100)
Percentile Rank	0.003**	0.003**	0.003**	0.002*	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HEI in Phnom Penh	0.127	-0.071	-0.113	0.186*	0.171*	0.184*
	(0.092)	(0.110)	(0.107)	(0.097)	(0.103)	(0.106)
Public HEI	0.087	0.121	0.150	-0.044	-0.071	-0.051
	(0.092)	(0.116)	(0.115)	(0.112)	(0.121)	(0.125)
Ln Tuition Fee	-0.005	0.196	0.238*	0.049	-0.029	-0.073
	(0.118)	(0.133)	(0.129)	(0.142)	(0.161)	(0.169)
Parent Alive	0.236*	0.058	0.004	-0.087	-0.140	-0.154
	(0.131)	(0.149)	(0.157)	(0.162)	(0.165)	(0.165)
Father Education	-0.017	-0.033***	-0.026**	-0.029**	-0.024**	-0.024**
	(0.012)	(0.012)	(0.013)	(0.012)	(0.011)	(0.011)
Mother Education	0.016	0.030**	0.029*	0.030*	0.033**	0.034**
	(0.014)	(0.015)	(0.016)	(0.015)	(0.016)	(0.015)
Father Occupation (Base Groups is farmer with land)						
- No Job	-0.038	-0.019	-0.044	0.021	0.076	0.099
	(0.103)	(0.110)	(0.107)	(0.102)	(0.104)	(0.103)
- Employee	-0.095	0.189	-0.202*	-0.199*	-0.188*	-0.153
	(0.214)	(0.253)	(0.117)	(0.107)	(0.105)	(0.107)

- Farmer with Land	-0.043	-0.115	-0.121	-0.148	-0.152	-0.085
	(0.111)	(0.134)	(0.138)	(0.125)	(0.124)	(0.126)
- Other Jobs	-0.217	-0.116	-0.218	-0.183	-0.121	-0.078
	(0.142)	(0.146)	(0.149)	(0.149)	(0.148)	(0.145)
Mother Occupation (Base Groups is farmer with land)						
- No Job	0.132	0.187	0.139	0.059	-0.003	-0.055
	(0.114)	(0.125)	(0.127)	(0.120)	(0.138)	(0.156)
- Employee	-0.074	0.051	-0.033	-0.025	-0.093	-0.109
	(0.121)	(0.126)	(0.128)	(0.124)	(0.142)	(0.158)
- Farmer with Land	0.007	0.229*	0.145	0.199	0.103	0.010
	(0.112)	(0.128)	(0.132)	(0.123)	(0.142)	(0.162)
- Other Jobs	0.157	0.385***	0.192	0.118	0.003	-0.043
	(0.115)	(0.122)	(0.135)	(0.134)	(0.154)	(0.171)
Total Member	0.019	0.032	0.037	0.011	0.020	0.017
	(0.022)	(0.025)	(0.026)	(0.026)	(0.026)	(0.026)
Children under 14	-0.038*	-0.041*	-0.030	-0.030	-0.017	-0.020
	(0.020)	(0.023)	(0.023)	(0.023)	(0.022)	(0.023)
Welfare Score	-0.000	0.001	0.001	0.002	0.001	0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Constant	-0.567	-2.233	-2.747	-1.370	0.059	0.918
	(2.517)	(2.659)	(2.711)	(2.617)	(2.554)	(2.570)
N	1427	1427	1427	1427	1427	1427
adj. R-sq	0.144	0.132	0.122	0.155	0.140	0.131

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix B.3. SPS Impact on Academic Outcomes (Other Matching Methods)

The idea of the propensity score matching method is to match sets of program participants to nonparticipants with similar observable characteristics (propensity scores). To compute propensity score of each individual, first the probability of being a treatment, or in this case receiving the Special Priority Scholarship (SPS) among the pooled sample of treatment and control groups is estimated with a probit model. The observable factors used to construct the poverty score for the scholarship eligibility screening are included in the estimation as covariates X. The predicted outcome represents the estimated probability of being selected as a treatment to participate in the program and also the propensity score. The predicted propensity score of each observation for both treatment and control is $\hat{P}(X|T = 1) = \hat{P}(X)$.

One of the assumptions required in PSM estimators is the overlap assumption. To check if the overlap assumption is violated, graphs showing the estimated density of the predicted probabilities an SPS student is SPS student and the predicted probabilities students with tuition waiver is SPS student is presented in the overlap plots. The graphs in Figure B.1 provide an idea that the common supports are fairly good, although the propensity scores or the probabilities that SPS students are assigned to be a treatment are rather concentrated in the lower bound. With very few of comparable untreated in the lower bound, the nearest neighbor matching without replacement would result in many unmatched treatment observations, and good proportion of the treated observations will be dropped. In the case, when nearest neighbor matching is used, with replacement option will be more appropriate.

In addition to IPWRA, nearest neighbor matching with replacement, radius matching and kernel matching methods are also used to check the robustness testing in the estimation of aggregate sample. These methods are not tested in the subsample estimations.

- **Nearest Neighbor Matching**: It is the most straightforward estimator in which each treatment unit is paired with the nonparticipant of the nearest propensity score. The matching can be done using “without replacement” or “with replacement” options. However since there are more of the program participants than the nonparticipants,

the “no placement” option is not desirable, as with “no replacement” the untreated units can be used only one time for the matchings. In addition “without replacement” matching will produce bad matches as propensity score distribution of the treatment is concentrated in the upper bound, while the distribution of the untreated group is more concentrated in the lower bound. A weakness of this matching nearest neighbor matching method is that it can produce bad matches when the gaps to the nearest untreated are large.

- **Radius Matching**: The radius of caliper is set at (0.003). With the radius matching, each treatment unit within the support area can be paired with any untreated units within the imposed radius. The imposed radius or maximum propensity score distance can reduce poor matchings and raise the matching quality.

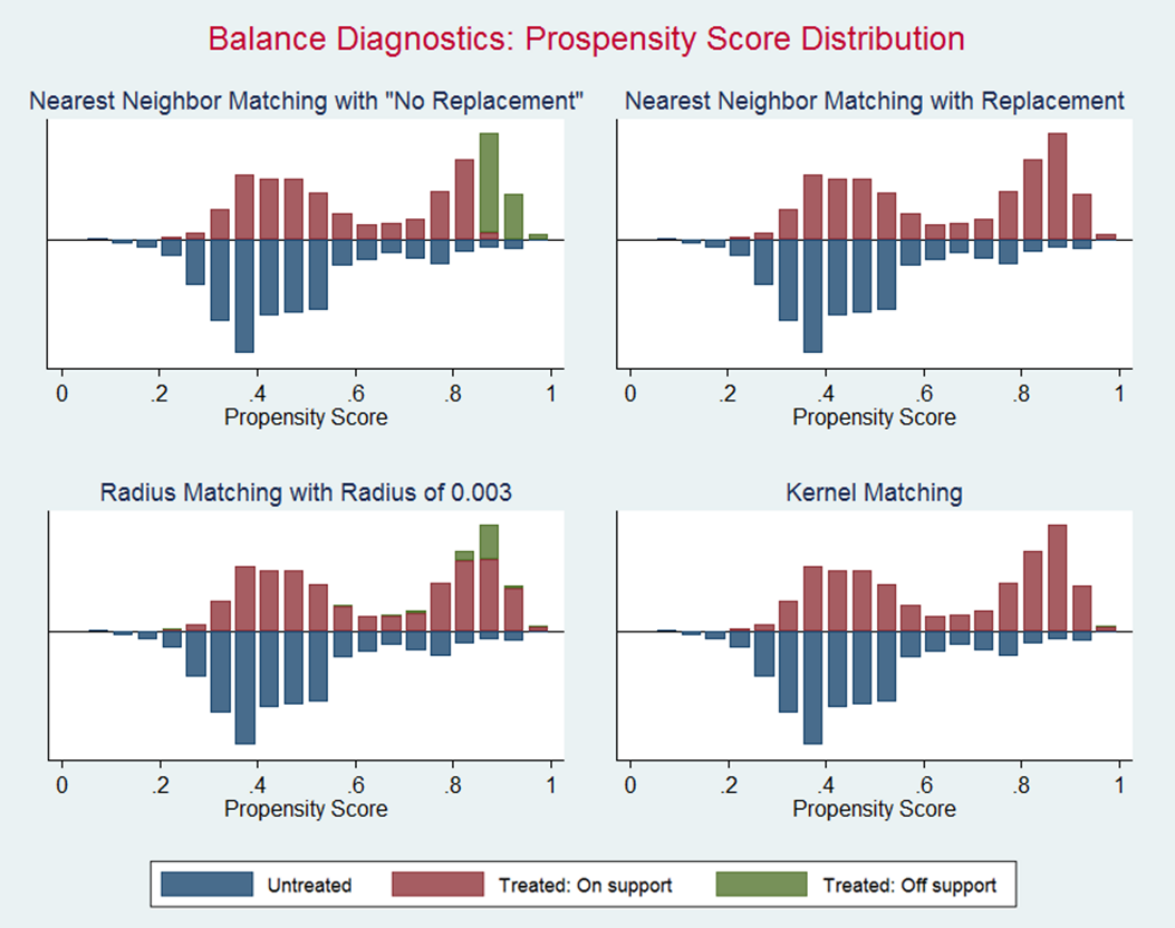
- **Kernel Matching**: The kernel matching approach matches the treatment with all nonparticipants by applying weighted average for the counterfactual matches. The weights are the inverse proposition of the distance between the propensity score of a program participant and the non-participants. The merit of Kernel matching estimators is that it allows the use of more information to lower variance; however, this approach can result in lower quality matches (Dehejia & Wahba, 2002).

Table A-1. Impact of SPS on Academic Outcomes (Various Matching Methods)

	Enrollment	Retention				Completion
		Year 1	Year 2	Year 3	Year 4	
IPWRA[1]	0.345***	0.423***	0.412***	0.388***	0.408***	0.389***
	(0.034)	(0.039)	(0.041)	(0.042)	(0.041)	(0.042)
NN Matching	0.247***	0.330***	0.362***	0.388***	0.444***	0.433***
	(0.020)	(0.022)	(0.023)	(0.024)	(0.023)	(0.024)
Radius Matching	0.247***	0.330***	0.362***	0.388***	0.444***	0.433***
	(0.020)	(0.022)	(0.023)	(0.024)	(0.023)	(0.024)
Kernel Matching	0.247***	0.330***	0.362***	0.388***	0.444***	0.433***
	(0.020)	(0.022)	(0.023)	(0.024)	(0.023)	(0.024)
Observations	1427	1427	1427	1427	1427	1427

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10
[1] Different from the main result, AY-2012 dummy variable is not included in this model.

Figure B.1. Propensity Score Distribution with Various Matching Methods



Appendix B.4. Estimation with Regression Discontinuity Design

The Regression Discontinuity Design (RDD) is a quasi-experimental technique where the treatment is assigned by a cut-off line. The cut-off line (or eligibility threshold) is used to generate a discounting in the treatment assignment. Initially, the SPS program was designed for RDD approach in mind; however, as explained in the main dissertation, there was some compliance issue that we decided to use the IPWRA approach for our main estimation.

In 2011, poor students were ranked based on the self-reported poverty questionnaire, and 1300 poorest students were selected for the household verification. Based on the verified poverty scores, the 1000 poorest students were awarded the SPS scholarships (treatments), the remaining 300 were supposed to receive the normal tuition waivers (controls). However, due to some misunderstandings, in the end, only 106 of the control students were awarded the tuition waivers. Moreover, since 70 students of SPS declined the stipends scholarship, among the 106, another 19 students were transferred to the SPS program to replace those declined the SPS scholarship offers. In our estimation, 19 substitute students are dropped from the sample, so that we can perform the sharp regression discontinuity. Therefore, there are only 87 observations in the control group for the RD analysis.

In the RD estimate, we specify student ability (Grade 12 test score), gender, age, regional dummies, and HEI type and location as covariates to be controlled for. The cut-off line is 828.106 (the poverty score of the individual ranked at 1000th, or the least poor student in the treatment group). Unlike the IPWRA estimate, the poverty scores in the RD is constructed with the verified information after household visits (not the self-report information). Linear and quartic functions are used for the global polynomial fit. The RD plots with both functions (Figure B-3 to B-6) show large jumps at the cutoff line.

Figure B-2. Impact of SPS on Enrollment and Retention Year 1 (Global Linear Function)



Figure B-3. Impact of SPS on Retention Year 3 and Year 4 (Global Linear Function)



Figure B-4. Impact of SPS on Enrollment and Retention Year 1 (Global Polynomial Fit of Order 4)



Figure B-5. Impact of SPS on Retention Year 3 and Year 4 (Global Polynomial Fit of Order 4)



With the RD approach the SPS impact on the academic outcomes are as follows:

SPS Impact	Enrollment	Retention 1	Retention 2	Retention 3	Retention 4
Linear Function	0.234*	0.261**	0.250**	0.309**	0.302**
	(0.123)	(0.125)	(0.124)	(0.134)	(0.135)
Quartic Functions	0.277	0.412**	0.443**	0.348	0.356*
	(0.191)	(0.194)	(0.203)	(0.214)	(0.215)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix C.1. Labor Outcome Survey Questionnaire

ID code | | | | | | **Scholarship Type** **1. SPS**

Ministry of Education Youth and Sports (MoEYS)

Department of Higher Educaution

Impact Evaluation of Special Priority Scholarship Program (SPS)

Questionnaire

Date of interview Day _____ Month _____ Year _____ Name of interviewer _____

Name of interviewer _____

Name of interviewee _____ Phone: _____

Start time: Hours _____ Minutes _____ End Time: Hours _____ Minutes _____

Mean of interviewing 1. Self Filling 2. Telephone 3. Self filing (home visit)

4. Email _____

A. Background

1) Sex 1. Male 2. Female

2) Marital status 1. Single 2. Married 3. Others _____

3) Home address Village _____ Commune _____

District/Khan _____ Province/City _____ Pcode _____

4) How far is your house from the provincial town? _____ km

5) Is there any member of your family a university graduate? 1. Yes 2. No

6) In what language(s) do you read the news and books?

- Khmer _____ %
- English _____ %
- Others _____ %

7) How often did you use computer during your last year at university?

1. Almost every day 2. One a week 3. Once a month

4. Rarely 5. Never

B. Education

1) Name of the high school you attended _____

2) Its location Province/City _____ Pcode _____

3) University where your scholarship was offered? _____ HEI Code _____

4) Its location Province/City _____ Pcode _____

5) Why did you choose this university?

1. Quality of education 2. Its location 3. Friend or relative's recommendation

4. It is easy to get the scholarship 5. Others _____

6) What was the major? _____

7) Why did you choose this major

1. I like it 2. It is a popular major 3. High demand (easy to get job)

4. My friend or relative's recommendation 5. Others _____

8) Did you accept the scholarship offer? 1. Yes 2. No

9) If no, what was the reason?

1. Education cost is too expensive 2. Cannot afford the living cost

3. No accommodation 4. Others _____

10) Did you enroll in any other course during your between 2011 to 2015?

1. Yes 2. No If no, skip to

11) What is the name of the university and major?

Second University

- Name of university _____ HEI Code _____
- Major _____ Stared in Year _____

Third University HEI Code _____

- Name of university _____
- Major _____ Stared in Year _____

12) Where did you live during your study and how much did it cost?

Resident code to fill the answer below

1. Parent/relative house *2. Rent house* *3.School dorm*

4. Other dorm (not school) *5. Temple* *6. Others* _____

	Where did you like	The monthly cost
- Year 1		
- Year 2		
- Year 3		
- Year 4		

13) How much did you spend per month in average during the time you studied?

_____ USD/month

What are the sources of your financial support and its percentage of the total amount?

1. SPS stipend _____ %
2. Other scholarship _____ %
3. From parents _____ %
4. Working part-time _____ %
5. Working full-time _____ %
6. Others _____ %

14) Did you graduate as expected? 1. Yes 2. No, I dropped 3. No, I repeated

15) If 2. No, I dropped, what was the reason?

1. Financial difficulty 2. Start working full-time
3. Family issue 4. Obained other scholarship
5. Not interested in the study 6. Others _____

16) When did you graduate/dropout? Month _____ Year _____

17) Have you ever worked as intern or volunteer?

1. Yes 2. No If 1. Yes, where, what and when you did it?

- Organization/Institution _____
- Type of Job _____
- Starting from Month _____ Year _____ to Month _____ Year _____

C. Employment

1) What were you doing the first year after your graduation?

1. Working full-time 2. Working part-time 3. Furthering your education
4. Looking for job 5. Idle 6. Others _____

2) Your first year activities after your graduation

**** Note on activity codes:***

1. Working full-time 2. Working part-time 3. Study
4. Looking for job 5. Idle 6. Others _____

If you graduated in June 2015, the 1st month is July 2015

		Activities Code*	**Monthly income**
1st Month	Jul-15		
2nd Month	Aug-15		
3rd Month	Sep-15		
4th Month	Oct-15		
5th Month	Nov-15		
6th Month	Dec-15		
7th Month	Jan-16		
8th Month	Feb-16		
9th Month	Mar-16		
10th Month	Apr-16		
11th Month	May-16		
12th Month	Jun-16		

3) What is your first job after your graduation

4) Occupation _____ Occu Code: _____

5) Sector Activity _____ Sector Code: _____

Sector Code	
1 Agriculture	*8 Other Manufacturing*
2 Communications	*9 Other Social Services*
3 Construction	*10 Public Administration and Defense*
4 Education	*11 Real Estate and Business Services*
5 Finance	*12 Tourism*
6 Garment	*13 Trade*
7 Health	*14 Transport*
	15 Others _____

6) Starting from Month _____ Year _____

7) What is your employment status?

1. Employee 2. Employer 3. Own account worker

4 . Unpaid family worker 5. Others _____

8) If the answer is 1, what type of your employer?

1. Private enterprise/company (International) 2. Private enterprise/company (National)

3. Public-state-owned enterprise 4. Government 5. Non-Profit Organization

6. Self-employed 7. Farming 8. Others _____

9) What is the name of your workplace? _____

10) Its location Province/City _____ Pcode _____

11) How you did you find your first job?

1. Job announcement 2. Through friend/relative 3. Job fair

4. Through recruit agent 5. Know someone working there 6. Others _____

12) During the 3rd month after your graduation, how many jobs do you have? _____ job(s)

If no job, skip

13) How many days did you work a week in average?

1. Job 1 _____ days/week 1. Job 2 days/week

14) How many hours did you work a day in average during that period?

1. Job 1 _____ hours/day 1. Job 2 _____ hours/day

15) How much did you earn during the period from all job(s) during the month?

In cash _____ USD in kind _____ USD

16) At the time, how much did you think the job is related to your studies?

1 2 3 4 5 (Five is the highest)

17) During the 9th month after your graduation, how many jobs do you have? _____ job(s)

If no job, skip

18) How many days did you work a week in average?

1. Job 1 _____ days/week 1. Job 2 _____ days/week

19) How many hours did you work a day in average during that period?

1. Job 1 _____ hours/day 1. Job 2 _____ hours/day

20) How much did you earn during the period from all job(s) during the month?

In cash _____ USD in kind _____ USD

21) At the time, how much did you think the job is related to your studies?

1 2 3 4 5 (Five is the highest)

22) Have you ever sent money to your family between July 2015 to June 2016? 1. Yes 2. No

23) If 1. Yes, how many time and how much in total?

_____ time(s) Total amount USD _____

Appendix C.2. Cox Proportional Hazard Results (Event=US$ 255)

VARIABLES	(1) All	(2) All	(3) Graduates	(4) Graduates Male	(5) Graduates Female
SPS	0.180	0.125	0.047	0.196	-0.100
	(0.178)	(0.189)	(0.217)	(0.299)	(0.348)
Male	0.508***	0.490***	0.521***		
	(0.164)	(0.169)	(0.189)		
Age	0.016	-0.004	-0.019	0.011	-0.076
	(0.053)	(0.054)	(0.061)	(0.081)	(0.103)
Single	0.179	0.285	0.483*	0.743*	0.359
	(0.210)	(0.220)	(0.279)	(0.402)	(0.433)
Grade C and B	0.390**	0.428**	0.282	0.564*	-0.257
	(0.189)	(0.194)	(0.217)	(0.294)	(0.353)
Grade D	0.286	0.506**	0.365	0.719*	-0.203
	(0.249)	(0.252)	(0.276)	(0.373)	(0.435)
Father Education	-0.027	-0.004	-0.003	-0.014	0.008
	(0.031)	(0.030)	(0.034)	(0.054)	(0.048)
Mother Education	0.057*	0.056	0.078**	0.093	0.104*
	(0.034)	(0.035)	(0.038)	(0.058)	(0.056)
HH Member Graduate	0.027	0.012	-0.035	0.125	-0.028
	(0.170)	(0.181)	(0.207)	(0.292)	(0.327)
HEIS in Phnom Penh	-0.439**	-0.188	-0.262	-0.325	-0.517
	(0.190)	(0.219)	(0.262)	(0.389)	(0.412)
Private HEIs	-0.132	-0.256	-0.150	-0.473	0.147
	(0.228)	(0.241)	(0.296)	(0.389)	(0.571)
Major Discipline					
Business Related	-0.373*	-0.595**	-0.671**	-0.862**	-0.643
	(0.224)	(0.240)	(0.272)	(0.368)	(0.452)
Science	-0.230	-0.251	-0.174	-0.529	0.243
	(0.219)	(0.226)	(0.258)	(0.367)	(0.408)
Social Science	-0.418*	-0.453*	-0.540**	-0.608*	-0.790
	(0.232)	(0.240)	(0.275)	(0.365)	(0.482)
English	0.007**	0.009**	0.008*	0.008	0.009
	(0.004)	(0.004)	(0.004)	(0.006)	(0.007)

VARIABLES	(1) All	(2) All	(3) Graduates	(4) Graduates	(5) Graduates
			Graduates	Male	Female
Computer Skill	0.407**	0.296	0.276	0.227	0.310
	(0.183)	(0.198)	(0.234)	(0.328)	(0.369)
Graduate	0.172	0.092	0.087	-0.097	0.564*
	(0.185)	(0.201)	(0.233)	(0.365)	(0.342)
Double Degree		0.172			
		(0.239)			
Experience		0.607**	0.675**	0.740	0.250
		(0.262)	(0.325)	(0.483)	(0.456)
Experience Square		-0.104**	-0.114*	-0.133	-0.012
		(0.050)	(0.067)	(0.100)	(0.094)
Intern or Volunteer (Private)		-0.127	0.004	0.509*	-0.985**
		(0.226)	(0.241)	(0.306)	(0.478)
Intern or Volunteer (NGO)		0.138	0.141	0.092	0.115
		(0.237)	(0.253)	(0.334)	(0.414)
Work in Phnom Penh		-0.510**	-0.425*	-0.382	-0.461
		(0.199)	(0.229)	(0.336)	(0.348)
Employer Type					
Private Sector		0.023	0.179	0.443	-0.115
		(0.205)	(0.239)	(0.342)	(0.365)
Public Sector		-0.553*	-0.846*	-0.926	-1.426**
		(0.328)	(0.432)	(0.622)	(0.642)
NGO		0.373	0.453	0.509	0.687
		(0.290)	(0.321)	(0.474)	(0.496)
Observations	600	548	424	202	222

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix C.3. Full Results of SPS Impact on Earnings

Table C.2 OLS Results on Earnings (All Sample)

VARIABLES	(1)	(2)	(3)	(4)
	3rd Month		9th Month	
	Total	In Cash	Total	In Cash
SPS	0.159***	0.154***	0.141***	0.153***
	(0.051)	(0.050)	(0.043)	(0.041)
Male	0.184***	0.171***	0.130***	0.117***
	(0.047)	(0.045)	(0.040)	(0.038)
Age	0.003	0.005	-0.003	0.004
	(0.015)	(0.015)	(0.013)	(0.012)
Single	0.007	-0.036	-0.008	-0.048
	(0.055)	(0.054)	(0.048)	(0.046)
Grade B & C	-0.000	0.010	0.091**	0.100**
	(0.051)	(0.049)	(0.043)	(0.041)
Grade D	0.025	0.024	0.098*	0.107*
	(0.066)	(0.065)	(0.058)	(0.055)
Father Education				
- Primary School	0.009	0.006	0.020	0.022
	(0.050)	(0.048)	(0.042)	(0.040)
- Lower Secondary	0.093	0.060	0.002	-0.005
	(0.085)	(0.083)	(0.073)	(0.070)
- Upper Secondary	0.335**	0.178	0.059	0.005
	(0.165)	(0.160)	(0.123)	(0.118)
Mother Education				
- Primary School	-0.026	-0.021	-0.001	0.011
	(0.050)	(0.048)	(0.042)	(0.040)
- Lower Secondary	-0.099	-0.056	-0.013	-0.004
	(0.098)	(0.095)	(0.079)	(0.075)
- Upper Secondary	-0.110	-0.066	-0.224	-0.206
	(0.236)	(0.229)	(0.179)	(0.170)
Graduate HH Member	0.119**	0.115**	0.066	0.069*
	(0.049)	(0.048)	(0.042)	(0.040)
HEI Characteristics				
- HEI in Phnom Penh	0.121	0.139	0.133	0.172
	(0.143)	(0.139)	(0.124)	(0.119)
- Public HEI	0.157	0.071	-0.174	-0.163
	(0.210)	(0.204)	(0.179)	(0.170)
Discipline				
- Business Related	-0.040	-0.048	0.004	-0.052
	(0.084)	(0.081)	(0.071)	(0.068)
- Science	0.065	0.043	-0.047	-0.086
	(0.071)	(0.069)	(0.060)	(0.057)
- Social Science	-0.118	-0.134*	-0.102	-0.174***

VARIABLES	(1)	(2)	(3)	(4)
	3rd Month		9th Month	
	Total	In Cash	Total	In Cash
	(0.080)	(0.077)	(0.066)	(0.063)
English language	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Computer Skill	0.092*	0.100**	0.060	0.073*
	(0.050)	(0.049)	(0.043)	(0.041)
Double Degree	0.084	0.091*	0.057	0.056
	(0.056)	(0.055)	(0.048)	(0.046)
Graduate	0.045	0.060	0.051	0.069
	(0.066)	(0.064)	(0.057)	(0.054)
Experience	0.031	0.021	0.038	0.055
	(0.073)	(0.071)	(0.060)	(0.057)
Experience Squared	-0.004	-0.002	-0.007	-0.010
	(0.013)	(0.013)	(0.011)	(0.011)
Intern or Volunteer				
- Private Institutions	-0.255**	-0.318***	0.030	-0.016
	(0.124)	(0.121)	(0.111)	(0.106)
- NGOs	-0.087	-0.110*	-0.045	-0.070
	(0.060)	(0.058)	(0.051)	(0.048)
Work in Phnom Penh	-0.084	-0.064	-0.072	-0.070
	(0.058)	(0.056)	(0.049)	(0.046)
Employer Type				
- Private Sector	-0.174*	-0.191**	-0.140*	-0.199**
	(0.093)	(0.090)	(0.081)	(0.077)
- Public	-0.165	-0.107	-0.060	-0.058
	(0.104)	(0.101)	(0.088)	(0.084)
- NGO	0.037	0.101	0.006	0.016
	(0.105)	(0.102)	(0.088)	(0.084)
Job Match	0.011	0.008	0.037***	0.041***
	(0.017)	(0.016)	(0.014)	(0.013)
HEI Fixed-effect	Yes	Yes	Yes	Yes
Constant	4.812***	4.749***	5.000***	4.768***
	(0.436)	(0.424)	(0.366)	(0.349)
Observations	440	440	493	493
R-squared	0.223	0.221	0.217	0.254

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Table C.2 OLS Results on Earnings (Graduate Sample)

VARIABLES	(1)	(2)	(3)	(4)
	3rd Month		9th Month	
	Total	In Cash	Total	In Cash
SPS	0.167***	0.161***	0.170***	0.169***
	(0.064)	(0.062)	(0.052)	(0.049)
Male	0.157***	0.146***	0.124***	0.110**
	(0.056)	(0.054)	(0.046)	(0.043)
Age	0.001	0.000	-0.008	-0.002
	(0.018)	(0.017)	(0.014)	(0.014)
Single	0.019	-0.013	-0.007	-0.039
	(0.069)	(0.066)	(0.058)	(0.055)
Grade B & C	-0.011	0.012	0.067	0.088*
	(0.061)	(0.059)	(0.050)	(0.048)
Grade D	0.004	0.005	0.092	0.095
	(0.080)	(0.077)	(0.068)	(0.064)
Father Education				
- Primary School	0.052	0.033	0.058	0.048
	(0.061)	(0.059)	(0.050)	(0.048)
- Lower Secondary	0.136	0.073	0.036	0.006
	(0.103)	(0.099)	(0.085)	(0.080)
- Upper Secondary	0.313*	0.118	0.101	-0.003
	(0.186)	(0.179)	(0.140)	(0.132)
Mother Education				
- Primary School	-0.046	-0.024	0.003	0.033
	(0.059)	(0.057)	(0.049)	(0.047)
- Lower Secondary	-0.092	-0.029	0.029	0.060
	(0.113)	(0.108)	(0.087)	(0.082)
- Upper Secondary	-0.167	-0.102	-0.228	-0.203
	(0.251)	(0.242)	(0.186)	(0.176)
Graduate HH Member	0.107*	0.107*	0.077	0.075
	(0.061)	(0.059)	(0.050)	(0.047)
HEI Characteristics				
- HEI in Phnom Penh	0.232	0.261	0.122	0.223
	(0.180)	(0.174)	(0.151)	(0.143)
- Public HEI	0.096	0.044	-0.075	-0.027
	(0.251)	(0.242)	(0.220)	(0.207)
Discipline				
- Business Related	-0.063	-0.071	-0.008	-0.090
	(0.103)	(0.099)	(0.084)	(0.080)
- Science	0.088	0.053	-0.055	-0.103
	(0.085)	(0.082)	(0.069)	(0.065)
- Social Science	-0.183*	-0.176*	-0.158**	-0.226***
	(0.098)	(0.094)	(0.078)	(0.074)
English language	0.002	0.002*	0.002**	0.002**

VARIABLES	(1)	(2)	(3)	(4)
	3rd Month		9th Month	
	Total	In Cash	Total	In Cash
	(0.001)	(0.001)	(0.001)	(0.001)
Computer Skill	0.109*	0.120**	0.079	0.090*
	(0.061)	(0.059)	(0.051)	(0.048)
Double Degree	0.073	0.093	0.072	0.067
	(0.072)	(0.070)	(0.060)	(0.057)
Graduate				
Experience	0.111	0.094	0.107	0.119*
	(0.097)	(0.094)	(0.076)	(0.072)
Experience Squared	-0.018	-0.014	-0.021	-0.022
	(0.019)	(0.018)	(0.015)	(0.015)
Intern or Volunteer				
- Private Institutions	-0.330**	-0.392***	-0.047	-0.085
	(0.142)	(0.137)	(0.124)	(0.117)
- NGOs	-0.096	-0.111	-0.017	-0.025
	(0.070)	(0.067)	(0.058)	(0.054)
Work in Phnom Penh	-0.136*	-0.122*	-0.096	-0.098*
	(0.073)	(0.070)	(0.059)	(0.055)
Employer Type				
- Private Sector	-0.145	-0.195*	-0.119	-0.211**
	(0.112)	(0.107)	(0.094)	(0.089)
- Public	-0.228*	-0.211*	-0.070	-0.116
	(0.124)	(0.119)	(0.102)	(0.097)
- NGO	0.089	0.121	0.043	0.006
	(0.122)	(0.117)	(0.099)	(0.094)
Job Match	0.004	0.001	0.029*	0.031**
	(0.020)	(0.020)	(0.016)	(0.016)
HEI Fixed-effect	Yes	Yes	Yes	Yes
Constant	4.936***	4.936***	5.124***	4.987***
	(0.514)	(0.495)	(0.418)	(0.395)
Observations	341	341	388	388
R-squared	0.224	0.228	0.210	0.254

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Table C.3 IPWRA Results on Earnings (All Sample)

VARIABLES	(1)	(2)	(3)	(4)
	3rd Month		9th Month	
	Total	In-Cash	Total	In-Cash
SPS	0.119	0.103	0.100	0.133**
	(0.078)	(0.074)	(0.070)	(0.061)
Male	-0.032	-0.039	0.034	0.003
	(0.083)	(0.079)	(0.090)	(0.083)
Age	0.023	0.022	0.061**	0.065**
	(0.025)	(0.025)	(0.029)	(0.025)
Single	-0.030	-0.043	-0.022	-0.031
	(0.117)	(0.111)	(0.084)	(0.072)
Grade 12 Exam Score				
- Grade B and C	0.055	0.080	0.319**	0.397***
	(0.128)	(0.124)	(0.130)	(0.105)
- Grade D	0.494***	0.511***	0.495***	0.568***
	(0.135)	(0.134)	(0.130)	(0.115)
Father Education	-0.042**	-0.041**	-0.022	-0.019
	(0.020)	(0.019)	(0.016)	(0.015)
Mother Education	0.031	0.036	-0.012	-0.011
	(0.025)	(0.025)	(0.019)	(0.017)
Household Graduate	0.089	0.075	0.026	-0.010
	(0.076)	(0.071)	(0.080)	(0.070)
HEI in Phnom Penh	0.225*	0.195*	0.254	0.216
	(0.115)	(0.112)	(0.160)	(0.136)
Public HEI	-0.114	-0.097	-0.056	-0.050
	(0.134)	(0.130)	(0.135)	(0.129)
Business Related	-0.144	-0.139	-0.009	-0.086
	(0.113)	(0.113)	(0.100)	(0.092)
Science	-0.107	-0.078	-0.272**	-0.282***
	(0.100)	(0.095)	(0.114)	(0.100)
Social Science	-0.417***	-0.404***	-0.129	-0.183*
	(0.136)	(0.134)	(0.114)	(0.104)
English	-0.000	-0.000	0.003	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Computer	0.011	-0.014	0.080	0.043

	(0.118)	(0.116)	(0.106)	(0.094)
Double Degree	0.091	0.093	-0.013	-0.011
	(0.110)	(0.105)	(0.092)	(0.089)
Experience	-0.202	-0.191	-0.023	0.039
	(0.158)	(0.156)	(0.130)	(0.116)
Experience Squared	0.037	0.034	-0.000	-0.012
	(0.027)	(0.027)	(0.025)	(0.022)
Graduate	-0.030	-0.039	-0.147	-0.151
	(0.080)	(0.077)	(0.100)	(0.092)
Constant	4.829***	4.806***	3.604***	3.498***
	(0.741)	(0.735)	(0.864)	(0.761)
N	306	306	335	335
adj. R-sq	0.384	0.379	0.349	0.406

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Appendix C.4. Program Intervention's Cost-Benefit Analysis

To justify the economic rationale for the investment on program intervention, we use the Net Present Value (NVP) for the cost-benefit analysis (CBA) to examine how long it takes to recover the investment costs. The CBA can help the decision makers to determine if the returns from the program are worth investing in the program. The NVP is simply the difference between total discounted benefit minus the total discounted costs. In this study, the annual discount rate is set at 10%. The NVP can be expressed as:

$$NPV = \sum_{t=1}^{n} \frac{B_t}{(1+i)^{t-1}} - \sum_{t=1}^{n} \frac{C_t}{(1+i)^{t-1}}$$

Where:

- *B* is the total annual program benefits,
- *C* is the total annual program costs,
- *t* is the years starting from 1, and

- *i* is the discount rate set at 10%

For the SPS students, the DHE paid both the tuition fees to the HEIs students enrolled, and at the same time provided the quarterly stipends directly to the eligible students. However, since the control group also received the tuition waivers, only stipend scholarships are treated as program costs in this study. The amounts of annual stipends are based on the SPS payment database maintained by the Admission Office of the DHE. For the program benefits, we consider both the program impact on university graduation and impact on the earnings among the graduates. Our study suggests that the SPS can increase the graduation by 33.7 percentage points, and graduated students are likely to earn about 15% more compared to the control group. We also know that there is no difference in earnings among the non-graduates.

Out of the 1,000 SPS students selected, 551 students graduate from their enrolled program without additional stipends assistance. However, SPS can help an additional 337 beneficiaries from low-income families to obtain bachelor degrees. Still, 147 SPS recipients are not able to finish their study even with financial support from the government.

Table C.7. Program Benefits

Recipients	Descriptions	Benefits
551	Base on the IPWRA estimation, the graduation rate of the control group is 55.1%. This means 551 out of 1,000 can graduation without the stipend scholarships. Among this group, the benefit is the earning difference (the impact on earnings is estimated to be at least around 15%). The annual in-cash incomes (excluding bonus) in the first year after the expected date of graduation is US$ 2,526[24].	=(1000 x 0.551 x 0.15) x US$2,526= US$ 208,774
337	With the SPS scholarship, the graduation rate increase by 39.8 percentage points. The program benefits for these 398 individuals include university premium and earning differences. Studies on the rates of return to education in Cambodia suggest the university education premiums ranges from 11% (Lall & Sakellariou, 2010) to 21% (Humphreys, 2015a). In the study, we set the return to higher education at the low scenario at 11%.	= (1,000 x 0.398) x (0.15 + 0.11) xUS$2,526 =US$ 261, 390

[24] Zero income earners and those who earn more than 1,000 per month are also excluded from this estimation.

147	Since there is no earning impact among non-graduates, there is no benefit from among this group.	0
Total Benefit in the first year		US$ 470,164

As time progresses, we expect individuals' earnings also to increase. Based on our 12-month information on monthly incomes, the annual wages increases is US$ 43 (or about 22%) from US$ 189 in the first month to $232 in the 12th month. We use this annual growth rate in annual salary to estimate the future earnings by assuming that this annual increase is constant over time.

The year 2011 is set the base year, and the amount of costs and benefits are adjusted at the rate of 10%. As seen in the Table, the costs occurred during the first four years, and we started to collect the benefits in the fifth year after the graduation. Based on this estimate, we expect to recover the investment costs in only six years after their graduation. We expect the graduates to work at least around 35 years before their retirement. Therefore the private returns to investment are high enough to justify the investment.

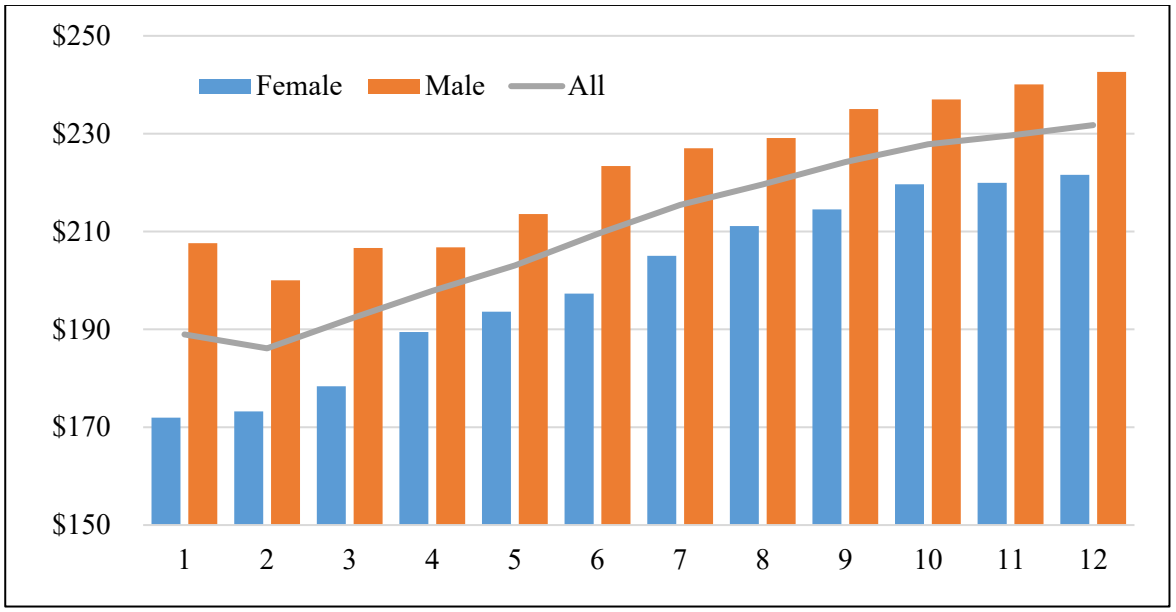


Figure C.1 Trends of Monthly Wage in the first 12 months.

Table C.8. Total Cost Benefit in (Thousand US$)

Year		Nominal		Discounted (10%)		
		Costs	Benefits	Costs	Benefits	B-C
1	Stipend Year 1	636.00	-	636.08	-	-636.00
2	Stipend Year 2	611.00	-	555.18	-	-1191.45
3	Stipend Year 3	594.00	-	491.12	-	-1682.36
4	Stipend Year 4	567.00	-	425.88	-	-2108.36
5	Annual Benefits Year 1	-	470.16	-	321.13	-1787.23
6	Annual Benefits Year 2	-	573.60	-	356.16	-1431.08
7	Annual Benefits Year 3	-	699.79	-	395.01	-1036.06
8	Annual Benefits Year 4	-	853.74	-	438.10	-597.96
9	Annual Benefits Year 5	-	1,041.56	-	485.90	-112.07
10	Annual Benefits Year 6	-	1,270.71	-	538.90	426.84

* Annual discount rate is set at 11%.