GENDER DISPARITIES IN SCHOOLING, LEARNING, AND LABOR MARKET OUTCOMES IN THE PHILIPPINES

A Dissertation

Submitted to the National Graduate Institute for Policy Studies (GRIPS)

in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy in International Development Studies

by

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September 2020

Abstract

The Philippine education system continues to face challenges in achieving the Sustainable Development Goal 4 on inclusive and equitable quality education. Such challenges include persistently low learning outcomes and gender disparities in school participation, learning achievements, and employment outcomes.

To support school participation, the Philippine government implemented free public and subsidized private secondary schooling in 1988 and 1989 through two major policies, namely R.A. 6655 (free secondary education) and R.A. 6728 (subsidized private schooling). The first analytical chapter investigates the long-run impacts of these two policies on schooling attainment, employment, and income using a regression discontinuity design (RDD) approach. RDD deals with the endogeneity problem of schooling in the employment and income functions. In this chapter, we report three main findings. First, younger cohorts, who are policy beneficiaries, have significantly higher educational attainment relative to non-beneficiaries. This is true for both genders. Women also exhibit higher schooling attainment than men. Second, an additional year of schooling increases the likelihood of formal employment and reduces the probability of informal employment. Third, an additional year of schooling significantly increases individual income. The analysis by subgroup shows significant returns to education among women in the informal sector and men in the formal sector. This indicates that women have fewer opportunities to participate and thrive in the formal sector and choose to settle in informal, vulnerable occupations.

The second analytical chapter explores the learning outcomes of Filipino children. It investigates the differences in cognitive skills of girls and boys, the household-related

determinants of exam performance, and the downstream effect of test scores on the proportion of working age individuals who are employed, formally employed, and informally employed. The study utilizes individual-level and provincial-level data. It also employs ordinary least squares (OLS) and two-stage least squares (2SLS) regressions. The chapter shows that girls outperform boys in learning achievements. Moreover, household characteristics affect test scores. In particular, electrification, land assets, and mother's education are positively correlated with student performance, while the opposite is true for household ownership of TV and radio. In terms of employment, higher test scores tend to increase the proportion of workers who are formally employed. The correlations, however, are higher among men than among women. Also, test scores only minimally decrease the proportion of informally employed women. In contrast, they significantly lower the proportion of informally employed men. This goes to show that women's better academic performance does not necessarily lead to more opportunities in the formal work sector and lower participation in informal occupations.

This dissertation points to the importance of implementing policies that address gender differences in schooling, learning, and labor market outcomes. It recommends a 5-point policy strategy. First, the government could improve schooling policies that target the most disadvantaged groups (i.e., boys from poorest rural areas). Second, it could establish interventions for women workers (i.e., gender employment quotas in the formal sector and social protection in the informal sector). Third, schools and teachers should take creative solutions to enhance learning. Fourth, the government could initiate infrastructure improvements and other institutional changes (i.e., electrification and educational TV shows). Finally, the study recommends a multi-sectoral approach in addressing gender-based issues in the education and labor market sectors.

Acknowledgements

I would like to extend my sincerest appreciation to my adviser, Professor Jonna P. Estudillo, who has supported and guided me throughout my M.A. and Ph.D. journey at GRIPS. I am also grateful to my committee members and previous professors, Professor Masako Kurosawa, Professor Dainn Wie, Professor Takashi Tsuchiya, Professor Ryuichi Tanaka, Professor Stephan Litschig, and Professor Tetsushi Sonobe for their valuable comments and insights that helped improve my dissertation.

I express my deepest gratitude to the government of Japan for giving me the opportunity to pursue my graduate studies at GRIPS. I thank the staff of the Philippine Statistics Authority, especially Mrs. Rosario Abragan, for providing the survey datasets. I also thank the staff of the Department of Education, especially Dr. Nelia Benito, Ms. Ann Legarte, Mr. Ricky Totañes, and Mr. Allan Barbosa, for allowing me to use their database. I am equally grateful to my godfather, Dr. Bobbet Revilla, for taking the time to proofread my chapters.

I give special thanks to my mentors, colleagues, and friends at the Philippine Institute for Development Studies and the Asian Development Bank Headquarters, who have encouraged me to aim high and work hard. My heartfelt appreciation also goes to my classmates and friends at GRIPS, especially all the Filipino students, who made my stay fun and worthwhile. I am also grateful to my high school and college best friends for their steadfast support over the years.

I sincerely thank my family, especially Mom, Dad, Ate, Biboy, and Mama Bhe, for their unwavering faith in me. They are my constant source of strength and inspiration. Finally, I am eternally grateful to God for making every impossible goal possible.

For the dreamer in each one of us.

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Chapter 1

Introduction

1.1. School participation over the years

In both developed and developing countries, education plays a critical role in advancing human capital. It provides the vital skills needed by individuals to contribute to and benefit from economic growth. Hence, it remains a key part of the development agenda in many international organizations and national governments. In 2015, the United Nations (UN) ratified the global goals for education through the Sustainable Development Goals (SDGs) which serves as a continuation of the Millennium Development Goals (MDGs). In particular, Goal 2 of the MDGs aims to ensure complete primary schooling for all children by 2015 (UN, 2015), while Goal 4 of the SDGs targets inclusive and equitable quality education for all individuals from 2015 to 2030 (UN, 2017).

Since the early 1990s, the world has experienced a significant rise in enrollment at all levels. Figures 1.1 and 1.2 show a convergence in primary and secondary school enrollments between girls and boys. Since 2013, girls were able to catch up with boys in basic education, as observed in the increasing gross enrollment rates[1]. However, gross enrollment rates in secondary and tertiary schools remain low. In 2017, the gross enrollment rates are 104 percent in primary and around 76 to 77 percent for both girls and boys in secondary. In terms of tertiary schooling, more girls are enrolled compared to

[1] Gross enrollment rate refers to the number of students enrolled in a given level of education, regardless of age, expressed as a percentage of the official school-age population corresponding to the same level of education, accessed from http://uis.unesco.org/en/glossary on 29 June 2018.

boys since 2002. The latest data show that the gross enrollment rates are 40 percent for girls and 36 percent for boys in 2017 (Figure 1.3).

In the Philippines, girls and boys are largely enrolled in primary school, with no significant gap between the two groups since the 1990s (Figure 1.4). However, girls start to outperform boys in school participation in secondary school. Figure 1.5 shows an apparent gap in gross enrollment rates between high school girls and boys. This is consistent from 1990 to 2016. In 2016, the gross enrollment rates are 93 percent for girls and 85 percent for boys. This disparity in school participation continues on to tertiary level (Figure 1.6). Evidently, the gap in tertiary gross enrollment rates has not changed much since 1992. In particular, the 1992 gross enrollment rates are 31 and 21 percent for girls and boys (10 percentage points gap), while the 2017 rates are 40 and 31 percent for girls and boys (9 percentage points gap), respectively.

While the world has seen a convergence in basic education enrollments only recently, the Philippines has observed higher enrollments for girls since three decades ago. However, Figures 1.4 and 1.5 show that enrollment rates fall as children transition from primary to secondary. This is consistent with the observation of Reyes, Tabuga, Mina, and Asis (2015) that enrollments decline as children get older and as school expenses borne by parents increase. This is one of the Philippines' challenges on achieving SDG 4 ("Quality education").

1.1.1. Factors affecting school participation: Households, markets, informal and formal institutions

According to the World Bank (2012), the interactions of households, markets, and institutions (formal and informal) influence school participation. Figure 1.7 shows an

illustration of how these four factors interact to affect school attainment and enrollment. The first factor in the diagram refers to households. Families decide on how income will be allocated to various expenditures and to the education and health of daughters and sons. Their choices may depend on preferences, incentives, and constraints of different family members. Since schooling is a normal good, it is expected that an increase in household income yields a favorable impact on children's secondary schooling (Behrman and Knowles, 1999). The second factor pertains to markets. Markets determine the returns to household decisions and investments. These may be markets for land, labor, credit, and goods, which can influence the incentives faced by households (World Bank, 2012). The development of labor markets and expansion of labor employment opportunities increase wages and, thus, raises the returns to schooling. This makes households perceive child schooling as a profitable investment. The third factor refers to informal institutions. Preferences are shaped by informal institutions, which refer to social norms, gender roles, and social networks. One example of such norm is observed in rural Philippines, where parents equalize the inter-generational transfers among children by giving land bequests to sons and by investing in daughters' schooling (Estudillo, Quisumbing, and Otsuka, 2001). The last factor relates to formal institutions. Formal institutions comprise all that pertain to the functioning of the state, which include the existing legal and regulatory framework (World Bank, 2012). They include, for instance, the laws and regulations that may either constrain or support education. Outcomes are, thus, seen through the interplay and workings of households, markets, informal, and formal institutions.

In the Philippines, formal institutions play an important role in ensuring school participation. Over the years, the government has implemented crucial policies to boost enrollments. The focus of the first analytical chapter is the long-term impact of two

important laws (Republic Act [R.A.] 6655 and R.A. 6728) on schooling attainment and labor market outcomes of Filipinos. Briefly, the government passed a major secondary education reform, entitled "An Act Establishing and Providing for a Free Public Secondary Education and for Other Purposes" or R.A. 6655 in 1988. This policy declares that the State shall provide for a free public secondary education to all qualified citizens and promote quality education at all levels[2]. Similarly, in 1989, the government enhanced access to private education through the implementation of the "Government Assistance to Students and Teachers in Private Education (GASTPE) Act" or R.A. 6728. This law aims to improve the access to and quality of private education through tuition fee supplements, the High School Textbook Assistance Fund, scholarship grants to students graduating as valedictorians and salutatorians, and the Educational Service Contracting (ESC) scheme[3]. These two policies serve as the most significant reforms since the expansion of primary education during the American colonial period in the early 1900s.

1.1.2. Philippine education reforms

Aside from R.A. 6655 and R.A. 6728, we enumerate other important reforms in the Philippine educational system in recent decades. The Magna Carta for Public School Teachers (R.A. 4670), implemented in 1966, protects the social and economic well-being of teachers. It specifically aims to improve teachers' working conditions and promote career advancement[4]. Article 14 of the 1987 Constitution of the Republic of the Philippines posits that the State shall protect and promote the right of all citizens to quality

[2] See https://www.lawphil.net/statutes/repacts/ra1988/ra_6655_1988.html, accessed on 30 May 2019.
[3] See https://www.lawphil.net/statutes/repacts/ra1989/ra_6728_1989.html, accessed on 30 May 2019.
[4] See https://www.lawphil.net/statutes/repacts/ra1966/ra_4670_1966.html, accessed on 30 May 2019.

education at all levels and ensure that education is accessible to all. It also aims to establish a system of free public education and provide assistance to private education in the elementary and high school levels[5]. Since R.A. 6655 and R.A. 6728, five other important policies were implemented. The first reform is the "Higher Education Act of 1994" (R.A. 7722), which aims to enhance access of all Filipinos to affordable quality education[6]. The second reform is the "Technical Education and Skills Development Act of 1994" (R.A. 7796), which focuses on providing high quality and efficient technical education and skills development[7]. The third reform is the "Fair and Equitable Access to Education Act" (R.A. 7880), which ensures fair and equitable access to the infrastructure and tools necessary for quality education[8]. The fourth reform, under the recent Aquino Administration, is the "Enhanced Basic Education Act of 2013" (R.A. 10533), which officially mandates a kindergarten plus 12-year basic education curriculum. This new system, often called the K to 12 program, includes six years of primary education, four years of junior high school, and two years of senior high school[9]. Essentially, it extends the years of basic education from the original 10 years to 12 years plus kindergarten. This policy is expected to improve the quality of basic schooling. Lastly, the fifth reform, under the Duterte Administration, is the "Universal Access to Quality Tertiary Education Act" (R.A. 10931), which declares free tuition fees in state universities and colleges[10]. This recent reform may increase the demand further for state universities and colleges at the expense of the existing private schools.

[5] See https://lawphil.net/consti/cons1987.html, accessed on 30 May 2019.
[6] See https://lawphil.net/statutes/repacts/ra1994/ra_7722_1994.html, accessed on 30 May 2019.
[7] See https://tesda.gov.ph/uploads/File/REPUBLIC%20ACT%20NO.%207796.pdf, accessed on 30 May 2019.
[8] See https://www.officialgazette.gov.ph/1995/02/20/republic-act-no-7880/, accessed on 30 May 2019.
[9] See https://www.lawphil.net/statutes/repacts/ra2013/ra_10533_2013.html, accessed on 30 May 2019.
[10] See https://www.lawphil.net/statutes/repacts/ra2017/ra_10931_2017.html, accessed on 30 May 2019.

1.1.3. Objectives, contributions, and main findings: First analytical chapter

The first analytical chapter investigates the long-run impact of free and subsidized secondary education (R.A. 6655 and R.A. 6728) on schooling attainment, employment, and earnings in the Philippines. It contributes to the extant literature on the impact of government policies on schooling and labor market outcomes. The chapter is one of the first to utilize a regression discontinuity design (RDD) in the analysis of education policies in the Philippines. The RDD is a quasi-experimental approach that finds a discontinuity in outcomes, based on the timing of a policy, to compare the effects on the treated and control groups. The study also serves as a large-scale empirical analysis on the gender-based impact of schooling policies using nationally-representative surveys (i.e., the Annual Poverty Indicators Survey [APIS]). The other contributions of the study to the existing body of literature are as follows. First, the analysis reflects the long-term effects, rather than short-term impacts, of two major educational policies. Second, the results of the RDD indicate causal linkages among the policies, educational attainment, employment, and individual income. Previous studies fail to establish causality among these outcomes. Lastly, the same empirical model in this study may be utilized in the evaluation of newly implemented schooling policies (i.e., the K to 12 program and the free college tuition act) once relevant data become available.

Briefly, the findings of the first analytical paper are the following. First, the beneficiaries of the policies tend to have significantly higher schooling attainment than non-beneficiaries. Women exhibit more years of schooling than men before and after policy implementation. Second, evidence suggests that as educational attainment increases, the probability of formal employment rises and the likelihood of informal employment decreases. This is true for both genders. Finally, higher levels of schooling

cause significant improvements in individual income. Further analyses reveal that women in the informal sector receive higher earnings compared to women in the formal sector. In the same way, men in the formal sector gain higher income compared to men in the informal sector. This means that women, who generally have higher years of schooling than men, tend to be worse off in terms of labor market outcomes.

1.2. Learning and labor market outcomes

In terms of education quality, global reports show that the increase in enrollment does not necessarily translate to improvements in cognitive skills. The World Bank (2018) notes that many countries exhibit low scores in local and international standardized exams. In addition, there are wide gaps in learning outcomes between groups (i.e., boys and girls, rich and poor, etc.). Such data confirm that the world is currently experiencing a learning crisis.

In the Philippines, despite the rise in enrollment in recent decades, students perform poorly in national and international standardized exams at the primary and secondary levels. Notably, boys lagged behind girls in all subject areas across all years based on available National Achievement Test (NAT) data.

1.2.1. Philippine participation in international and national standardized exams

Figure 1.8 depicts the performance of the Philippines in terms of test scores vis-à-vis other selected Asian countries (Brunei, China, Indonesia, Japan, Malaysia, Singapore, South Korea, Thailand, and Vietnam) in the Programme for International Student Assessment (PISA) 2018. The PISA is implemented by the Organisation for Economic Cooperation and Development (OECD) to evaluate the academic skills of 15-

year-old students across nations. The figure shows that in Mathematics, girls tend to outperform boys in most countries. In Science, the disparities between the two groups are minimal. In Reading, girls dramatically achieve higher test scores than boys in all countries. These observations indicate gender gaps in learning outcomes, with boys lagging behind girls especially in Reading skills.

Notably, Filipino girls and boys exhibit the poorest performance among Asian nations in all subject areas. In Mathematics, the average scores of Filipino girls and boys are 358 and 346, while those of Chinese top scorers are 586 and 597. In Science, the Philippines' scores are 359 for girls and 355 for boys, which are way below the scores of students in China (584 for girls and 596 for boys). In Reading, Filipino girls and boys score 352 and 325, while Chinese counterparts score 562 and 549. Clearly, among all the neighboring Asian countries that performed in the PISA, the Philippines exhibit the lowest academic skills.

Given the low performance in international exams, the result of the national exams may not come as a surprise (Figure 1.9). Based on the National Achievement Test (NAT), which is a standardized exam organized by the DepEd annually across the Philippines, the mean percentage scores of high school girls and boys are commonly lower than 60 percent. This is true for all years between 2005 and 2018. Among the three core subjects (Mathematics, Science, and English), the scores are lowest in Science. In fact, the Science average scores of both girls and boys do not even reach 50 percent in any year.

In terms of gender disparities in test scores, a clear pattern emerges. Girls perform better than boys across all critical subjects and all years. The most evident gap is in English, which may explain the very low Reading scores of boys in the PISA.

1.2.2. Labor market outcomes of women and men

Lack of access to schooling or low learning outcomes affect labor market participation in the long run. Luo and Terada (2009) mention that highly educated individuals work in well paid occupations while the less educated settle in lowly paid service sector jobs. Clearly, education is a significant factor in expanding an individual's employment opportunities and in decreasing income disparities across groups. Aside from education, we note that there are other factors which affect employment possibility. These factors may be related to the labor market structure (imperfections) and other cultural factors. These factors similarly influence the differences in employment outcomes of women and men.

Table 1.1 presents the employment distribution of women and men by class of worker in the Philippines between 2009 and 2019. During this period, we observe an increase in the percentage of women and men in wage and salaried employment (formal work). The increase, however, is smaller among women than among men (8 and 12 percentage points increase, respectively). In the case of informal employment, we note a decline in the percentage of men who are self-employed without any paid employee, employers in own family-operated farm or business, and workers without pay in own-family-operated farm or business. In contrast, we notice almost no change in the percentage of women who are self-employed without any paid employee and employers in own family-operated farm or business during the 10-year period. While we observe a decline in the percentage of women who worked without pay in own family-operated farm or business, the overall decrease in the percentage of men informal workers is still higher.

Essentially, men workers tend to dominate formal sector jobs, while women settle in informal, vulnerable occupations even if women have higher scores than men in various standardized exams. These observations depict the importance of exploring the factors that affect gender differences in labor market outcomes.

1.2.3. Objectives, contributions, and main findings: Second analytical chapter

The second analytical chapter aims to explore the gender disparities in cognitive skills, the household and parental variables that affect test scores, and the impact of learning achievements on labor market outcomes of women and men in the Philippines. It analyzes the determinants of NAT scores and the relationship between provincial test performance and employment outcomes between genders using both individual-level and provincial level data and by employing ordinary least squares (OLS) and instrumental variable two-stage least squares (IV 2SLS) regressions. It utilizes an extensive gender-disaggregated data on test scores (2005-2018) from the DepEd and employment status data from the APIS. This paper complements the existing literature on gender inequities in learning and labor market outcomes. First, it demonstrates how gender and other household-related variables affect academic performance. Second, it is one of the first in the Philippines to link provincial test outcomes and skills with employment levels (i.e., proportion of employed, proportion of formally employed, and proportion of informally employed) by gender. Finally, the results of the study provide insights on how to improve gender-related interventions in schools and the formal and informal labor market sectors. From a policy standpoint, evaluating gender-based outcomes is vital in promoting these well-targeted policy responses.

The second study has three main findings. First, girls significantly outperform boys across all subject areas based on various specifications using our pooled dataset (2009 to 2018). Second, certain household and parental characteristics yield significant impacts on children's test scores. Our results reveal that access to electricity, agricultural land ownership, and mother's years of schooling positively correlate with exam performance, while ownership of TV and radio are negatively associated with test scores. This is true for both girls and boys. Third, provincial-level analyses show positive correlation between NAT scores and the proportion of formally employed and negative association between NAT scores and the proportion of informally employed. These correlations are evidently higher among boys than among girls.

1.3. Analytical framework

This dissertation aims to analyze the linkages among education, skills, employment, and income in the Philippines. We follow a modified version of Fasih's (2008) analytical framework to present the pathways by which the determinants of schooling influence education outcomes and, in turn, labor market outcomes of individuals (Figure 1.10).

The first level of linkages shows the determinants of education. These factors may be related to the demand side or supply side. On the one hand, demand-side factors refer to an individual's characteristics (i.e., household-related characteristics) and societal characteristics (i.e., community characteristics and informal institutions, such as culture and norms). On the other hand, supply-side factors are school characteristics and other inputs, which may represent the school's service capacity (i.e., infrastructure, teachers, class size, institutional set-up, textbooks, and school management), and formal

institutions, which refer to the existing legal and regulatory framework (i.e., laws and regulations) that may either constrain or support education (World Bank, 2012). In the Philippines, formal institutions play an important role in influencing school participation. The implementation of R.A. 6655 and R.A. 6728, for instance, lowers the fees for secondary schooling, which means that the price of education faced by the parents effectively decline with the implementation of the two laws. In particular, through R.A. 6655, secondary students enrolled in national high schools, trade, technical, vocational, agricultural schools, and other high schools funded by local government units are able to get free tuition and other school fees. Relatedly, R.A. 6728 enables children from poor households, who cannot be accommodated by public high schools, to enter private schools with subsidized tuition fees. Institutional change that involves a reduction of user fees in schools, such as the passing of R.A. 6655 and R.A. 6728, affects educational outcomes as it induces households to keep their children in school for a longer period of time.

The second level of linkages involves the education outcomes that result from the various determinants mentioned above. Time spent in school enables children to gain general and specific knowledge on different subject areas and develop cognitive skills. Such skills serve as signals that a child learned and made use of her or his time while in school. These skills also lead to higher chances of participating in the labor market.

The third and final set of linkages refers to the labor market outcomes of individuals. Fields (2007) defines labor market as the buying and selling of labor services. In this market, an individual can either be employed or not employed. The category of not being employed is characterized by being unemployed (i.e., not working but seeking and available to work) or out of the labor force (i.e., not working and not seeking work).

Meanwhile, employment may be classified into formal (wage) work or informal (non-wage) work. Broadly, formal employment occurs when labor is sold to others. Thus, this includes wage and salaried employment. In contrast, informal employment is where workers sell services and labor to themselves. Self-employment falls under this category.

Employment is an important labor market outcome for educated individuals. Education affects employment possibilities in several ways. First, those with lower years of schooling, fewer skills, or lower learning achievements are less likely to attract potential employers or less able to start their own businesses. Second, the type of skills gained from education (i.e., general or technical-vocational skills) affects the type of occupation that an individual can participate in. Third, and lastly, educational attainment and cognitive outcomes affect the earnings of individuals in a particular job sector. Being formally employed ensures a more regular flow of income (i.e., formal or wage income), while being informally employed does not guarantee consistent or stable income (i.e., informal or non-wage income). We mention that in both formal and informal occupations, workers are exposed to various forms of trainings and apprenticeships that enhance their overall work experience and acquired skills. They represent the non-monetary gains from being employed.

Higher-order labor market outcomes, which include higher wages, promotions, access to more trainings, access to credit, and business expansion opportunities, among others, are affected not only by educational outcomes but, more importantly, by previous employment, acquired skills, and knowledge. These long-term labor market outcomes are more likely influenced by skills and knowledge gained from years of employment.

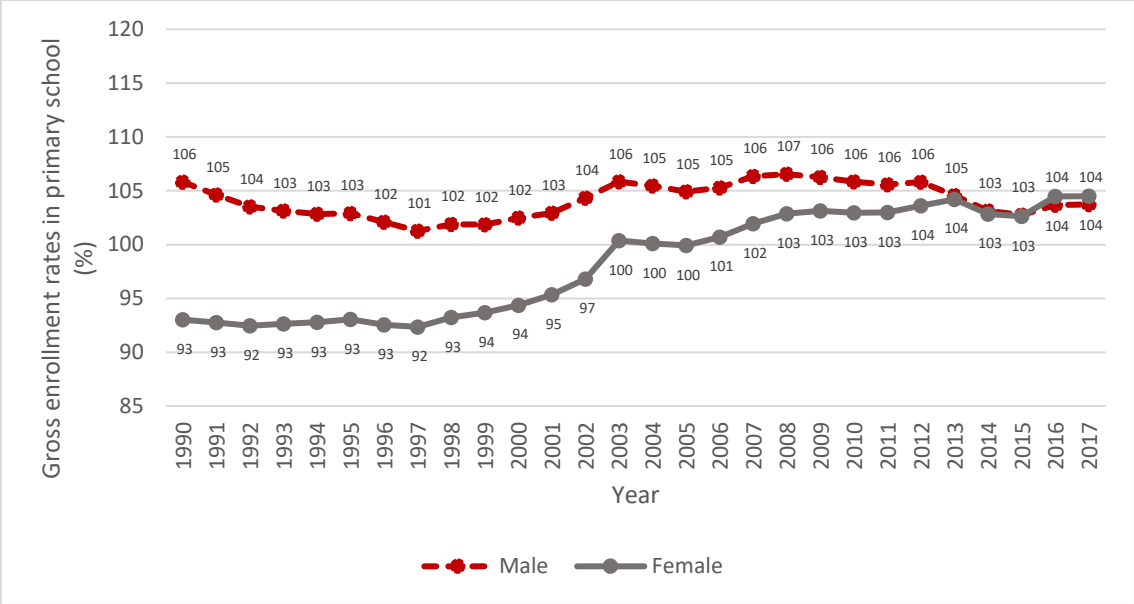
It is worth noting that the determinants of education may impact girls' and boys' schooling differently, resulting to gaps in educational outcomes and skills between the

two groups. Likewise, gender differences in employment and income may exist due to the disparities in skills gained from schooling, existing labor market structure, and other traditional or cultural factors.

1.4. Roadmap to the dissertation

This dissertation has three remaining chapters. Chapter 2 investigates the impact of free and subsidized secondary schooling on educational attainment, employment, and income in the Philippines. It likewise explores the differences in outcomes between genders. Chapter 3 discusses the gender disparities in learning outcomes and employment probability. Finally, Chapter 4 offers a summary of findings and policy implications from the two main chapters.

Figures



Note: Figure drawn using available data from the World Development Indicators, accessed from https://databank.worldbank.org/source/world-development-indicators on 15 May 2020.

Figure 1.1: Gross enrollment rates in primary school (%), by gender, World, 1990 to 2017

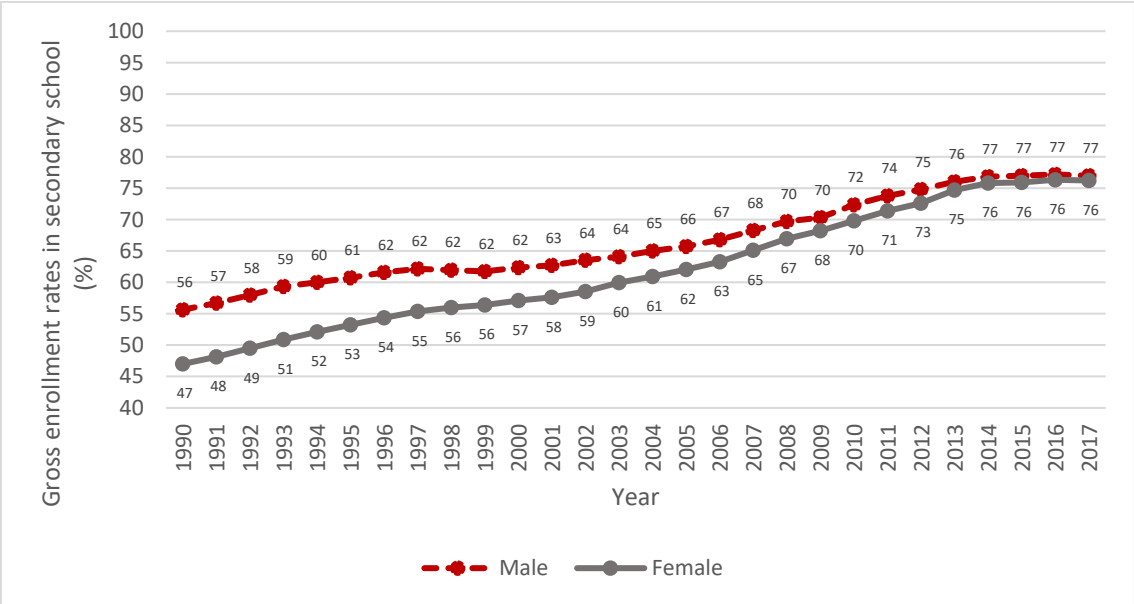


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Figure 1.2: Gross enrollment rates in secondary school (%), by gender, World, 1990 to 2017

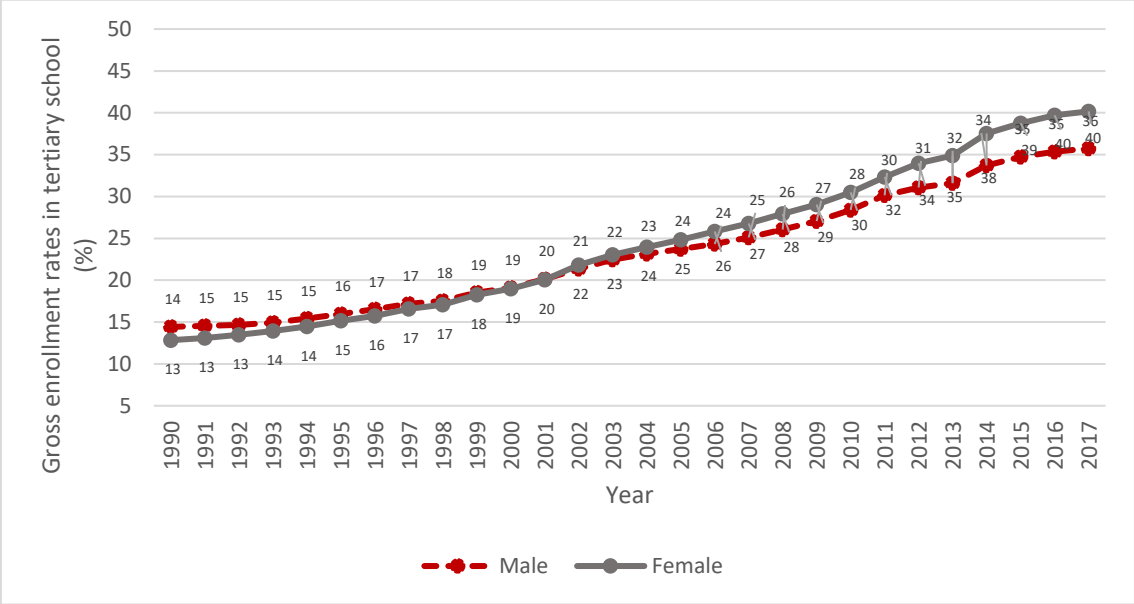

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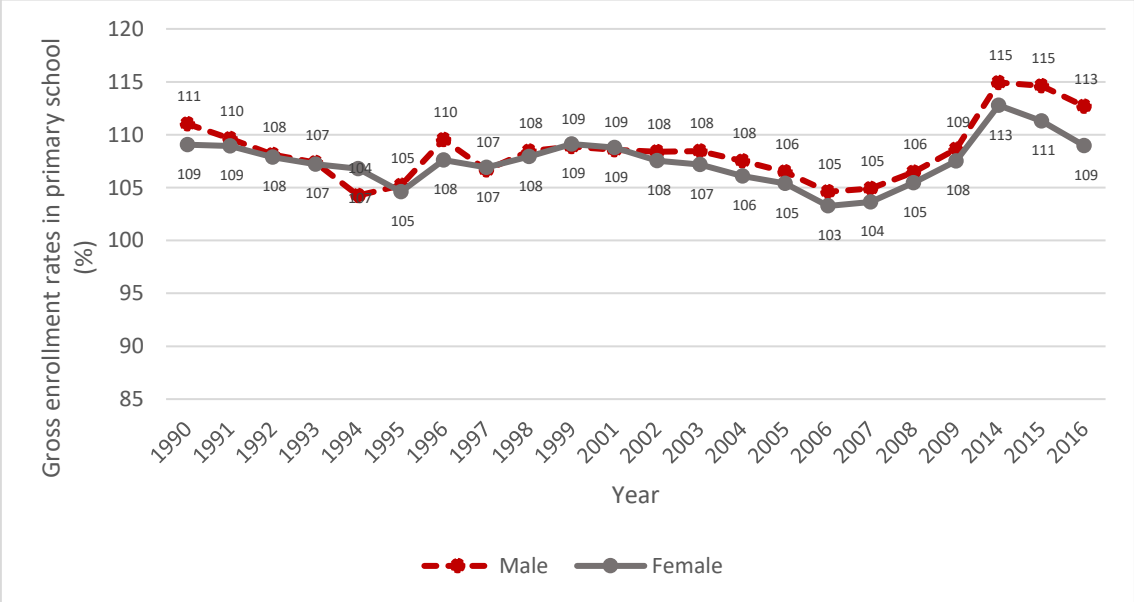
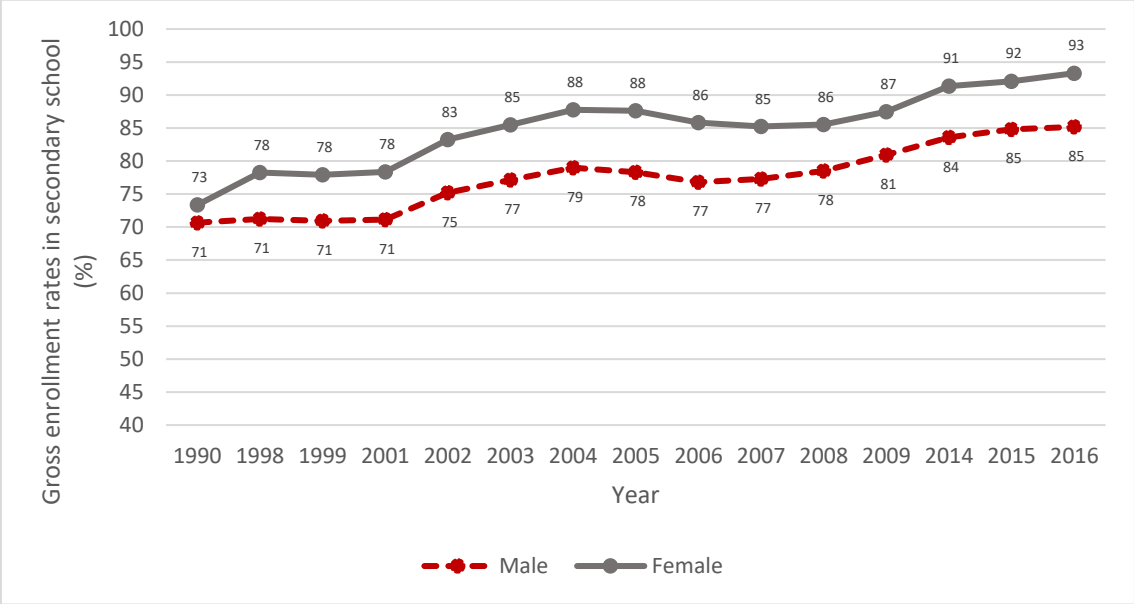
Figure 1.3: Gross enrollment rates in tertiary school (%), by gender, World, 1990 to 2017



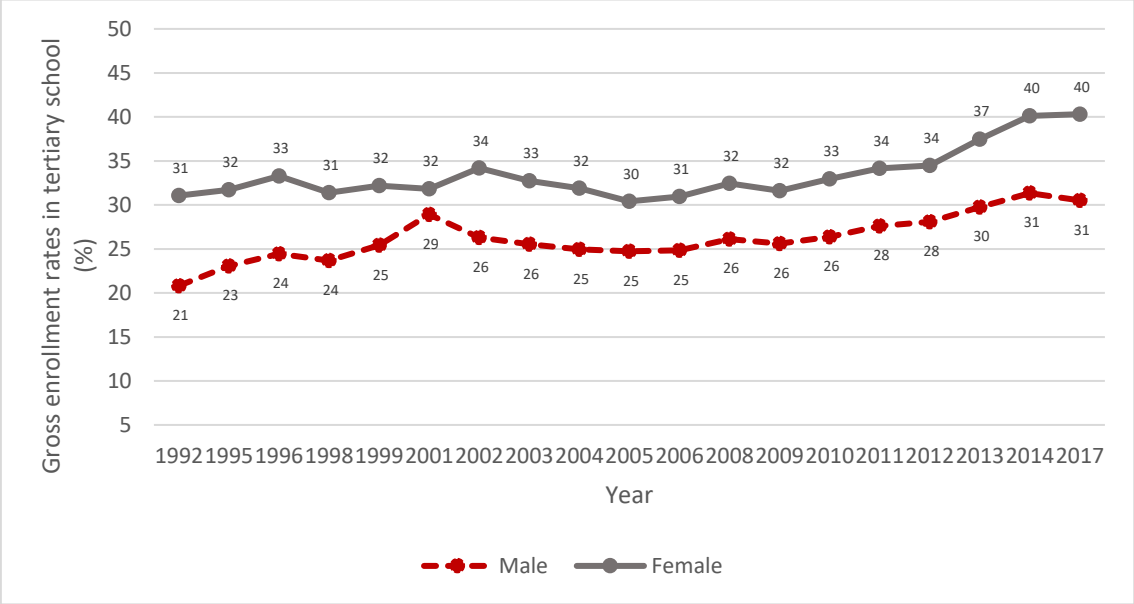
Note: Figure drawn using available data from the World Development Indicators, accessed from https://databank.worldbank.org/source/world-development-indicators on 15 May 2020.

Figure 1.4: Gross enrollment rates in primary school (%), by gender, Philippines, 1990 to 2016



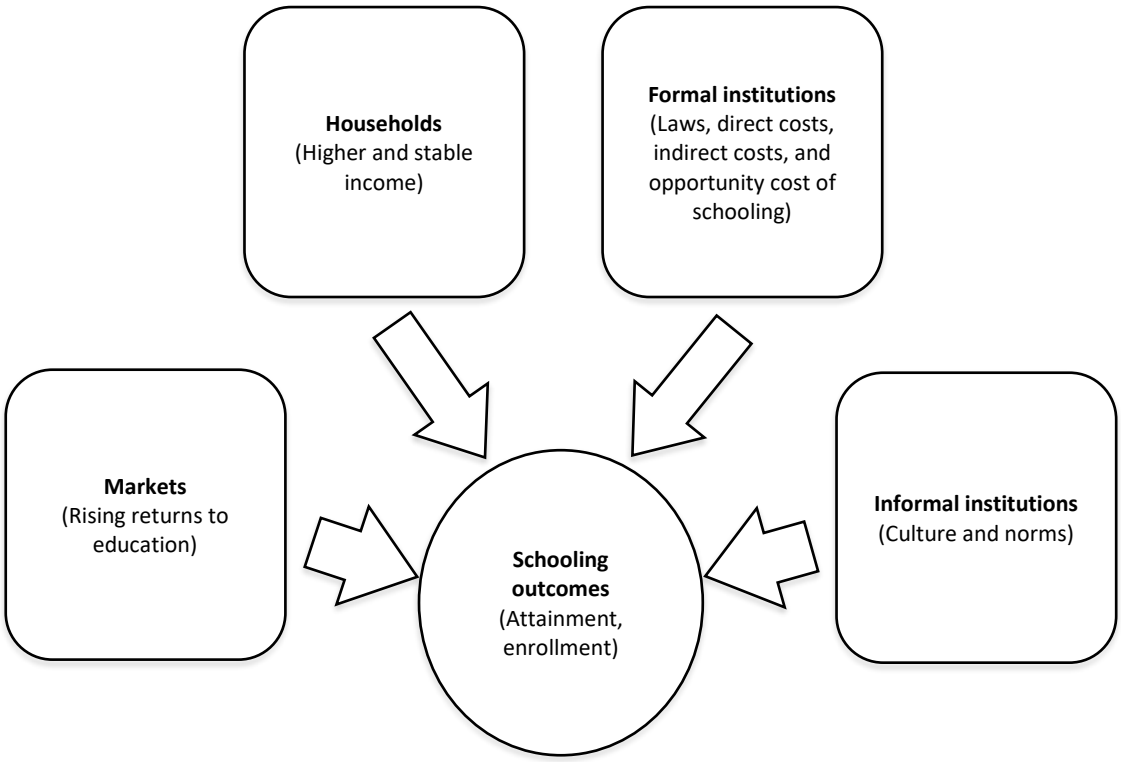
Note: Figure drawn using available data from the World Development Indicators, accessed from https://databank.worldbank.org/source/world-development-indicators on 15 May 2020.

Figure 1.5: Gross enrollment rates in secondary school (%), by gender, Philippines, 1990 to 2016



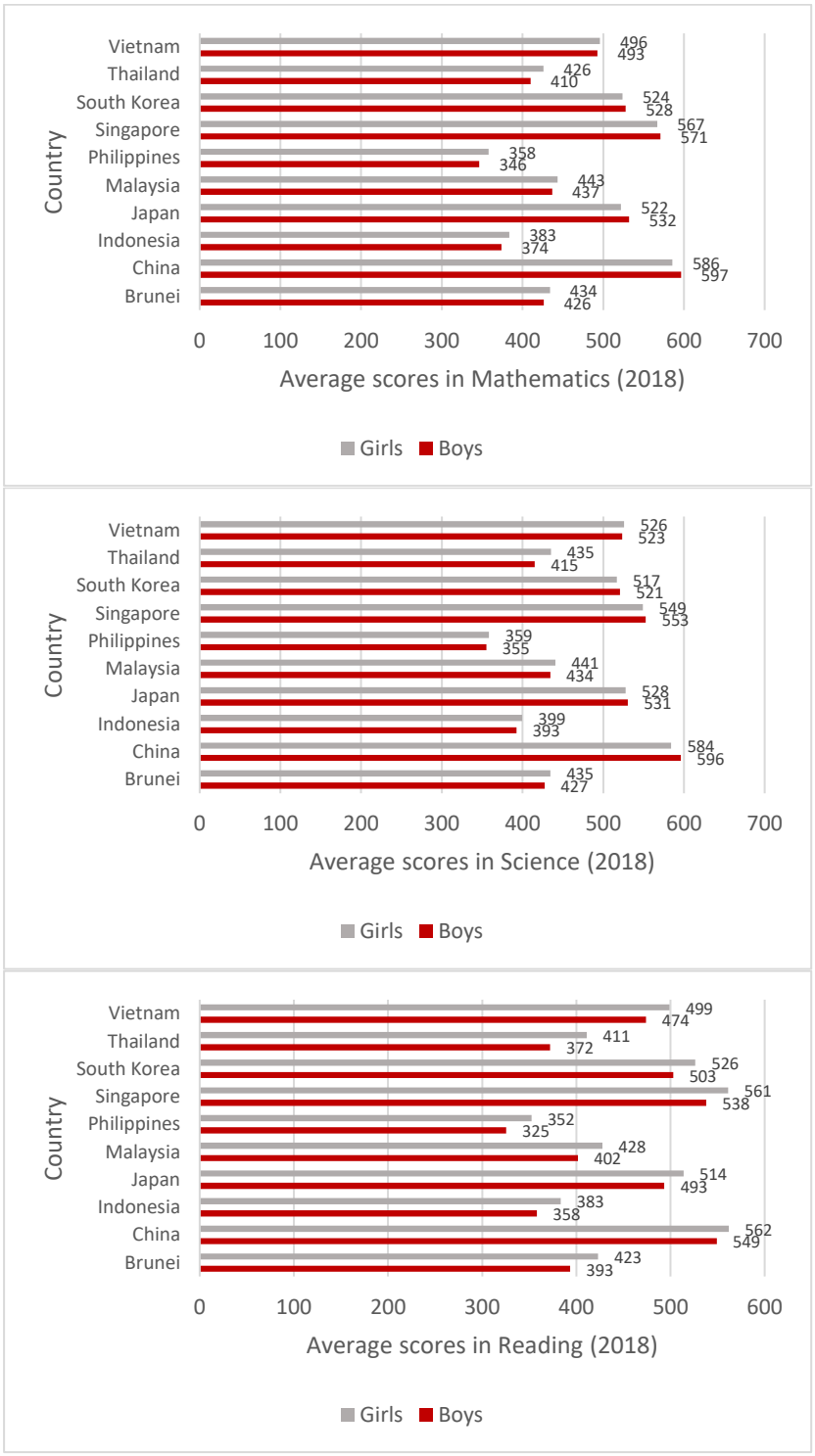
Note: Figure drawn using available data from the World Development Indicators, accessed from https://databank.worldbank.org/source/world-development-indicators on 15 May 2020.

Figure 1.6: Gross enrollment rates in tertiary school (%), by gender, Philippines, 1992 to 2017



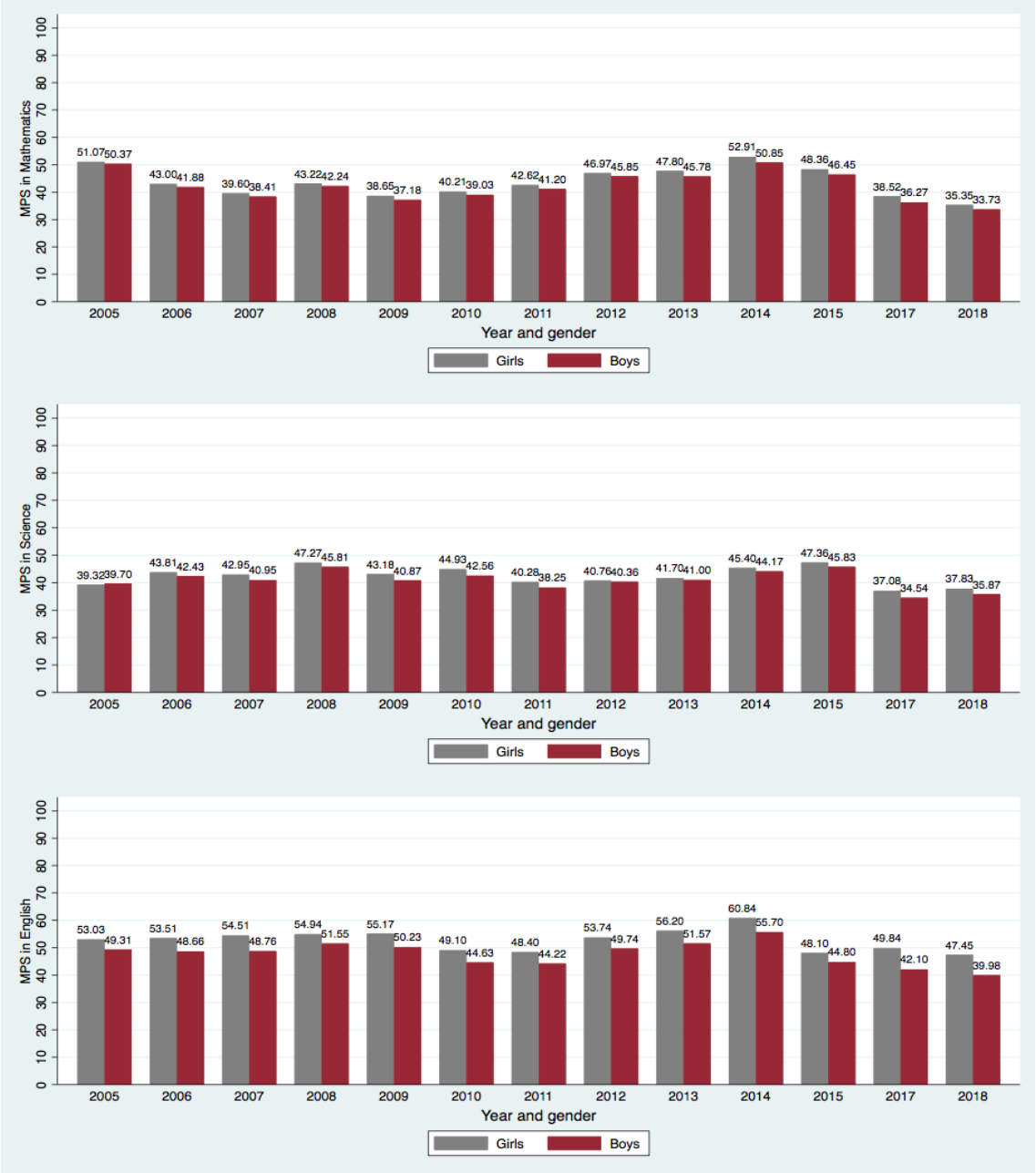
Note: Adapted from the World Development Report (2012).

Figure 1.7: Factors affecting school participation



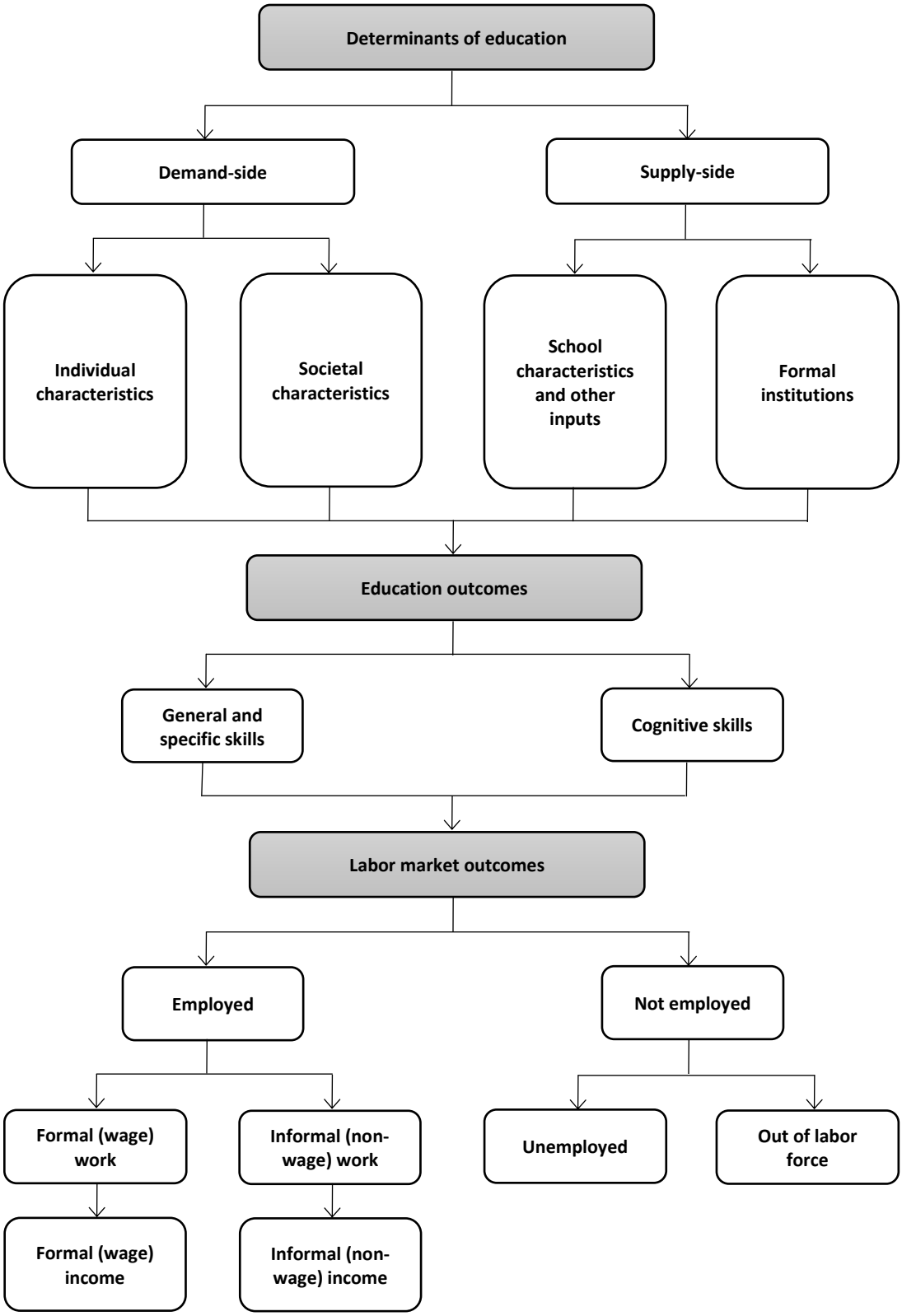
Note: Figure drawn using data from the OECD, accessed from https://pisadataexplorer.oecd.org/ide/idepisa/dataset.aspx on 15 May 2020. China includes four participating provinces: Beijing, Shanghai, Jiangsu, and Zhejiang. Vietnam data is from 2015 (latest available). Participants are 15-year-old pupils.

Figure 1.8: Programme for International Student Assessment (PISA) average scores in Mathematics, Science, and Reading, by gender, selected Asian countries, 2018



Note: Figure drawn using data from the Department of Education.

Figure 1.9: National Achievement Test (NAT) mean percentage scores of secondary school students in Mathematics, Science, and English, by gender, Philippines, 2005 to 2018



Note: Adapted from Fasih (2008).

Figure 1.10: Analytical framework on the determinants of education, education outcomes, and labor market outcomes

Table

Table 1.1: Employment distribution by class of worker and gender (%), Philippines, 2009 and 2019

Class of worker (%)	2009		2019		Percentage point change (2019-2009)	
	Men	Women	Men	Women	Men	Women
Wage and Salary Workers	54	52	66	60	12	8
Worked for Private Household	1	12	1	9	0	-2
Worked for Private Establishment	46	30	58	38	12	8
Worked for government and government-controlled corporation	7	11	7	13	0	2
Worked with pay in own family-operated farm or business	0	0	0	0	0	0
Self-employed without any paid employee	32	28	27	29	-5	0
Employer in own family-operated farm or business	5	2	3	2	-2	0
Worked without pay in own family-operated farm or business	9	17	4	10	-4	-8
Total	100	100	100	100		

Note: Details may not add up to totals due to rounding. 2009 data were averages of four Labor Force Survey rounds (January, April, July, and October), while 2019 data were based on the July 2019 round, as reported by the Philippine Statistics Authority. Accessed from https://psa.gov.ph/sites/default/files/Table%203.10_2.pdf and http://www.psa.gov.ph/statistics/survey/labor-and-employment/labor-force-survey/table-title/July%202019%20Statistical%20Tables on 15 May 2020.

Chapter 2

Secondary Education Reforms, Schooling Attainment, Employment Outcomes, and Income[11]

2.1. Introduction

Education is widely recognized as an important factor in advancing human capital. It plays a crucial role in helping individuals gain marketable skills that may lead to better prospects of employment and higher income (Fasih, 2008). Governments and international organizations have placed high emphasis on prioritizing education in their policy agenda. The United Nations (UN), for instance, has set targets in improving the quality of and access to education through the Millennium Development Goals (MDGs) and in the Sustainable Development Goals (SDGs). Specifically, Goal 2 of the MDGs aims to ensure that by 2015, children in all countries will be able to complete primary schooling (UN, 2015). Likewise, Goal 4 of the SDGs aims to continue the agenda of the MDGs by ensuring inclusive and equitable quality education for all from 2015 to 2030 (UN, 2017). Such goals of the UN focus on increasing access to quality education that can enhance individual productivity and improve labor market outcomes.

After the 1986 revolution, the Philippines started to invest more in higher education to enhance the skills of its labor force through two major policies. First, in 1988, the government implemented the Free Public Secondary Education Act or Republic Act (R.A.) 6655, which eliminates tuition fees in all public high schools. Second, in the following year, it supported private schools through the passing of the Government

[11] Part of this chapter was presented at the 5th International Conference on Education on January 10-12, 2020 in Hawai'i, USA and the 11th Asian Conference on Education on October 31-November 3, 2019 in Tokyo, Japan.

Assistance to Students and Teachers in Private Education (GASTPE) Act or R.A. 6728, which subsidizes private schooling. These two policies lower the cost of schooling by reducing the relative price of schooling and by easing the resource constraints of households in sending their children to school. Notably, the two republic acts serve as the most important educational reforms since the implementation of free public primary schooling during the American colonial period (1898-1946)[12]. Since the passage of R.A. 6655 and R.A. 6728 in 1988 and 1989, the Philippines saw improvements in secondary schooling as evident in the higher gross enrollment rates[13], employment of additional teachers, and decrease in pupil-teacher ratio[14].

In terms of labor market outcomes, the least educated Filipinos, like many others worldwide, are employed in lowly paid service sector jobs. Those with higher educational attainment or post-secondary education work in highly paid occupations. Moreover, inequality in income persists as the gap between the wages of less educated and the more educated individuals remains wide. Evidently, education serves as the single most important factor that influences employment opportunities and income differentials (Luo and Terada, 2009) and the two policies may help in improving labor market prospects for all children.

Over the years, researchers conducted impact assessments of education programs using different approaches. The most commonly used econometric methods are the

[12] See http://www.deped.gov.ph/about-deped/history/, accessed on 28 May 2019.
[13] Gross enrollment rate refers to the number of students enrolled in a given level of education, regardless of age, expressed as a percentage of the official school-age population corresponding to the same level of education, while net enrollment rate refers to the total number of students in the theoretical age group for a given level of education, expressed as a percentage of the total population in that age group, accessed from http://uis.unesco.org/en/glossary on 29 June 2018.
[14] Pupil-teacher ratio refers to the average number of pupils per teacher in secondary education, based on headcounts of both pupils and teachers, accessed from http://uis.unesco.org/node/334770 on 29 June 2018.

difference-in-differences approach, randomized control trials, instrumental variables approach, propensity score matching, and regression discontinuity design[15]. In general, these methods allow for individuals to be assigned into control and treatment groups. The assessment of treatment effect is then based on the difference in outcomes between the two groups after the implementation of the policy.

To our knowledge, no rigorous impact assessment of R.A. 6655 and R.A. 6728 had been conducted in the Philippines. This study aims to explore the impact of free and subsidized secondary education on schooling attainment in the Philippines and to assess its downstream impacts on employment and earnings. Our main hypothesis is that R.A. 6655 and R.A. 6728 are expansionary educational reforms that promote participation in school, increase educational attainment, and eventually improve employment outcomes and individual income.

The study utilizes a quasi-experimental approach called the regression discontinuity design (RDD), which allows us to select a cut-off, based on the year of policy implementation, to observe the effects on the group affected by the policy. Briefly, the main findings of this chapter are the following: First, the policies have the impact of significantly increasing the educational attainment of beneficiaries vis-à-vis the non-beneficiaries. Second, educational attainment increases the probability of being formally employed and, to some extent, decreases the likelihood of being informally employed. Finally, schooling causally increases individual income.

Our study contributes to the extant literature in several ways. First, in contrast to studies that analyze mostly short-term effects, our analysis captures long-term effects of

[15] See Duflo (2001), Angrist, Bettinger, and Kremer (2006), Winters (2015), Behrman, Parker, and Todd (2011), and Keats (2018) for examples of each of these approaches.

educational policies on schooling, employment, and income. Second, to our knowledge, this study is one of the first in the Philippines to link specific educational policies to employment and income using the regression discontinuity approach. Third, while earlier studies show mere associations, our results reflect causal relations on the nexus between education, employment, and individual income. Fourth, the same model in our study may be used to analyze more recent schooling policies such as the K to 12 program[16] and the free college tuition act[17] once data become available.

This chapter has five remaining sections. Section 2.2 presents a background on the major public and private secondary education policies implemented in 1988 and 1989. Section 2.3 provides the literature review. Section 2.4 describes the empirical strategy and data. Section 2.5 discusses the results. Finally, Section 2.6 concludes the chapter.

2.2. Background on the major secondary education reforms

With the aim of making secondary education accessible to all, the Philippine government implemented the Free Public Secondary Education Act, also called R.A. 6655, in May 1988. This law ensures that public secondary schools, including national high schools, general comprehensive high schools, and high schools funded by local government units, are free from tuition and other school fees (i.e., medical, dental, athletic, library, and laboratory fees). To finance the implementation of this policy, budgets were realigned within the education ministry, formerly called the Department of Education, Culture and Sports (DECS). Additional adjustments in the budget were also

[16] See https://www.lawphil.net/statutes/repacts/ra2013/ra_10533_2013.html for details, accessed on 30 May 2019.
[17] See https://www.lawphil.net/statutes/repacts/ra2017/ra_10931_2017.html for details, accessed on 30 May 2019.

incorporated in the succeeding fiscal years. R.A. 6655 took effect in school year 1988-1989[18]. Likewise, in recognition of the importance of the private sector in providing and promoting quality education, the government implemented the GASTPE Act or R.A. 6728 in June 1989. Specifically, the law provides assistance to students in private secondary schools through tuition fee supplements, the High School Textbook Assistance Fund, and the Educational Service Contracting (ESC) scheme.

Tuition fee assistance is based on several criteria, which include school characteristics (i.e., amount of tuition fees and overall performance), regional characteristics (i.e., socio-economic, geographic, and demographic profile), and student characteristics (i.e., academic qualifications and financial status). Meanwhile, the ESC scheme allows the DECS to enter into contracts with private schools and settle fees of students who cannot be accommodated by public high schools due to congestion or children who live in areas with no public schools. The budget of DECS in 1989 was again realigned to accommodate the GASTPE Act[19]. In February 1998, the policy was expanded under R.A. 8545 to subsidize the salaries of private school teachers and adjust the income criteria for eligibility in the programs[20].

Since the implementation of R.A. 6655 and R.A. 6728 in 1988 and 1989, the Philippines has evidently experienced rising gross enrollment rates in secondary school, as shown in Figure 2.1. The graph also shows that even before R.A. 6655 and R.A. 6728, there was a modest rise in secondary school enrollment, indicating that there are other factors that affect participation other than free and subsidized secondary school. Yet, it is evident that the jump becomes more visible in 1989, suggesting that the implementation

[18] See https://www.lawphil.net/statutes/repacts/ra1988/ra_6655_1988.html, accessed on 30 May 2019.
[19] See https://www.lawphil.net/statutes/repacts/ra1989/ra_6728_1989.html, accessed on 30 May 2019.
[20] See https://www.lawphil.net/statutes/repacts/ra1998/ra_8545_1998.html, accessed on 30 May 2019.

of R.A. 6655 and R.A. 6728 contributes more effectively to higher secondary school enrollment.

Meanwhile, the number of teachers in secondary school also increased substantially after 1989 (Figure 2.2), indicating that the two policies led to the employment of additional teachers. The pupil-teacher ratio, as presented in Figure 2.3, also significantly decreased in the late 1980s, after a continuous increase from 1985 to 1988. This decrease in the number of students assigned per teacher may improve efficiency of instruction as each teacher could spend more time for each student.

It is worth noting that the Philippine secondary education system has recently gone through another major reform. In 2013, the government passed the Enhanced Basic Education Act or the K to 12 program, which extends secondary education from 4 to 6 years[21]. Hence, the country's education system now follows the basic 6-6-4 structure: 6 years of primary, 6 years of secondary, and 4 years of undergraduate. Pre-primary and basic education are compulsory, while public pre-primary, basic, and higher education are tuition-free[22]. Normally, pre-primary education begins at age 3, primary education at age 6, secondary education at age 12 (or, specifically, junior high school at age 12 and senior high school at age 16), and higher education at age 18 (Figure 2.4).

Given this structure and the year of implementation of our major reforms, the cut-off year in our regression discontinuity design should be the year of birth of those individuals who were at least in fourth year high school or around 15 years old in 1989. Thus, those individuals born in and after 1974 are part of our treatment group (beneficiaries of the reform), while those born before 1974 are part of our control group

[21] See https://www.lawphil.net/statutes/repacts/ra2013/ra_10533_2013.html, accessed on 30 May 2019.
[22] See https://www.lawphil.net/statutes/repacts/ra2017/ra_10931_2017.html, accessed on 30 May 2019.

(non-beneficiaries). It is important to mention that the beneficiaries of the program are those who entered the labor force after the economic liberalization in 1986 and, thus, were able to benefit from the rising returns to education due to liberalization.

2.3. Literature review

2.3.1. Education policies, schooling, employment, and income

Previous literature provides a vast array of studies on the impact of education policies on three interrelated outcomes, namely schooling, employment, and income. Since investment in education theoretically improves human capital, promotes employment, and increases income (Schultz, 1975), previous research focus on these three facets collectively. Depending on data availability and restrictions, these studies use various experimental and quasi-experimental methods in generating causal estimates. We review some of them here.

One commonly used method in impact evaluation is the difference-in-differences (DID) approach. A classic study by Duflo (2001) utilizes this approach to analyze the impact of a major school construction program in Indonesia. She finds that one school built per 1,000 children increases educational attainment by 0.12 to 0.19 years and wages by 1.5 to 2.7 percent, on average. Additionally, returns to education with the policy is estimated to be around 7 to 10 percent per year. Likewise, Meghir and Palme (2005) note that the compulsory education reform in Sweden in the 1950s increases educational attainment and, subsequently, wages of a major part of the population. Similarly, Behrman, Parker, and Todd (2011) explores the long-term impacts of Mexico's conditional cash transfer (CCT) program, called Progresa/Oportunidades (now called Prospera), on schooling and working. Results show that program recipients experience

an increase of about 0.3 years of schooling. Also, the completed grades of the group with longer program exposure are higher by about 2.4 percent for boys and 2.7 percent for girls. In terms of employment, longer exposure to the program decreases the proportion of boys in school-age who are engaged in work by 4.1 percent, while for younger school-age girls, there is no significant impact. For older girls, however, there is a significant increase in the proportion of those who are engaged in work, suggesting that older girls enter the workforce to allow their younger siblings to attend school.

Another approach in impact analysis is the randomized control trial (RCT). Using this method, Duflo, Dupas, and Kremer (2017) show that Ghana's scholarship program increases educational attainment by 1.3 years and the probability of completing secondary school by 55 percent. The recipients are also more likely to increase their earnings significantly. For vocational students, total earnings rise by about 19 percent, while their rate of returns to education is around 13 percent. Overall, this subgroup exhibits improvements in labor market outcomes. Moreover, in Colombia, Angrist, Bettinger, and Kremer (2006) conclude that the PACES vouchers, which subsidize private schooling, increase eighth grade completion rates by 10 percentage points and high school graduation rates by 5 to 7 percentage points. In a related RCT study, the authors mention that voucher beneficiaries tend to work less to attend school than non-beneficiaries (Angrist, Bettinger, Bloom, King, and Kremer, 2002).

Alternatively, Chicoine (2016) employs the instrumental variables approach to assess the effects of free primary education in Ethiopia. He reports that the policy increases schooling by about 1.2 years and leads to improvements in terms of employment possibility and higher wage. Similarly, Oreopoulos (2007) finds evidence on the favorable impacts of compulsory schooling laws, noting that the effects of raising the

dropout age or school-leaving age on educational attainment are 0.24 year in the United States (US), 0.41 year in Canada, and 0.5 year in the United Kingdom (UK). Also, an additional year of compulsory schooling reduces the probability of being unemployed and yields a 15-percent increase in wealth through additional earnings. In particular, students exposed to the compulsory schooling program in the UK earn about 14 percent more (Harmon and Walker, 1995; Oreopoulos, 2006).

Several studies that use IV have been conducted in the US to analyze returns to schooling. For instance, Angrist and Krueger (1991) and Acemoglu and Angrist (2001) estimate the impact of compulsory schooling laws on earnings using quarter of birth (i.e., birth month falls on first, second, third, or fourth quarter of the year) and differences in compulsory attendance and child labor laws across the US as IV. They reveal that a year of compulsory education raises annual earnings of students by approximately 10 percent. This is also equal to the rate of return estimated by Psacharopoulos and Patrinos in 2004. Note that 10 percent is also equal to the returns to physical capital. Relatedly, Acemoglu and Angrist (1999) estimate the private and social returns to education using 1960 to 1990 Census data and quarter of birth as instrument for individual schooling. They find that the private returns to education is about 7 percent, while the social returns are low and insignificant. By the same token, Winters (2015) uses mother's education as instrument and reports that an increase in educational attainment increases hourly wages of men and women by 10 and 12.6 percent, respectively. The higher rates of returns for women have been documented as early as mid-1980s (Psacharopoulos, 1985).

There are other recent papers that use the IV approach. Brudevold-Newman (2016) points out that the 2008 free secondary education reform in Kenya raises years of schooling of primary school graduates by 0.8 years. In terms of labor market outcomes,

women with post-primary education are 28 percent more likely to be in skilled employment and 80 percent less likely to be employed in agriculture. Meanwhile, Heckman, Humphries, and Veramendi (2018) use a dynamic model of educational choice to show that schooling has strong causal effects on earnings and that programs which promote high school completion strongly benefit disadvantaged individuals in the US.

Furthermore, a relatively less common approach to impact evaluation is natural experiment. Utilizing this method, Kyui (2016) investigates the effect of higher education reforms in Russia by taking advantage of exogenous differences in educational access. The main findings indicate that the reforms, which expand the capacity of universities to absorb students, improve educational access and positively impact employment and wages.

Finally, the regression discontinuity design is another method frequently applied in the analysis of education reforms. As an example, Filmer and Schady (2014) use sharp regression discontinuity design to explore the effects of a three-year scholarship program in Cambodia. Results indicate a substantial increase in schooling attainment of 0.6 years. However, they show no significant impact on employment and earnings. Next, the study of Ozier (2016) on the impact of secondary school completion on employment in Kenya reveal that men in their 20s, who have completed secondary school, are 50 percent less likely to be in low-skill self-employment. The likelihood of formal employment is positive, although insignificant, in all specifications. Ozier utilize the probability of entering government secondary school as a basis for his cut-off in the regression discontinuity approach. In the case of Uganda, Keats (2018) mentions that the universal primary education reform increases women's educational attainment by 0.6 years and improves women's employment outcomes. To be specific, additional schooling increases

the probability of working by 9.2 percent, of having an employed work (and not business) by 33 percent, and of receiving cash payment by 13 percent. It also improves women's scores on a household assets index by 0.12 standard deviations.

On a different note, other literatures focus on examining the impact of education reforms on schooling outcomes only while skipping the analysis of program impact on employment and income. These include studies on free primary education in Mozambique (Fox, Santibañez, Nguyen, and André, 2012), Kenya (Tooley, Dixon, and Stanfield, 2008; Mwirigi and Muthaa, 2015; Oketch and Ngware, 2010), Malawi (Al‐Samarrai and Zaman, 2007), Lesotho (Lekhetho, 2013), Rwanda (Williams, Abbott, and Mupenzi, 2015), Nigeria (Lincove, 2009), and Pakistan (Saqib, 1998). Further, previous analyses on free or subsidized secondary education and schooling were conducted in Ghana (Iddrisu, 2016), Uganda (Asankha and Takashi, 2011), Japan (Hori and Shimizutani, 2018), and Norway (Brinch, Bratsberg, and Raaum, 2012).

Overall, educational reforms contribute positively to schooling attainment. Although they go further by improving employment and income in many cases, some studies show that these reforms do not necessarily affect labor market outcomes. This indicates that labor market conditions are equally important in explaining an individual's chances of success in the labor market. This study is similar to Duflo (2001) in that it comprehensively explores the nexus between schooling, employment, and income.

2.3.2. The Philippine case

In the Philippines, analysis of schooling policies and outcomes that utilize experimental and quasi-experimental approaches are still limited. For instance, Maluccio (1998) exploits distance to secondary school as a main instrument in analyzing returns to

education in the Bicol region of the Philippines. He observes that estimates of returns to schooling increase substantially when instruments are used to address the endogeneity of schooling. His dataset, however, is based only on 250 observations in Bicol and is not nationally representative. Thus, Maluccio's (1998) estimates are specific to the Bicol region only. Meanwhile, Sakellariou (2006) uses a national survey dataset from the Philippines in 1999 to examine the causal effect of schooling on wages. For his IV method, he uses the implementation of free secondary schooling policy in 1988 and secondary enrollment levels when the individual was 12 years old as instruments. Consistent with previous evidence, he finds that IV estimates are typically higher than OLS estimates. He specifies that returns to education are around 6 to 8 percent for OLS and 16 percent for IV.

Other studies use descriptive statistics and ordinary least squares (OLS) regressions (i.e., Mincerian) which provide non-causal estimates of association between interventions and outcomes. One study presents initial evidence of a positive relationship between free public secondary education and national-level schooling outcomes using dummy variable on program exposure (Revilla and Estudillo, 2016). However, despite the implementation of free public education, another paper by Tan and Siriban (2017) shows that the country still faces challenges in school access, especially among the poor. Accordingly, almost 40 percent of the youth from the poorest income decile stop at the elementary level, while the same is true for only 2.5 percent from the top income decile. Maligalig and Albert (2008) confirm that the high out-of-pocket cost of education is one of the top reasons for low school attendance. This might imply that schooling reforms that target the demand side tend to address the very core problem of low schooling attendance.

With regard to labor market outcomes, Luo and Terada (2009) examine how educational attainment, as influenced by various policies, relates to employment and unemployment. University graduates and partial elementary finishers have the highest employment rates, while elementary and secondary graduates have the lowest. When it comes to unemployment, secondary and college graduates have the highest rates, while those who have some or completed the full primary school have the lowest. Unexpectedly, the most educated people have the highest unemployment rate. This shows that the supply of high skilled labor does not meet the existing demand. It appears that there is a mismatch between supply and demand of skills with the supply not satisfying the existing market demand for various skills. Importantly, it may be indicative of the low quality of education and low-level skills that these graduates receive, hindering them from entering the labor market.

In terms of returns to schooling (or the impact of an additional year of education on wages), Schady (2000) reiterates that, given the cost of sending children to school, those who finish college still receive the highest returns. In 2000, the estimate of returns to schooling in the Philippines is 12.6 percent (Kaboski, 2003). In 2003 to 2007, based on data from the Labor Force Survey, elementary, secondary, and tertiary graduates are paid 10, 40, and 100 percent more than those who have no education (Luo and Terada, 2009). Likewise, Sauler and Tomaliwan (2017) use Heckman approach to estimate the returns to education from 2008 to 2012. The results reveal that an additional year of college education increases wage by 21 to 23 percent. The returns from college education remain higher than the returns from elementary and secondary which could be due to scarcity of college-educated workers. This finding means that, indeed, there are clear

gains in schooling investments in terms of returns, even though the chance of unemployment exists even for those with higher levels of education.

Taken as a whole, the Philippines still faces issues on schooling access, unemployment, and income differentials. The impact of the government's policies on these outcomes have yet to be analyzed. Therefore, this paper aims to fill this gap in the literature.

2.4. Empirical strategy and data

2.4.1. Empirical strategy

The goals of the study are, first, to investigate the relationship between the free and subsidized secondary education policies and years of schooling attainment, and second, to examine the causality between educational attainment and labor market outcomes (i.e., formal employment, informal employment, and income). However, the main challenge in these kinds of analyses is the endogeneity of schooling. Essentially, this means that crucially important observed and unobserved factors (such as ability, IQ, parental characteristics, etc.) are captured in the error term and their impacts are not reflected on both years of schooling and our outcomes of interest. This problem may lead to biased estimates of the regression coefficients.

To address this issue, we employ the regression discontinuity design (RDD), which is a quasi-experimental method that measures causal effects of interventions. The main intuition behind the RDD is that those observations near a certain cut-off or threshold are, on average, similar between control and treated groups in most respects (i.e., motivation, exposure to economic and environmental factors, etc.) and are made different solely because of the intervention. Hence, if outcomes exhibit a discontinuity at

the cut-off, it might be reasonable to infer that this is due primarily to the intervention. In other words, outcomes would be continuous if it were not for the policy. The RDD provides us with a local average treatment effect (LATE), which means that the impact is estimated only for compliers or subgroup of beneficiaries (i.e., in this case, those who avail the free and subsidized schooling upon its implementation). One limitation of the RDD is that the effect is strictly evaluated only around the threshold (De Janvry and Sadoulet, 2015). Nonetheless, this method, which was pioneered by Thistlethwaite and Campbell (1960) in their analysis of merit certificates and scholarship, has gained popularity in empirical research in recent decades.

In our estimation of the causal effect of an additional year of schooling, we take advantage of the timing of the free public secondary education and GASTPE reforms to conduct an RDD. Our running variable in this case is year of birth, which is considered exogenous and randomized (as an individual cannot choose or manipulate his or her year of birth)[23]. We mention that in all our calculations, years of birth are normalized and re-centered at the discontinuity so that coefficients may be interpreted directly. As for our cut-off (c), we use the year of policy implementation (1989) as basis for selection. Children born in or after 1974 are aged 15 or younger in 1989 and are, thus, able to take advantage of the reforms (treated group). We note that in 1989, children at age 15 are

[23] We argue that there is low likelihood of manipulation of year of birth around the cut-off since the Philippine basic education system requires the birth certificate of the child upon enrollment to Grade 1 to verify that she or he enters primary school at the required age level. In addition, data from the World Bank show that the percentage of primary school repeaters (those who are enrolled in the same grade as in the previous year as a percentage of all students enrolled in primary school) in the Philippines is lower than the world average. In 1989, the percentage of primary school repeaters among girls are 2.0 percent in the Philippines and 6.4 percent in the world, while the percentage among boys are 1.6 percent in the Philippines and 7.7 percent in the world. The same trend persists in 1999 where the percentage of primary school repeaters among girls are 1.4 percent in the Philippines and 4.9 percent in the world, while the percentage among boys are 2.4 percent in the Philippines and 5.5 percent in the world. These information ensure that individuals are less likely to move from one side of the cut-off to another. Accessed from https://data.worldbank.org/indicator/SE.PRM.REPT.FE.ZS?locations=PH on 20 July 2020.

normally at their fourth and last year in high school (Figure 2.4). Conversely, those born before 1974 are aged 16 or older in 1989 and are expected to have completed secondary school (control group). This older cohort is not exposed to the policy at all.

Given our cut-off of 1974, we establish our control group as the cohort at the left-hand side of the cut-off that did not receive treatment and our treatment group as the cohort at the right-hand side that received treatment (Figure 2.5).

In hindsight, as individuals on the left-hand and right-hand side of the cut-off have similar features and their year of birth is exogenous, the implementation of R.A. 6655 and R.A. 6728 yields variations in highest grade completed across age groups, and that is as good as randomized (Lee, 2008). Our RDD hinges on this key assumption. In particular, we follow a fuzzy RDD. In a fuzzy RDD setting, treatment assignment does not mean that individuals actually got treated. This means that there may be some observations at the right-hand side of the cut-off that are untreated and some at the left-hand side that are treated. For instance, if some individuals who are born before 1974 experience a delay in schooling, then they might have been able to avail themselves of the reforms. Likewise, there may be individuals born after 1974 who did not take advantage of the programs. Examples are those who chose to attend expensive private school despite the availability of free public school and subsidized private school. Thus, the probability of treatment jumps by less than 1 at the cut-off (Imbens and Lemieux, 2008). The formal model for the causal effect of an additional year of schooling in the fuzzy RDD is:

$$\tau_{FRD} = \frac{\lim_{x \downarrow c} \mathbb{E}[Y \mid Birthyear{=}x] - \lim_{x \uparrow c} \mathbb{E}[Y \mid Birthyear{=}x]}{\lim_{x \downarrow c} \mathbb{E}[Sch \mid Birthyear{=}x] - \lim_{x \uparrow c} \mathbb{E}[Sch \mid Birthyear{=}x]} \quad (2.1)$$

Equation 2.1 denotes that the causal impact, τ_{FRD}, is the ratio of (i) the difference in the outcome from a regression on the treatment-determining or running variable (year of birth) and (ii) the difference in the treatment (schooling) from a regression on the running variable. Both differences are estimated with respect to the cut-off (Keats, 2018).

A paper by Hahn, Todd, and Van der Klaauw (2001) shows that τ_{FRD} can be estimated using an instrumental variables (IV) approach (i.e., two-stage estimation). In our analysis, we employ two types of IV approaches. First, we use the IV two-stage least squares (2SLS) to analyze the impact of schooling on income. The causal effect, τ_{FRD}, is equivalent to the estimator β_{FRD}, provided that the bandwidth and order of the polynomial are the same in both the first and second stages. Correspondingly, the set of equations in the IV 2SLS is:

$$Y = \alpha + \beta_{FRD}\widehat{Sch} + f(Birthyear - c) + \varepsilon \tag{2.2}$$

$$Sch = \gamma + \delta Z + g(Birthyear - c) + v \tag{2.3}$$

Equation 2.3 represents the first stage, where *Sch* refers to years of schooling and *Z* is a dummy variable that takes the value of 1 if birthyear ≥ 1974 and 0 if birthyear < 1974. Note that *Z* is exogenous and also serves as our instrumental variable. The regression parameter δ captures the impact of *Z* on *Sch*. We expect δ to be significant to satisfy the correlation condition in the 2SLS. In Equation 2.2, our second stage, we specify *Y* as the outcome of interest (income) and $\widehat{Sch}$ as the predicted values of *Sch* from the first stage. $\widehat{Sch}$ is now independent of the error term (i.e., no longer endogenous) since we estimate it using an exogenous IV that is not correlated with the error term from the main equation. Importantly, our parameter of interest β_{FRD} represents the causal effect of an additional

year of schooling on the outcome. Finally, *f(·)* and *g(·)* denote the polynomial functions under consideration and *v* and *ε* represent the error terms for the first and second stage.

Second, as our employment outcomes are binary, we utilize a maximum likelihood approach called the IV Probit in the same vein as Ozier (2018). The first stage is similar to that of the IV 2SLS given in Equation 3, while the second stage is:

$$Pr\ [W = 1] = \Phi\ (\sigma + \lambda_{FRD}\widehat{Sch} + f(Birthyear - c)) \qquad (2.4)$$

In Equation 2.4, λ_{FRD} represents the causal impact of schooling on the probability (*Pr*) of being formally employed or informally employed (*W*). The cumulative standard distribution function $\Phi(.)$ transforms the right-hand side of the equation such that its value lies between 0 and 1 in the standard normal table. Hence, the estimates from a Probit regression are similar to z-scores (i.e., given a unit increase in $\widehat{Sch}$, the z-score of *Pr [W=1]* changes by the value of the coefficient). The interpretation is not as straightforward as that of a typical linear regression. In practice, various statistical software are used to calculate the direct marginal effects on the dependent variable in a Probit model.

Further, two critical aspects of the RDD approach are the choice of bandwidth (data window) and polynomial specification. Several methods may be undertaken to determine the optimal bandwidth *h** and the order of the polynomial[24]. In our study, we use the Imbens and Kalyanaraman (IK) approach, which suggests that the optimal bandwidth should minimize the mean squared error (Imbens and Kalyanaraman, 2012). Based on this minimization criterion, IK derived a plug-in equation that estimates the optimal bandwidth in the fuzzy RDD setting. Calonico, Cattaneo, Farrell, and Titiunik

[24] Some of these methods include the leave-one-out-cross-validation technique (Imbens and Lemieux, 2008) and the Akaike's information criterion (Akaike, 1974).

(2017) note that the IK method works well in realistic settings. To estimate *h** and the coefficient on *h**, we utilize the *rdbwselect* and *rdrobust* commands in Stata which are based on an upgraded version of the IK bandwidth selection approach developed by Calonico et. al (2017).

To determine the order of the polynomial, Lee and Lemieux (2010) emphasize that examining near the cut-off is better because this distance provides higher certainty that observations at the left-hand and right-hand side are similar, except for the exposure to the treatment. In this scenario, the left-hand side group better represents the counterfactual state of not having the treatment. If we estimate close to the cut-off, the number of polynomial terms needed for estimation decreases (i.e., local linear specification). Local linear regression is shown to have attractive properties and proven to be rate optimal[25] (Porter, 2003).

In our analysis, we present results for both the optimal bandwidth and some additional *ad hoc* bandwidths. These *ad hoc* bandwidths help verify the consistency of our results and contribute as robustness checks. In particular, we include *ad hoc* bandwidths 8 and 12, which refer to years of birth 1966 to 1981 and 1962 to 1985, respectively[26].

Moreover, as data are at a certain distance from the cut-off, RDD estimates are sensitive to functional form (Lee and Lemieux, 2010), we address this issue by including combinations of various specifications – linear with and without controls and quadratic with and without controls[27].

[25] The optimal rate denotes that the bias is reduced to a level not worse than that commonly found in non-parametric conditional mean estimation (Porter, 2003).
[26] We tried all possible bandwidths, but we only show results for *ad hoc* bandwidths 8 and 12 here to organize our presentation.
[27] Control variables include male and regional dummies.

As summarized by Keats (2018), the validity of fuzzy RDD estimates hinges on the following assumptions. First is the exogeneity of the treatment status. There should be no manipulation in the treatment status of individuals. Second is the smoothness assumption, which ensures that factors that may elicit effects on both educational attainment and outcomes vary smoothly across the threshold. Third and last is the significance of $\beta_{\text{FRD.}}$ This means that the additional year of schooling solely and significantly affects the changes in outcomes. As our model addresses the endogeneity issues and tests of assumptions, our estimates could effectively deliver causal effects.

2.4.2. Data

2.4.2.1. Datasets

In our main analyses, we utilize the Annual Poverty Indicators Survey (APIS) from the Philippine Statistics Authority (PSA). The APIS is a nationally representative survey that collects household-level and individual-level information on the socioeconomic characteristics and living conditions of Filipinos. The datasets, which are publicly available, are especially useful for poverty-related research. The sampling design of the earlier APIS (i.e., 2008 to 2011) is based on the 2003 master sample for household surveys derived from the 2000 Census of Population (Census). It follows a three-stage scheme. The first and second stages are the selection of primary sampling units (PSUs) and sample enumeration areas (EAs). The PSUs and EAs are chosen with probability proportional to the number of households in the Census. The third and final stage is the selection of sample housing units using systematic sampling[28].

[28] See https://psa.gov.ph/content/annual-poverty-indicators-survey-apis, accessed on 12 June 2019.

To increase our sample size and reduce noise, we pool data from both the APIS 2008 and 2011, the only years containing data on individual wage. As estimates in the IV approach, while consistent, may be biased, a large sample size is crucial (Angrist and Krueger, 2001)[29]. In total, the APIS 2008 has 40,613 households and 190,171 individuals, while the APIS 2011 has 42,063 households and 193,097 individuals. We extract and calculate our individual-level variables, such as years of schooling, employment status, income, age, year of birth, region, location, and gender, from our pooled dataset.

To verify our results, we use additional information on employment outcomes from the Labor Force Survey (LFS) from 2007 to 2011. The LFS is a survey that gathers information on the characteristics of the labor force. It is also administered nationwide by the PSA on a quarterly basis (January, April, July, and October). The sample size in the LFS is also large. For instance, the 2011 LFS consists of approximately 51,000 households[30].

Meanwhile, we choose father's and mother's educational attainment and household location of residence (i.e., urban or rural) to test the smoothness assumption. As mentioned earlier, these selected variables should vary smoothly across the cut-off to ensure that the policies only affect individual schooling (our endogenous variable of interest) and that schooling solely drives changes in our outcomes. If these other variables jump across the cut-off, then the policies or certain events in 1974 may have also affected other factors which can later contribute to changes in employment and income. As the reforms primarily impact schooling attainment, parental characteristics and location should not vary significantly across the cut-off and, hence, should not affect our long-

[29] Note that if we do not pool the data, the results do not vary substantially.
[30] See https://psa.gov.ph/content/technical-notes-labor-force-survey-lfs and https://psa.gov.ph/sites/default/files/LFS_April2011_0.pdf, accessed on 12 June 2019.

term outcomes. We again use the pooled APIS 2008 and 2011 to find the educational attainment of parents whose children are born within a given bandwidth. For location of residence, we use only APIS 2011 since APIS 2008 does not have data on urban residence. Nevertheless, APIS 2011 could represent all individuals from our pooled dataset as APIS datasets are nationally representative. Lastly, one way to verify the significance of the jump across our cut-off is to find evidence of discontinuity in other datasets. In this case, we use a more recent dataset, the APIS 2017 (the latest one available to date).

2.4.2.2. Years of schooling calculation

To calculate the years of schooling of an individual, we follow a modified version of Barro and Lee's (1993) categorization. Table 2.1 presents the schooling categories and corresponding years of education and completed grade levels. We consider the economically active population (i.e., those who are 25 years old and above or those who are 24 years old and below but are no longer attending school) in our computations. We note that Filipino households commonly finish investments in children schooling at age 24[31].

[31] Based on Section D1 of the APIS 2008 and 2011 questionnaire, the question on schooling status (i.e., if the child is currently attending school) is asked only among children aged 3 to 24 years old. Hence, we are able to capture those who are no longer attending school in this age group. However, if an individual is 25 years old or older, no variable indicates his or her schooling status. Thus, we consider all individuals aged 25 and above and assume that most of them have completed their schooling and have entered the labor force.

2.4.2.3. Employment variable

Our employment variable is based on the work status of individuals in the last 6 months (i.e., January to June 2008 for APIS 2008 and January to June 2011 for APIS 2011). Broadly, an individual is employed if he reports working on a job or business in that given time period.

We then classify employment into formal or informal. The formal sector includes corporations and partnerships, cooperatives and foundations, single proprietorships with employment of 10 and over, and single proprietorships with branches[32]. Based on the APIS questionnaire, formal sector workers are mostly those in private households, private establishments, and government offices or corporations. Likewise, they receive wage or salary on a regular basis along with social security provisions. In contrast, the informal sector includes household unincorporated enterprises, which may be informal own-account enterprises or enterprises of informal employers. These establishments do not hire employees on a permanent basis. They may also employ unpaid family members especially women and children[33]. Based on the APIS questionnaire, informal sector workers are largely self-employed without any employee and employed in own family-operated farm or business.

In this study, our employment outcome variables are formally employed and informally employed. For the dichotomous formal employment outcomes, we set formally employed equal to 1 and informally employed or unemployed equal to 0. Both informally employed and unemployed are equal to 0 since schooling is not a common requirement in informal employment. We expect that the probability of formal

[32] See https://psa.gov.ph/content/2010-annual-survey-philippine-business-and-industry-construction-sector-final-results, accessed on 12 June 2019.
[33] See https://psa.gov.ph/content/informal-sector-operational-definition, accessed on 12 June 2019.

employment increases as years of schooling increases, given that college education is commonly a requirement in private companies and government offices. Meanwhile, the binary outcomes for informal employment are 1 for informally employed and 0 for formally employed. In contrast to the aforementioned hypothesis, we perceive a decrease in the likelihood of informal employment if schooling attainment increases, as marginal returns to schooling is lower in informal sector.

2.4.2.4. Income calculation

We calculate per capita income based on an individual's type of employment and sources of income. For formal workers or wage earners, income is computed by adding *basic salaries and wages* and *allowances, honoraria, tips, etc*. For informal workers or non-wage earners, income is estimated by dividing *family's total entrepreneurial and other income* by the *number of non-wage earners in the family*. We impute a worker's non-wage income based on the *family's total entrepreneurial and other income* since these data are not available at the individual-level. On a final note, consistent with Mincer's earnings function, we use the logarithm (log) of income in the regressions to deal with outliers.

2.4.2.5. Descriptive statistics

Table 2.2 presents some descriptive statistics for our *ad hoc* bandwidths (8 and 12). We note that *employed* and *log of income* refer to employment status and income in the last 6 months. Also, the calculations are based on individual-level information given at the time of the survey (i.e., 2008 and 2011). Panel A of Table 2.2 suggests that on average the control group is 8 years older than the treatment group for bandwidth 8 (40

vs. 32 years old). In terms of gender distribution, the proportion of men equals the proportion of women (both at 50 percent). Meanwhile, Panel B of Table 2.2 shows that, based on the test of difference in means or t-test[34], the difference in average years of schooling between the control and treatment groups are significant at the 1 percent level. This is true for both *ad hoc* bandwidths. This means that the average years of schooling of the treated cohort, who benefited from the policy, is statistically higher compared to that of the untreated cohort, who were not exposed to the program. Specifically, for bandwidth 8, years of schooling of the treatment group is 9.61 years, while that of the control group is 8.93 years (0.68-year difference). For bandwidth 12, average years of schooling is 9.80 for the treated and 8.89 for the control (0.91-year difference). Both men and women exhibit significant increase in years of schooling after policy intervention. In particular, for bandwidth 12, men in the control group have 8.58 years of schooling while those in the treatment group have 9.42 years. Similarly, women in the control group have 9.20 years of schooling while those in the treatment group have 10.19 years. In terms of completion, the proportion of individuals who finish at least tertiary is lower than the proportion of individuals who finish at least elementary or at least secondary. For instance, for the treated group in bandwidth 8, 87 percent of individuals completed at least elementary, 62 percent achieved at least secondary, and only 18 percent finished at least tertiary level. In addition, we find highly significant differences in employment between the control and treatment groups based on the t-test (Panels C and D of Table 2.2). The probability of formal employment among the treated group is higher compared to that of the control group (0.45 and 0.43 for bandwidth 8). Also, the probability of

[34] The t-test is a hypothesis test that determines if the difference in means of two groups is statistically different from 0 (DeCoster, 2006), accessed from http://www.stat-help.com/notes.html on 12 June 2019.

informal employment among the treated group is lower compared to that of the control group (0.29 and 0.37 for bandwidth 8), indicating favorable effects of the policies on employment outcomes. Moreover, we generally find minimal change in the log of income between the control and treatment groups. For instance, the log of income from formal employment increases from 10.49 to 10.52 (bandwidth 8). This means that the policies have effectively increased schooling and appear to have improved labor market outcomes as well.

2.5. Results

The following tables provide our estimates of program effects. We present results from our optimal bandwidth and *ad hoc* bandwidths (8 and 12). For each bandwidth, we include various specifications such as polynomial order 1 (linear) with and without controls and polynomial order 2 (quadratic) with and without controls. Note that the results are generally similar across different bandwidths and specifications, indicating robustness of our estimates.

We tackle this section by first analyzing the effect on schooling attainment and then evaluating its downstream effects on employment outcomes (formal and informal employment) and income.

2.5.1 Effect on schooling

The first stage estimates show that beneficiaries of the policy attain significantly higher years of schooling compared to non-beneficiaries (Table 2.3)[35]. Specifically, Panel

[35] Appendix table 2.1 presents the full version of Table 2.3. Unlike the summarized version, the full version includes the outcomes on additional control variables such as year of birth, Z x year of birth, (year of birth)^2, and Z x (year of birth)^2.

A of Table 2.3 shows that for the members of the labor force (total of employed and unemployed) within the optimal bandwidth, exposure to the program leads to about 0.170 to 0.208 more years of schooling. The results from our *ad hoc* bandwidths, which vary from 0.155 to 0.240 years, are fairly close to 0.170 and 0.208 years from the optimal bandwidths. The outcomes are statistically significant at the 1 percent and 5 percent significance levels. Graphically, the jump in years of schooling is evident at the 1974 cut-off year (Figure 2.5). Consistent with other impact assessments reviewed in Section 2.3 and our findings in the earlier t-test, the treatment group indeed benefited from the free and subsidized secondary schooling reforms. Households gained easier access to education due to lower tuition and school-related fees. Specifically, the reforms decreased the relative price of schooling, leading households to substitute education for other goods and services (i.e., substitution effect) (Tiongson, 2005).

Likewise, the policies lead to a 0.269 to 0.317 additional years of schooling among men in the labor force and 0.151 to 0.194 more years of schooling among women. The result among women, however, is insignificant (Panels B and C, Table 2.3). Further, among the employed, the effect on the optimal bandwidth is anywhere between 0.210 to 0.255 additional years of schooling (Panel D, Table 2.3). Figure 2.6 presents this significant jump in years of schooling across the cut-off among the employed. Moreover, based on Panels E and F of Table 2.3, the effect on employed men is statistically significant at around 0.179 to 0.185 more years of education, while the effect on employed women, which is around 0.188 to 0.263 years is insignificant. These results suggest that men tend to benefit more from the free and subsidized secondary education than women.

Further, among those who are employed in the formal sector, we find no statistically significant evidence of any first stage effect across bandwidths (Panel B, Table 2.5). However, among those employed in the informal sector, we find statistically significant effect on schooling of about 0.352 to 0.435 additional years, based on the optimal bandwidth (Panel C, Table 2.5). This effect, which is uniform across different specifications, is higher than that estimated among the total labor force in Panel A of Table 2.5. Thus, it appears that the policies contribute largely to the schooling attainment of individuals in the informal sector.

Despite improvements in the overall educational attainment of the treatment group, the average years of schooling is still at 9.80 for bandwidth 12 (Table 2.2). This means that children leave school, more or less, during their fourth year in high school or right after. They are not able to finish basic education (10 years) nor proceed to university. This is problematic because individuals in developing countries should acquire more years of schooling to compensate for the low quality of education that they receive. In Pakistan and Ghana, for instance, it takes at least 8 to 12 years of education to acquire functional literacy and numeracy skills. Thus, staying longer in school, as a means to invest more in human capital, helps individuals gain the foundational skills needed for productive employment in developing countries (Fasih, 2008).

In the Philippines, a substantial portion of school-aged children are not in school. Around 40 percent of children aged 12 to 15 years old (secondary school-aged) in 2008 are not in secondary school despite the reforms. To understand this phenomenon, we look into some demand and supply side factors that affect participation in secondary school. On the demand side, based on the 2008 APIS and Functional Literacy, Education and Mass Media Survey (FLEMMS), secondary school-aged children do not attend school

mainly because of lack of personal interest, followed by high cost of education[36]. If the main reason for being out-of-school is lack of personal interest, policies should focus on determining the cause of this behavior and encouraging children to build interest in learning. Meanwhile, households may force children to leave school and engage in labor due to poverty. Among secondary school-aged children in 2008, about 10 percent are employed. About 47 percent of these employed children are from the poorest income quintile and the likelihood that these working children leave school is 7.07 times higher, *ceteris paribus*. Indeed, poverty forces children to sacrifice schooling for work (Albert, Quimba, and Ramos, 2011). On the supply side, Tan (2017) mentions the lack of good quality facilities (i.e., classrooms and toilets) and highly-trained teachers which means that there is little gain in learning even if a student attends school regularly. Additional budget or better budget allocation may help implement projects to improve schooling inputs. These projects may include renovation of facilities, retraining of teachers, and hiring additional personnel to relieve teachers of their non-academic administrative workload.

It is worth mentioning that unlike in primary school, keeping children in secondary school has higher opportunity cost particularly for older children who can join the labor force or stay at home to help take care of younger siblings. Poor households commonly send their children to work to gain additional household income and, thus, these poor households deem it less profitable to keep their children in school. Also, older children may not gain much in school since lessons at the secondary level are more specialized and cannot be used in home production and may not even be useful for their

[36] 47 percent (APIS 2008) and 45 percent (FLEMMS 2008) of secondary-aged children report lack of personal interest as reason for not attending school, while 25 percent (APIS 2008) and 29 percent (FLEMMS 2008) report high cost of education as reason (Albert et al., 2011).

future jobs. Thus, school dropout remains a major challenge in secondary education (David and Albert, 2015).

Moreover, Albert et al. (2011) show other significant determinants of non-attendance in secondary school, which include age, gender, location of residence, family size, and pupil-teacher ratio. Holding all other factors constant, children aged 13 to 15 are less likely to attend school than those aged 12. Boys are also at a disadvantage. They are more likely to work on the farms or take care of the work animals. Thus, high school-aged girls are 1.8 times more likely to stay in school than boys. Meanwhile, children living in rural areas have lower chances of attending school compared to children in urban areas. Large family size and high pupil-teacher ratio are also associated with higher risk of non-participation. Hence, education strategies should target students who are (i) halfway through high school, (ii) boys, (iii) residing in rural areas, (iv) from families with many children, and (v) living in areas with high pupil-teacher ratio (or poor school quality).

We emphasize that the passing of R.A. 6655 and R.A. 6728 substantially improved schooling attainment of recipients. However, the policies are apparently not enough to encourage the most disadvantaged students to stay in school[37]. It appears that complementary programs that address the persisting demand and supply side issues should be in place.

[37] We note that despite the recent efforts of the Department of Education (DepEd) to implement new programs on student retention (i.e., remedial classes, alternative delivery mechanisms, and modified in-school, out-of-school approach (MISOSA)), non-participation in secondary school persists among the marginalized. This calls for more thorough investigation on the causes of low school participation to identify appropriate imperatives and solutions. Relatedly, it is important to carefully track and assess the impact of each of the DepEd programs on student retention to design better policies (David and Albert, 2015).

2.5.2. Effect on employment

The second stage IV Probit results provide suggestive evidence that with the implementation of the two policies there is an increase in the probability of formal employment and a decrease in the likelihood of informal employment, though the coefficients are not significant across specifications (Table 2.4)[38]. Panels A, B, and C of Table 2.4 suggest a positive relationship between schooling and formal work. Among women in the labor force, an increase in schooling tends to increase the probability of formal employment by around 3 percent based on the *ad hoc* bandwidths. However, the coefficients for the optimal bandwidth, which represents those who are closer to the cut-off, are insignificant.

In addition, we find a reduction in the probability of informal employment, albeit insignificant, of about 2.1 to 2.5 percent among employed individuals; that is, 1.5 to 2.2 percent among employed men and 3.3 to 3.7 percent among employed women[39] (Panels D, E, and F, Table 2.4).

These findings are consistent with other impact assessment studies on similar programs. For instance, Ozier (2018) finds an increase, although statistically insignificant, in the likelihood of formal employment among men who completed secondary school in Kenya. He also provides strong evidence of a decrease in the probability of informal employment. In another study, Filmer and Schady (2014) report that a scholarship program in Cambodia does not have significant effect on employment, particularly on the likelihood of working for pay or even without pay. Also, Behrman,

[38] Appendix table 2.2 presents the full version of Table 2.4. Unlike the summarized version, the full version includes the outcomes on additional control variables such as year of birth, Z x year of birth, (year of birth)^2, and Z x (year of birth)^2.
[39] As mentioned earlier, we also did not find a first stage effect among employed women.

Parker, and Todd (2011) mention that Mexico's conditional cash transfer program, Progresa/Oportunidades, yields ambiguous effects on the probability of working due to the various trade-off mechanisms between staying in school and entering the labor market (i.e., older girls working to give way to younger siblings' education). This suggests that other cultural and traditional factors may be in play. Panels A and B of Figure 2.7 illustrate the minimal shift in the average probability of formal and informal employment across the cut-off year. In the next two sections, we explain the lack of causality between education and employment by looking into certain macroeconomic and microeconomic mechanisms.

2.5.2.1. Macroeconomic perspective of education-labor market linkage

From a macroeconomic viewpoint, the Philippines faced economic shocks, low labor demand, and labor market imperfections during the survey years (2008-2011). These events could have affected labor market outcomes in terms of employment probability, wages, and income. Firstly, the global financial crisis in 2007 led to adverse effects on the Philippine economy. Many workers were laid off as the formal sector contracted. Most of these workers came from the manufacturing sector, wherein around 9,000 were displaced in the electronics industry, 5,359 in the mining industry, and 4,117 in the garments industry. As a solution, the government initiated an Economic Resiliency Plan (ERP) which includes, among others, a comprehensive livelihood and emergency employment program (CLEEP) that aims to create and provide jobs. CLEEP assists in emergency employment and oversees livelihood projects. Some of the recipients were poor workers, export industry workers, and out-of-school youths. The program, however, only provided mostly short-term and low-income jobs (Balboa and Mantaring, 2011).

Hence, despite an increase in employment in 2009 as the economy was recovering, most workers were employed in vulnerable types of jobs, especially in the informal sector (Albert, Dumagan, and Martinez, Jr., 2015). The government strived to implement other programs related to job placement, training, and livelihood to support displaced workers. Thus, the global economic slowdown and local macroeconomic instability between 2008 and 2011 may have contributed to unstable labor market conditions faced by the Filipino workers, regardless of his or her educational attainment and gender.

Secondly, employment is affected by the availability of jobs in the market which in turn is affected by aggregate macroeconomic and local economic conditions. In this case, level of education has weak connection with employment. Limited job opportunities, especially in the rural areas, cause even educated workers to settle for lowly paid unskilled jobs (Rutkowski, Olfindo, Okamura, and Avalos, 2016). Domestically, the country's level of economic growth fails to create sufficient number of jobs to accommodate those who are looking for jobs. Newly-created formal and high value-added sector jobs are emerging as potential source of jobs but remain a small segment of the job market. The informal job market remains the most dominant employer and where higher education is not a requisite. Economic growth in the Philippines has to be higher, sustainable, and inclusive to make both formal and informal job markets sufficiently buoyant to accommodate job seekers. To increase employment in the short-run, labor demand can come from the agricultural sector through the so-called high-value revolution. In the long-run, however, labor demand could shift from agriculture to industry, which is the common development trajectory taken by more successful economies (Albert et al., 2015).

Meanwhile, the international labor market, an important source of job opportunities for Filipinos, creates higher demand for educated workers than the domestic market[40]. Our education system responds to this by providing training for specific skills that are in demand not only in local industries but also in foreign labor markets (Orbeta, Jr., Gonzales, and Cortes, 2016). However, despite the government's efforts to make education more responsive to both local and international labor markets, skills mismatch remains prevalent.

Finally, labor market imperfections also affect the employment of the more educated individuals. The Philippines has a strong minimum wage law that is set above the equilibrium wage (Rutkowski et al., 2016), which creates artificial unemployment in the formal sector, where the minimum wage law is strictly implemented. The unemployed in the formal sector including the more educated workers move to the informal sector where they are overqualified in terms of skill requirements and where they compete with a huge number of lowly educated workers. Because of the excess supply of labor in the informal sector, wages in the informal sector equilibrate at a lower level. Thus, in a regime of minimum wage laws, there seems to be no significant relationship between education, employment possibility, and wages because the more educated workers are willing to take up low levels of jobs and accept lower wages.

[40] As far as women have higher educational attainment than men, based on the 2019 Survey on Overseas Filipinos, there are more women OFWs than men OFWs (56.0 percent vs. 44.0 percent). We observe large heterogeneity on the type of work that they engage in. To enumerate, 17.4 percent of men OFWs and only 1.9 percent of women OFWs are technicians and associate professionals; 24.7 percent of men OFWs and only 2.3 percent of women OFWs are plant and machine operators and assemblers; 17.3 percent of men OFWs and only 0.9 percent of women OFWs are craft and related trade workers; and only 10.5 percent of men OFWs and 62.5 percent of women OFWs engage in elementary occupations. Accessed from https://psa.gov.ph/content/total-number-ofws-estimated-22-million on 19 July 2020.

To sum up, higher levels of schooling are not enough to ensure that individuals get employed or receive high income when they enter the labor market. Other policies that increase the demand for their skills and programs that assist in job searching are equally important as education. Fasih (2008) emphasizes the need for a multi-sectoral approach in analyzing education outcomes and labor demand. Such holistic approach helps strengthen the education-labor market linkage through understanding the macroeconomic factors that affect demand for skills (i.e., technological change, trade, and industrial policies), evaluating market signals, and adjusting policies to address labor market imperfections. This also helps ensure that workers benefit from and contribute to economic growth.

2.5.2.2. Microeconomic perspective of education-labor market linkage

From a microeconomic lens, the ambiguous connection between education and employment could be explained by an individual's choice to delay employment as well as by the inadequate knowledge and skills gained from schooling. First, individuals may choose to delay employment for various reasons. They may want to pursue higher levels of education (i.e., graduate studies) particularly during economic slack or take their time finding a job that agreeably matches their qualifications and other preferences. Albert et al. (2015) points out that around 81 percent of the unemployed in 2012 are not poor and may, thus, be unemployed simply by choice. In contrast, very few of the poor are unemployed. In fact, around the world, the poor are not unemployed as they cannot afford to do so. The poor are working with low levels of income – working hard, working poor.

Second, entering and finishing school do not translate to acquiring enough knowledge and skills that are needed for productive employment. If a school has poor

quality, then attending classes may not help in learning and in getting employed. One factor that crucially contributes to low school quality is the surge in enrollment due to the implementation of free primary or secondary schooling[41]. In the case of the Philippines, the increase in enrollment upon the implementation of R.A. 6655 and 6728 may have aggravated the country's resource constraints problem in basic education. To be specific, our basic education system lacks high quality pedagogical resources, adequate supply of learning materials, well-trained teachers, and basic infrastructure (i.e., classrooms, toilets, and clean water supply). Without these important inputs, schools fail to increase student productivity, teaching efficiency, and overall learning outcomes (Tan, 2017). Getting a high school diploma, thus, does not necessarily translate to being ready for college or for the labor market.

Meanwhile, the Philippines still lacks policies that effectively give schooling access to the marginalized sectors and improve the skills of learners. Government-led initiatives such as school vouchers and mentoring, which can help the poor gain more access to education, improve learning capacities, and create broader opportunities for employment, remain limited. Also, the country invests poorly in early childhood education which is critical in long-term skills development and employment outcomes (Fasih, 2008).

In recognition of these issues pertinent to the Philippines and other developing countries, the World Bank and the International Monetary Fund (IMF) (2015) identify a set of mechanisms that would help developing countries build human capital. The framework is called Skills Toward Employment and Productivity (STEP), which

[41] See Asankha and Takashi (2011), Mwirigi and Muthaa (2015), and Chicoine (2016) for evidence of decrease in school quality in Uganda, Kenya, and Ethiopia due to free schooling policies. The problems may be due to overworking of staff, inadequate teacher and learning facilities, and poor sanitation.

proposes some strategies to enhance individual productivity and employability. The first approach is ensuring child survival and early childhood development. Since brain development in the first 1,000 days affects a child's long-term ability to learn, investment in proper health and nutrition at a young age has significant implications for schooling outcomes[42]. The second concern in the STEP framework is improving education attainment and learning. An individual's long-term participation in the labor market depends on his knowledge, skills, and competency. Thus, schools and teachers should thoroughly monitor the performance of students through various learning assessments and guide them in transitioning from school to workforce[43]. Finally, educators and employers should coordinate to improve labor mobility and job matching. The Philippines can follow the STEP framework as a basis for creating policies and programs that address educational investment issues on early childhood development, building skills, school-to-work transition, and labor productivity as STEP goes beyond free secondary schooling. Overall, investing in human capital is a road worth taking as it equips and prepares Filipino children for their roles as productive and employable citizens of the future.

2.5.3. Effect on income

We expand our analysis to include the returns to schooling of employed individuals using the same RDD strategy. While returns to education has been widely studied since the late 1950s, most analyses focus on high-income countries and rarely on

[42] The World Bank's early childhood development strategies include packages for Family Support, Pregnancy, Birth, Child Health and Development, and Preschool (Denboba et al., 2014).
[43] Pre-employment briefings and on-the-job trainings that are relevant to labor market needs may be conducted.

developing economies (Peet, Fink, and Fawzi, 2015). The few earlier estimations argue that workers in developing countries receive higher returns than those in more developed countries (Card, 2001; Duflo, 2001). Also, previous studies note that estimated returns using the IV approach are usually higher than those using OLS (Card, 1999; Sakellariou, 2006). Here we provide additional empirical evidence on returns to schooling in a developing country using fuzzy RDD.

Based on our optimal bandwidth, an additional year of schooling increases income by about 17.2 to 23.0 percent. Our *ad hoc* bandwidths confirm this positive relationship, indicating a 13.6 to 31.4 percent increase. All results have high statistical significance (Panel A, Table 2.6). Graphically, Panel C of Figure 2.7 shows a jump in income across the cut-off. Thus, in the Philippines, higher levels of education, brought forth by secondary schooling policies, yield significantly higher income. Consistent with previous research, it is still economically wise to obtain more years of education. The results also imply that the benefits of free and subsidized schooling can only be realized if the individual is employed because labor income is by far the most important source of individual income. This finding has poverty-reducing implication because additional schooling, employment, and income move an individual into higher long-term income trajectory (Fasih, 2008).

2.5.3.1. Effect on income by sector

For an in-depth analysis, we explore where the change in income comes from by dividing our employed sample into formally and informally employed workers.

Tables 2.5 and 2.6[44] show the first stage and second stage estimates of our IV 2SLS on income. Interestingly, the policies have no significant effect on the schooling of formally employed individuals (Panel B, Table 2.5) but have significant impact on the schooling of the informally employed sample (Panel C, Table 2.5). Likewise, an additional year of schooling has no significant effect on income of formal wage earners (Panel B, Table 2.6) but has significant effect on income of informal wage earners (Panel C, Table 2.6). In particular, an additional year of education increases informal income significantly by 10.4 to 12.0 percent based on the optimal bandwidth. This may indicate that the contraction of the formal sector and low labor demand between 2008 and 2011 forced individuals to venture into the informal sector, even those who are more educated. As data from the Asian Development Bank (ADB) and International Labour Organization (ILO) (2011) reveal, employment in the formal sector contracted while employment in the informal sector, particularly for women, grew during the crisis.

Figure 2.8 depicts the relationship between year of birth and our income variables, by sector and gender. We notice an increase in average income among informally employed workers across the cut-off (Panel B, Figure 2.8). In the formal sector, however, the change in average earnings is not statistically significant (Panel A, Figure 2.8).

The differences in returns to schooling of individuals in the two sectors are consistent with previous literature which show that the benefits of schooling may be distributed unequally (Fasih, 2008). In the case of the Philippines, the contraction of the aggregate economy makes the informal job market buoyant, making returns to schooling disproportionately increase in the sector. In the next subsection, we explain the

[44] Appendix tables 2.3 and 2.4 present the full version of Tables 2.5 and 2.6. Unlike the summarized version, the full version includes the outcomes on additional control variables such as year of birth, Z x year of birth, (year of birth)^2, and Z x (year of birth)^2.

heterogeneity in our estimates by investigating the returns to schooling across genders in each sector.

2.5.3.2. Effect on income by sector and gender

In Table 2.2 (Panels C and D), we initially provide the descriptive statistics of employed individuals by sector and gender. We observe that informally employed men have the lowest average years of schooling both before and after policy implementation (7.83 and 8.33 years for bandwidth 12). In contrast, formally employed women have the highest grades of schooling at 10.41 years before the reforms and 11.70 years after. The educational attainment of informally employed women are almost comparable to that of formally employed men. These may indicate that the formal labor market could be less accommodating to women, even to the more educated ones, perhaps because of the cost associated with maternal leave, which is most likely borne by formal enterprises. Women may choose to work in the informal sector because they prefer jobs that are flexible which allow them to perform their task in home production. Indeed, in terms of employment, the proportion of men working in the formal sector are consistently higher than the proportion of women working in the formal sector (i.e., for the treatment group in bandwidths 8 and 12, 59 percent of men are employed in the formal sector whereas only 30 to 31 percent of women are engaged in formal employment). Moreover, for the treatment group in bandwidth 8, the proportion of women working in the informal sector is 25 percent, which is almost equal to the abovementioned proportion of women in the formal sector (30 percent). The mean log of income of these women is comparable to the mean log of income of men in the informal sector (i.e., 10.22 and 10.16, respectively), indicating favorable returns in informal work for women. We apply the same RDD

strategy in our succeeding analyses of the causal effect of schooling on income gained by men and women in formal and informal occupations.

2.5.3.2.a. Effect on income in the formal sector by gender

Based on the first stage estimates, we find statistically significant evidence that men who are currently employed in the formal sector have benefitted more in the programs (Panel D, Table 2.5). Men employed in the formal sector who were exposed to the free and subsidized secondary schooling have around 0.259 to 0.309 more years of education (based on the optimal bandwidth). The second stage estimates reveal that an additional year of schooling causes a 36 percent increase in the income of these men (Panel D, Table 2.6). On the contrary, the policies appear to have exerted no significant effect on the schooling of formally employed women (Panel E, Table 2.5)[45]. Moreover, there is no significant relationship between women's schooling and income in this case (Panel E, Table 2.6)[46]. These results suggest that men in the formal sector benefited more from the policy by gaining more years of schooling and receiving higher earnings. These may also be reflective of how women in the formal sector are at a disadvantage vis-à-vis men during this period. According to the ADB and ILO (2011), women in the Philippines suffered disproportionately during the global financial crisis for two reasons. First is that women have limited employment opportunities as gender disparities in employment and income have been observed even before the crisis began. Second, female-dominated

[45] Based on the findings, different subgroups of women and men respond differently to changes in the price of education (i.e., different price elasticity of demand). For instance, in the formal sector, employed men are more responsive to free and subsidized education than employed women. The opposite is true for the informal sector.

[46] Note that since we do not have a first stage effect on formally employed women's schooling, we fail to satisfy the correlation condition for IV. The second stage results cannot be directly analyzed.

industries, such as garments, electronics, and export processing zones[47], were hit the hardest by economic shocks. Most lay-offs occurred in these female-dominated industries. To illustrate, Figure 2.8 shows a significant increase in average income among men in the formal sector (Panel C) and no significant change in average income among women (Panel D). Regardless of schooling policies and educational attainment, if the formal labor market favors men over women, gender inequities in employment and income will continue to persist.

2.5.3.2.b. Effect on income in the informal sector by gender

The results in the informal sector are quite different from those found in the formal sector. Panel F of Table 2.5 indicates that the policies did not exert significant impact on schooling of currently employed men in the informal sector. Also, based on the optimal bandwidth in the second stage, there is no significant relationship between male schooling and income (Panel F, Table 2.6)[48].

Meanwhile, the results for women in the informal sector are in contrast to those found for women in the formal sector who carried the burden of job loss and low labor demand. Panel G of Table 2.5 reveals that the policies have exerted a significant rise in schooling attainment of women workers in the informal sector. The increase is anywhere between 0.586 and 0.694 years of schooling based on the optimal range. This result is statistically significant and consistent across our *ad hoc* bandwidths and specifications. Remarkably, among women in informal occupations, an additional year of schooling significantly increases their income by about 15.8 to 17 percent (Panel G, Table 2.6).

[47] Around 75 percent of workers in export processing zones are women (ADB and ILO, 2011).
[48] Note that since we do not have a first stage effect on informally employed men's schooling, we fail to satisfy the correlation condition for IV. The second stage results cannot be directly analyzed.

These results imply that the informal sector absorbed even the highly educated women who cannot be accommodated in the formal sector during aggregate economic contraction. This influx of women into informal work is consistent with the findings of ADB and ILO (2011) that when the crisis hit, women strongly felt the burden of meeting immediate family needs (i.e., food, water, and healthcare). Thus, they opted to engage in informal activities, either through self-employment, home-based work, small businesses, or other sidelines, to compensate for income loss and ensure family survival.

2.5.4. Gender segregation in employment

There is a common observation that women tend to settle for low-productivity, low-paying, or informal jobs and are not commonly promoted to higher positions in formal jobs. This does not mean, however, that women are worse workers or less educated than men (i.e., the education gap has narrowed over time). According to the World Bank (2012), this phenomenon may be explained by three factors, namely care responsibilities and time use, lack of access to land and credit, and market and institutional failures.

First, women's productivity and earnings are affected by their household responsibilities and time allocation across activities. Gendered norms and traditions dictate that women should spend significantly more time in housework and care responsibilities than men. Thus, women are more likely to choose jobs with flexible working arrangements (i.e., part-time, informal, or casual work), which in turn offer lower wages. Men also generally spend more time in market work than women. While the presence of small children in the family increases the amount of care by both men and

women, women still clock in more hours than men[49]. Thus, the high fixed costs of market work (i.e., fixed schedules and minimum required hours), particularly formal work, remain a burden for women, causing them to choose jobs that offer flexible schedules. In this way, they can make smaller adjustments in time allocation between market work and housework. In some cases, women may have to leave work completely. This prolonged unemployment may lead to weak labor market attachment for women, making it difficult for them to re-enter the labor market when they need to or transition from informal to formal work.

In the Philippines, the expansion in employment opportunities, as a result of economic growth, has not been inclusive for women. Time-use patterns in domestic, care, and market work reveal gender-based work gaps. In domestic and care work, gendered norms lead women to spend more time in domestic and care work compared to men. Around 84 percent of women's time in the household is allocated to child care responsibilities. This amount of unpaid domestic labor from women increases as the Philippines sees higher fertility rates (2.979 births per woman in 2013 according to the World Bank) and inefficient provision of day care programs. Relatedly, in terms of market work, there is a low percentage of Filipino women in formal wage, non-agricultural employment. A higher percentage of women are engaged in vulnerable employment, which includes own account work and unpaid work in family businesses, relative to men. Meanwhile, gaps in decent work, which broadly refers to employment that provides security, voice, fairness, and safe working conditions, persist since women

[49] In Japan, deeply rooted traditions on the division of household labor between husband and wife, in which the husband works and the wife is the homemaker, highly contributes to the gender gaps in labor market opportunities. Notably, as their children grow older (6-14 years old), Japanese women experience more difficulties in balancing work and family life. Their chances of becoming managers or supervisors at this point significantly decrease (Yamaguchi, 2019).

are underrepresented in wage employment and continue to settle for informal low-wage work. This decent work gap then leads to the social protection gap which indicates that women have lower access to various forms of social insurance and benefits (ADB, 2013).

Second, women workers have less access to land and credit compared to men in many countries. This may be due to discrimination and pricing differentials. Based on the World Bank's country database, on average, it is less likely for female-headed households to access and own lands compared to male-headed households. Even if they are able to own and operate some plots, these lands are often small with low security of tenure. In terms of formal credit and loans, female-headed households are less likely to access credit compared to male-headed households. Women business owners also have a lower probability of receiving loans than their male counterparts. They also tend to apply to and borrow more from rotating savings and credit associations (ROSCAs) and microfinance institutions (World Bank, 2012).

In the Philippines, agriculture data show that women own fewer land than men, have less access to extension training and credit, and are less likely to produce and earn from cash crops (ADB, 2013). Despite the implementation of the Philippine joint land titling program in 1978[50], various agrarian reform laws, and the Magna Carta of Women (MCW) in 2009, women continue to face challenges in land rights and ownership. This is due to existing cultural and discriminatory practices, lack of information and awareness, and poor implementation of policies. As of 2012, only 29 percent of the 2.3 million agrarian reform beneficiaries are women. Land ownership and titles are crucial in raising women's access to credit, extension services, and productive inputs (Corral,

[50] See https://www.officialgazette.gov.ph/1978/06/11/presidential-decree-no-1517-s-1978/ for details, accessed on 30 April 2020.

2015). Women also face more credit constraints than men. Based on data from 2002 to 2006, Malapit (2012) confirms that women's reputation, credit background, and repayment delays contribute to the low credit access of women.

Third, market and institutional failures also affect women's choice of employment and employers' ability to assess women's skills and capacities. Market failures in information, for instance, affect women's participation in formal sector jobs and employers' decision-making. Since women have low presence in certain job sectors, employers are not fully informed of their knowledge and skills. This means that employers are not aware of their potential work performance and will, thus, find it difficult to hire and promote more women. Likewise, a firm with only male employees may not hire women because they are not sure of how women will behave in an all-male work setting.

Moreover, institutional failures in terms of infrastructure, especially transportation, lower women's access to economic opportunities due to longer travel time to work and decreased mobility. Poor women, who often reside in remote villages, settle for low-productivity and informal jobs due to the difficulty of traveling to cities or urban areas where better work opportunities are available. Similarly, if a woman is of reproductive age, she may find it difficult to apply for a formal sector job since the costs of maternal leaves may be borne as additional expenses by the company (World Bank, 2012)

Based on data from the Philippines' LFS, the proportion of women in the informal sector rose from 39 percent in 2007 to 41 percent in 2011, while that of men in the same sector slid from 61 to 59 percent (Table 2.7). In Panel F of Figure 2.8, we illustrate a significant jump in average income among women in the informal sector across our cut-

off year. This is possibly because of the increase in women's hours of work as wages commonly go down or remain the same during economic downturn. In comparison, we observe no significant change in average income among men in informal work (Panel E, Figure 2.8). As mentioned earlier, while the expansion of jobs in the informal sector tends to favor women, these jobs are usually vulnerable and short-term. Workers do not receive social protection and are constantly at risk of being laid off as economic downturns occur. They likewise need to compete largely with new entrants who have been retrenched from the formal sector (ADB and ILO, 2011). Hence, our results also shed light on the need to protect workers in the informal economy, many of whom are women who strive to earn extra income for their families.

Further, to increase and sustain women's access to formal sector jobs, there is a need for interventions that allow flexible work schedules, improve access to productive inputs, and correct market and institutional failures.

According to ADB (2013), the Philippines can implement solutions that can protect women in vulnerable employment, increase women's opportunities for decent work, and ensure employment growth. First, the government must establish social protection policies for workers in the informal sector. Second, expanding decent work opportunities for women requires industry-specific strategies. As mentioned above, in agriculture, women own fewer land, have less access to extension training and credit, and are less likely to produce and earn from cash crops. Thus, the Philippines needs to develop programs that lessen all these constraints on women in agriculture such as trainings to improve productivity and guidelines to engage in commercial production. In manufacturing, gender-based analysis of employment in various subsectors and firms may help identify and raise work opportunities for women. Moreover, in the services

sector, particularly in tourism and business processing outsourcing (BPO), several steps may be taken. The tourism industry should set targets on the number of women to hire in different tourism-related sectors to ensure gender parity. Meanwhile, the BPO sector, which has seen rapid expansion over the past decade, opens up opportunities for women college graduates. These women should receive proper skills training to enable them to participate across various BPO occupations, including those usually associated with men (i.e., hardware and software technology jobs). In 2016, the BPO industry employs 1.3 million workers, the majority of which are women (53.2 percent)[51]. In entrepreneurship, women represent about 60 percent of workers in the wholesale and retail trade and services sector. These are mostly self-employed workers and microenterprises owners. To support women in setting up and upgrading their own businesses, they need improved access to microcredit programs, training activities, information, and government or private outreach services. Lastly, to increase and sustain women's employment growth, the government needs to improve child care services, which can reduce the burden of unpaid domestic work among women. Likewise, universities may develop programs that train women based on industry demand. It is vital to strengthen linkages between universities and employers. Relatedly, sex-disaggregated data on education and employment outcomes should be collected and made available. These will help monitor the progress of women in the labor market and serve as guide in establishing gender-specific strategies such as employment quotas, allotment of government benefits, and provision for opportunities catering to women in specific sectors ADB (2013).

[51] See https://apwld.org/wp-content/uploads/2019/04/2019_Labour_FPAR_country_brief_Philippines_Bien.pdf for details, accessed on 30 April 2020.

2.5.5. Smoothness assumption and evidence of discontinuity in other datasets

We validate our RDD by testing the smoothness assumption and finding similar discontinuity in other available datasets. For the smoothness assumption, we show that respondents' fathers' and mothers' education do not jump significantly across the cut-off (Appendix figures 2.1 and 2.2). We similarly find no signs of discontinuity in individuals' urban/rural location (Appendix figure 2.3). Since these variables vary smoothly across the cut-off, we verify that the policies only affect schooling and that schooling, in turn, primarily drives changes in our outcomes[52].

To provide supportive evidence of discontinuity in education, we use APIS 2017 and find that there is also a significant jump in schooling attainment at the cut-off (Appendix figure 2.4). This means that the treatment group in this dataset also benefited from the policies. In the second stage, we again uncover no significant relationship between education and formal employment (Appendix figure 2.5) and between education and informal work (Appendix figure 2.6). Overall, these checks validate our RDD.

2.6. Conclusion

Schooling attainment remains low in developing countries and many programs were implemented to solve this problem. Free public and subsidized private secondary schooling has been implemented in the Philippines in 1988 and 1989. Through R.A. 6655, the government eliminated tuition and other school fees in public high schools. Similarly, through R.A. 6728, it provided tuition fee supplements and textbook funds to private high school students.

[52] We mention that the smoothness assumption can be further tested using other variables such as marital status, number of children, number of siblings, educational attainment of spouse, and income of spouse.

In this study, we conducted a rigorous assessment on the long-run impact of these policies on schooling attainment, employment outcomes, and income using a regression discontinuity design approach. Briefly, this study found that the policies have significant positive impacts on schooling attainment and income, but weakly positive effect on employment outcomes.

First, beneficiaries of the policies attained significantly more years of schooling than non-beneficiaries. For bandwidth 12, the treatment group gained 0.91 more years of schooling than the control group, indicating the effectiveness of the programs in enhancing schooling attainment. This rise in years of schooling after policy implementation is true for both women and men. In addition, the first stage estimates indicate an increase of 0.170 to 0.208 years of educational attainment among those in the labor force. However, an average Filipino still barely finishes high school or the 10 years of basic education. In fact, Filipinos exposed to the programs have on average 9.80 years of schooling and those who are not exposed have 8.89 years.

Second, an additional year of schooling weakly increases the likelihood of formal employment and reduces the probability of informal employment. Across specifications, the results are not statistically significant. We explored this lack of causality between education and employment outcomes by looking into the underlying macroeconomic and microeconomic mechanisms. From a macroeconomic standpoint, the lack of significant correlation between education and the labor market may be due to the contraction of the labor market brought about by the global financial crisis, low labor demand, and labor market imperfections during the study period in 2008 and 2011. Turning to the microeconomic mechanism, the result may be explained by the choice of individuals to delay employment or simply poor skills training or low learning outcomes even with

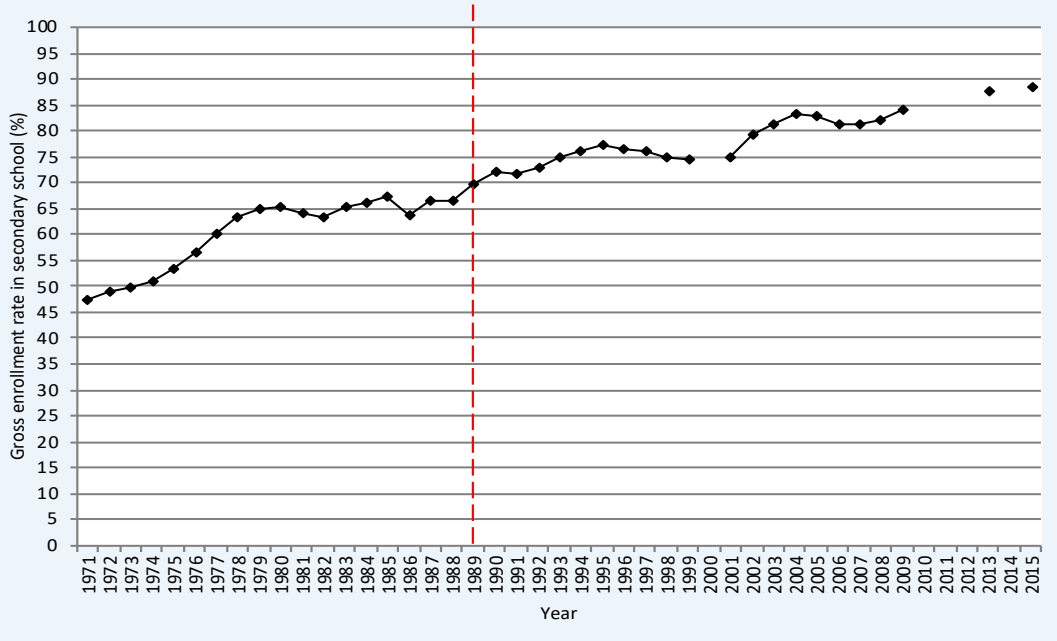
higher education. This study points to the need for a multi-sectoral approach in enhancing individual productivity and employability. This includes, among others, improving programs on job matching, adjusting the curricula based on labor market needs, upgrading school facilities and learning materials, and complementing current policies on early childhood health and education.

Finally, in general, schooling significantly increases income. We noticed an increase in income among our sample of employed individuals after policy implementation. When we divided our sample of workers based on sector and gender, the results are quite different. We found that the policy had a significant impact on schooling attainment and returns to education among women in the informal sector and among men in the formal sector. These results are observed although women employed in the informal sector attained a higher increase in schooling than men employed in the formal sector (based on the first stage estimates). This may imply that there are labor market imperfections in the formal sector that put women at a disadvantage.

Our results contribute to the limited literature on the long-term impacts of basic education policies in developing countries. We conclude that the reforms encouraged school participation and significantly increased completed years of schooling. Yet the downstream impact of the schooling reforms on labor market outcomes in terms of employment possibility and earnings tend to be heterogeneous across sectors. This study has evidence showing that male workers in the formal sector benefited from the reforms both in terms of schooling attainment and higher income. For women, the benefits of the reforms in terms of increased schooling and increased income accrue largely to women employed in the informal sector. Overall, the reforms appear to have the unexpected

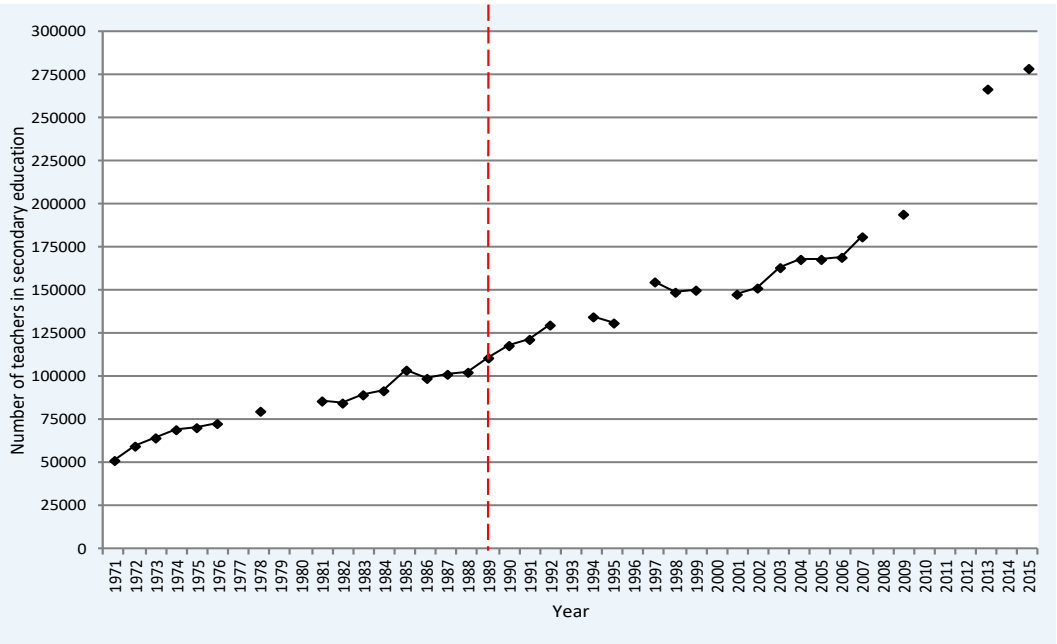
outcome of improving the welfare of men in the formal sector and women in the informal sector.

Figures



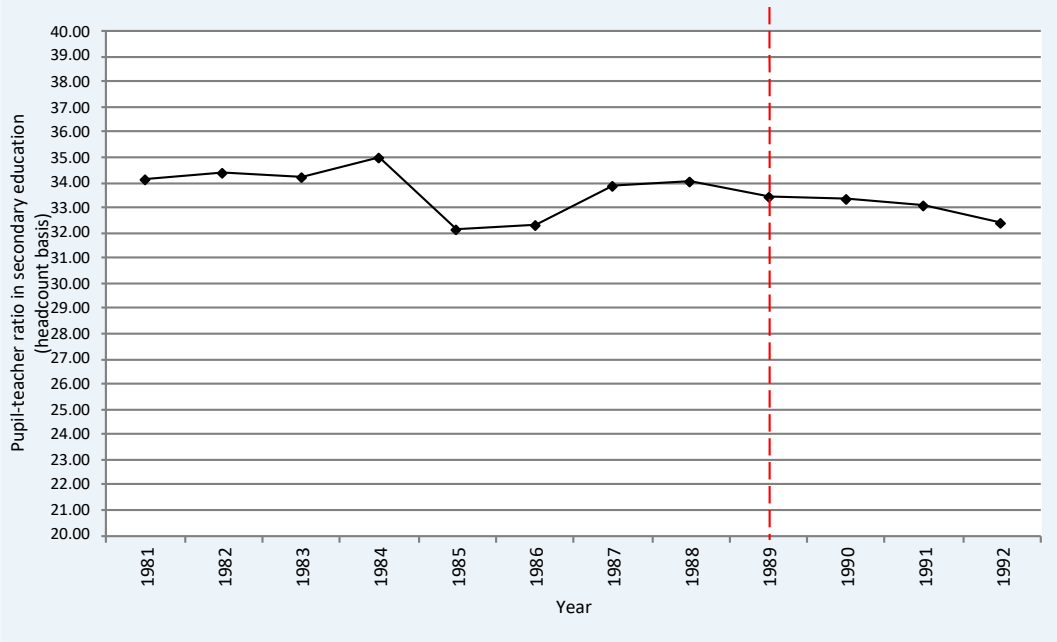
Note: Figure drawn using data from UNESCO Institute for Statistics, accessed from http://data.uis.unesco.org/ on 28 June 2018.

Figure 2.1: Gross enrollment rate in secondary school (%), Philippines, 1971-2015



Note: Figure drawn using data from UNESCO Institute for Statistics, accessed from http://data.uis.unesco.org/ on 28 June 2018.

Figure 2.2: Number of teachers in secondary education, Philippines, 1971-2015



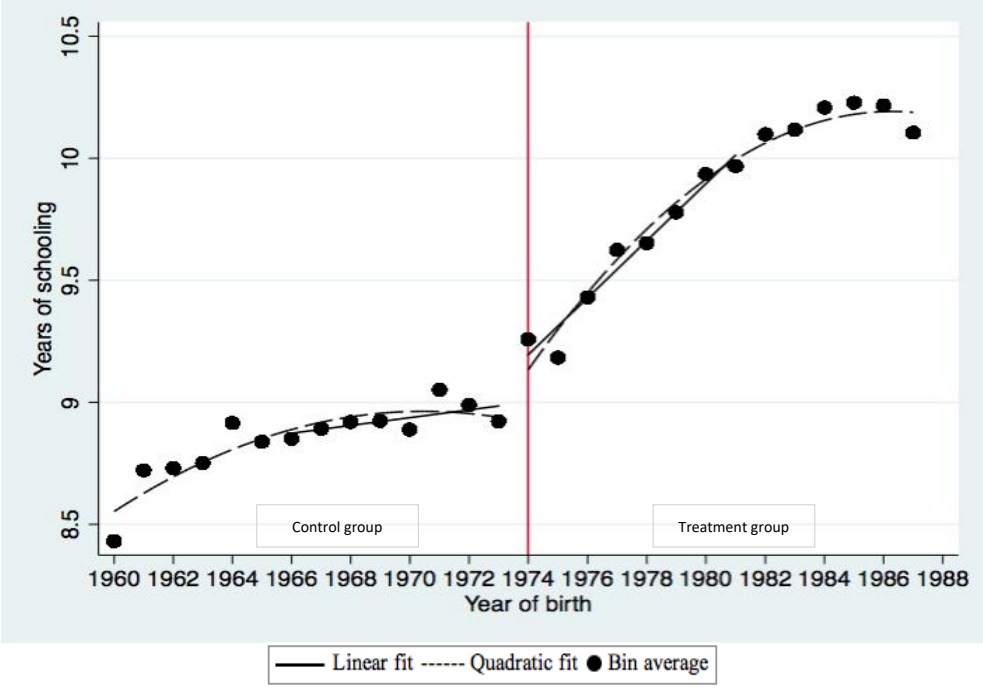
Note: Figure drawn using data from UNESCO Institute for Statistics, accessed from http://data.uis.unesco.org/ on 28 June 2018.

Figure 2.3: Pupil-teacher ratio in secondary education, Philippines, 1981-1992

Approximate age	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	…….
Approximate grade				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	…….
Level of education	Pre-primary education			Primary education						Secondary education						Higher education						
																Bachelor's degree						
																					Master's, Doctorate	
				Basic education																		
				Compulsory education																		
				Free public education																		

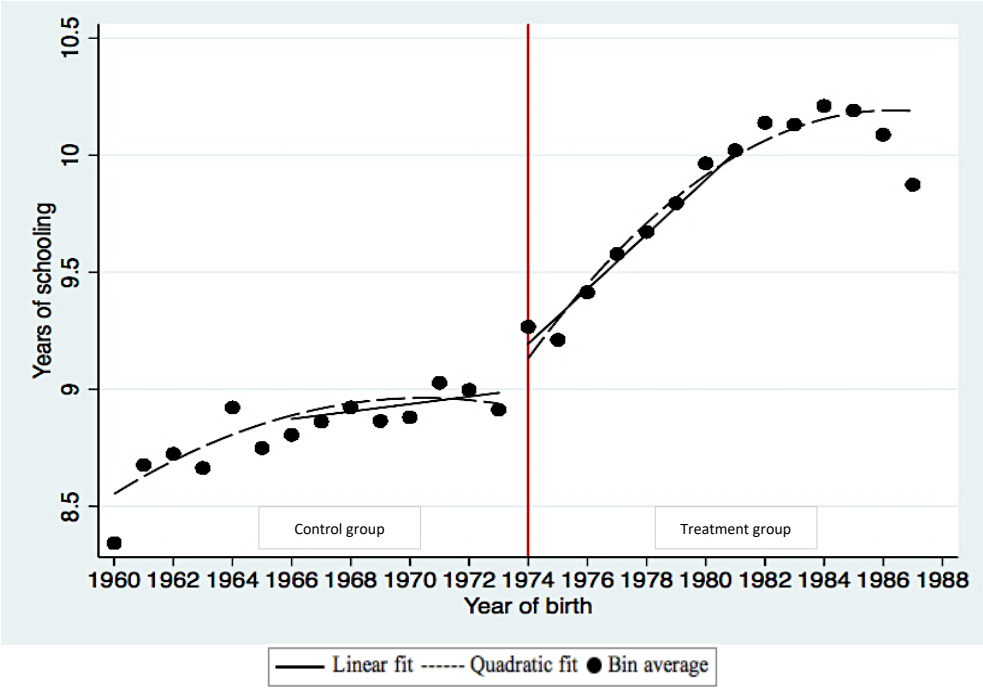
Note: Adapted from Calderbank (2009), Enhanced Basic Education Act of 2013 (2013), David and Albert (2015), and Universal Access to Quality Tertiary Education Act (2016).

Figure 2.4: Philippine education structure: Approximate age, year level, and duration



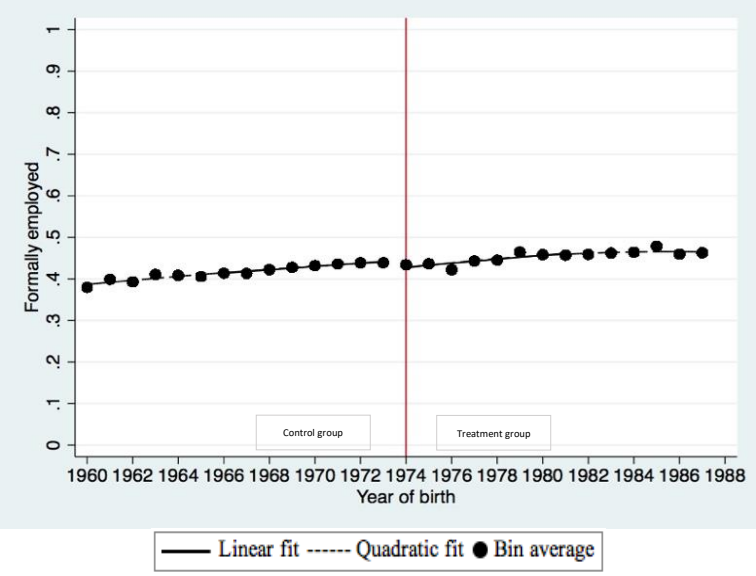
Note: Figure drawn using data from the Annual Poverty Indicators Survey 2008 and 2011.

Figure 2.5: Fit of the first stage regression: Year of birth and education, labor force, Philippines, 2008 to 2011

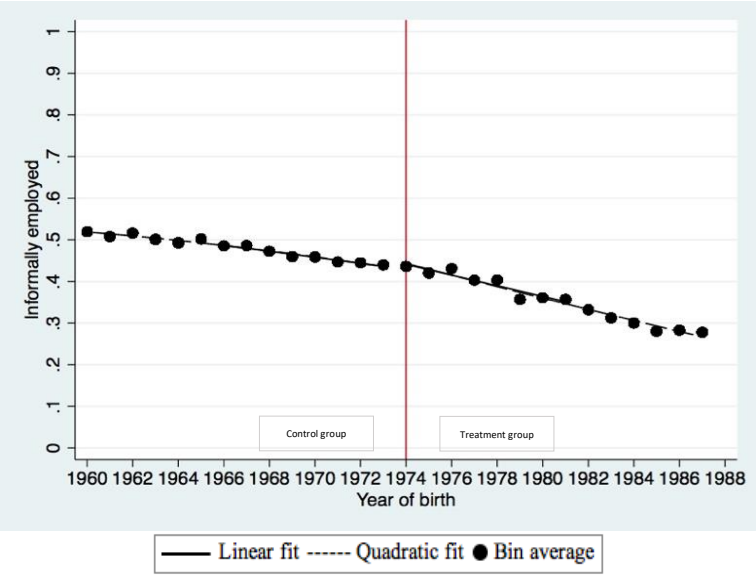


Note: Figure drawn using data from the Annual Poverty Indicators Survey 2008 and 2011.

Figure 2.6: Fit of the first stage regression: Year of birth and education, employed individuals, Philippines, 2008 to 2011

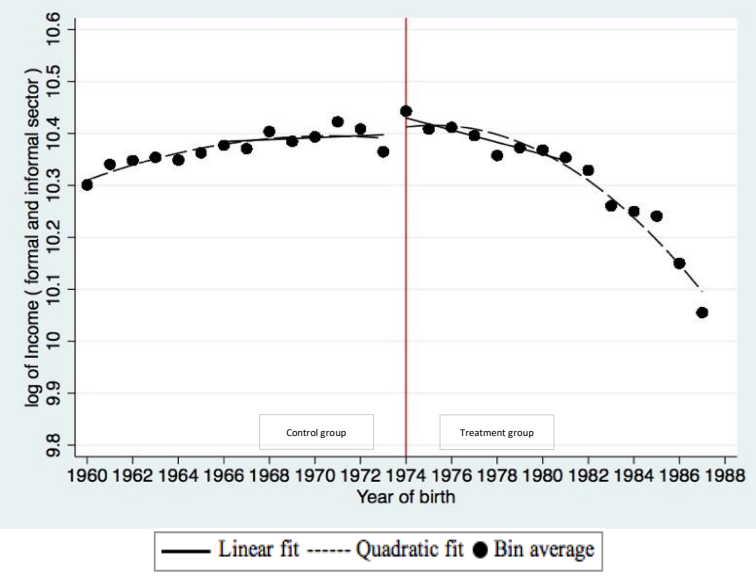


(A) Year of birth and probability of formal employment (labor force)



(B) Year of birth and probability of informal employment (all workers)

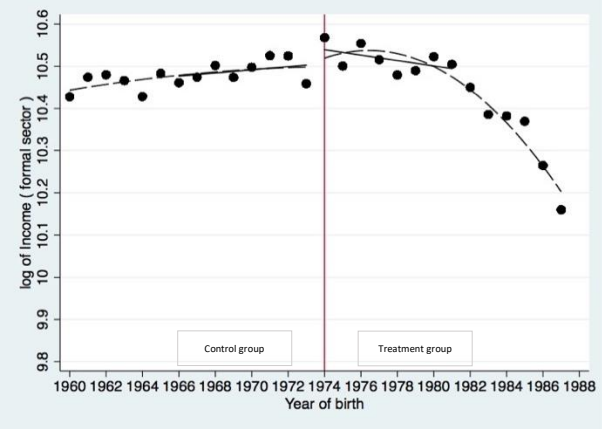
Figure 2.7: Year of birth and main outcome variables, Philippines, 2008 to 2011



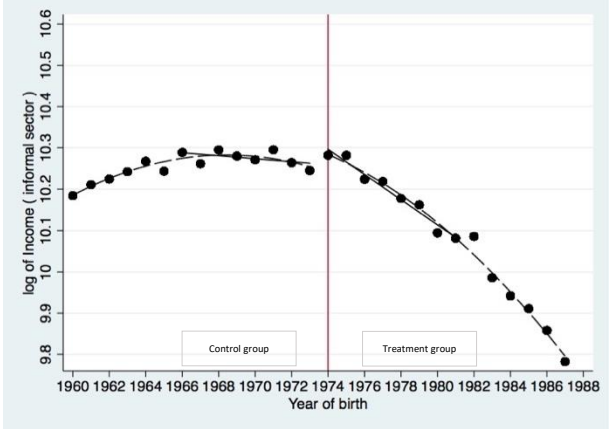
(C) Year of birth and log of income (all workers)

Note: Figure drawn using data from the Annual Poverty Indicators Survey 2008 and 2011.

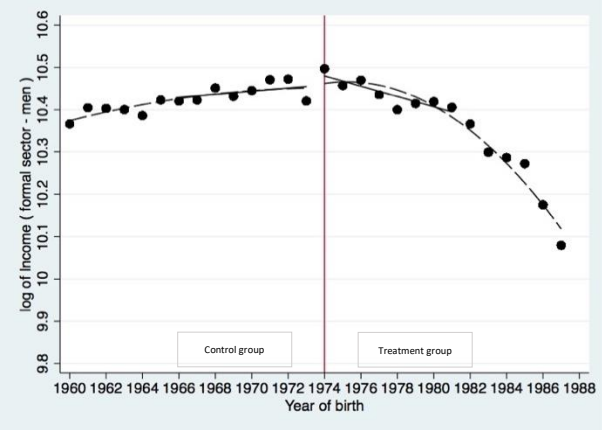
Figure 2.7: ***(Continued)***



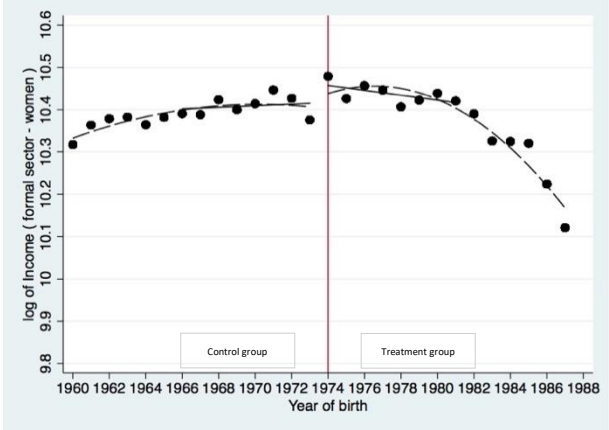
(A) Year of birth and log of income (formal sector workers)



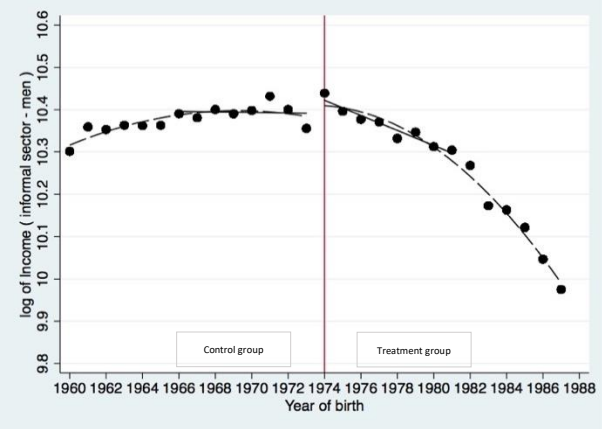
(B) Year of birth and log of income (informal sector workers)



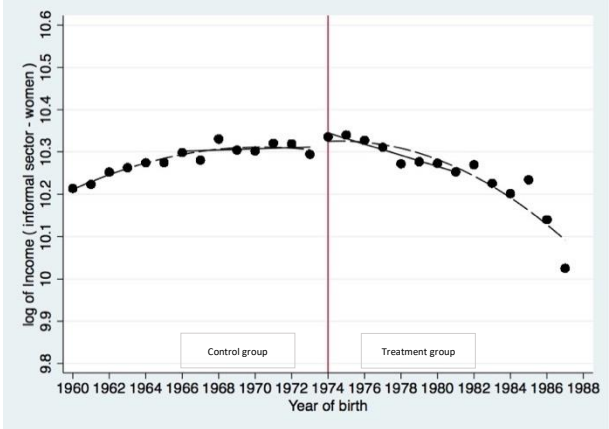
(C) Year of birth and log of income (formal sector workers, men)



(D) Year of birth and log of income (formal sector workers, women)



(E) Year of birth and log of income (informal sector workers, men)



(F) Year of birth and log of income (informal sector workers, women)

Note: Figure drawn using data from the Annual Poverty Indicators Survey 2008 and 2011.

Figure 2.8: Year of birth and income, by sector and gender, Philippines, 2008 to 2011

Tables

Table 2.1: Educational attainment levels, Philippines

Category	Years of schooling	Highest grade completed
No schooling	0	No grade completed, Nursery, Kinder, Preparatory
Partial primary	1	Grade 1
	2	Grade 2
	3	Grade 3
	4	Grade 4
	5	Grade 5
Complete primary	6	Elementary graduate
Partial secondary	7	1st year high school
	8	2nd year high school
	9	3rd year high school
Complete secondary	10	High school graduate
Partial tertiary	11	1st year post-secondary; 1st year college
	12	2nd year post-secondary; 2nd year college
	13	Post-secondary graduate; 3rd year college
Complete tertiary	14	4th year college or higher
	15	With some units earned or enrolled in graduate school

Note: Adapted from Barro and Lee (1993).

Table 2.2: Characteristics of control and treatment groups, by bandwidth, Philippines, 2008 to 2011

		Bandwidth					
		8 *(Year of birth: 1966 to 1981)*			12 *(Year of birth: 1962 to 1985)*		
		Control	Treatment	t-test	Control	Treatment	t-test
Panel A: Demography							
Age	*mean*	40	32	8***	42	30	12***
	sd	(2.70)	(2.75)	(0.02)	(3.74)	(3.77)	(0.02)
	N	37,863	37,448	75,311	54,980	57,047	112,027
Male	*mean*	0.50	0.50	0.00	0.50	0.51	-0.01**
	sd	(0.50)	(0.50)	(0.00)	(0.50)	(0.50)	(0.00)
	N	37,863	37,448	75,311	54,980	57,047	112,027
Panel B: Education							
Years of schooling	*mean*	8.93	9.61	-0.68***	8.89	9.80	-0.91***
	sd	(3.80)	(3.76)	(0.03)	(3.84)	(3.73)	(0.02)
	N	37,863	37,448	75,311	54,980	56,735	111,715
Years of schooling | men	*mean*	8.61	9.25	-0.63***	8.58	9.42	-0.84***
	sd	(3.79)	(3.78)	(0.04)	(3.81)	(3.75)	(0.03)
	N	18,900	18,678	37,578	27,420	28,653	56,073
Years of schooling | women	*mean*	9.24	9.98	-0.73***	9.20	10.19	-0.99***
	sd	(3.78)	(3.70)	(0.04)	(3.85)	(3.67)	(0.03)
	N	18,963	18,770	37,733	27,560	28,082	55,642
Years of schooling | formally employed	*mean*	9.57	10.23	-.54***	9.53	10.42	-.89***
	sd	(3.83)	(3.75)	(.05)	(3.88)	(3.70)	(.03)
	N	16,208	16,677	32,885	23,136	25,664	48,800
Years of schooling | informally employed	*mean*	8.14	8.68	-.54***	8.12	8.71	-.59***
	sd	(3.71)	(3.72)	(.05)	(3.75)	(3.71)	(.04)
	N	13,888	10,923	24,811	20,896	14,891	35,787
Years of schooling | men, formally employed	*mean*	9.06	9.64	-0.58***	9.04	9.76	-0.72***
	sd	(3.67)	(3.65)	(0.05)	(3.72)	(3.61)	(0.04)
	N	10,425	11,018	21,443	14,766	16,895	31,661

Table 2.2: ***(Continued)***

		Bandwidth					
		8 *(Year of birth: 1966 to 1981)*			12 *(Year of birth: 1962 to 1985)*		
		Control	Treatment	t-test	Control	Treatment	t-test
Years of schooling | women, formally employed	*mean*	10.48	11.38	-0.90***	10.41	11.70	-1.29***
	sd	(3.94)	(3.68)	(0.07)	(4.00)	(3.53)	(0.06)
	N	5,783	5,659	11,442	8,370	8,769	17,139
Years of schooling | men, informally employed	*mean*	7.86	8.26	-0.40***	7.83	8.33	-0.50***
	sd	(3.78)	(3.75)	(0.06)	(3.78)	(3.72)	(0.05)
	N	7,509	6,218	13,727	11,201	8,809	20,010
Years of schooling | women, informally employed	*mean*	8.47	9.24	-0.77***	8.45	9.26	-0.81***
	sd	(3.60)	(3.61)	(0.07)	(3.69)	(3.62)	(0.06)
	N	6,379	4,705	11,084	9,695	6,082	15,777
At least elementary completed	*mean*	0.84	0.87	-0.03***	0.83	0.88	-0.05***
	sd	(0.37)	(0.34)	(0.00)	(0.37)	(0.33)	(0.00)
	N	37,863	37,448	75,311	54,980	56,735	111,715
At least secondary completed	*mean*	0.54	0.62	-0.08***	0.53	0.64	-0.11***
	sd	(0.50)	(0.49)	(0.00)	(0.50)	(0.48)	(0.00)
	N	37,863	37,448	75,311	54,980	56,735	111,715
At least tertiary completed	*mean*	0.14	0.18	-0.04***	0.14	0.19	-0.05***
	sd	(0.34)	(0.38)	(0.00)	(0.35)	(0.39)	(0.00)
	N	37,863	37,448	75,311	54,980	56,735	111,715
Panel C: Employment							
Employed	*mean*	0.79	0.74	0.06***	0.80	0.71	0.09***
	sd	(0.40)	(0.44)	(0.00)	(0.40)	(0.45)	(0.00)
	N	37,863	37,448	75,311	54,980	56,735	111,715
Employed | men	*mean*	0.95	0.92	0.03***	0.95	0.90	0.05***
	sd	(0.22)	(0.27)	(0.00)	(0.22)	(0.30)	(0.00)
	N	18,900	18,678	37,578	27,420	28,653	56,073

Table 2.2: ***(Continued)***

		Bandwidth					
		8 *(Year of birth: 1966 to 1981)*			12 *(Year of birth: 1962 to 1985)*		
		Control	Treatment	t-test	Control	Treatment	t-test
Employed | women	*mean*	0.64	0.55	0.09***	0.66	0.53	0.13***
	sd	(0.48)	(0.50)	(0.01)	(0.48)	(0.50)	(0.00)
	N	18,963	18,770	37,733	27,560	28,082	55,642
Formally employed	*mean*	0.43	0.45	-0.02***	0.42	0.45	-0.03***
	sd	(0.49)	(0.50)	(0.00)	(0.49)	(0.50)	(0.00)
	N	37,863	37,448	75,311	54,980	56,735	111,715
Informally employed	*mean*	0.37	0.29	0.08***	0.38	0.26	0.12***
	sd	(0.48)	(0.45)	(0.00)	(0.49)	(0.44)	(0.00)
	N	37,863	37,448	75,311	54,980	56,735	111,715
Formally employed | men	*mean*	0.55	0.59	-0.04***	0.54	0.59	-0.05***
	sd	(0.50)	(0.49)	(0.01)	(0.50)	(0.49)	(0.00)
	N	18,900	18,678	37,578	27,420	28,653	56,073
Formally employed | women	*mean*	0.30	0.30	0.00	0.30	0.31	0.00**
	sd	(0.46)	(0.46)	(0.00)	(0.46)	(0.46)	(0.00)
	N	18,963	18,770	37,733	27,560	28,082	55,642
Informally employed | men	*mean*	0.40	0.33	0.06***	0.41	0.31	0.10***
	sd	(0.49)	(0.47)	(0.00)	(0.49)	(0.46)	(0.00)
	N	18,900	18,678	37,578	27,420	28,653	56,073
Informally employed | women	*mean*	0.34	0.25	0.09***	0.35	0.22	0.14***
	sd	(0.47)	(0.43)	(0.00)	(0.48)	(0.41)	(0.00)
	N	18,963	18,770	37,733	27,560	28,082	55,642
Panel D: Income							
log of Income	*mean*	10.39	10.39	0.00	10.38	10.35	0.03***
	sd	(0.94)	(0.92)	(0.01)	(0.96)	(0.93)	(0.01)
	N	30,096	27,600	57,696	44,032	40,554	84,586

Table 2.2: ***(Continued)***

		Bandwidth					
		8 *(Year of birth: 1966 to 1981)*			12 *(Year of birth: 1962 to 1985)*		
		Control	Treatment	t-test	Control	Treatment	t-test
log of Income | men	*mean*	10.46	10.42	0.05***	10.45	10.35	0.10***
	sd	(0.87)	(0.86)	(0.01)	(0.89)	(0.89)	(0.01)
	N	17,934	17,236	35,170	25,967	25,704	51,671
log of Income | women	*mean*	10.29	10.34	-0.06***	10.28	10.35	-0.08***
	sd	(1.03)	(1.00)	(0.01)	(1.04)	(1.00)	(0.01)
	N	12,162	10,364	22,526	18,065	14,850	32,915
log of Income | formally employed	*mean*	10.49	10.52	-0.03**	10.48	10.47	0.01***
	sd	(0.99)	(0.93)	(0.01)	(1.01)	(0.95)	(0.01)
	N	16,208	16,677	32,885	23,136	25,664	48,800
log of Income | informally employed	*mean*	10.28	10.19	0.08***	10.27	10.14	0.13***
	sd	(0.86)	(0.86)	(0.01)	(0.88)	(0.87)	(0.01)
	N	13,888	10,923	24,811	20,896	14,890	35,786
log of Income | formally employed, men	*mean*	10.55	10.52	0.03**	10.55	10.45	0.10***
	sd	(0.89)	(0.86)	(0.01)	(0.90)	(0.90)	(0.01)
	N	10,425	11,018	21,443	14,766	16,895	31,661
log of Income | formally employed, women	*mean*	10.38	10.50	-0.12***	10.36	10.52	-0.16***
	sd	(1.15)	(1.06)	(0.02)	(1.17)	(1.03)	(0.02)
	N	5,783	5,659	11,442	8,370	8,769	17,139
log of Income | informally employed, men	*mean*	10.34	10.22	0.12***	10.32	10.15	0.17***
	sd	(0.84)	(0.84)	(0.01)	(0.85)	(0.85)	(0.01)
	N	7,509	6,218	13,727	11,201	8,809	20,010
log of Income | informally employed, women	*mean*	10.20	10.16	0.04***	10.20	10.11	0.08***
	sd	(0.89)	(0.89)	(0.02)	(0.92)	(0.89)	(0.01)
	N	6,379	4,705	11,084	9,695	6,081	15,776

Note: Datasets used are the Annual Poverty Indicators Survey 2008 and 2011. Bandwidth 8 refers to years of birth 1966 to 1981, while bandwidth 12 refers to years of birth 1962 to 1985. *Employed* = proportion of employed with respect to the total labor force. *Formally (informally) employed* = proportion of formally (informally) employed with respect to the total labor force. *Formally (informally) employed men (women)* = proportion of formally (informally) employed men (women) with respect to the total number of men (women) in the labor force. t-test refers to the test of difference in means. Standard deviations in parentheses. ∗∗∗, ∗∗, and ∗ indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 2.3: First stage estimates (IV Probit): Effect of free and subsidized secondary schooling policies on schooling, by bandwidth, Philippines, 2008 to 2011

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel A. Sample: Labor force										
Z	0.194***	0.157***	0.240***	0.188**	0.232***	0.194***	0.204***	0.155**	0.208***	0.170***
	(0.056)	(0.053)	(0.090)	(0.085)	(0.045)	(0.043)	(0.071)	(0.067)	(0.053)	(0.050)
Bandwidth	8	8	8	8	12	12	12	12	10	11
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.011	0.100	0.011	0.100	0.018	0.108	0.018	0.108	0.014	0.106
No. of observations	75,311	75,311	75,311	75,311	111,715	111,715	111,715	111,715	93,550	102,899
Panel B. Sample: Labor force, men										
Z	0.184**	0.161**	0.315**	0.293**	0.247***	0.216***	0.175*	0.161*	0.269***	0.317***
	(0.079)	(0.076)	(0.127)	(0.122)	(0.064)	(0.062)	(0.100)	(0.096)	(0.101)	(0.115)
Bandwidth	8	8	8	8	12	12	12	12	6	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.009	0.092	0.009	0.092	0.015	0.098	0.016	0.098	0.005	0.090
No. of observations	37,578	37,578	37,578	37,578	56,073	56,073	56,073	56,073	28,235	23,470
Panel C. Sample: Labor force, women										
Z	0.182**	0.154**	0.153	0.084	0.197***	0.174***	0.216**	0.154	0.194	0.151
	(0.078)	(0.075)	(0.125)	(0.120)	(0.064)	(0.061)	(0.099)	(0.095)	(0.126)	(0.122)
Bandwidth	8	8	8	8	12	12	12	12	4	4
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.013	0.097	0.013	0.097	0.023	0.107	0.023	0.107	0.005	0.092
No. of observations	37,733	37,733	37,733	37,733	55,642	55,642	55,642	55,642	18,761	18,761

Table 2.3: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Ad hoc bandwidths								Optimal bandwidths	
Panel D. Sample: Employed in the formal and informal sector										
Z	0.184***	0.150**	0.258**	0.197**	0.243***	0.205***	0.180**	0.134*	0.210***	0.255***
	(0.064)	(0.061)	(0.103)	(0.098)	(0.053)	(0.050)	(0.081)	(0.077)	(0.071)	(0.095)
Bandwidth	8	8	8	8	12	12	12	12	8	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.011	0.108	0.011	0.108	0.018	0.118	0.018	0.118	0.011	0.103
No. of observations	57,696	57,696	57,696	57,696	84,587	84,587	84,587	84,587	57,696	36,272
Panel E. Sample: Employed men										
Z	0.175**	0.145*	0.281**	0.243*	0.239***	0.204***	0.171*	0.145	0.185**	0.179*
	(0.081)	(0.078)	(0.130)	(0.124)	(0.066)	(0.063)	(0.102)	(0.098)	(0.083)	(0.093)
Bandwidth	8	8	8	8	12	12	12	12	9	7
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.008	0.096	0.008	0.096	0.012	0.101	0.012	0.101	0.010	0.093
No. of observations	35,170	35,170	35,170	35,170	51,671	51,671	51,671	51,671	39,373	30,749
Panel F. Sample: Employed women										
Z	0.184*	0.157	0.218	0.126	0.229***	0.201**	0.178	0.121	0.263	0.188
	(0.103)	(0.100)	(0.164)	(0.158)	(0.085)	(0.081)	(0.130)	(0.125)	(0.162)	(0.149)
Bandwidth	8	8	8	8	12	12	12	12	4	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.021	0.091	0.021	0.091	0.039	0.108	0.039	0.108	0.006	0.080
No. of observations	22,526	22,526	22,526	22,526	32,916	32,916	32,916	32,916	11,271	14,153

Note: *Z* is a dummy variable that takes the value of 1 if birth year ≥ *1974* and 0 if birth year < *1974*. Years of birth were normalized based on the cut-off (1974) so that coefficients may be interpreted directly. Linear specification includes year of birth and Z x year of birth. Quadratic specification adds (year of birth)^2 and Z x (year of birth)^2. Datasets used are the Annual Poverty Indicators Survey 2008 and 2011. Bandwidth 8 refers to years of birth 1966 to 1981, while bandwidth 12 refers to years of birth 1962 to 1985. Estimates for the optimal bandwidth were generated using the *rdbwselect* and *rdrobust* commands in Stata. Control variables include male and regional dummies. Standard errors in parentheses are clustered at the year of birth level. ∗∗∗, ∗∗, and ∗ indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 2.4: Second stage estimates (IV Probit): Effect of schooling on employment outcomes, by bandwidth, Philippines, 2008 to 2011

Dependent variable: P [Formally employed]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel A. Sample: Labor force										
Years of schooling	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.019	0.020
	(0.027)	(0.025)	(0.026)	(0.030)	(0.020)	(0.019)	(0.032)	(0.033)	(0.021)	(0.020)
Bandwidth	8	8	8	8	12	12	12	12	10	11
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	75,311	75,311	75,311	75,311	111,715	111,715	111,715	111,715	93,550	102,899
Panel B. Sample: Labor force, men										
Years of schooling	0.017	0.011	0.017	0.011	0.016	0.010	0.016	0.010	0.017	0.010
	(0.054)	(0.056)	(0.040)	(0.037)	(0.033)	(0.037)	(0.066)	(0.071)	(0.059)	(0.040)
Bandwidth	8	8	8	8	12	12	12	12	6	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	37,578	37,578	37,578	37,578	56,073	56,073	56,073	56,073	28,235	23,470
Panel C. Sample: Labor force, women										
Years of schooling	0.029*	0.027*	0.029*	0.027	0.031**	0.028**	0.031*	0.028**	0.029	0.027
	(0.015)	(0.015)	(0.017)	(0.022)	(0.015)	(0.013)	(0.017)	(0.014)	(0.020)	(0.024)
Bandwidth	8	8	8	8	12	12	12	12	4	4
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	37,733	37,733	37,733	37,733	55,642	55,642	55,642	55,642	18,761	18,761

Table 2.4: ***(Continued)***

Dependent variable: P [Informally employed]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel D. Sample: Employed in the formal and informal sector										
Years of schooling	-0.025	-0.022	-0.025	-0.022	-0.026	-0.022	-0.026	-0.022	-0.025	-0.021
	(0.031)	(0.032)	(0.021)	(0.037)	(0.020)	(0.019)	(0.035)	(0.046)	(0.031)	(0.044)
Bandwidth	8	8	8	8	12	12	12	12	8	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	57,696	57,696	57,696	57,696	84,587	84,587	84,587	84,587	57,696	36,272
Panel E. Sample: Employed men										
Years of schooling	-0.022	-0.015	-0.022	-0.015	-0.022	-0.015	-0.022	-0.015	-0.022	-0.015
	(0.061)	(0.056)	(0.043)	(0.043)	(0.036)	(0.032)	(0.059)	(0.066)	(0.062)	(0.062)
Bandwidth	8	8	8	8	12	12	12	12	9	7
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	35,170	35,170	35,170	35,170	51,671	51,671	51,671	51,671	39,373	30,749
Panel F. Sample: Employed women										
Years of schooling	-0.036	-0.032	-0.036	-0.032	-0.037	-0.033	-0.037	-0.033	-0.037	-0.033
	(0.040)	(0.035)	(0.061)	(0.044)	(0.026)	(0.022)	(0.052)	(0.043)	(0.057)	(0.071)
Bandwidth	8	8	8	8	12	12	12	12	4	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	22,526	22,526	22,526	22,526	32,916	32,916	32,916	32,916	11,271	14,153

Note: *Z* is a dummy variable that takes the value of 1 if birth year ≥ *1974* and 0 if birth year < *1974*. Years of birth were normalized based on the cut-off (1974) so that coefficients may be interpreted directly. Linear specification includes year of birth and Z x year of birth. Quadratic specification adds (year of birth)^2 and Z x (year of birth)^2. Marginal effects are shown for IV Probit second stage. Datasets used are the Annual Poverty Indicators Survey 2008 and 2011. Bandwidth 8 refers to years of birth 1966 to 1981, while bandwidth 12 refers to years of birth 1962 to 1985. Estimates for the optimal bandwidth were generated using the *rdbwselect* and *rdrobust* commands in Stata. Control variables include male and regional dummies. Standard errors in parentheses are clustered at the year of birth level. ∗∗∗, ∗∗, and ∗ indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 2.5: First stage estimates (IV 2SLS): Effect of free and subsidized secondary schooling policies on schooling, by bandwidth, Philippines, 2008 to 2011

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel A. Sample: Employed in the formal and informal sector										
Z	0.184***	0.150**	0.258**	0.197**	0.232***	0.205***	0.180**	0.134*	0.230***	0.162**
	(0.064)	(0.061)	(0.103)	(0.098)	(0.045)	(0.050)	(0.081)	(0.077)	(0.056)	(0.065)
Bandwidth	8	8	8	8	12	12	12	12	13	9
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.011	0.108	0.011	0.108	0.018	0.118	0.018	0.118	0.019	0.111
No. of observations	57,696	57,696	57,696	57,696	111,715	84,587	84,587	84,587	91,173	64,530
Panel B. Sample: Employed in the formal sector										
Z	0.016	-0.007	0.136	0.104	0.161**	0.124*	-0.032	-0.042	0.180	0.073
	(0.085)	(0.081)	(0.136)	(0.130)	(0.069)	(0.066)	(0.107)	(0.102)	(0.131)	(0.110)
Bandwidth	8	8	8	8	12	12	12	12	5	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.011	0.100	0.012	0.100	0.018	0.110	0.019	0.111	0.004	0.095
No. of observations	32,885	32,885	32,885	32,885	48,800	48,800	48,800	48,800	20,478	24,714
Panel C. Sample: Employed in the informal sector										
Z	0.449***	0.376***	0.433***	0.351**	0.439***	0.374***	0.471***	0.375***	0.435***	0.352***
	(0.095)	(0.089)	(0.150)	(0.142)	(0.078)	(0.073)	(0.119)	(0.113)	(0.110)	(0.118)
Bandwidth	8	8	8	8	12	12	12	12	7	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.006	0.119	0.006	0.119	0.006	0.120	0.006	0.120	0.005	0.120
No. of observations	24,811	24,811	24,811	24,811	35,787	35,787	35,787	35,787	21,724	18,834

Table 2.5: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel D. Sample: Employed men in the formal sector										
Z	0.105	0.076	0.325**	0.273*	0.247***	0.208***	0.081	0.057	0.309**	0.259*
	(0.102)	(0.099)	(0.163)	(0.159)	(0.083)	(0.080)	(0.129)	(0.125)	(0.143)	(0.141)
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.009	0.068	0.009	0.068	0.012	0.072	0.013	0.073	0.003	0.062
No. of observations	21,443	21,443	21,443	21,443	31,661	31,661	31,661	31,661	13,402	13,402
Panel E. Sample: Employed women in the formal sector										
Z	-0.139	-0.168	-0.191	-0.224	0.036	-0.019	-0.227	-0.242	-0.149	-0.226
	(0.145)	(0.141)	(0.231)	(0.226)	(0.116)	(0.113)	(0.180)	(0.176)	(0.217)	(0.199)
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.021	0.069	0.021	0.069	0.040	0.083	0.041	0.084	0.009	0.060
No. of observations	11,442	11,442	11,442	11,442	17,139	17,139	17,139	17,139	7,076	7,076
Panel F. Sample: Employed men in the informal sector										
Z	0.319**	0.260**	0.222	0.189	0.271**	0.225**	0.314*	0.260*	0.247	0.184
	(0.129)	(0.122)	(0.207)	(0.195)	(0.105)	(0.099)	(0.162)	(0.153)	(0.160)	(0.165)
Bandwidth	8	8	8	8	12	12	12	12	7	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.003	0.120	0.003	0.120	0.005	0.120	0.005	0.120	0.003	0.127
No. of observations	13,727	13,727	13,727	13,727	20,010	20,010	20,010	20,010	11,989	10,361

Table 2.5: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Ad hoc bandwidths								Optimal bandwidths	
Panel G. Sample: Employed women in the informal sector										
Z	0.581***	0.505***	0.676***	0.544***	0.606***	0.542***	0.629***	0.505***	0.694***	0.586***
	(0.137)	(0.131)	(0.216)	(0.206)	(0.115)	(0.109)	(0.174)	(0.166)	(0.205)	(0.192)
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.012	0.101	0.012	0.101	0.012	0.105	0.012	0.105	0.010	0.097
No. of observations	11,084	11,084	11,084	11,084	15,777	15,777	15,777	15,777	7,077	7,077

Note: *Z* is a dummy variable that takes the value of 1 if birth year ≥ *1974* and 0 if birth year < *1974*. Years of birth were normalized based on the cut-off (1974) so that coefficients may be interpreted directly. Linear specification includes year of birth and Z x year of birth. Quadratic specification adds (year of birth)^2 and Z x (year of birth)^2. Datasets used are the Annual Poverty Indicators Survey 2008 and 2011. Bandwidth 8 refers to years of birth 1966 to 1981, while bandwidth 12 refers to years of birth 1962 to 1985. Estimates for the optimal bandwidth were generated using the *rdbwselect* and *rdrobust* commands in Stata. Control variables include male and regional dummies. Standard errors in parentheses are clustered at the year of birth level. ∗∗∗, ∗∗, and ∗ indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 2.6: Second stage estimates (IV 2SLS): Effect of schooling on income, by bandwidth, Philippines, 2008 to 2011

Dependent variable: log of Income	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel A. Sample: Employed in the formal and informal sector										
Years of schooling	0.166**	0.179**	0.293***	0.314***	0.149***	0.136**	0.231***	0.271***	0.172***	0.230**
	(0.069)	(0.076)	(0.059)	(0.067)	(0.049)	(0.056)	(0.080)	(0.105)	(0.052)	(0.095)
Bandwidth	8	8	8	8	12	12	12	12	13	9
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	57,696	57,696	57,696	57,696	84,586	84,586	84,586	84,586	91,172	64,529
Panel B. Sample: Employed in the formal sector										
Years of schooling	2.015	-3.559	0.707	0.721	0.379***	0.370*	-1.243	-0.782	0.572	0.858
	(13.339)	(63.567)	(0.655)	(0.966)	(0.129)	(0.190)	(8.026)	(3.981)	(0.352)	(1.131)
Bandwidth	8	8	8	8	12	12	12	12	5	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	32,885	32,885	32,885	32,885	48,800	48,800	48,800	48,800	20,478	24,714
Panel C. Sample: Employed in the informal sector										
Years of schooling	0.083**	0.072	0.119**	0.126	0.053	0.039	0.099**	0.100	0.104**	0.120*
	(0.039)	(0.054)	(0.056)	(0.080)	(0.038)	(0.048)	(0.046)	(0.068)	(0.053)	(0.071)
Bandwidth	8	8	8	8	12	12	12	12	7	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	24,811	24,811	24,811	24,811	35,786	35,786	35,786	35,786	21,724	18,834

Table 2.6: ***(Continued)***

Dependent variable: log of Income	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel D. Sample: Employed men in the formal sector										
Years of schooling	0.321*	0.348	0.349***	0.337***	0.297***	0.295***	0.475	0.515	0.361**	0.367**
	(0.192)	(0.322)	(0.108)	(0.129)	(0.069)	(0.086)	(0.681)	(1.107)	(0.145)	(0.177)
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	21,443	21,443	21,443	21,443	31,661	31,661	31,661	31,661	13,402	13,402
Panel E. Sample: Employed women in the formal sector										
Years of schooling	-0.248	-0.179	-0.301	-0.196	1.186	-1.122	-0.165	-0.162	-0.246	-0.091
	(0.385)	(0.312)	(0.409)	(0.311)	(3.117)	(7.349)	(0.238)	(0.251)	(0.708)	(0.303)
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	11,442	11,442	11,442	11,442	17,139	17,139	17,139	17,139	7,076	7,076
Panel F. Sample: Employed men in the informal sector										
Years of schooling	0.010	-0.031	0.054	0.011	-0.030	-0.079	0.030	0.002	0.040	0.014
	(0.063)	(0.091)	(0.147)	(0.186)	(0.063)	(0.093)	(0.074)	(0.103)	(0.132)	(0.191)
Bandwidth	8	8	8	8	12	12	12	12	7	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	13,727	13,727	13,727	13,727	20,010	20,010	20,010	20,010	11,989	10,361

Table 2.6: ***(Continued)***

Dependent variable: log of Income	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel G. Sample: Employed women in the informal sector										
Years of schooling	0.138***	0.129***	0.153***	0.156**	0.099***	0.083**	0.154***	0.150**	0.158**	0.170**
	(0.032)	(0.047)	(0.042)	(0.069)	(0.031)	(0.039)	(0.041)	(0.062)	(0.064)	(0.073)
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	11,084	11,084	11,084	11,084	15,776	15,776	15,776	15,776	7,077	7,077

Note: *Z* is a dummy variable that takes the value of 1 if birth year ≥ *1974* and 0 if birth year < *1974*. Years of birth were normalized based on the cut-off (1974) so that coefficients may be interpreted directly. Linear specification includes year of birth and Z x year of birth. Quadratic specification adds (year of birth)^2 and Z x (year of birth)^2. Datasets used are the Annual Poverty Indicators Survey 2008 and 2011. Bandwidth 8 refers to years of birth 1966 to 1981, while bandwidth 12 refers to years of birth 1962 to 1985. Estimates for the optimal bandwidth were generated using the *rdbwselect* and *rdrobust* commands in Stata. Control variables include male and regional dummies. Standard errors in parentheses are clustered at the year of birth level. ∗∗∗, ∗∗, and ∗ indicate significance at the 1, 5, and 10 percent levels, respectively.

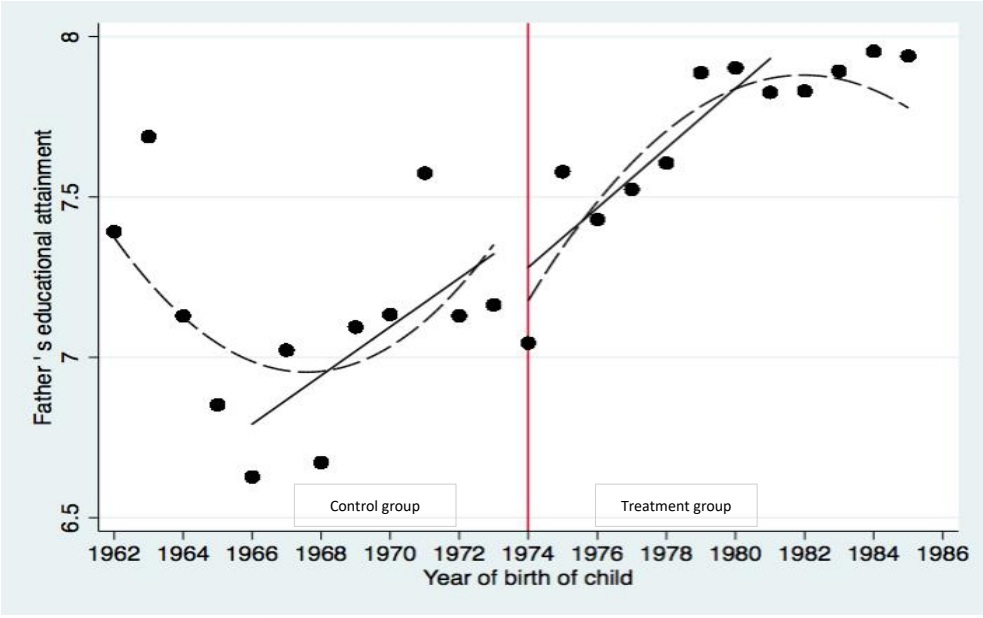
Table 2.7: Employment by sector and gender, Philippines, 2007 to 2011

Work sector	2007	2008	2009	2010	2011
Formal sector (‘000)					
Men	10,827	11,093	11,581	12,137	12,750
Women	6,682	6,754	7,099	7,489	7,787
Total	17,509	17,847	18,680	19,626	20,537
Proportion of men (%)	62	62	62	62	62
Proportion of women (%)	38	38	38	38	38
Informal sector (‘000)					
Men	9,716	9,866	9,822	9,784	9,823
Women	6,336	6,376	6,558	6,624	6,831
Total	16,052	16,242	16,380	16,408	16,654
Proportion of men (%)	61	61	60	60	59
Proportion of women (%)	39	39	40	40	41

Note: Details may not add up to totals due to rounding. Data were averages of four Labor Force Survey rounds (January, April, July, and October) for years 2007 to 2011, as reported by the Philippine Statistics Authority. Accessed from https://psa.gov.ph/sites/default/files/Table%203.10_2.pdf on 23 May 2019.

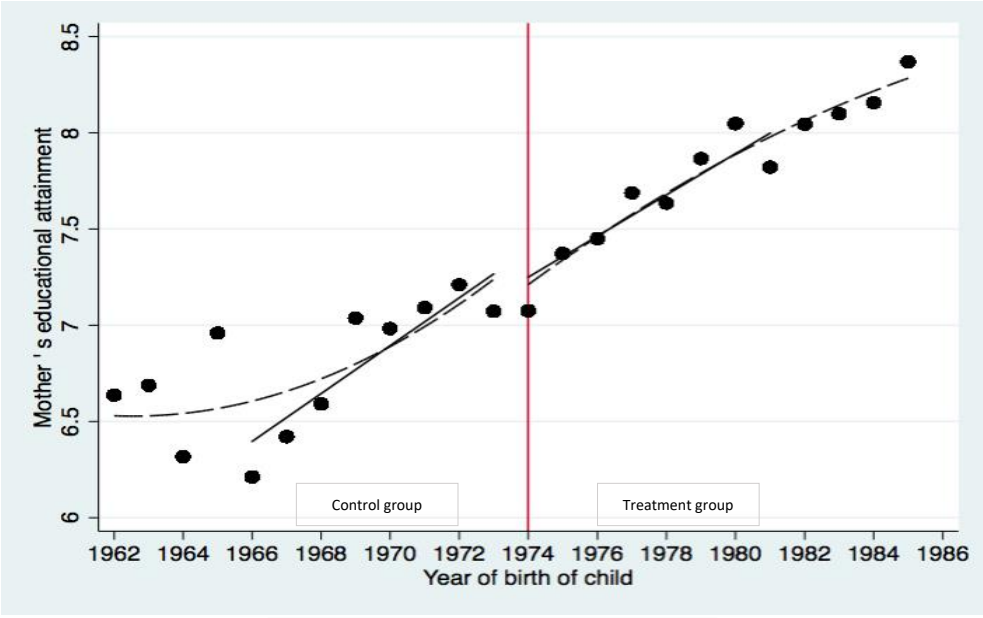
Appendices

Appendix Figures



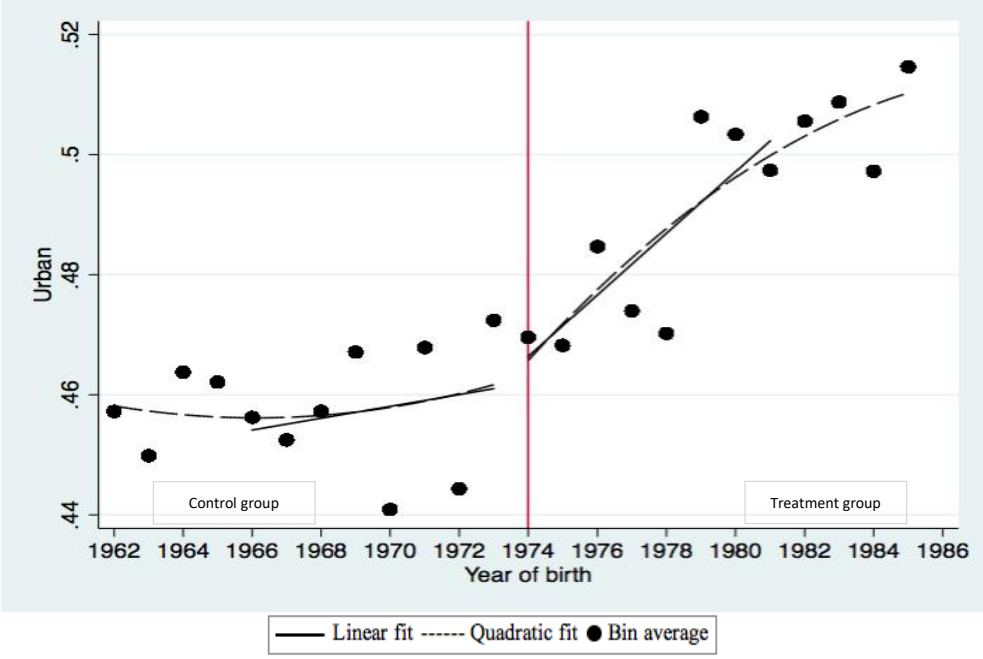
Note: Figure drawn using data from the Annual Poverty Indicators Survey 2008 and 2011.

Appendix figure 2.1: Year of birth of child and father's education, Philippines, 2008 to 2011



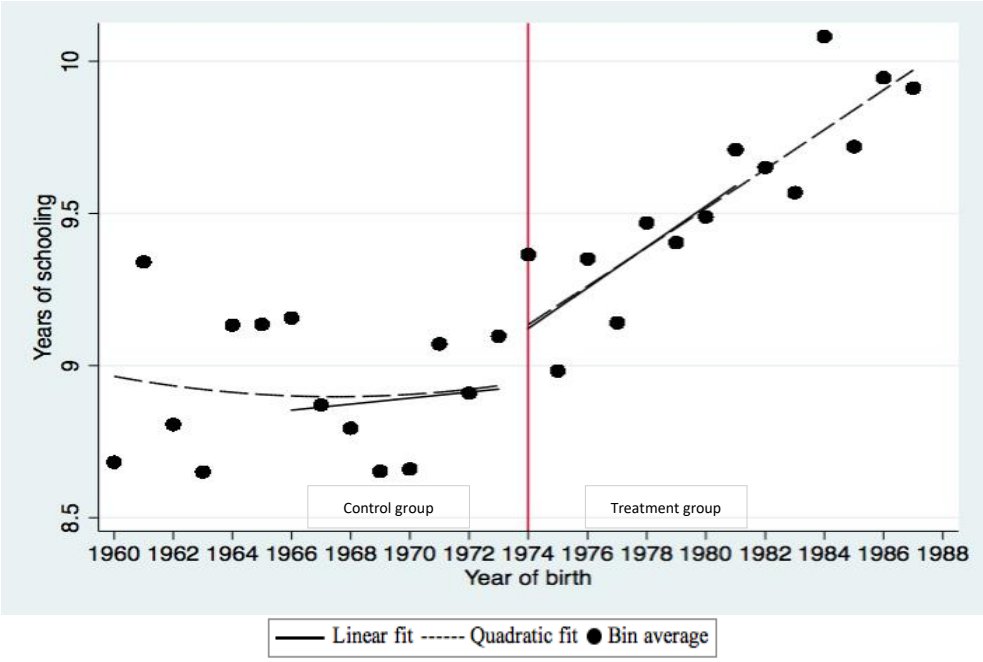
Note: Figure drawn using data from the Annual Poverty Indicators Survey 2008 and 2011.

Appendix figure 2.2: Year of birth of child and mother's education, Philippines, 2008 to 2011



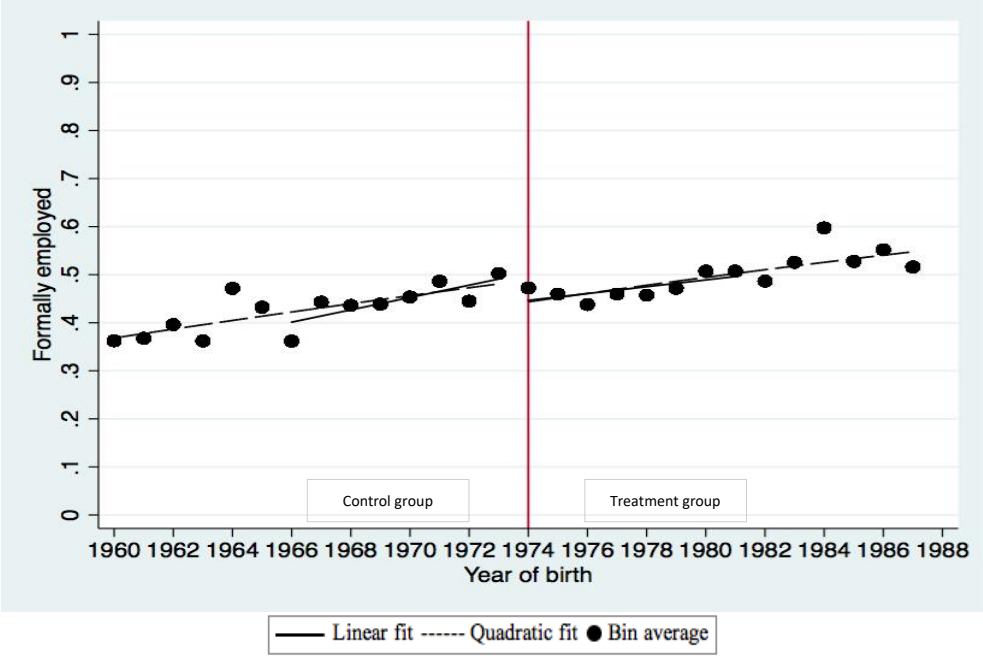
Note: Figure drawn using data from the Annual Poverty Indicators Survey 2011.

Appendix figure 2.3: Year of birth and urbanity, Philippines, 2008 to 2011



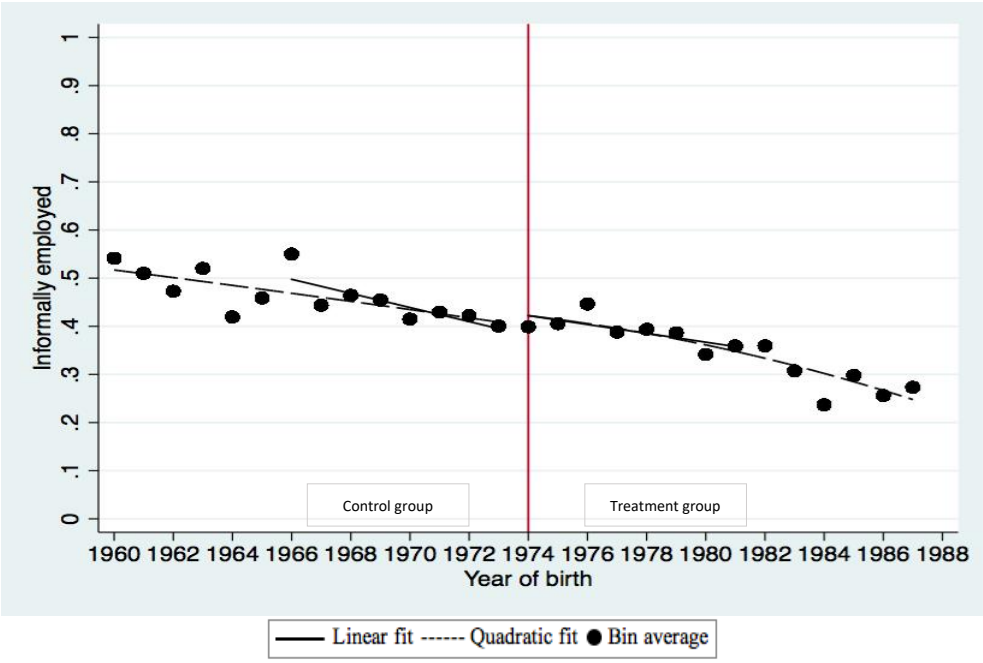
Note: Figure drawn using data from the Annual Poverty Indicators Survey 2017.

Appendix figure 2.4: Fit of the first stage regression: Year of birth and education, Philippines, 2017



Note: Figure drawn using data from the Annual Poverty Indicators Survey 2017.

Appendix figure 2.5: Year of birth and probability of formal employment, Philippines, 2017



Note: Figure drawn using data from the Annual Poverty Indicators Survey 2017.

Appendix figure 2.6: Year of birth and probability of informal employment, Philippines, 2017

Appendix Tables

Appendix table 2.1: (Full Table 2.3) First stage estimates (IV Probit): Effect of free and subsidized secondary schooling policies on schooling, by bandwidth, Philippines, 2008 to 2011

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel A. Sample: Labor force										
Z	0.194***	0.157***	0.240***	0.188**	0.232***	0.194***	0.204***	0.155**	0.208***	0.170***
	(0.056)	(0.053)	(0.090)	(0.085)	(0.045)	(0.043)	(0.071)	(0.067)	(0.053)	(0.050)
Year of birth	0.016*	0.021***	-0.019	-0.009	0.020***	0.023***	-0.005	0.005		
	(0.009)	(0.008)	(0.039)	(0.037)	(0.005)	(0.004)	(0.020)	(0.019)		
Z x year of birth	0.101***	0.087***	0.149***	0.136***	0.079***	0.071***	0.154***	0.136***		
	(0.012)	(0.011)	(0.050)	(0.047)	(0.007)	(0.006)	(0.027)	(0.026)		
(Year of birth)^2	-	-	-0.004	-0.003	-	-	-0.002	-0.001		
	-	-	(0.004)	(0.004)	-	-	(0.002)	(0.001)		
Z x (Year of birth)^2	-	-	0.002	0.001	-	-	-0.003	-0.003		
	-	-	(0.006)	(0.006)	-	-	(0.002)	(0.002)		
Bandwidth	8	8	8	8	12	12	12	12	10	11
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.011	0.100	0.011	0.100	0.018	0.108	0.018	0.108	0.014	0.106
No. of observations	75,311	75,311	75,311	75,311	111,715	111,715	111,715	111,715	93,550	102,899

Appendix table 2.1: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel B. Sample: Labor force, men										
Z	0.184**	0.161**	0.315**	0.293**	0.247***	0.216***	0.175*	0.161*	0.269***	0.317***
	(0.079)	(0.076)	(0.127)	(0.122)	(0.064)	(0.062)	(0.100)	(0.096)	(0.101)	(0.115)
Year of birth	0.012	0.011	-0.049	-0.053	0.016**	0.016**	-0.007	-0.009		
	(0.012)	(0.012)	(0.055)	(0.052)	(0.007)	(0.006)	(0.029)	(0.028)		
Z x year of birth	0.099***	0.090***	0.131*	0.132*	0.071***	0.063***	0.167***	0.155***		
	(0.017)	(0.016)	(0.070)	(0.067)	(0.009)	(0.009)	(0.038)	(0.036)		
(Year of birth)^2	-	-	-0.007	-0.007	-	-	-0.002	-0.002		
	-	-	(0.006)	(0.006)	-	-	(0.002)	(0.002)		
Z x (Year of birth)^2	-	-	0.011	0.010	-	-	-0.005	-0.004		
	-	-	(0.008)	(0.008)	-	-	(0.003)	(0.003)		
Bandwidth	8	8	8	8	12	12	12	12	6	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.009	0.092	0.009	0.092	0.015	0.098	0.016	0.098	0.005	0.090
No. of observations	37,578	37,578	37,578	37,578	56,073	56,073	56,073	56,073	28,235	23,470

Appendix table 2.1: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel C. Sample: Labor force, women										
Z	0.182**	0.154**	0.153	0.084	0.197***	0.174***	0.216**	0.154	0.194	0.151
	(0.078)	(0.075)	(0.125)	(0.120)	(0.064)	(0.061)	(0.099)	(0.095)	(0.126)	(0.122)
Year of birth	0.022*	0.031***	0.007	0.034	0.024***	0.029***	-0.001	0.019		
	(0.012)	(0.011)	(0.054)	(0.052)	(0.007)	(0.006)	(0.029)	(0.027)		
Z x year of birth	0.104***	0.086***	0.172**	0.145**	0.091***	0.080***	0.139***	0.117***		
	(0.017)	(0.016)	(0.069)	(0.066)	(0.009)	(0.009)	(0.038)	(0.036)		
(Year of birth)^2	-	-	-0.002	0.000	-	-	-0.002	-0.001		
	-	-	(0.006)	(0.006)	-	-	(0.002)	(0.002)		
Z x (Year of birth)^2	-	-	-0.006	-0.009	-	-	-0.000	-0.002		
	-	-	(0.008)	(0.008)	-	-	(0.003)	(0.003)		
Bandwidth	8	8	8	8	12	12	12	12	4	4
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.013	0.097	0.013	0.097	0.023	0.107	0.023	0.107	0.005	0.092
No. of observations	37,733	37,733	37,733	37,733	55,642	55,642	55,642	55,642	18,761	18,761

Appendix table 2.1: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel D. Sample: Employed in the formal and informal sector										
Z	0.184***	0.150**	0.258**	0.197**	0.243***	0.205***	0.180**	0.134*	0.210***	0.255***
	(0.064)	(0.061)	(0.103)	(0.098)	(0.053)	(0.050)	(0.081)	(0.077)	(0.071)	(0.095)
Year of birth	0.021**	0.025***	-0.015	-0.007	0.024***	0.028***	0.007	0.013		
	(0.010)	(0.009)	(0.044)	(0.042)	(0.005)	(0.005)	(0.023)	(0.022)		
Z x year of birth	0.102***	0.089***	0.124**	0.128**	0.075***	0.066***	0.153***	0.143***		
	(0.014)	(0.013)	(0.057)	(0.054)	(0.008)	(0.007)	(0.031)	(0.029)		
(Year of birth)^2	-	-	-0.004	-0.004	-	-	-0.001	-0.001		
	-	-	(0.005)	(0.005)	-	-	(0.002)	(0.002)		
Z x (Year of birth)^2	-	-	0.006	0.003	-	-	-0.004*	-0.005*		
	-	-	(0.007)	(0.007)	-	-	(0.003)	(0.002)		
Bandwidth	8	8	8	8	12	12	12	12	8	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.011	0.108	0.011	0.108	0.018	0.118	0.018	0.118	0.011	0.103
No. of observations	57,696	57,696	57,696	57,696	84,587	84,587	84,587	84,587	57,696	36,272

Appendix table 2.1: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel E. Sample: Employed men										
Z	0.175**	0.145*	0.281**	0.243*	0.239***	0.204***	0.171*	0.145	0.185**	0.179*
	(0.081)	(0.078)	(0.130)	(0.124)	(0.066)	(0.063)	(0.102)	(0.098)	(0.083)	(0.093)
Year of birth	0.013	0.012	-0.035	-0.037	0.019***	0.018***	-0.009	-0.011		
	(0.012)	(0.012)	(0.056)	(0.053)	(0.007)	(0.007)	(0.030)	(0.028)		
Z x year of birth	0.087***	0.081***	0.108	0.115*	0.053***	0.048***	0.158***	0.152***		
	(0.018)	(0.017)	(0.072)	(0.069)	(0.010)	(0.009)	(0.039)	(0.037)		
(Year of birth)^2	-	-	-0.005	-0.005	-	-	-0.002	-0.002		
	-	-	(0.006)	(0.006)	-	-	(0.002)	(0.002)		
Z x (Year of birth)^2	-	-	0.009	0.008	-	-	-0.005	-0.005		
	-	-	(0.009)	(0.008)	-	-	(0.003)	(0.003)		
Bandwidth	8	8	8	8	12	12	12	12	9	7
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.008	0.096	0.008	0.096	0.012	0.101	0.012	0.101	0.010	0.093
No. of observations	35,170	35,170	35,170	35,170	51,671	51,671	51,671	51,671	39,373	30,749

Appendix table 2.1: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel F. Sample: Employed women										
Z	0.184*	0.157	0.218	0.126	0.229***	0.201**	0.178	0.121	0.263	0.188
	(0.103)	(0.100)	(0.164)	(0.158)	(0.085)	(0.081)	(0.130)	(0.125)	(0.162)	(0.149)
Year of birth	0.042***	0.044***	0.015	0.039	0.038***	0.038***	0.040	0.048		
	(0.015)	(0.015)	(0.069)	(0.067)	(0.008)	(0.008)	(0.037)	(0.035)		
Z x year of birth	0.133***	0.109***	0.172*	0.154*	0.126***	0.108***	0.153***	0.133***		
	(0.022)	(0.022)	(0.092)	(0.088)	(0.012)	(0.012)	(0.050)	(0.048)		
(Year of birth)^2	-	-	-0.003	-0.001	-	-	0.000	0.001		
	-	-	(0.007)	(0.007)	-	-	(0.003)	(0.003)		
Z x (Year of birth)^2	-	-	0.001	-0.005	-	-	-0.003	-0.004		
	-	-	(0.011)	(0.011)	-	-	(0.004)	(0.004)		
Bandwidth	8	8	8	8	12	12	12	12	4	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.021	0.091	0.021	0.091	0.039	0.108	0.039	0.108	0.006	0.080
No. of observations	22,526	22,526	22,526	22,526	32,916	32,916	32,916	32,916	11,271	14,153

Note: *Z* is a dummy variable that takes the value of 1 if birth year ≥ *1974* and 0 if birth year < *1974*. Years of birth were normalized based on the cut-off (1974) so that coefficients may be interpreted directly. Linear specification includes year of birth and Z x year of birth. Quadratic specification adds (year of birth)^2 and Z x (year of birth)^2. Datasets used are the Annual Poverty Indicators Survey 2008 and 2011. Bandwidth 8 refers to years of birth 1966 to 1981, while bandwidth 12 refers to years of birth 1962 to 1985. Estimates for the optimal bandwidth were generated using the *rdbwselect* and *rdrobust* commands in Stata. Control variables include male and regional dummies. Standard errors in parentheses are clustered at the year of birth level. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Appendix table 2.2: (Full Table 2.4) Second stage estimates (IV Probit): Effect of schooling on employment outcomes, by bandwidth, Philippines, 2008 to 2011

Dependent variable: P [Formally employed]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel A. Sample: Labor force										
Years of schooling	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.019	0.020
	(0.027)	(0.025)	(0.026)	(0.030)	(0.020)	(0.019)	(0.032)	(0.033)	(0.021)	(0.020)
Year of birth	0.004***	0.004***	0.002	0.005**	0.004***	0.004***	0.004***	0.005***		
	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)	(0.000)	(0.001)	(0.002)		
Z x year of birth	-0.001	-0.002	-0.001	-0.004	-0.002	-0.003	-0.002	-0.003		
	(0.003)	(0.003)	(0.006)	(0.006)	(0.002)	(0.002)	(0.005)	(0.005)		
(Year of birth)^2	-	-	-0.000*	0.000	-	-	0.000	0.000		
	-	-	(0.000)	(0.000)	-	-	(0.000)	(0.000)		
Z x (Year of birth)^2	-	-	0.000	0.000	-	-	0.000	-0.000		
	-	-	(0.000)	(0.001)	-	-	(0.000)	(0.000)		
Bandwidth	8	8	8	8	12	12	12	12	10	11
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	75,311	75,311	75,311	75,311	111,715	111,715	111,715	111,715	93,550	102,899

Appendix table 2.2: ***(Continued)***

Dependent variable: P [Formally employed]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel B. Sample: Labor force, men										
Years of schooling	0.017	0.011	0.017	0.011	0.016	0.010	0.016	0.010	0.017	0.010
	(0.054)	(0.056)	(0.040)	(0.037)	(0.033)	(0.037)	(0.066)	(0.071)	(0.059)	(0.040)
Year of birth	0.006***	0.007***	0.001	0.003	0.007***	0.008***	0.003	0.004*		
	(0.001)	(0.002)	(0.003)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)		
Z x year of birth	-0.004	-0.005	0.006	0.004	-0.007**	-0.008***	0.003	0.002		
	(0.007)	(0.007)	(0.012)	(0.010)	(0.003)	(0.003)	(0.013)	(0.011)		
(Year of birth)^2	-	-	-0.001**	-0.001*	-	-	-0.000*	-0.000		
	-	-	(0.000)	(0.000)	-	-	(0.000)	(0.000)		
Z x (Year of birth)^2	-	-	-0.000	-0.000	-	-	-0.000	-0.000		
	-	-	(0.001)	(0.001)	-	-	(0.001)	(0.000)		
Bandwidth	8	8	8	8	12	12	12	12	6	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	37,578	37,578	37,578	37,578	56,073	56,073	56,073	56,073	28,235	23,470

Appendix table 2.2: ***(Continued)***

Dependent variable: P [Formally employed]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel C. Sample: Labor force, women										
Years of schooling	0.029*	0.027*	0.029*	0.027	0.031**	0.028**	0.031*	0.028**	0.029	0.027
	(0.015)	(0.015)	(0.017)	(0.022)	(0.015)	(0.013)	(0.017)	(0.014)	(0.020)	(0.024)
Year of birth	-0.000	0.000	0.003	0.005**	-0.000	-0.000	0.003**	0.004**		
	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)		
Z x year of birth	0.000	0.000	-0.011	-0.011**	0.002	0.002	-0.008	-0.008**		
	(0.002)	(0.002)	(0.007)	(0.005)	(0.002)	(0.001)	(0.005)	(0.004)		
(Year of birth)^2	-	-	0.000	0.000*	-	-	0.000**	0.000***		
	-	-	(0.000)	(0.000)	-	-	(0.000)	(0.000)		
Z x (Year of birth)^2	-	-	0.001	0.001	-	-	0.000	0.000		
	-	-	(0.001)	(0.001)	-	-	(0.000)	(0.000)		
Bandwidth	8	8	8	8	12	12	12	12	4	4
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	37,733	37,733	37,733	37,733	55,642	55,642	55,642	55,642	18,761	18,761

Appendix table 2.2: ***(Continued)***

Dependent variable: P [Informally employed]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel D. Sample: Employed in the formal and informal sector										
Years of schooling	-0.025	-0.022	-0.025	-0.022	-0.026	-0.022	-0.026	-0.022	-0.025	-0.021
	(0.031)	(0.032)	(0.021)	(0.037)	(0.020)	(0.019)	(0.035)	(0.046)	(0.031)	(0.044)
Year of birth	-0.007***	-0.007***	-0.005***	-0.008***	-0.006***	-0.007***	-0.007***	-0.008***		
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.003)		
Z x year of birth	-0.004	-0.003	-0.003	0.000	-0.007***	-0.006***	0.001	0.003		
	(0.003)	(0.002)	(0.007)	(0.007)	(0.001)	(0.001)	(0.006)	(0.007)		
(Year of birth)^2	-	-	0.000	-0.000	-	-	-0.000	-0.000		
	-	-	(0.000)	(0.000)	-	-	(0.000)	(0.000)		
Z x (Year of birth)^2	-	-	-0.001	-0.000	-	-	-0.001	-0.001		
	-	-	(0.001)	(0.001)	-	-	(0.000)	(0.001)		
Bandwidth	8	8	8	8	12	12	12	12	8	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	57,696	57,696	57,696	57,696	84,587	84,587	84,587	84,587	57,696	36,272

Appendix table 2.2: ***(Continued)***

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
P [Informally employed]				Ad hoc bandwidths					Optimal bandwidths	
Panel E. Sample: Employed men										
Years of schooling	-0.022	-0.015	-0.022	-0.015	-0.022	-0.015	-0.022	-0.015	-0.022	-0.015
	(0.061)	(0.056)	(0.043)	(0.043)	(0.036)	(0.032)	(0.059)	(0.066)	(0.062)	(0.062)
Year of birth	-0.007***	-0.008***	-0.002	-0.004*	-0.007***	-0.007***	-0.004**	-0.006***		
	(0.001)	(0.002)	(0.002)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)		
Z x year of birth	-0.001	-0.001	-0.006	-0.005	-0.002	-0.002	-0.002	-0.001		
	(0.006)	(0.005)	(0.011)	(0.010)	(0.002)	(0.001)	(0.012)	(0.011)		
$(\text{Year of birth})^2$	-	-	0.001**	0.000	-	-	0.000	0.000		
	-	-	(0.000)	(0.000)	-	-	(0.000)	(0.000)		
Z x $(\text{Year of birth})^2$	-	-	-0.001	-0.000	-	-	-0.000	-0.000		
	-	-	(0.001)	(0.001)	-	-	(0.001)	(0.001)		
Bandwidth	8	8	8	8	12	12	12	12	9	7
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	35,170	35,170	35,170	35,170	51,671	51,671	51,671	51,671	39,373	30,749

Appendix table 2.2: ***(Continued)***

Dependent variable: P [Informally employed]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel F. Sample: Employed women										
Years of schooling	-0.036	-0.032	-0.036	-0.032	-0.037	-0.033	-0.037	-0.033	-0.037	-0.033
	(0.040)	(0.035)	(0.061)	(0.044)	(0.026)	(0.022)	(0.052)	(0.043)	(0.057)	(0.071)
Year of birth	-0.005***	-0.005***	-0.009**	-0.013**	-0.005***	-0.005***	-0.010***	-0.012**		
	(0.001)	(0.001)	(0.004)	(0.007)	(0.001)	(0.001)	(0.004)	(0.005)		
Z x year of birth	-0.007*	-0.006**	0.007	0.010	-0.014***	-0.013***	0.008	0.009		
	(0.004)	(0.003)	(0.021)	(0.017)	(0.002)	(0.002)	(0.014)	(0.012)		
(Year of birth)^2	-	-	-0.000	-0.001	-	-	-0.000*	-0.001*		
	-	-	(0.000)	(0.001)	-	-	(0.000)	(0.000)		
Z x (Year of birth)^2	-	-	-0.001	-0.000	-	-	-0.001	-0.001		
	-	-	(0.002)	(0.001)	-	-	(0.001)	(0.001)		
Bandwidth	8	8	8	8	12	12	12	12	4	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	22,526	22,526	22,526	22,526	32,916	32,916	32,916	32,916	11,271	14,153

Note: *Z* is a dummy variable that takes the value of 1 if birth year ≥ *1974* and 0 if birth year < *1974*. Years of birth were normalized based on the cut-off (1974) so that coefficients may be interpreted directly. Linear specification includes year of birth and Z x year of birth. Quadratic specification adds (year of birth)^2 and Z x (year of birth)^2. Marginal effects are shown for IV Probit second stage. Datasets used are the Annual Poverty Indicators Survey 2008 and 2011. Bandwidth 8 refers to years of birth 1966 to 1981, while bandwidth 12 refers to years of birth 1962 to 1985. Estimates for the optimal bandwidth were generated using the *rdbwselect* and *rdrobust* commands in Stata. Control variables include male and regional dummies. Standard errors in parentheses are clustered at the year of birth level. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Appendix table 2.3: (Full Table 2.5) First stage estimates (IV 2SLS): Effect of free and subsidized secondary schooling policies on schooling, by bandwidth, Philippines, 2008 to 2011

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel A. Sample: Employed in the formal and informal sector										
Z	0.184***	0.150**	0.258**	0.197**	0.232***	0.205***	0.180**	0.134*	0.230***	0.162**
	(0.064)	(0.061)	(0.103)	(0.098)	(0.045)	(0.050)	(0.081)	(0.077)	(0.056)	(0.065)
Year of birth	0.021**	0.025***	-0.015	-0.007	0.020***	0.028***	0.007	0.013		
	(0.010)	(0.009)	(0.044)	(0.042)	(0.005)	(0.005)	(0.023)	(0.022)		
Z x year of birth	0.102***	0.089***	0.124**	0.128**	0.079***	0.066***	0.153***	0.143***		
	(0.014)	(0.013)	(0.057)	(0.054)	(0.007)	(0.007)	(0.031)	(0.029)		
(Year of birth)^2	-	-	-0.004	-0.004	-	-	-0.001	-0.001		
	-	-	(0.005)	(0.005)	-	-	(0.002)	(0.002)		
Z x (Year of birth)^2	-	-	0.006	0.003	-	-	-0.004*	-0.005*		
	-	-	(0.007)	(0.007)	-	-	(0.003)	(0.002)		
Bandwidth	8	8	8	8	12	12	12	12	13	9
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.011	0.108	0.011	0.108	0.018	0.118	0.018	0.118	0.019	0.111
No. of observations	57,696	57,696	57,696	57,696	111,715	84,587	84,587	84,587	91,173	64,530

Appendix table 2.3: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel B. Sample: Employed in the formal sector										
Z	0.016	-0.007	0.136	0.104	0.161**	0.124*	-0.032	-0.042	0.180	0.073
	(0.085)	(0.081)	(0.136)	(0.130)	(0.069)	(0.066)	(0.107)	(0.102)	(0.131)	(0.110)
Year of birth	0.029**	0.031**	-0.030	-0.045	0.021***	0.024***	0.040	0.030		
	(0.013)	(0.013)	(0.059)	(0.056)	(0.007)	(0.007)	(0.031)	(0.030)		
Z x year of birth	0.113***	0.097***	0.153**	0.187***	0.083***	0.071***	0.153***	0.152***		
	(0.018)	(0.017)	(0.076)	(0.072)	(0.010)	(0.010)	(0.041)	(0.039)		
(Year of birth)^2	-	-	-0.007	-0.008	-	-	0.001	0.001		
	-	-	(0.006)	(0.006)	-	-	(0.002)	(0.002)		
Z x (Year of birth)^2	-	-	0.009	0.006	-	-	-0.009***	-0.008***		
	-	-	(0.009)	(0.009)	-	-	(0.003)	(0.003)		
Bandwidth	8	8	8	8	12	12	12	12	5	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.011	0.100	0.012	0.100	0.018	0.110	0.019	0.111	0.004	0.095
No. of observations	32,885	32,885	32,885	32,885	48,800	48,800	48,800	48,800	20,478	24,714

Appendix table 2.3: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel C. Sample: Employed in the informal sector										
Z	0.449***	0.376***	0.433***	0.351**	0.439***	0.374***	0.471***	0.375***	0.435***	0.352***
	(0.095)	(0.089)	(0.150)	(0.142)	(0.078)	(0.073)	(0.119)	(0.113)	(0.110)	(0.118)
Year of birth	-0.011	0.008	-0.015	0.013	0.006	0.020***	-0.055	-0.021		
	(0.014)	(0.013)	(0.063)	(0.060)	(0.008)	(0.007)	(0.033)	(0.031)		
Z x year of birth	0.054***	0.050**	0.081	0.062	0.017	0.024**	0.148***	0.126***		
	(0.021)	(0.020)	(0.084)	(0.079)	(0.012)	(0.011)	(0.046)	(0.044)		
(Year of birth)^2	-	-	-0.000	0.001	-	-	-0.005*	-0.003		
	-	-	(0.007)	(0.006)	-	-	(0.002)	(0.002)		
Z x (Year of birth)^2	-	-	-0.003	-0.003	-	-	-0.002	-0.003		
	-	-	(0.010)	(0.010)	-	-	(0.004)	(0.004)		
Bandwidth	8	8	8	8	12	12	12	12	7	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.006	0.119	0.006	0.119	0.006	0.120	0.006	0.120	0.005	0.120
No. of observations	24,811	24,811	24,811	24,811	35,787	35,787	35,787	35,787	21,724	18,834

Appendix table 2.3: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel D. Sample: Employed men in the formal sector										
Z	0.105	0.076	0.325**	0.273*	0.247***	0.208***	0.081	0.057	0.309**	0.259*
	(0.102)	(0.099)	(0.163)	(0.159)	(0.083)	(0.080)	(0.129)	(0.125)	(0.143)	(0.141)
Year of birth	0.006	0.002	-0.101	-0.106	0.009	0.005	-0.003	-0.010		
	(0.016)	(0.015)	(0.071)	(0.069)	(0.009)	(0.009)	(0.038)	(0.037)		
Z x year of birth	0.118***	0.111***	0.183**	0.203**	0.065***	0.064***	0.190***	0.185***		
	(0.022)	(0.021)	(0.090)	(0.088)	(0.012)	(0.012)	(0.049)	(0.048)		
(Year of birth)^2	-	-	-0.012	-0.012	-	-	-0.001	-0.001		
	-	-	(0.008)	(0.008)	-	-	(0.003)	(0.003)		
Z x (Year of birth)^2	-	-	0.018	0.015	-	-	-0.009**	-0.008**		
	-	-	(0.011)	(0.011)	-	-	(0.004)	(0.004)		
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.009	0.068	0.009	0.068	0.012	0.072	0.013	0.073	0.003	0.062
No. of observations	21,443	21,443	21,443	21,443	31,661	31,661	31,661	31,661	13,402	13,402

Appendix table 2.3: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel E. Sample: Employed women in the formal sector										
Z	-0.139	-0.168	-0.191	-0.224	0.036	-0.019	-0.227	-0.242	-0.149	-0.226
	(0.145)	(0.141)	(0.231)	(0.226)	(0.116)	(0.113)	(0.180)	(0.176)	(0.217)	(0.199)
Year of birth	0.085***	0.082***	0.082	0.067	0.055***	0.056***	0.119**	0.106**		
	(0.022)	(0.021)	(0.099)	(0.097)	(0.012)	(0.012)	(0.052)	(0.051)		
Z x year of birth	0.095***	0.079***	0.153	0.173	0.103***	0.091***	0.107	0.102		
	(0.031)	(0.030)	(0.128)	(0.125)	(0.017)	(0.016)	(0.068)	(0.066)		
(Year of birth)^2	-	-	-0.000	-0.002	-	-	0.005	0.004		
	-	-	(0.011)	(0.010)	-	-	(0.004)	(0.004)		
Z x (Year of birth)^2	-	-	-0.007	-0.009	-	-	-0.011**	-0.009*		
	-	-	(0.015)	(0.015)	-	-	(0.005)	(0.005)		
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.021	0.069	0.021	0.069	0.040	0.083	0.041	0.084	0.009	0.060
No. of observations	11,442	11,442	11,442	11,442	17,139	17,139	17,139	17,139	7,076	7,076

Appendix table 2.3: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel F. Sample: Employed men in the informal sector										
Z	0.319**	0.260**	0.222	0.189	0.271**	0.225**	0.314*	0.260*	0.247	0.184
	(0.129)	(0.122)	(0.207)	(0.195)	(0.105)	(0.099)	(0.162)	(0.153)	(0.160)	(0.165)
Year of birth	0.002	0.020	0.054	0.058	0.012	0.027***	-0.026	-0.004		
	(0.019)	(0.018)	(0.087)	(0.082)	(0.010)	(0.010)	(0.045)	(0.043)		
Z x year of birth	0.021	0.016	-0.025	-0.015	0.017	0.015	0.083	0.070		
	(0.028)	(0.027)	(0.116)	(0.109)	(0.016)	(0.015)	(0.063)	(0.059)		
(Year of birth)^2	-	-	0.006	0.004	-	-	-0.003	-0.002		
	-	-	(0.009)	(0.009)	-	-	(0.003)	(0.003)		
Z x (Year of birth)^2	-	-	-0.007	-0.005	-	-	0.000	0.000		
	-	-	(0.014)	(0.013)	-	-	(0.005)	(0.005)		
Bandwidth	8	8	8	8	12	12	12	12	7	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.003	0.120	0.003	0.120	0.005	0.120	0.005	0.120	0.003	0.127
No. of observations	13,727	13,727	13,727	13,727	20,010	20,010	20,010	20,010	11,989	10,361

Appendix table 2.3: ***(Continued)***

Dependent variable: Years of schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel G. Sample: Employed women in the informal sector										
Z	0.581***	0.505***	0.676***	0.544***	0.606***	0.542***	0.629***	0.505***	0.694***	0.586***
	(0.137)	(0.131)	(0.216)	(0.206)	(0.115)	(0.109)	(0.174)	(0.166)	(0.205)	(0.192)
Year of birth	-0.022	-0.007	-0.092	-0.041	0.001	0.010	-0.078	-0.044		
	(0.020)	(0.019)	(0.091)	(0.087)	(0.011)	(0.010)	(0.048)	(0.046)		
Z x year of birth	0.110***	0.100***	0.207*	0.153	0.039**	0.043**	0.231***	0.208***		
	(0.030)	(0.029)	(0.122)	(0.116)	(0.018)	(0.017)	(0.069)	(0.065)		
(Year of birth)^2	-	-	-0.008	-0.004	-	-	-0.006*	-0.004		
	-	-	(0.010)	(0.009)	-	-	(0.004)	(0.003)		
Z x (Year of birth)^2	-	-	0.004	0.001	-	-	-0.005	-0.007		
	-	-	(0.015)	(0.014)	-	-	(0.006)	(0.006)		
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.012	0.101	0.012	0.101	0.012	0.105	0.012	0.105	0.010	0.097
No. of observations	11,084	11,084	11,084	11,084	15,777	15,777	15,777	15,777	7,077	7,077

Note: *Z* is a dummy variable that takes the value of 1 if birth year ≥ *1974* and 0 if birth year < *1974*. Years of birth were normalized based on the cut-off (1974) so that coefficients may be interpreted directly. Linear specification includes year of birth and Z x year of birth. Quadratic specification adds (year of birth)^2 and Z x (year of birth)^2. Datasets used are the Annual Poverty Indicators Survey 2008 and 2011. Bandwidth 8 refers to years of birth 1966 to 1981, while bandwidth 12 refers to years of birth 1962 to 1985. Estimates for the optimal bandwidth were generated using the *rdbwselect* and *rdrobust* commands in Stata. Control variables include male and regional dummies. Standard errors in parentheses are clustered at the year of birth level. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Appendix table 2.4: (Full Table 2.6) Second stage estimates (IV 2SLS): Effect of schooling on income, by bandwidth, Philippines, 2008 to 2011

Dependent variable: log of Income	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Ad hoc bandwidths								Optimal bandwidths	
Panel A. Sample: Employed in the formal and informal sector										
Years of schooling	0.166**	0.179**	0.293***	0.314***	0.149***	0.136**	0.231***	0.271***	0.172***	0.230**
	(0.069)	(0.076)	(0.059)	(0.067)	(0.049)	(0.056)	(0.080)	(0.105)	(0.052)	(0.095)
Year of birth	-0.002	-0.004	-0.015***	-0.016***	0.001	-0.000	-0.007	-0.010**		
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)		
Z x year of birth	-0.030***	-0.034***	-0.039***	-0.043***	-0.034***	-0.034***	-0.036***	-0.046***		
	(0.005)	(0.006)	(0.014)	(0.015)	(0.003)	(0.003)	(0.012)	(0.017)		
(Year of birth)^2	-	-	-0.001**	-0.001*	-	-	-0.000**	-0.000*		
	-	-	(0.000)	(0.001)	-	-	(0.000)	(0.000)		
Z x (Year of birth)^2	-	-	0.002**	0.002*	-	-	0.001	0.001		
	-	-	(0.001)	(0.001)	-	-	(0.001)	(0.001)		
Bandwidth	8	8	8	8	12	12	12	12	13	9
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	57,696	57,696	57,696	57,696	84,586	84,586	84,586	84,586	91,172	64,529

Appendix table 2.4: ***(Continued)***

Dependent variable: log of Income	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel B. Sample: Employed in the formal sector										
Years of schooling	2.015	-3.559	0.707	0.721	0.379***	0.370*	-1.243	-0.782	0.572	0.858
	(13.339)	(63.567)	(0.655)	(0.966)	(0.129)	(0.190)	(8.026)	(3.981)	(0.352)	(1.131)
Year of birth	-0.056	0.111	-0.002	0.009	-0.004	-0.007	0.050	0.021		
	(0.422)	(1.899)	(0.021)	(0.024)	(0.006)	(0.007)	(0.262)	(0.082)		
Z x year of birth	-0.237	0.332	-0.109	-0.132	-0.052***	-0.048***	0.189	0.114		
	(1.483)	(6.237)	(0.078)	(0.156)	(0.010)	(0.013)	(1.266)	(0.639)		
(Year of birth)^2	-	-	0.002	0.003	-	-	0.001	0.000		
	-	-	(0.003)	(0.006)	-	-	(0.008)	(0.002)		
Z x (Year of birth)^2	-	-	-0.001	-0.001	-	-	-0.013	-0.007		
	-	-	(0.004)	(0.004)	-	-	(0.069)	(0.030)		
Bandwidth	8	8	8	8	12	12	12	12	5	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	32,885	32,885	32,885	32,885	48,800	48,800	48,800	48,800	20,478	24,714

Appendix table 2.4: ***(Continued)***

Dependent variable: log of Income	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel C. Sample: Employed in the informal sector										
Years of schooling	0.083**	0.072	0.119**	0.126	0.053	0.039	0.099**	0.100	0.104**	0.120*
	(0.039)	(0.054)	(0.056)	(0.080)	(0.038)	(0.048)	(0.046)	(0.068)	(0.053)	(0.071)
Year of birth	-0.003	-0.001	-0.015*	-0.017	0.002	0.004	-0.010**	-0.009		
	(0.002)	(0.004)	(0.008)	(0.012)	(0.002)	(0.003)	(0.005)	(0.006)		
Z x year of birth	-0.031***	-0.033***	-0.014	-0.016	-0.037***	-0.038***	-0.019**	-0.025***		
	(0.004)	(0.003)	(0.012)	(0.011)	(0.002)	(0.002)	(0.010)	(0.009)		
(Year of birth)^2	-	-	-0.001	-0.002	-	-	-0.001***	-0.001**		
	-	-	(0.001)	(0.001)	-	-	(0.000)	(0.000)		
Z x (Year of birth)^2	-	-	0.001	0.001	-	-	0.000	0.001		
	-	-	(0.001)	(0.002)	-	-	(0.001)	(0.001)		
Bandwidth	8	8	8	8	12	12	12	12	7	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	24,811	24,811	24,811	24,811	35,786	35,786	35,786	35,786	21,724	18,834

Appendix table 2.4: ***(Continued)***

Dependent variable: log of Income	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel D. Sample: Employed men in the formal sector										
Years of schooling	0.321*	0.348	0.349***	0.337***	0.297***	0.295***	0.475	0.515	0.361**	0.367**
	(0.192)	(0.322)	(0.108)	(0.129)	(0.069)	(0.086)	(0.681)	(1.107)	(0.145)	(0.177)
Year of birth	-0.004	-0.004	0.001	0.002	-0.003	-0.004	-0.004	-0.002		
	(0.005)	(0.005)	(0.011)	(0.011)	(0.003)	(0.003)	(0.016)	(0.012)		
Z x year of birth	-0.050**	-0.054	-0.070***	-0.069***	-0.048***	-0.048***	-0.086	-0.097		
	(0.021)	(0.033)	(0.016)	(0.017)	(0.004)	(0.005)	(0.119)	(0.192)		
(Year of birth)^2	-	-	0.001	0.001	-	-	0.000	0.000		
	-	-	(0.001)	(0.001)	-	-	(0.001)	(0.001)		
Z x (Year of birth)^2	-	-	0.001	0.001	-	-	0.002	0.003		
	-	-	(0.002)	(0.002)	-	-	(0.007)	(0.011)		
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	21,443	21,443	21,443	21,443	31,661	31,661	31,661	31,661	13,402	13,402

Appendix table 2.4: ***(Continued)***

Dependent variable: log of Income	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel E. Sample: Employed women in the formal sector										
Years of schooling	-0.248	-0.179	-0.301	-0.196	1.186	-1.122	-0.165	-0.162	-0.246	-0.091
	(0.385)	(0.312)	(0.409)	(0.311)	(3.117)	(7.349)	(0.238)	(0.251)	(0.708)	(0.303)
Year of birth	0.033	0.023	0.025	0.008	-0.055	0.070	0.033*	0.022		
	(0.029)	(0.020)	(0.020)	(0.016)	(0.180)	(0.399)	(0.020)	(0.016)		
Z x year of birth	0.021	0.004	0.053	0.045	-0.124	0.095	0.011	0.006		
	(0.038)	(0.030)	(0.091)	(0.080)	(0.322)	(0.671)	(0.037)	(0.040)		
(Year of birth)^2	-	-	-0.001	-0.002	-	-	0.001	0.000		
	-	-	(0.003)	(0.003)	-	-	(0.001)	(0.001)		
Z x (Year of birth)^2	-	-	-0.001	-0.002	-	-	-0.002	-0.001		
	-	-	(0.003)	(0.003)	-	-	(0.002)	(0.002)		
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	11,442	11,442	11,442	11,442	17,139	17,139	17,139	17,139	7,076	7,076

Appendix table 2.4: ***(Continued)***

Dependent variable: log of Income	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Ad hoc bandwidths								Optimal bandwidths	
Panel F. Sample: Employed men in the informal sector										
Years of schooling	0.010	-0.031	0.054	0.011	-0.030	-0.079	0.030	0.002	0.040	0.014
	(0.063)	(0.091)	(0.147)	(0.186)	(0.063)	(0.093)	(0.074)	(0.103)	(0.132)	(0.191)
Year of birth	0.001	0.004	-0.005	-0.004	0.007***	0.010**	-0.008**	-0.005		
	(0.002)	(0.004)	(0.012)	(0.018)	(0.002)	(0.004)	(0.003)	(0.005)		
Z x year of birth	-0.038***	-0.038***	-0.036***	-0.030*	-0.045***	-0.043***	-0.022*	-0.024*		
	(0.005)	(0.005)	(0.013)	(0.016)	(0.003)	(0.003)	(0.013)	(0.013)		
(Year of birth)^2	-	-	-0.001	-0.001	-	-	-0.001***	-0.001***		
	-	-	(0.001)	(0.002)	-	-	(0.000)	(0.000)		
Z x (Year of birth)^2	-	-	0.001	0.001	-	-	0.000	0.000		
	-	-	(0.003)	(0.003)	-	-	(0.001)	(0.001)		
Bandwidth	8	8	8	8	12	12	12	12	7	6
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	13,727	13,727	13,727	13,727	20,010	20,010	20,010	20,010	11,989	10,361

Appendix table 2.4: ***(Continued)***

Dependent variable: log of Income	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Ad hoc bandwidths					Optimal bandwidths	
Panel G. Sample: Employed women in the informal sector										
Years of schooling	0.138***	0.129***	0.153***	0.156**	0.099***	0.083**	0.154***	0.150**	0.158**	0.170**
	(0.032)	(0.047)	(0.042)	(0.069)	(0.031)	(0.039)	(0.041)	(0.062)	(0.064)	(0.073)
Year of birth	-0.007**	-0.005	-0.022**	-0.020	-0.002	-0.001	-0.015**	-0.012		
	(0.003)	(0.004)	(0.011)	(0.014)	(0.002)	(0.003)	(0.007)	(0.008)		
Z x year of birth	-0.029***	-0.031***	0.003	-0.006	-0.030***	-0.029***	-0.022*	-0.030**		
	(0.005)	(0.005)	(0.015)	(0.018)	(0.003)	(0.003)	(0.013)	(0.014)		
(Year of birth)^2	-	-	-0.002	-0.002	-	-	-0.001*	-0.001		
	-	-	(0.001)	(0.002)	-	-	(0.001)	(0.001)		
Z x (Year of birth)^2	-	-	-0.001	-0.000	-	-	0.001	0.002		
	-	-	(0.002)	(0.002)	-	-	(0.001)	(0.002)		
Bandwidth	8	8	8	8	12	12	12	12	5	5
Polynomial	Linear	Linear	Quadratic	Quadratic	Linear	Linear	Quadratic	Quadratic	Linear	Linear
With controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	11,084	11,084	11,084	11,084	15,776	15,776	15,776	15,776	7,077	7,077

Note: *Z* is a dummy variable that takes the value of 1 if birth year ≥ *1974* and 0 if birth year < *1974*. Years of birth were normalized based on the cut-off (1974) so that coefficients may be interpreted directly. Linear specification includes year of birth and Z x year of birth. Quadratic specification adds (year of birth)^2 and Z x (year of birth)^2. Datasets used are the Annual Poverty Indicators Survey 2008 and 2011. Bandwidth 8 refers to years of birth 1966 to 1981, while bandwidth 12 refers to years of birth 1962 to 1985. Estimates for the optimal bandwidth were generated using the *rdbwselect* and *rdrobust* commands in Stata. Control variables include male and regional dummies. Standard errors in parentheses are clustered at the year of birth level. ∗∗∗, ∗∗, and ∗ indicate significance at the 1, 5, and 10 percent levels, respectively.

Chapter 3

Learning and Employment Outcomes

3.1. Introduction

Schooling does not necessarily translate to learning. According to the World Development Report of the World Bank (2018), the global expansion in schooling in recent decades did not lead to higher level of learning. Data show that the learning outcomes, across groups and subject areas, in developing countries are so low that they are now facing a learning crisis. This is especially evident in many low- and middle-income countries. More than half of children in all low- and middle-income countries experience learning poverty[53] (Saavedra, 2019). The low quality of learning in primary schools alone leaves us far from achieving Sustainable Development Goal (SDG) 4, which aims to "ensure free, equitable and quality primary and secondary education for all" by 2030 (UN, 2017).

Poor learning outcomes have repercussions in the long-run. Children will find it difficult to catch up in secondary school if they do not develop their reading skills by the age of 10. Likewise, they are less likely to continue into higher levels of education, leading to poor labor market prospects and higher vulnerability to poverty. Based on skills data from 41 countries, more than 2.1 billion out of 4.6 billion workers (around 46 percent), aged 15 to 64, lack crucial foundational skills. The skills gap is even greater among the younger generation (15- to 24-year-olds) in developing economies. In this age group, approximately 25 percent in East Asia and Pacific, 35 percent in South Asia, and

[53] Learning poverty refers to the rate at which children cannot read and comprehend a simple text by the age of 10.

40 percent in Latin America and the Caribbean have low reading proficiency (World Bank, 2018).

In the Philippines, the learning crisis is also evident. Both primary and secondary students perform poorly in national and international standardized exams. Data from the National Achievement Tests (NAT), conducted annually by the Department of Education (DepEd), reveal that the average scores of students in Mathematics, Science, and English are lower than 50 percent. This poor performance is also reflected in the low scores and ranking of Filipino children in international standardized tests, including the Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA). Boys lagged behind girls in all subject areas and the widest gaps are evident in Science, English, and Filipino. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2008), this situation is similar to the case of other developing countries.

David, Albert, and Carreon-Monterola (2009) cite possible explanations for this gender disparity in test scores in the Philippines. First is household preference in investments in child schooling and learning. Second are school-related mechanisms, including unequal support or treatment given to girls and boys and teachers' gender bias (Lloyd, Mensch, and Clark, 2000). Third, economic factors may also play a role. The increase in demand for labor in female-dominated job markets, such as teaching and nursing, may have increased the schooling outcomes of girls. If parents expect their daughter to have a higher chance of working abroad (i.e., as an overseas Filipino worker [OFW]), then they may invest more on her education than on their son's. Lastly, attitudinal factors against boys may contribute to the disparity. Results of the Annual Poverty Indicators Survey (APIS) indicate that boys are 40 percent more likely than girls

to leave schools, *ceteris paribus*. Interestingly, among children aged 13 to 16 who are not in school, a higher percentage of boys noted lack of personal interest as their reason for leaving school compared to girls. The more prevalent cause for dropping out among girls is lack of money (David, Albert, and Carreon-Monterola, 2009). Hence, motivation, attitude, and personal interest appear to be important facets in understanding the high dropout rates and poor academic performance among boys.

The objectives of this chapter are to investigate the determinants of learning outcomes in the Philippines and explore gender differences in employment outcomes given disparities in learning. We have three hypotheses:

Hypothesis 1 (H1): Gender remains to be an important factor in determining test scores, with girls performing better than boys.

Hypothesis 2 (H2): Household-level characteristics (such as infrastructure and parental background) affect learning outcomes.

Hypothesis 3 (H3): Despite higher test scores among girls, labor market outcomes tend to favor boys.

The study uses ordinary least squares (OLS) and two-stage least squares (2SLS) regressions to analyze the determinants of NAT scores and the proportion of employed in the formal and informal sector by gender. To summarize, the main findings of the chapter are as follows. First, girls perform better than boys across all subjects in our pooled dataset (2009 to 2018). Second, provincial results suggest that household access to electricity, agricultural land ownership, and mother's educational attainment are positively associated with test scores, while household ownership of TV and radio have negative correlation with exam performance. This is true for both girls and boys. Finally, provincial test scores are positively correlated with the proportion of formally employed

and negatively associated with the proportion of informally employed, with the correlations higher among boys than among girls.

This paper contributes to the literature on learning poverty and gender inequities in learning and labor market outcomes. It provides insights on how individual-level and provincial-level variables affect test scores and, in turn, how these learning outcomes relate to employment. To our knowledge, this study is one of the first in the Philippines to explore the linkages among test scores, household variables, and employment outcomes. Importantly, our results may be used to craft policies that address issues on gender biases in the education and labor market sectors.

The rest of the chapter is organized as follows. Section 3.2 provides a background on the high school system in the Philippines. Section 3.3 reviews the previous literature. Section 3.4 presents the empirical strategy and data. Section 3.5 explores the results. Finally, Section 3.6 states the conclusion.

3.2. Background on the high school system in the Philippines

3.2.1. Education structure and growth

The Philippine high school system is originally composed of 4 year-levels (from first year to fourth year). It was not until 2013 that the government implemented the Enhanced Basic Education Act or the K to 12 program, which aims to expand secondary schooling from 4 to 6 years[54]. The country's education system now follows the basic structure of 6 years of primary, 6 years of secondary, and 4 years of undergraduate. Under

[54] See https://www.lawphil.net/statutes/repacts/ra2013/ra_10533_2013.html, accessed on 30 May 2019.

the K to 12 program, pre-primary and basic education are compulsory, while public pre-primary, basic, and higher education are tuition-free[55].

In terms of administration, the Department of Education and Culture was reorganized in the mid-1990's into three offices, namely the DepEd for all basic education (elementary and high school), the Commission on Higher Education, and the Technical and Skills Development Authority for technical-vocational courses. The DepEd administers high school education in the Philippines through the DepEd regular high schools (public and private) and the DepEd science high schools. The independent high schools include the Philippine Science High School (PSHS) system under the Department of Science and Technology and the high schools under the University of the Philippines (UP) (Tan 2017).

Over the years, the Philippines consistently saw growth in secondary enrollment. Figure 3.1 shows that from AY 2006-2007 to 2016-2017, total enrollment grew by 19 percent, from 6,317,615 to 7,519,035. In the same period, female enrollment jumped from 3,072,962 to 3,724,639 (21 percent growth), while that of males increased from 3,244,653 to 3,794,396 (17 percent growth). With increasing demand for education came the increase in the number of public and private high schools (Figure 3.2). Public high schools doubled from 4,116 to 8,082 between AY 1998-1999 and 2015-2016. The highest increase was between AY 2009-2010 and 2010-2011, with a 28 percent growth in the number of public high schools. In the case of private high schools, the number of facilities rose from 2,901 to 5,492 between AY 1998-1999 and 2015-2016. A significant increase of 21 percent was recorded in AY 2009-2010 to 2010-2011. The expansion in school

[55] See https://www.lawphil.net/statutes/repacts/ra2017/ra_10931_2017.html, accessed on 30 May 2019.

construction appears to be a response to the boom in enrollments in the 1990s perhaps because of the robust economic growth after the economic liberalization in the mid-1980s.

Furthermore, Figure 3.3 exhibits the rise in the number of teachers from AY 1997-1998 to 2016-2017. During this period, the number of public school teachers increased from 105,240 to 237,083 (125 percent growth) and the number of private school teachers surged from 39,422 to 99,315 (152 percent growth). The highest jump for private was between AY 2015-2016 and 2016-2017 (54 percent) and for public was between AY 2012-2013 and 2013-2014 (19 percent). The employment of additional teachers was part of the preparation for the full blast implementation of the K to 12 program.

The growth of the Philippine education system entails the need for higher budget allotment and better allocation of resources. The DepEd receives the allocation for basic education. The State Universities and Colleges (SUCs) obtain their budget from the Congress, while the PSHS system takes its funds from the Department of Science and Technology. Overall, education takes around 15 percent of the national budget. Appendix table 3.1 indicates the budget per student in public high schools, PSHS, and SUCs in the Philippines in 2015. On average, in public high schools, a student receives an allocation of PhP 14,599 or USD 287. In the SUCs and PSHS, per-student budgets are PhP 29,141 or USD 573 (almost twice that of public high schools) and PhP 170,799 or USD 3,356 (more than 10 times that of public high schools), respectively. In addition, DepEd science high schools allot a slightly higher budget per student than the regular DepEd public schools, which is around PhP 15,550 (USD 306). Evidently, the per capita budget of the PSHS system is way larger than those of public high schools, SUCs, and science high schools (Tan, 2017). In general, the low expenditure per student and lack of well-targeted

allocations could have contributed to the inferior quality of publicly provided basic education in the Philippines.

3.2.2. Education quality

International or national standardized exams help assess the quality of education of Filipino children. Sheehan (2012) points out that the best way to evaluate students' academic standing is to look into these international or national tests. Filipino students participate in international assessments once every few years. In 2003 (the latest data available), selected Grade 8 pupils participated in the Trends in International Mathematics and Science Study (TIMSS), which is conducted internationally every three years. The results reveal that in both Mathematics and Science, the Filipino students perform lower than the average. The Philippines ranked 41st in Mathematics and 42nd in Science out of 45 countries (Appendix table 3.2). The three countries below the Philippines are from Africa (Botswana, Ghana, and South Africa). Neighboring Asian countries such as Singapore, Korea, Hong Kong, Japan, Malaysia, and Indonesia all ranked higher than the Philippines.

Also, for the first time, Filipino learners participated in the Programme for International Student Assessment (PISA) 2018. The PISA is organized by the Organisation for Economic Cooperation and Development (OECD) to evaluate the academic performance of 15-year-old students across nations. It is composed of three subject areas, namely Mathematics, Science, and Reading. Appendix Tables 3.3, 3.4, and 3.5 present the PISA 2018 ranking and scores in Mathematics, Science, and Reading of selected countries. In Mathematics, the Philippines ranked 76th out of 78 countries. The top 7 performers, which are all from Asia, include China (highest score and rank),

Singapore, Macao, Hong Kong, Taiwan, Japan, and South Korea. The score of the Philippines in Mathematics is 353, which is 40 percent lower than the highest listed score of 591. Notably, the Philippines ranked lower than Thailand and Indonesia. In Science, the top 7 countries with the highest scores again include China (highest score and rank), Singapore, Macao, Japan, and South Korea. The Philippines' ranking is 77th out of 78 countries, with a score of 357, which is 40 percent lower than the highest score (590). The most dramatic result is in Reading. The Philippines received the lowest ranking out of 77 countries, causing alarm over the poor literacy skills of Filipino students. The score of the Philippines is 38.7 percent lower than the highest score (555 vs. 340). The result reiterates the need to act on the reading crisis through strict measures and interventions[56]. Appendix table 3.6 lists the overall PISA ranking and scores in Mathematics, Science, and Reading. Lagging behind in overall performance, the Philippines ranked 76 out of 77 countries, sparking discussions and debates on what is truly lacking in the basic education system (i.e., financial constraints, lack of facilities, bullying, hunger, etc.)[57]. The DepEd released a statement on the PISA performance citing the results as a wake-up call to work urgently on improving the quality of learning among Filipino students. The department proposed 4 key reforms which include the monitoring and revising of the K to 12, enhancement of learning facilities, implementation of professional development programs that train and retrain teachers and school heads, and ensuring support and cooperation among all stakeholders[58].

[56] See https://www.manilatimes.net/2019/12/12/campus-press/congress-urged-to-act-on-non-reader-problem/663348/, accessed on 20 February 2020.
[57] See https://www.scmp.com/week-asia/economics/article/3041033/philippines-dismal-pisa-scores-spark-soul-searching-over-state, accessed on 20 February 2020.
[58] See https://www.deped.gov.ph/2019/12/04/statement-on-the-philippines-ranking-in-the-2018-pisa-results/, accessed on 20 February 2020.

Further, national standardized exams are also conducted annually by the DepEd for elementary (Grade 6) and high school students in their second year or fourth year across regions. The National Achievement Test (NAT)[59], which started in 2001, is a standardized multiple-choice exam administered by the National Education Testing and Research Center (NETRC) of the DepEd. The high school NAT is composed of 6 subjects, namely Mathematics, Science, English, Filipino, Social Studies (*Araling Panlipunan*), and Critical Thinking[60] (National Committee on Education for All, 2015). In the next section, we look into previous studies related to learning outcomes.

3.3. Literature review

3.3.1. Determinants of learning outcomes: Learners, teachers, school management, and school inputs

According to the World Bank (2018), the global boom in enrollments did not necessarily produce enough learning in schools. Indicators on learning outcomes (i.e., basic literacy and numeracy) are so low that the developing world is considered as facing a learning crisis. Such shortcomings in learning affect the employability of students into the workforce. Assessment data of Grade 6 students from various parts of Africa show that a large percentage are not sufficiently competent in Mathematics and Reading. In Honduras, children from the poorest quintiles lag behind those from the richest quintiles in reading competency. Given such alarming data, this subsection reviews a selection of previous literature on the determinants of learning outcomes.

[59] The NAT is formerly called the National College Entrance Examination (until 1994) and the National Secondary Achievement Test (until 2001).
[60] The Critical Thinking exam was first given by the DepEd in 2012 and was administered only to Grade 10 students.

Once an individual is able to attain more years of schooling or enroll in higher levels of secondary education, his or her learning outcomes are expected to improve. However, according to Pritchett (2013), schooling does not necessarily lead to learning. In 2009, only one out of eight children who enter fourth grade in India learn basic division problem. Likewise, only one out of five will learn how to read a simple story in the fourth grade.

The World Bank (2018) notes that the first important determinant of learning in schools is the learner's preparation. Children may or may not be prepared enough to meet the demands of schooling. For instance, children from disadvantaged backgrounds (i.e., poor families, minorities, etc.) do not arrive in school ready to learn. They exhibit learning deficits that leave them unprepared to undertake formal education. This may be due to lack of robust early childhood development in terms of health and nutrition. This leads to a decline in learning trajectories. Likewise, some household-related infrastructure such as access to electricity, availability of water in the dwelling, ownership of television, radio, and telephone, etc. also affect learning outcomes. For instance, Kanagawa and Nakata (2008) report that the electrification of rural areas in Assam state, India increases the literacy rate of children from 63.3 percent to 74.4 percent.

Additionally, parental assets and education affect investments in children's human capital. Kim and Sherraden (2011) mention that parental assets (i.e., financial and home property) significantly affect secondary and tertiary school completion of children. Filmer and Pritchett (2001) add that, on average, a child from a rich family in India has a higher likelihood of being in school (about 31 percentage points) than a child from a poor family. Relatedly, parental assets are positively associated with children's learning achievements, specifically with Mathematics and Reading performance, and parental

participation in school affairs (Zhan and Sherraden, 2003; Zhan, 2006). Also, maternal education is found to be associated with child health and education. In the aspect of child health, higher levels of education among women lead to improvements in child survival, infant health, utilization of prenatal care, vaccine uptake, and child nutrition (Hobcraft, 1993; Hill and King, 1995; Breierova and Duflo, 2004; Currie and Moretti, 2003; Keats, 2018). In terms of education, previous research show that an increase in educational attainment among women improves children's education and learning. Andrabi, Das, and Khwaja (2012) point out that mothers in Pakistan who have some levels of education have children who spend 72 more minutes studying at home and exhibit higher test scores (by about 0.23 to 0.35 standard deviations). Magnuson (2007) notes that additional maternal schooling improves children's academic skills, with improvements more apparent in Reading than in Mathematics. Similarly, maternal education is positively related to literacy skills of preschoolers (Sticht and McDonald, 1990) and cognitive scores of first graders (Harding, 2015).

Second, teachers are considered to be the most important determinant of student learning. Teachers' skills and motivation influence what and how children will learn. In the US, students with a poor teacher advance 0.5 grade levels, whereas those under a good teacher advance 1.5 grade levels over a single school year (Hanushek, 1992; Rockoff, 2004). In low-income countries, the short supply of high-quality teachers remains a challenge. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (2006), in several Sub-Saharan African countries, an average teacher performs worse on reading tests than the best performing grade 6 students. Candidates entering the teaching profession in Latin America are shown

to be academically weaker than the other higher education students who wish to enter a different profession (Bruns and Luque, 2015).

Third, school management affects overall education outcomes as well. Effective and high-quality school management depends on the capacity and autonomy of schools in decision-making. Lack of autonomy may prevent management committees from enhancing service delivery. However, even if autonomy exists, schools may lack the will or capacity to exercise authority. School administrators in many developing countries exhibit poor management and leadership skills (World Bank, 2018). In Uganda, only about 57 percent of school management members were able to read the committee's handbook (Najjumba, Habyarimana, and Bunjo, 2013).

Lastly, the availability of inputs (i.e., teachers and classrooms) determines the capacity of schools to accommodate students and provide quality education. The rising enrollments led to a rapid increase both in the construction of classrooms and recruitment of teachers. However, such efforts were not enough to increase per capita input availability. Given the challenges in learning in schools, a policy focus on education quality appears to be important. Educational policies should be expanded to include improvements in learning quality in developing countries, including the Philippines (World Bank, 2018).

3.3.2. Improving Learning in Schools

Duflo, Dupas, and Kremer (2011) note that student tracking (regrouping of students based on performance) in Kenya improves test scores as it allows teachers to adjust their instruction according to the level of achievement of the students in a specific class. Tailoring the level of instruction particularly benefited lower-achieving pupils.

Meanwhile, the results of a regression discontinuity design in Israel reveal that a smaller class size substantially increases reading test scores for fourth and fifth graders and Mathematics scores for fifth graders (Angrist and Lavy, 1999).

Nakajima, Kijima, and Otsuka (2018) report that the amount of time spent on household chores decreases literacy attainment in primary school in India. Likewise, the presence of local job opportunities and the consequent increase in the expected returns to schooling affect school progression. The study finds that the presence of factory jobs is associated with the expansion of children's schooling, especially that of girls, since these jobs increase the expected returns to education. There are other pathways by which job opportunities impact schooling. For instance, the new demand for IT and finance specialists in India led to a jump in enrollment and a rise in investment in English education and computer skills (Oster and Steinberg, 2013). In contrast, low-skilled job opportunities may affect schooling negatively. An increase in wages in agriculture or construction work may induce children to drop out of school and engage in child labor (Shafiq, 2007).

Further, Muralidharan and Sundararaman (2011) evaluate the teacher performance pay program, two years after its implementation, across rural primary schools in the Indian state of Andhra Pradesh. The results show that the test scores in Mathematics and Language of students in incentive schools, where teachers are given bonuses, were significantly higher by 0.27 and 0.17 standard deviations than those of students in control schools.

Banerjee, Cole, Duflo, and Linden (2007) discuss the impacts of a remedial education program, in which public schools recruit young women to assist in teaching pupils have low numeracy and literacy performance, using a randomized

evaluation of programs implemented across two cities in India. The findings show that program beneficiaries have higher test scores in the first year (0.14 standard deviations) and second year (0.28 standard deviations). Also, the intervention is shown to have greater positive impact on the scores of the low-performing students in the class.

Yamauchi and Liu (2013) report that a large-scale supply-side education policy in the Philippines, called the Third Elementary Education Project, which provided classrooms, learning materials, teacher trainings, and guidance in school management, increased test scores of students in grades 4 to 6 by about 5 points. Also, the study provides evidence that public investments in elementary education improve academic outcomes at the later stages of schooling (i.e., high school and college).

In terms of interventions that address gender bias, Evans and Yuan (2019) mention that, in general, programs that are not targeted by gender tend to yield similar gains as interventions that are specific to girls (i.e., school latrines, sanitary products provision, etc.). An examination of at least 300 studies on the impact of programs on educational outcomes show that improvements in enrollments and scores do not differ substantially between general and girl-targeted interventions. Among the most effective gender-neutral programs are the literacy program, mother-tongue as mode of instruction program, and adjustment of teaching method based on student abilities. Also, interventions that tend to confer benefit to both girls and boys are more politically acceptable.

Lastly, Seifert and Beck (1984) explore the achievement gains of 60 high school students in relation to classroom teaching methods in the US. The lecture (or discussion) instructional method induce the highest student achievement gains, while the use of seatwork leads to the lowest level of achievement. These findings suggest that the

teachers' direct control of instruction enables students to spend more time on tasks and achieve more, while activities without direct supervision lead to lower achievement levels.

3.3.3. Gender disparities in learning outcomes

A major issue in the analysis of academic performance is the disparity in learning across particular subgroups (i.e., poor and rich, girls and boys, public and private schools, etc.). This subsection looks into some studies on the differences in cognitive skills between girls and boys.

3.3.3.1. The shift in interest from gender differences in schooling to learning

Earlier studies on gender differences in education focus solely on school retention and drop out, and not on learning. Depending on the country, there can relatively be more girls or boys enrolled in secondary or higher education. Lloyd et al. (2000), for instance, explain that gender disparities in enrollment occur due to differences in academic opportunities between girls and boys, varying behavior of teachers depending on gender, level of discrimination, and biased rules and regulations. A study in Kenya shows that school environment highly affects girls' enrollment and retention. Schools that support boys more than girls have teachers that prioritize boys' learning of hard subjects (i.e., Mathematics), allow boys to freely harass girls, and tolerate gender-based violence. Schools with fewer latrines also discourage girls' school attendance. The shift in interest, from gender differences in school retention to competencies, came as we come close to sex parity in enrollments in primary and secondary schools globally.

3.3.3.2. Factors affecting gender gaps in learning

Jakiela and Hares (2019) note that learning gaps against girls may happen if they cannot attend school regularly, are not eating enough, have to avoid unnecessary attention from teachers, and cannot spend more time for homework. In addition, though girls tend to perform better than boys in primary schools, they may choose to intentionally downplay their skills as they enter high school in order to be liked or appreciated by their peers (Davies, 2005).

Girls' education is crucial as it has long-term impacts on family outcomes. Kaffenberger, Pritchett, and Sandefur (2018) show that increased literacy among women contributes to 36 percent of improvement in child survival, 50 percent of reduction in fertility, and 80 percent of rise in women empowerment. Meanwhile, the likelihood of child survival is higher among countries with high levels of learning relative to those with low levels of learning among women (Oye, Pritchett, and Sandefur, 2016).

Moreover, Freeman (2004) discusses how girls and boys tend to perform differently across subjects. Essentially, high school students tend to choose subjects associated with their gender. Girls choose Arts and Literature, while boys choose Mathematics and Science. These choices lead to markedly different academic performance in these subjects by the end of high school and eventually gender-segregated choice of occupation.

Several studies point out the role and importance of teachers in the gender-based learning gap. According to Wilkinson and Marrett (1985), teachers may talk to girls at a closer physical distance compared to boys. Relatedly, girls are expected to receive a more nurturing approach, while boys are exposed to a more formal, business-like treatment. Hence, interacting with boys may be more public and can be heard by others, while that

with girls is more private (Basow and Rubenfeld, 2003; Myaskovsky, Unikel, and Dew, 2005). In terms of giving praise and criticism, Golombok and Fivush (1994) and Delamont (1996) mention that teachers may be biased against girls if they tend to praise boys more for their good work and criticize girls more for their poor performance. This may lead to making boys feel more important and girls feel less competent in class. The opposite goes for understanding classroom behavior. Teachers may overly praise girls for good behavior and be very critical of boys' bad behavior. This may lead to girls feeling more behaved than they actually are and boys feeling meaner than they may really be (Golombok and Fivush, 1994). In the context of assessing performance in a specific subject, Cimpian (2018) state that in the US, given a boy and a girl with the same socio-economic background, race, behavior, and Mathematics performance, teachers tend to praise boys as more competent in Mathematics than girls.

3.3.3.3 Evidence from standardized exams

Data from international standardized exams reveal a lot about the gender gap in competency. Meinck and Brese (2019) analyze the extremes of the ability distributions in Mathematics and Science of girls and boys using data from the TIMSS. Results are heterogeneous across countries – some have more boys among the low achievers, while some have more girls. Interestingly, in many educational systems, there are more boys among the high achievers in Mathematics and Science than girls. This situation creates gender inequities in academic competencies, contributing to the inadequate representation of women in the scientific field.

In Reading, girls tend to have a significant advantage based on data from the Progress in International Reading Literacy Study (PIRLS) and PISA. In 2015, the gap in

favor of girls in Reading skills of 15-year-olds in OECD states is equivalent to around two-thirds of a school year. In 2016, the gender disparity among Grade 4 students is equivalent to approximately one-third of a school year. This gap increases by the time they finish lower secondary education. In some countries in Northern Africa and Western Asia, the results are more dramatic. By Grade 4, the gender gap against boys is equivalent to nearly one year of schooling and, by age 15, reaches the equivalent of more than a year (UNESCO, 2018). The type of educational system and policies appear to contribute to the inequality in reading performance in favor of girls. Countries with more standardized curricula exhibit poorer reading skills. Also, standardization is more negatively correlated with boys' reading abilities than with girls' (van Hek, Buchmann, and Kraaykamp, 2019).

3.3.3.4. Consequences of low learning outcomes among boys

Several literature show why it is important to help boys cope amidst the learning crisis. First, men with low levels of education exhibit gender bias and discrimination (Barker et al., 2011). Second, if boys are engaged in good quality education, they are less likely to participate in gang violence and experience exclusion. During the 1990s civil war in Sierra Leone, those with at least post-primary education are nine times less likely to join rebel groups than those with no education (Humphreys and Weinstein, 2008). In Brazil, violence-related deaths are more common among men who have low levels of income and education (Imbusch, Misse, and Carrión, 2011). Third, based on data from Bangladesh, Papua New Guinea, Indonesia, and Cambodia, men who did not complete secondary school have higher probability of committing physical and sexual violence against a female partner. This may also cause their children to imitate the same culture of violence when they grow up. Thus, education plays a vital role in breaking the pattern of

violence within households across generations (Fulu, Jewkes, Roselli, and Garcia-Moreno, 2013). This is especially important given that, globally, women are more exposed to violence by an intimate partner. In South Africa, for instance, half of female homicide cases are in the hands of an intimate partner (World Bank, 2012). Finally, father's education may improve child development outcomes. Using data from countries with the lowest measles vaccination uptake, fathers with at least secondary education are more likely to avail measles immunization for their children (Rammohan, Fernandez, and Awofeso, 2012).

3.3.3.5. Gender differences in learning in the Philippines

In the case of the Philippines, David, Albert, and Carreon-Monterola (2009) provide evidence of gender gap in learning outcomes. In the 2006-2007 academic year, the NAT results show that boys lag behind girls in every single subject, with the most notable disparities evident in English, Filipino, and Science. This substantial advantage of girls over boys is present in most school divisions across the country.

Reports also show that, among 10- to 15-year-olds, functional literacy rate is lower among boys than girls (55.5 percent and 63.0 percent). Meanwhile, the NAT mean percentage scores of Grade 6 students are consistently higher among girls than boys in all subjects, namely Mathematics, Science, English, Filipino, and Social Studies (Paqueo, Orbeta, and Albert, 2011).

Paqueo and Orbeta (2019) review possible reasons for this phenomenon. Firstly, there is more pressure for boys to drop out of school for work to earn additional family income since boys are more employable in agricultural work. Secondly, there seems to be a trade-off where sons inherit land and daughters obtain more education. In rural

Philippines, parents equalize the inter-generational transfers among children by providing land bequests to sons and investing in daughters' schooling (Estudillo, Quisumbing, and Otsuka, 2001). Thirdly, from a cultural perspective, parents invest more in girls' education since girls are more disciplined in their studies, can work stable jobs, and can assist and take care of them in their old age. Parents, especially those from poor families, tend to rely heavily on their daughter's future income (Gustafson, 2018). Lastly, according to Tan, Canales, Cruz and Punongbayan (2011), women study more because private returns to education are higher for women compared to those of men. This is also related to the growth of educational institutions and labor market opportunities for women.

David, Albert, and Vizmanos (2018) emphasize the need for urgent measures that focus more on assisting boys in realizing their full academic potential. First, teachers should be given flexibility when it comes to the methods of teaching to keep boys focused and interested. Activity-based learning methods, which refer to more interactive approaches, are said to be helpful for boys. Second, teachers should receive incentives from the DepEd if they develop new learning methods that specifically target boys' learning. Third, schools may increase the number of male teachers as they may serve as role models and communicate better with boys. Finally, the DepEd may coordinate with local governments to ensure that high school-aged boys do not engage in vices, such as smoking and drinking, which have adverse effects in their schooling. This could be done through information campaign in the various media outlets such as mass media and social media.

The Philippines needs to step up in addressing the issues of gender imbalance in education and learning. The rise in the number of less educated men has long-term

negative socioeconomic impacts which include intergenerational poverty and discrimination, abuse, and violence against women (David, Albert, and Vizmanos, 2018). Hence, for the Philippines to find effective solutions to this phenomenon, there is a need to analyze the available data on learning and labor market outcomes of females and males. This chapter aims to address this research gap.

3.4. Empirical strategy and data

3.4.1. Empirical strategy

The objectives of this chapter are to assess the gender disparities in test scores and relate them to the employment outcomes of women and men. In the analysis of employment, provincial NAT data enables us to associate test scores with the proportion of employed in the formal and informal sectors at the provincial-level. There is no mechanism to match individual test scores with employment outcomes since the individuals in the NAT dataset are not the same as the individuals in the household surveys.

To investigate the determinants of NAT percentage scores at the individual-level for each subject, we utilize ordinary least squares (OLS) and instrumental variable two-stage least squares (IV 2SLS) regressions. First, Equation 3.1 exhibits the OLS model. The dependent variable Y_{ij} represents the NAT percentage score of individual *i* for subject *j* in our pooled dataset (2009 to 2018). The independent variable boy_{ij} is a dummy variable that refers to the gender of the student. It takes the value of 1 if the student is a boy and 0 if the student is a girl. The binary variable $public_{ij}$ denotes if the student is from a public school (*public*=1) or private school (*public*=0). Next, the variables *R* and *X* represent our vector of controls for region and exam year. We specify our α and β_s as the regression

parameters, which provide the impact of each explanatory variable on the outcome variable, and ε as the error term.

$$Y_{ij} = \alpha_{ij} + \beta_1 boy_{ij} + \beta_2 public_{ij} + \beta_3 R_{ij} + \beta_4 X_{ij} + \varepsilon_{ij} \quad (3.1)$$

Second, Equations 3.2 and 3.3 represent the IV 2SLS approach. We conduct the IV 2SLS because of the potential endogeneity of the variable *public*. This means that there are observed or unobserved factors in the error term that affect the choice of public or private school while public and private schooling at the same time affect test scores. For instance, schooling quality, which is a variable that is captured in the error term, highly relates to public or private education since public schools usually have more developed curricula or private schools have better facilities. Another variable that relates to the choice of school is income. Poor families normally cannot afford private schools and thus choose public schools. These pathways are examples of how our *public* variable can be endogenous. We address this issue by employing the IV 2SLS approach. This technique involves two sequential regressions. In the first stage, we find an instrumental variable which is highly correlated with our endogenous regressor and unrelated with our main outcome variable. As shown in Equation 3.3, we choose *distance (of school division) to the nearest major city center* as our instrumental variable. It may serve as a good instrument since being far from the city center may be correlated with the choice of public or private schooling. Note that there are fewer private schools and more public schools in areas that are far from the city center or in remote areas that are less developed. Families will more likely choose to send their children to public schools if they live far from the major cities. Likewise, *distance* may not be directly correlated with the error term in Equation 3.1 because distance is unlikely to affect cognitive skills and test

scores[61]. To verify the validity of this instrument, we run the first stage regression and check the F-statistic. We calculate the ratio of private to public schools for each school division to show that the ratio decreases as the distance of the school division increases which means that households in remote areas are more likely to choose public schools. In the second stage (Equation 3.2), we show Y_{ij} as our dependent variable (test score) and use $\widehat{public}_{ij}$, the predicted values of *public* from Equation 3, as one of our independent variables.

$$Y_{ij} = \sigma_{ij} + \beta_8 boy_{ij} + \beta_9 \widehat{public}_{ij} + \beta_{10} R_{ij} + \beta_{11} X_{ij} + u_{ij} \quad (3.2)$$

$$public_{ij} = \gamma_{ij} + \beta_5 distance_{ij} + \beta_6 R_{ij} + \beta_7 X_{ij} + v_{ij} \quad (3.3)$$

Note that our main variable of interest in Equations 3.1 and 3.2 is *boy*. The OLS results are commonly lower than the IV results[62].

We explore the determinants of NAT scores at the provincial-level by using OLS regressions and the Annual Poverty Indicators Survey (APIS) which provide provincial data. In particular, we conduct two regression runs utilizing the (i) APIS 2008 and NAT 2010 in tandem and (ii) APIS 2013 and NAT 2015 in tandem. Note that we use two-year lag in the provincial independent variables since their effects on NAT scores more likely manifest in the succeeding years. Equation 3.4 shows the regression model. The dependent variable Y_{pj} indicates the NAT percentage score of province *p* for subject *j*.

[61] We likewise argue that *distance (of school division) to the nearest major city center* is exogenous in this case since it is not correlated with other variables in the error term (i.e., family income or employment opportunities). For instance, while distance of child's home address may be correlated with family income, there is no precise scientific information that a child's home address is similar to her or his school division. Thus, *distance (of school division)* is exogenous to a certain extent. Importantly, the DepEd decides on the location and reorganization of school divisions, making it a fiscal decision rather than a household decision (i.e., regardless of family income, households have no control over the *distance (of school division) to the nearest major city center*).

[62] This is commonly observed in empirical research. For instance, Kaffenberger et al. (2018), show that, in the analysis of female basic education completion and child mortality, the OLS result of 21 percent reduction in child mortality is less than the IV outcome of 68 percent.

The independent variables, which represent average household characteristics in the province, are as follows: (i) *elec* means proportion of households with electricity, (ii) *comp* means proportion of households with computer, (iii) *TV* means proportion of households with television, (iv) *tphone* means proportion of households with telephone, (v) *cphone* means proportion of households with cellular phone, (vi) *radio* means proportion of households with radio, (vii) *water* means proportion of households with tube water in dwelling, (viii) *scholar* means proportion of households that received scholarship grants (i.e., government scholarship or conditional cash transfer), (ix) *hunger* means proportion of households with member/s that experienced hunger, (x) *agriland* refers to proportion of households that own agricultural land, (xi) *income* means average family income in the province, (xii) *ays_women* refers to average years of schooling of women household heads (15 to 64 years old), and (xiii) *ays_men* means average years of schooling of men household heads (15 to 64 years old)[63]. The τ and β_s are our regression parameters, which denote the impact of each explanatory variable on the outcome variable. The e represents the error term.

$$Y_{pj} = \tau_{pj} + \beta_{12} elec_{pj} + \beta_{13} comp_{pj} + \beta_{14} TV_{pj} + \beta_{15} tphone_{pj} + \beta_{16} cphone_{pj} + \beta_{17} radio_{pj} + \beta_{18} water_{pj} + \beta_{19} scholar_{pj} + \beta_{20} hunger_{pj} + \beta_{21} agriland_{pj} + \beta_{22} income_{pj} + \beta_{23} ays\_women_{pj} + \beta_{24} ays\_men_{pj} + e_{pj} \quad (3.4)$$

[63] We also conduct runs with variables representing labor demand (i.e., proportion of men or women household heads working for private establishment among men or women household heads in the labor force, proportion of men or women household heads working for government among men or women household heads in the labor force, proportion of men or women household heads working with pay in own family-operated farm or business among men or women household heads in the labor force, etc.). The impacts of these variables, however, are insignificant, suggesting that the influence of labor demand on test scores is indirect (i.e., passes through other channels). Moreover, we recommend adding supply-side independent variables (i.e., number of teachers, number of classrooms, number of public or private schools, and pupil-teacher ratio by province) in future research if data are readily available.

We calculate these independent variables for each province in the APIS datasets. Upon merging the APIS and NAT datasets, the total number of provinces and major cities in 2010 and 2015 are 116 and 114, respectively.

Further, we employ OLS regressions to analyze the relationship between provincial test scores and proportion of provincial labor force in various sectors (employed, formally employed, and informally employed)[64]. We use APIS 2011 in generating our proportion of provincial labor force in various sectors since APIS 2011 is the only dataset that has both individual-level data on employment and corresponding provincial identifiers. We also consider one- and two-year lags in the independent variables (provincial NAT scores 2009 and 2010) since students may not immediately enter the labor force right after high school. In total, there are 101 provinces and major cities each in 2009 and 2010.

$$W = \lambda + \beta_{25} MPS_j + h \tag{3.5}$$

Equation 3.5 presents the OLS regression model. The outcome of interest W represents the provincial employment levels. Specifically, we consider three employment outcomes in the analysis: (i) proportion of employed, (ii) proportion of formally employed, and (iii) proportion of informally employed. The independent variable MPS_j refers to the provincial mean percentage score in subject j (Mathematics, Science, English, and Overall MPS). The β_{25} serves as the regression parameter or coefficient, which represents the effect of test scores on the employment variable, and h is the error term. We did the estimate of Equation 3.5 on all, female, and male workers.

[64] While we focus our regressions on the labor force sample, future studies may conduct the same analysis using the sample of working-age individuals.

3.4.2. Data

3.4.2.1. Datasets

We use the NAT scores, in the analysis of the relationship between gender and learning outcomes, as our main dataset. The NAT dataset contains individual-level data from the Bureau of Education Assessment, Education Research Division of the DepEd. The available NAT high school data are from 2005 to 2018. The NAT takers for each year are as follows: Grade 10 students in 2005, 2012 to 2015, 2017, and 2018; and Grade 8 students in 2006 to 2011. There were no available data for 2016 as the DepEd conducted the NAT for only a small sample this year. According to the DepEd, the exam takers in this dataset are randomly selected (i.e., using stratified random sampling), representing 10 percent of the student population.

Moreover, the NAT is composed of 6 subjects (Mathematics, Science, English, Filipino, Social Studies, and Critical Thinking). As for the point system, the NAT for Grade 8 students is composed of 60 points per subject, with a total of 300 points, while the exam for Grade 10 students consists of 50 points for Mathematics, 60 points each for Science, English, Filipino, and Social Studies, and 20 points for Critical Thinking, with a total of 310 points.

To specify, the individual-level student variables given by the DepEd are region, school division code, school division name, school ID, examinee number, exam year, grade level, gender, raw scores on the 6 subjects and overall, and percentages score on the 6 subjects and overall. In our OLS and IV 2SLS regressions on the determinants of learning outcomes, we utilize only the data between 2009 and 2018 as these are the only years with sampled students from private schools.

In the IV 2SLS, we select *distance to the nearest major city center* as our instrumental variable. Appendix table 3.7 shows the 4 major city centers in the Philippines (National Capital Region (NCR) or Metro Manila, Cebu City, Cagayan de Oro City, and Davao City) and the data on distance in kilometers, which is based on the fastest possible route to the nearest major city center.

Meanwhile, in the provincial-level analysis of the determinants of NAT and the determinants of employment levels, we merge the provincial NAT MPS by subject with the Annual Poverty Indicators Survey (APIS), which contains household-level and individual-level information on the demographic and socioeconomic conditions of the population. Household-level data include ownership of various appliances, ownership of agricultural land, access to infrastructure, dwelling characteristics, participation in government programs, income, and expenditures. Individual-level information of each household member include age, gender, residence, marital status, education level, and employment status in the last 6 months. Of great interest to this chapter is the child gender and education of female heads. We categorize employment into formal or informal. Based on the APIS questionnaire, formal sector workers are mostly those employed in private households, private establishments, and government offices or corporations, while informal sector workers include those who are self-employed without any employee and employed in own family-operated farm or business. In the analysis of employment outcomes, we consider only the economically active population (aged 15 to 64). All the APIS datasets are publicly available[65]. However, only selected APIS years have provincial identifiers.

[65] See https://psa.gov.ph/content/annual-poverty-indicators-survey-apis for details, accessed on 30 May 2019.

3.4.2.2. Descriptive Statistics

We present some descriptive statistics on the NAT takers and their mean percentage scores (MPS). We focus on Mathematics, Science, and English as these are the critical subjects considered in various international standardized exams and are crucial in gaining skills that are in demand in the labor market.

Table 3.1 shows the total number of NAT takers by gender between 2005 and 2018 (53.46 percent girls and 46.54 percent boys). In terms of their overall MPS, Figure 3.4 gives the overall MPS by year. The overall MPS ranges from 44.31 percent in 2017 to 53.79 percent in 2014. Alarmingly, the MPS for both genders does not even reach 55 percent for all years. This is reflective of the poor quality of education in high school. Likewise, Appendix figures 3.1 to 3.6 prove the dismal performance of students in each subject. In 2018, MPS in Mathematics is 34.61 percent (Appendix figure 3.1), MPS in Science is 36.93 percent (Appendix figure 3.2), and MPS in English is 44.02 percent (Appendix figure 3.3)[66]. This is alarming because jobs in developing economies increasingly demand skills and training in Science, Technology, and English. Similarly, strong foundational skills in these 3 courses are crucial in pursuing higher education.

Regional overall MPS indicate the same story (Table 3.2). Region VIII (Eastern Visayas) typically perform better than most of the other regions (58.57 percent in 2005, 65.16 percent in 2008, 59.73 percent in 2011, 59.40 percent in 2014, and 45.48 percent in 2018). CARAGA Region also exhibit relatively favorable scores in the earlier years (55.17 percent in 2005, 62.61 percent in 2008, 61.07 percent in 2011, and 64.22 percent in 2014), but not in 2018 (42.41 percent). The regions that perform poorly are Region V

[66] In 2018, MPS in Filipino is 58.65 (Appendix figure 3.4), MPS in Social Studies is 51.39 percent (Appendix figure 3.5), and MPS in Critical Thinking is 45.08 percent (Appendix figure 3.6).

(Bicol Region), with total MPS of 42.58 percent in 2005, 40.11 percent in 2008, 45.11 percent in 2011, 51.40 percent in 2014, and 44.09 percent in 2018, and the Autonomous Region in Muslim Mindanao (ARMM), with 36.93 percent in 2005, 45.81 percent in 2008, 37.07 percent in 2011, 44.47 percent in 2014, and 43.64 percent in 2018. It is notable that these two poorest regions (Bicol and ARMM) have the lowest test scores as well. The scores of the other regions are around the same range, indicating poor learning outcomes as a whole.

If we look at the overall performance by gender, a striking pattern emerges. Girls outperform boys in every year (Table 3.3 and Figure 3.9). The difference reaches as high as 4.50 percentage points in 2018. In Mathematics, girls gain higher scores than boys in all the years between 2005 and 2018 (Figure 3.5). The highest Mathematics MPS is in 2014 (52.91 percent for girls and 50.85 percent for boys), while the lowest is in 2018 (35.35 percent for girls and 33.73 percent for boys). In Science, girls and boys have almost similar standing in 2005 but girls perform consistently better from 2006 to 2018. This is in contrast to the findings of Meinck and Brese (2019) which mention that in many educational systems there are more boys among the high achievers in Science than girls. In the Philippines, even though girls perform better, the Science MPS of both groups are very low. They do not even reach 50 percent in any year. In 2018, girls' Science MPS is only 37.83 percent while that of boys is 35.87 percent (Figure 3.6). In English, the disparity appears more evident. The English MPS of boys in 2018 is 42.10 percent while that of girls is 49.84 percent. Almost similar differences are observed between 2005 and 2017 (Figure 3.7). The same is true for the Critical Thinking exam, which was administered from 2012 to 2015. Girls have higher scores than boys throughout 2012 to

2015 with the highest gap in 2012 (51.22 percent for girls and 45.67 percent for boys) (Figure 3.8).

We verify the persistence of gender disparities in academic performance by looking into the test scores of girls and boys in each region. Figures 3.10 and 3.11 exhibit the MPS in Mathematics in 2015 and 2017 by region and gender. Consistently, girls' MPS surpass boys' MPS in both years. The gap is not substantial in NCR and Region VIII (Eastern Visayas) but apparent in Region IV-B (MIMAROPA). In Science, the MPS of girls across all regions in 2015 and 2017 are higher than those of boys, with Regions IV-A (CALABARZON) and IV-B (MIMAROPA) displaying the widest gaps (Figures 3.12 and 3.13). In both Mathematics and Science, the disparity between girls and boys in the ARMM Region is low. However, the scores in this region are usually the lowest or second to the lowest among all the regions (barely reaching 40 percent in 2017). In English, the learning gaps between girls and boys increased significantly between 2015 and 2017 as shown in Figures 3.14 and 3.15. In 2017, all regions show wide gaps in English MPS in favor of girls. These gaps are higher than those in Mathematics and Science. This is indicative of how the reading crisis apparently affects boys more than girls. We also observe huge differences in Critical Thinking skills in 2015 (Figure 3.16). Boys perform poorer than girls in all regions. Though the gap in performance in ARMM is relatively small, both MPS of girls and boys in this region are the lowest among all the regions. Expectedly, boys lag behind girls in overall MPS in 2015 and 2017 (Figures 3.17 and 3.18). Across regions, the figures denote the need for interventions and support at the local level to help boys catch up with girls in critical subject areas[67].

[67] It is worth noting that in terms of school participation, gender disparities across regions also persist. In both Region XII (SOCCSKSARGEN) and CARAGA Region, the rate of out-of-school children (OOSC) for boys is four times higher than the OOSC rate for girls. Additionally, based on the APIS 2017, ARMM

These statistics indicate that attending school does not necessarily lead to learning. The overall NAT MPS fluctuates from year to year but does not show much improvement. It is still lower than the 75 percent target of the country's Education For All (EFA) initiative goal (National Committee on Education for All, 2015). Notably, the worrisome gap in achievements between girls and boys denote the inequities in our basic education system. In the succeeding section, we discuss the results of our OLS and IV 2SLS regressions.

3.5. Results

This section presents our findings on the relationship between gender and test scores, the provincial determinants of NAT scores, and the impact of learning achievements on provincial employment outcomes of women and men.

3.5.1. Individual-level determinants of learning outcomes in the Philippines

Table 3.4 offers an overview of the differences in test score means[68] between girls and boys from 2005 to 2018 by type of school and subject. The statistical gender disparities in MPS in Mathematics, Science, English, and Overall are all highly significant for all students and in all schools (Panel A of Table 3.4), in public schools (Panel B of Table 3.4), or in private schools (Panel C of Table 3.4). This indicates that, indeed, girls overtake boys in academic performance. We also notice that girls and boys in private schools usually have larger gaps in score means than those in public schools. For instance, the differences in Mathematics, Science, and English in 2015 are 1.68, 1.24,

exhibits the highest rate of OOSC for both gender (13.8 percent for boys and 10.6 percent for girls) (David, Albert, and Vizmanos, 2018).

[68] We conduct the test of difference in means using the t-test for unequal variances (Welch correction).

and 2.74 percentage points for public schools and 2.17, 2.33, and 5.51 percentage points for private schools. Also, in 2015, the disparities in Overall means are 3.04 percentage points for public schools and 5.03 percentage points for private schools.

Moreover, we explore the factors that affect NAT scores of individuals by conducting OLS and IV 2SLS regressions. In all the runs, we use pooled data of students from 2009 to 2018[69]. Table 3.5 provides the OLS results. Girls tend to outperform boys across all subjects. Holding all other factors constant, the overall MPS of girls is 3.931 percentage points higher than that of boys (Column 7 of Table 3.5), respectively. The differences in Mathematics, Science, and English are 1.506, 1.546, and 4.896 percentage points in favor of girls. These effects are highly statistically significant at the 1 percent level. We emphasize the high disparity in English relative to Mathematics and Science. This result relates to the low performance of Filipino students in the Reading exam of PISA.

To test a different specification and address the endogeneity of the *public* variable, we apply the IV 2SLS with *distance to the nearest major city center* as instrumental variable. Figure 3.19 depicts the Philippine map. It illustrates the 17 regions of the Philippines and the respective major city centers, namely the National Capital Region (NCR) or Metro Manila, Cebu City, Cagayan de Oro City, and Davao City. *Distance to the nearest major city center* could serve as a good IV for *public* since living far from a major city center may be related to the decision of parents to send their children to a public or private school. In the Philippines, there are more public schools than private schools in areas that are far from the city center, which are also usually the less developed

[69] As mentioned earlier, we utilize data between 2009 and 2018 as these are the only years with students sampled from private schools.

areas. To verify this claim, we calculate the ratio of private to public schools for each school division. Indeed, for every year, the ratio decreases as the distance of the school division increases (i.e., downward-sloping trend) (Figure 3.20). Hence, families will more likely choose public schooling for their children if they live far from the major cities as there is limited option. In addition, we test the validity of the IV by running the first stage regression, with *public* as the dependent variable and *distance* as the independent variable. We find statistically significant, positive correlation between *distance* and *public* schooling based on the estimates in Table 3.6. We also mention that the F-statistic is greater than 10, which indicates that *distance* is not a weak instrument. Hence, given the validity of our IV, we proceed to the second stage regression. Table 3.7 reveals the second stage estimates. On average, girls score higher than boys in Mathematics by 1.150 points (Column 1 of Table 3.7), Science by 1.323 points (Column 1 of Table 3.7), and English by 5.013 points (Column 3 of Table 3.7), *ceteris paribus*. These differences are highly statistically significant at the 1 percent level. Note that the estimates on the impact of gender on test scores based on the OLS and IV 2SLS are generally similar, ranging from 1.150 to 1.506 points in Mathematics, 1.323 to 1.546 points in Science, 4.896 to 5.013 points in English, and 3.931 to 3.981 in Overall MPS, respectively. This suggests robustness of our results. As mentioned earlier, the effects of public or private schooling on test scores based on the OLS and IV 2SLS vary, with most of the IV 2SLS results expectedly higher than the OLS results. We note that the test of difference in means, OLS, and IV 2SLS results are consistent with our *Hypothesis 1* that gender is an important factor in determining test scores, with girls performing better than boys.

In terms of girls' and boys' performance in the science high schools vis-à-vis those in the regular (science, public, and private) high schools, we compare the learning

outcomes of students from selected top science high schools and the remaining regular science, public, and private high schools in 2015 (Table 3.8). We observe that students in top science high schools perform way better than those in the remaining regular schools. The overall MPS of girls in top science high schools is 72.78 percent, while that of boys is 71.74 percent. In the remaining regular schools, girls' overall MPS is 51.19 percent, while that of boys is 47.71 percent. Remarkably, while boys lag way behind girls in the remaining regular schools, they appear to perform equally with girls in the top science high schools. These boys in top science high schools even perform slightly better than girls in all the 3 critical subjects. In Mathematics, Science, and English, girls' MPS are 74.79 percent, 71.90 percent, and 70.95 percent. Boys' MPS in these 3 core subjects are 77.78 percent, 73.24 percent, and 71.76 percent. These results may mean that boys perform better than girls in top science high schools because they are in an environment that pushes them to study better, stay disciplined, and gain proper motivation. Also, since students in science high schools commonly come from well-off families, they may indicate that boys could perform as good as girls in test scores in the absence of household financial constraints. In terms of quality, these may reflect the poor quality of education (i.e., low budget per student, poor facilities, and lack of teacher training) in other regular high schools that puts boys at a deeper disadvantage. Clearly, the gender gaps can be minimized if the quality, budget, and facilities of regular high schools are similar or at least close to those of science high schools. This will help boys build the foundational skills needed for admission in high-quality higher education institutions and ultimately to participate fully in the labor market.

The results above are consistent with the findings of previous studies on the underachievement in education of boys in the Philippines. The gender disparities in

learning outcomes shown above may not come as a surprise. Previous data reveal that boys have always been at a disadvantage when it comes to school participation. David, Albert, and Vizmanos (2018) note that in 2017, 65 percent of out-of-school children (OOSC), who are between 5 and 15 years old, are boys. The gap in participation is observed since 2008 when the Philippines is experiencing low economic growth. The reasons that explain the low rate of school participation of boys in schools may also explain their poor academic achievements. First, since boys are often at risk of leaving school to work and help earn additional income for their families as informal laborers, farm workers, and unpaid family workers (DepEd, Philippine Institute for Development Studies (PIDS), and United Nations Children's Fund (UNICEF), 2012), boys may lose motivation to study harder and sustain their schooling, knowing that they may have to drop out soon. This is especially true for boys from poor families who run the risk of being out-of-school to help put food on the table. The problem can also be seen as cultural. Generations of boys have grown up thinking that they should prioritize work over school in order to help in the household (Fontanos and Ocampo, 2019).

Second, if boys obtain low grades initially, they may be moved to lower sections, where students with poor performance are placed together, or they may not proceed to the next grade level (David, Albert, and Vizmanos, 2018). This cycle may lead to even poorer performance for boys, especially if they could not obtain motivation among their peers in the lower section or they become overaged in their current grade level. There is a common observation that relatively less competent teachers are assigned to lower sections.

Third, lack of personal interest is cited as the top reason of boys for dropping out of school based on the APIS 2017. As mentioned above, lack of interest in studying can either be a cause or an effect.

Fourth, boys are more exposed to influence from peers, more prone to vices (i.e., smoking and drinking), and more inclined to playing gadgets (i.e., computer and mobile phone games). Okabe (2018), in a study conducted in Western Visayas, particularly points out the adverse effects of *barkada* (peer group) and computer shops on boys' school performance. Overall, these external factors contribute to laziness, poor study habits, and lack of focus. Boys may come to school tardy and sleep deprived (David, Albert, and Vizmanos, 2018).

Fifth, and finally, the traditional inheritance pattern of boys receiving farm land and girls receiving education makes learning less valuable to boys because many skills learned in school are not necessarily required in farming (Estudillo, Quisumbing, and Otsuka, 2001).

3.5.2. Provincial-level determinants of learning outcomes in the Philippines

Tables 3.9 and 3.10 present the results of our OLS on the determinants of provincial-level NAT scores by gender in 2010 and 2015. We find that in both years, the proportion of households with electricity positively correlates with the MPS in Mathematics, Science, English, and Overall MPS. The results are also highly statistically significant. In 2010, a 1 percentage point increase in the proportion of households with electricity increases the Mathematics MPS by 0.505 percentage point, the Science MPS by 0.519 percentage point, the English MPS by 0.445 percentage point, and the Overall MPS by 0.398 (Panel A of Table 3.9). In 2015, a much later dataset, a 1 percentage point

increase in the proportion of households with electricity improves the Mathematics MPS by 0.245 percentage point, the Science MPS by 0.257 percentage point, the English MPS by 0.192 percentage point, and the Overall MPS by 0.243 (Panel A of Table 3.10). Consistent with previous studies (see Kanagawa and Nakata, 2008), electrification of households improves learning capabilities of children as it allows them to study at night in their own homes. In addition, electrification improves classroom environment leading to better learning outcomes inside the classroom.

Further, the proportion of households with TV is negatively correlated with the NAT scores. The 2010 and 2015 results show that a 1 percentage point increase in the proportion of households with TV decreases the Mathematics MPS by about 0.237 to 0.348 percentage point, the Science MPS by around 0.227 to 0.373 percentage point, the English MPS by about 0.173 to 0.350 percentage point, and the Overall MPS by around 0.197 to 0.275 percentage point (Panel A of Tables 3.9 and 3.10). Clearly, TV negatively affects the learning habits of children as it may serve as a distraction or vice for some. Also, local Philippine TV does not contain much educational programs that are beneficial to children's learning. In 2010, an increase in the proportion of households with radio also decreases NAT scores across subjects (Panel A of Table 3.9).

Furthermore, we find suggestive evidence of positive impacts of agricultural land ownership and mother's education on test scores. In some specifications in 2010 and all specifications in 2015, the proportion of households that own agricultural land positively and significantly affect exam performance. Ownership of assets, such as lands, increases family income which is then allocated to children's schooling. This finding seems to echo the findings of previous studies (see Kim and Sherraden, 2011; Filmer and Pritchett, 2001; Zhan and Sherraden, 2003; Zhan, 2006) on the impact of asset ownership on

children's educational attainment and learning. Notably, the Philippine land reform program is found to have a significant effect on schooling attainment of children from rice-farming households who were beneficiaries of the program (Estudillo, Quisumbing, and Otsuka, 2001). These results denote the importance of policies that support asset ownership of families, especially of those who are not well-off.

Importantly, we highlight the positive correlation between average years of schooling of women household heads and children's test scores. The results are statistically significant across specifications in 2010 and insignificant in 2015 (since the impacts, though positive, are low). We mention that these findings are in line with previous studies that report the positive association between women's schooling and children's human capital (see Andrabi, Das, and Khwaja, 2012; Magnuson, 2007; Sticht and McDonald, 1990; Harding, 2015). Educated mothers are better skilled and well-informed when it comes to allocating resources to children's schooling and in helping children acquire important skills from school. For instance, when they receive income or cash transfers, they are knowledgeable on how to manage the funds for their children's needs including those expenditures that assist children in learning. The other household-related explanatory variables that we included in the runs are all insignificant.[70] We note that these results echo our *Hypothesis 2* that certain household-level characteristics (such as infrastructure and parental background) affect learning outcomes.

As shown in Panels B and C of Tables 3.9 and 3.10, the results among girls and boys are generally similar to the overall results mentioned above. This means that children, regardless of gender, respond similarly to the presence of certain parental

[70] We conducted some regressions using growth variables (i.e., percentage changes in NAT scores and percentage changes in the explanatory variables) but they yield insignificant results.

characteristics, infrastructure, or household appliances. Thus, interventions related to these findings need not be gender-specific (i.e., electrification programs, time limits in watching TV, asset-based public policies, support for women's education, etc.). Such gender-neutral programs are deemed effective in enhancing learning outcomes of both girls and boys, as mentioned by Evans and Yuan (2019).

3.5.3. Test scores and employment outcomes in the Philippines

One of the goals of this chapter is to relate the NAT scores to employment outcomes. Given the differences in cognitive skills between girls and boys, we expect differences in their labor market outcomes as well. Individual abilities may have impacts on employment outcomes.

Figures 3.21 to 3.29 provide visual evidence of how provincial test scores (2009 and 2010) could influence employment, formal employment, and informal employment of women and men (2011). We enumerate the following observations. As provincial test scores (on the three critical subjects and Overall MPS) increase, the proportion of those who are employed in the labor force (15 to 64 years old) also increases (Figure 3.21). This positive correlation is also true for the proportion of employed women among women in the labor force (Figure 3.22) and proportion of employed men among men in the labor force (Figure 3.23). This is an initial indication that improvements in skills generally increases the chances of being employed. Figure 3.24 reflects the positive correlation between provincial test scores and proportion of formally employed among those in the labor force both women and men. If we disaggregate the observations by gender, the same increasing trend is observed. Figures 3.25 and 3.26 show an increase in the proportion of formally employed women among women in the labor force and

proportion of formally employed men among men in the labor force as NAT scores increase. In the case of informal employment, Figure 3.27 exhibits downward trends between provincial test scores and the proportion of informally employed among those employed in the labor force both women and men. Interestingly, among women, there seems to be a positive relationship between Mathematics MPS and the proportion of informally employed women among employed women in the labor force. The opposite is true for the other subjects (Figure 3.28). Among men, provincial test scores are consistently negatively associated with the proportion of informally employed men among employed men in the labor force (Figure 3.29). Looking closely at the figures, a clear pattern emerges. Higher test scores or better academic performance generally induces employment in the formal sector and discourages informal work.

To verify the statistical significance of these trends, we conduct simple regressions on the employment proportions using provincial test scores as independent variables. Table 3.11 confirms the positive relationship between provincial test scores and the proportion of those employed. The results are statistically significant among women but not among men (Panels B and C of Table 3.11). This goes to show that the labor market appears to have specific needs on skills when it comes to women. The impact of test scores on the employment of men, albeit positive, is small and almost nil.

We categorize employment into formal and informal to enable us to explore the type of occupations that women and men are engaged in. Based on Panel A of Table 3.12, Science, English, and Overall MPS are positively and significantly associated with the proportion of formally employed, indicating that Science and English skills are critical in performing jobs in the formal sector (i.e., private companies and government offices). In addition, Panel B of Table 3.12 shows that only English and Overall MPS are positively

linked with the proportion of formally employed women. The relationship between Science scores and formal employment of women is insignificant, which may mean that women are at a disadvantage in jobs needing scientific skills. Panel C of Table 3.12 portrays that Science, English, and Overall MPS are positively related with the proportion of formally employed men. Strikingly, the impact of test scores on the proportion of formally employed men is higher than the impact on the proportion of formally employed women. For instance, a one percentage point increase in the Overall MPS of women leads to a 0.244 percentage point increase in the proportion of formally employed women. In the case of formally employed men, the increase is 0.424 percentage point. This goes to show that men, despite performing poorly than women in standardized exams, have a better chance of working in the formal sector if their test scores are high.

In Table 3.13, we discuss the relationship between provincial test scores and the proportion of informally employed. An increase in Science, English, and Overall test scores significantly decreases the proportion of informally employed individuals, both women and men (Panel A of Table 3.13). However, increase in test scores (Mathematics and Science) do not significantly decrease the proportion of informally employed women. Only an increase in English and Overall MPS decreases the proportion of informally employed women by 0.230 and 0.206 percentage point (significant at the 5 and 10 percent levels only) (Panel B of Table 3.13). These results indicate that higher academic scores do not necessarily discourage informal employment among women. Worldwide and even in the Philippines, women tend to engage in vulnerable jobs such as unpaid family work, part-time work, and informal enterprises and farming. They also tend to occupy positions needing less Science training such as jobs in the Humanities, Social Affairs, and Welfare. Among men, an increase in Science, English, and Overall MPS significantly decreases

the proportion of informally employed men by 0.266, 0.378, and 0.456 percentage point, respectively (Panel C of Table 3.13). This means that, indeed, as men receive higher test scores, they are less likely to work in the informal sector.

These results suggest differences in the labor force participation of women and men depending on the test scores. As we mentioned in *Hypothesis 3*, despite higher test scores among girls, labor market outcomes tend to favor boys. Men typically work in the formal sector when they gain higher test scores, while women, even if they have high test scores, tend to settle in informal occupations. In the Philippines, more women compared to men work in informal and vulnerable occupations (i.e., self-employed or employed in family farm or business), even if women generally have better academic outcomes. These women are often paid cheaply under unfavorable working conditions (David, Albert, and Vizmanos, 2017). Such scenario suggests that there are labor market imperfections that put women at a disadvantage. These include gendered norms (that women should spend more time in domestic and care work), lack of flexible working hours in the formal sector, women's lower access to land and credit, and market and institutional failures. We highlight the importance of increasing job opportunities for women in the formal sector, promoting flexible working hours, providing maternity benefits and day care services, and protecting women workers in the informal, vulnerable sector as they receive low wages and few social security benefits.

3.6. Conclusion

Low learning outcomes is a persistent issue in many developing countries. Based on previous reports, children in these countries exhibit poor performance in both

international and national standardized exams. Noticeably, girls' and boys' test performance differ substantially across various assessments.

In this chapter, we assessed gender disparities in test performance, evaluated the household characteristics that affect provincial test scores, and investigated the effect of learning achievements on labor market outcomes of women and men. We employed descriptive statistics, OLS, and IV 2SLS regressions using a rare individual-level dataset of NAT scores (2005-2018) from the DepEd. This dataset gave us the opportunity to calculate test scores at the provincial-level, which were then merged with the Annual Poverty Indicators Survey (APIS), to analyze provincial employment outcomes.

Briefly, the main findings are as follows. First, boys lag behind girls in learning by significant margins across the most critical subjects (Mathematics, Science, and English) and overall performance. The overall mean percentage score is about 3.931 to 3.981 points higher for girls. The study recommends taking measures that allow teachers to have flexible teaching methods that target boys, incentivize teachers' efforts to develop new ways to motivate students, hire more male teachers, and coordinate with the local governments to guide boys in the community.

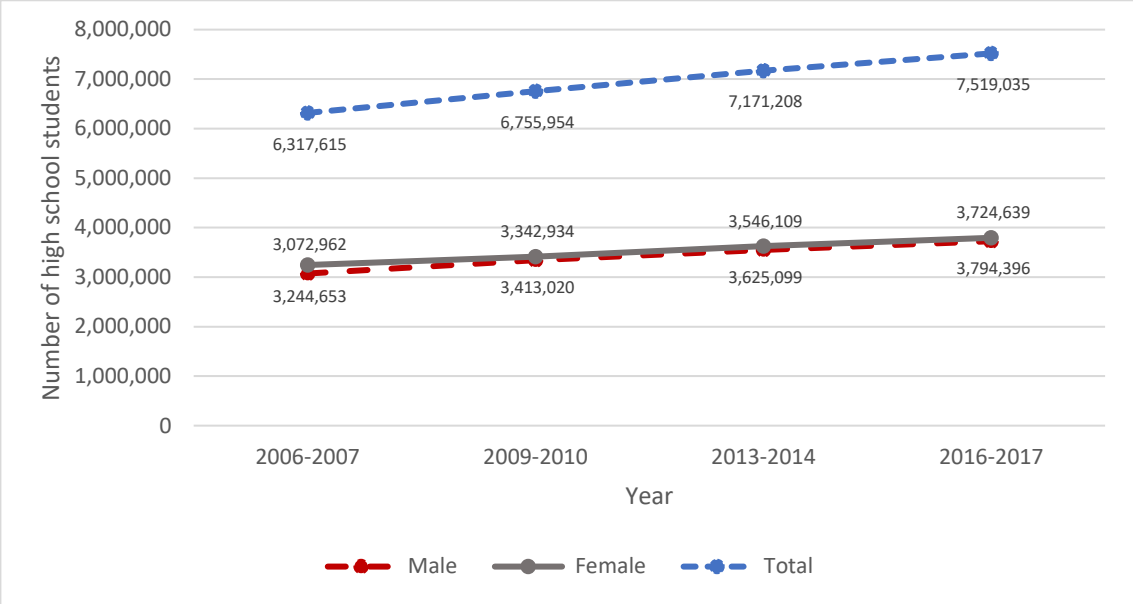
Second, provincial analyses reveal that access to electricity, agricultural land ownership, and mother's schooling attainment are positively correlated with test scores. In contrast, ownership of TV and radio are negatively associated with test performance. Regardless of gender, the availability of certain infrastructure or home appliances affect the study habits of children. Likewise, certain parental assets and characteristics also relate with children's cognitive skills. Hence, measures that provide infrastructure (i.e., electrification in rural areas), promote good quality TV shows that enhance learning,

protect family's assets, or support women's education may be effective in improving learning achievements of both girls and boys.

Third, in terms of employment, we found that higher provincial NAT scores positively affect the proportion of formally employed and negatively influence the proportion of informally employed individuals. The positive impact of an increase in test scores on formal employment is higher among men than among women. Meanwhile, its negative effect on the proportion of informally employed is also more apparent among men. This may reflect how women find it difficult to sustain formal sector jobs and how they settle for low-skilled, informal work despite having better academic outcomes than men. Hence, we emphasize the need to protect women in vulnerable sectors and to encourage formal sector companies to support women workers by providing maternity benefits and child care while they are on duty.

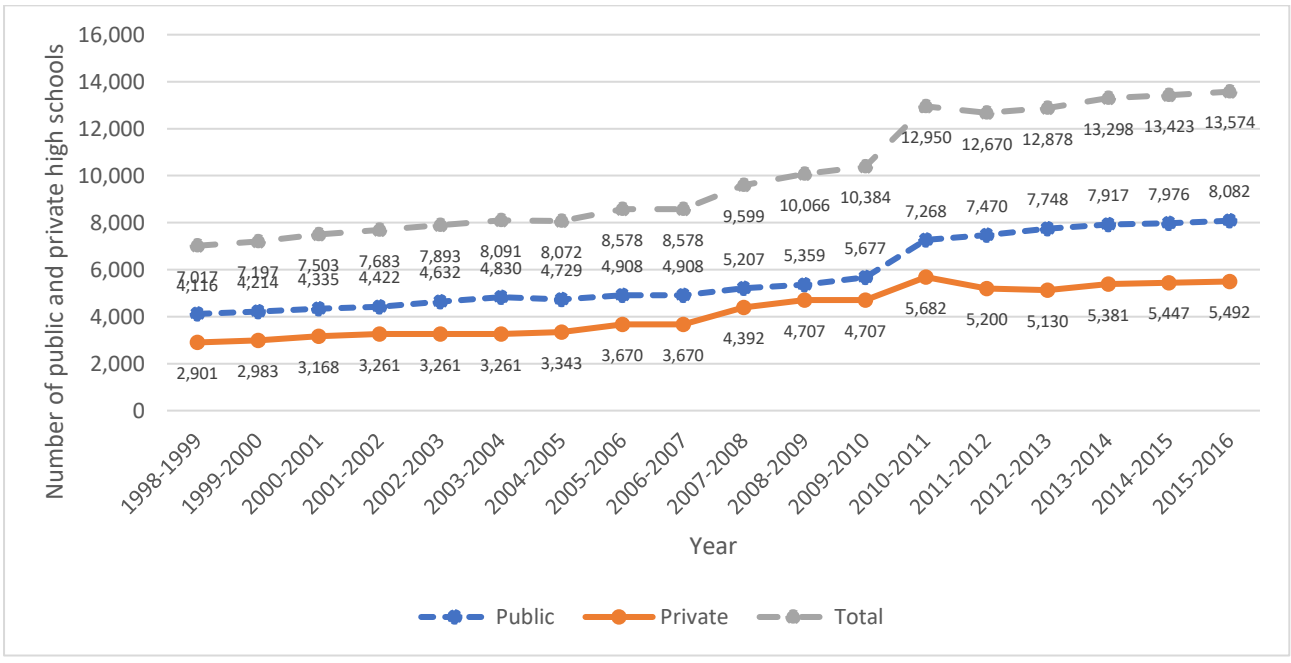
Our results provide a gender perspective on learning poverty, the relationship between household characteristics and test scores, and the linkage between academic performance and employment outcomes. In conclusion, girls continue to outperform boys in cognitive achievements. Household-related factors appear to equally affect girls' and boys' learning. However, there are imperfections in the labor market which lead to inequities in employment outcomes that tend to favor men. Despite women having better test scores, men have a higher chance of being formally employed and lower probability of being informally employed.

Figures



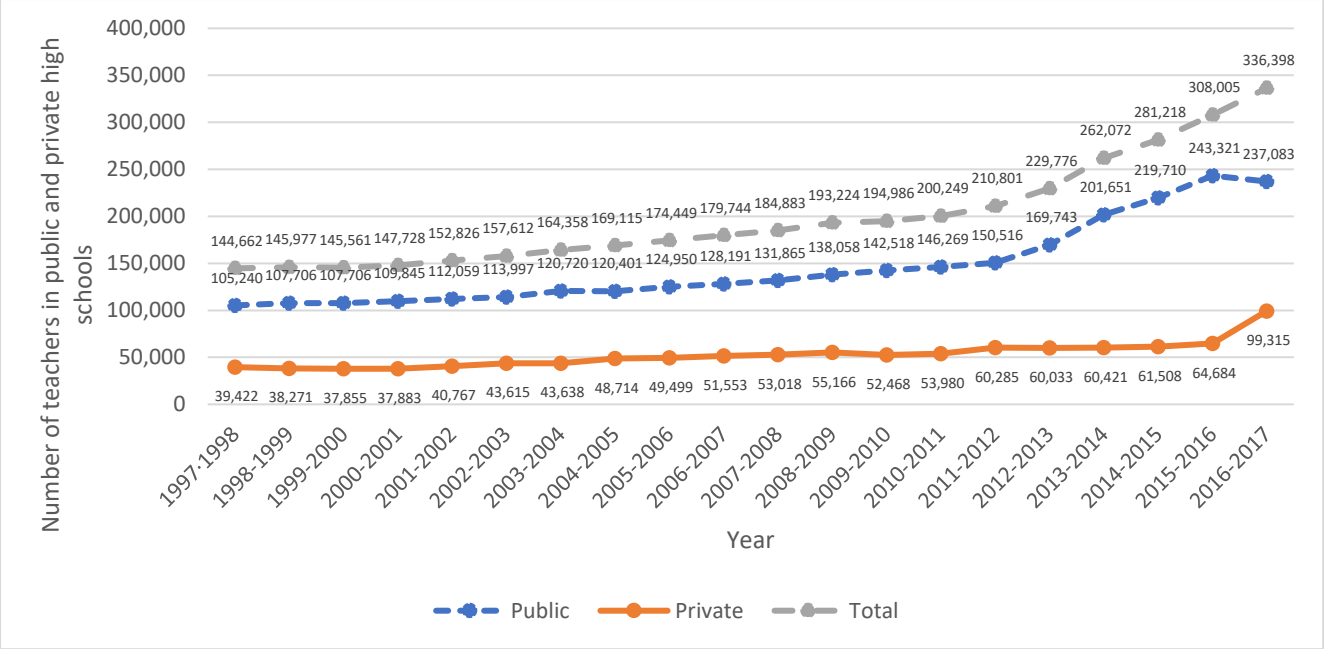
Note: Figure drawn using data from the Department of Education. AY 2006-2007 enrollment in public does not include laboratory schools of SUCs. AY 2013-2014 is the start of the K to 12 program; thus, AY 2013-2014 and 2016-2017 include students in Grades 7 to 12, while AY 2006-2007 and 2009-2010 include students in first to fourth year high school.

Figure 3.1: Enrollment in public and private high schools, Philippines, AY 2004-2005 to 2016-2017



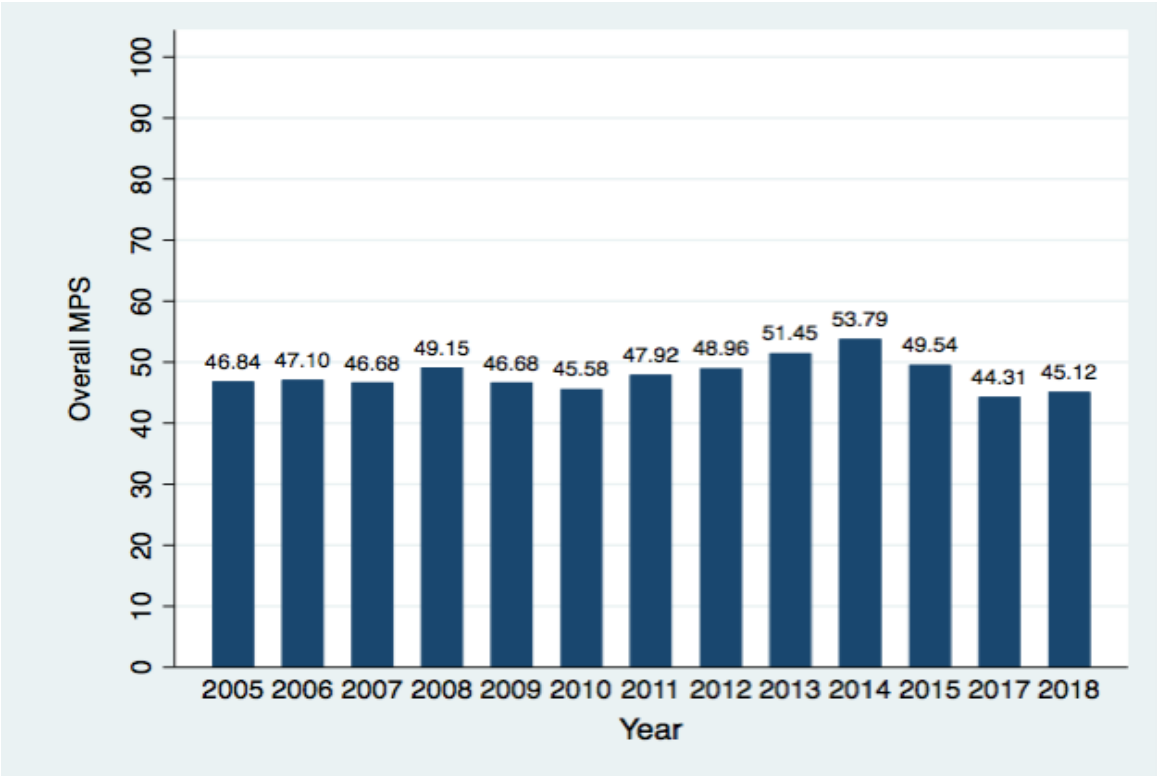
Note: Figure drawn using data from the Department of Education.

Figure 3.2: Number of public and private high schools, Philippines, AY 1998-1999 to 2015-2016



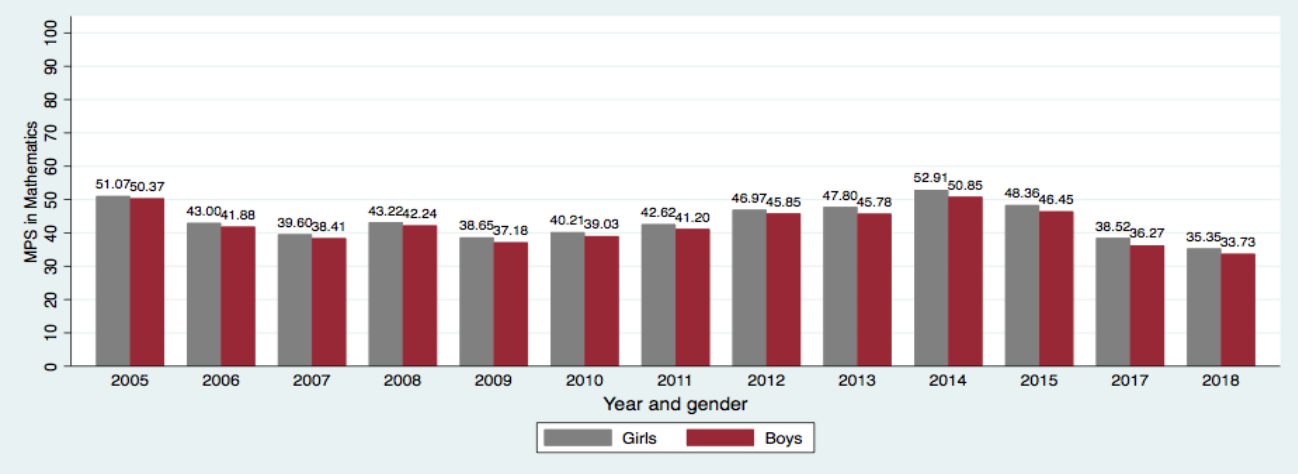
Note: Figure drawn using data from the Department of Education.

Figure 3.3: Number of teachers in public and private high schools, Philippines, AY 1997-1998 to 2016-2017



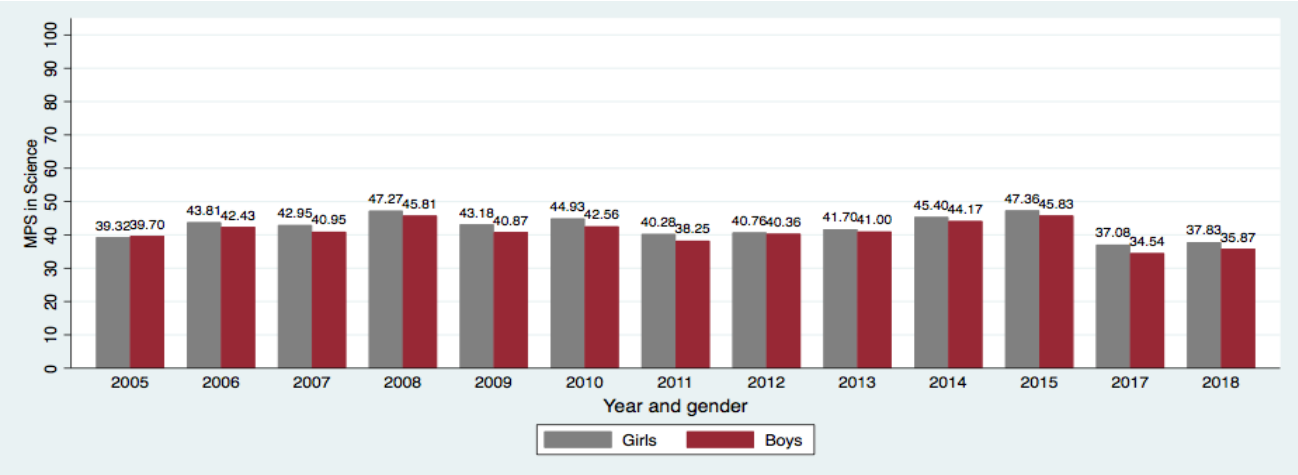
Note: Figure drawn using data from the Department of Education.

Figure 3.4: Overall mean percentage scores, Philippines, 2005 to 2018



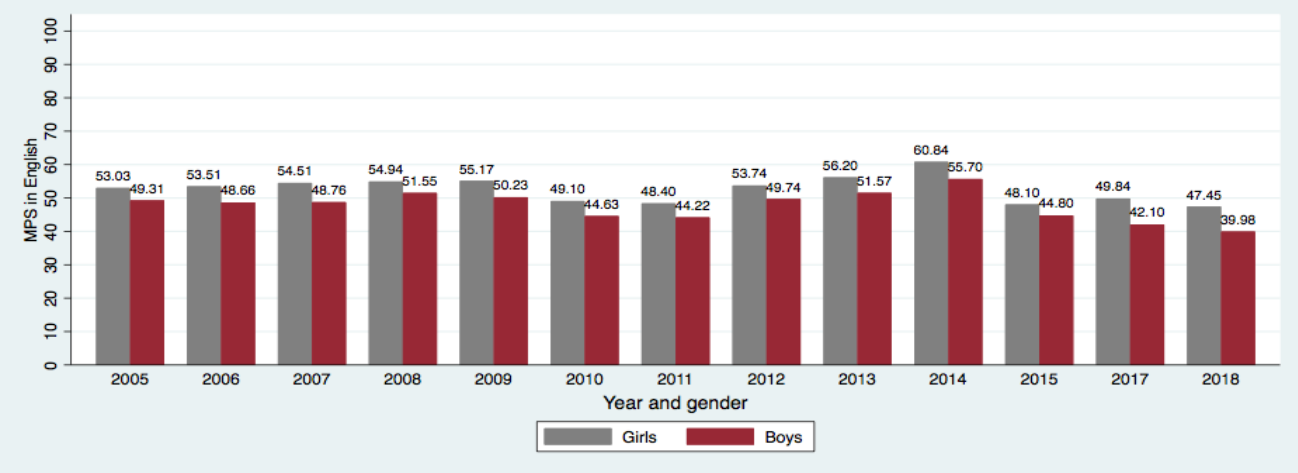
Note: Figure drawn using data from the Department of Education.

Figure 3.5: Mean percentage scores in Mathematics, by gender, Philippines, 2005 to 2018



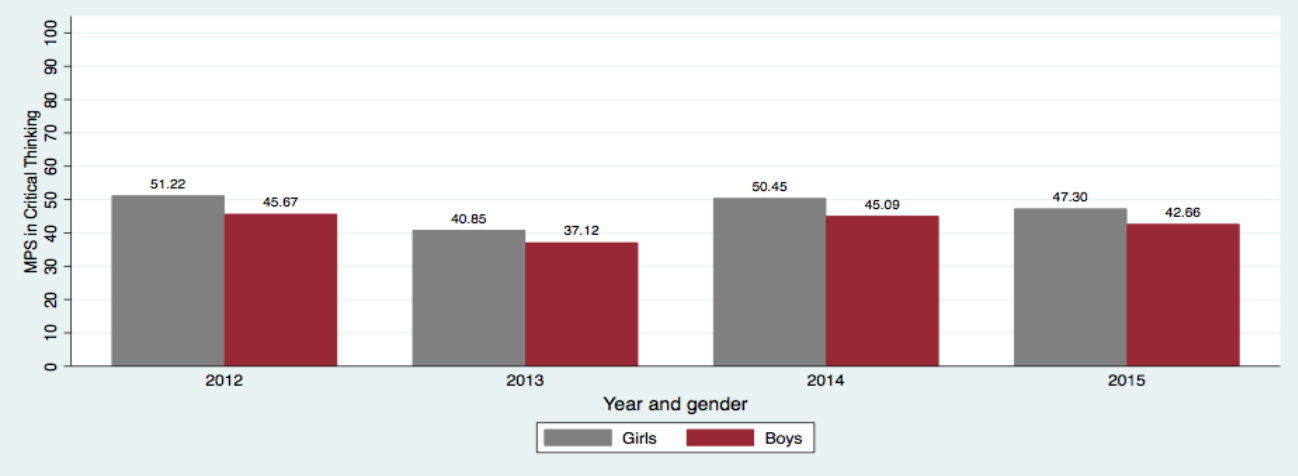
Note: Figure drawn using data from the Department of Education.

Figure 3.6: Mean percentage scores in Science, by gender, Philippines, 2005 to 2018



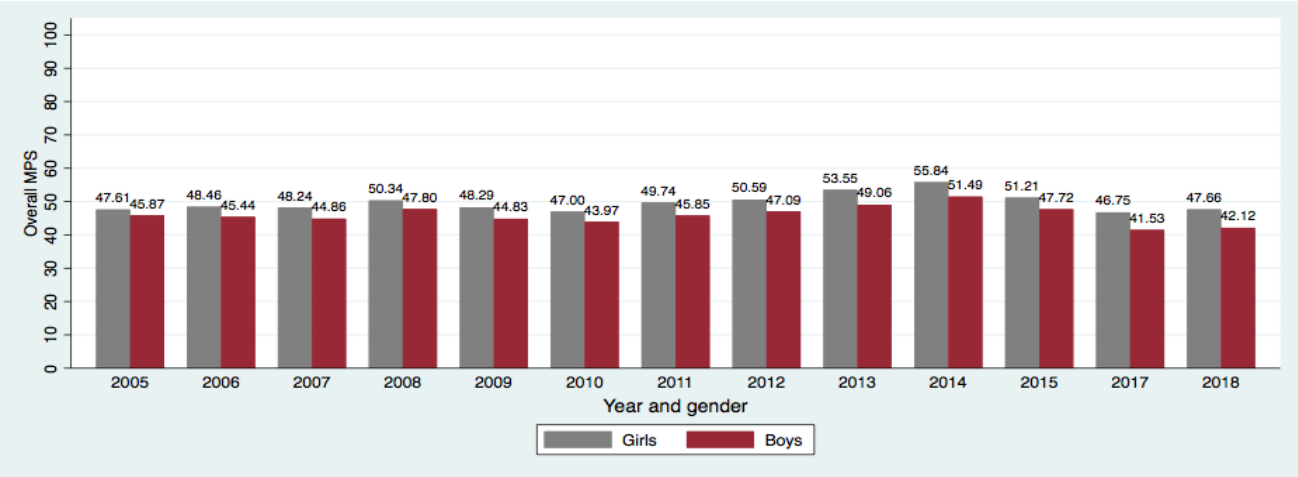
Note: Figure drawn using data from the Department of Education.

Figure 3.7: Mean percentage scores in English, by gender, Philippines, 2005 to 2018



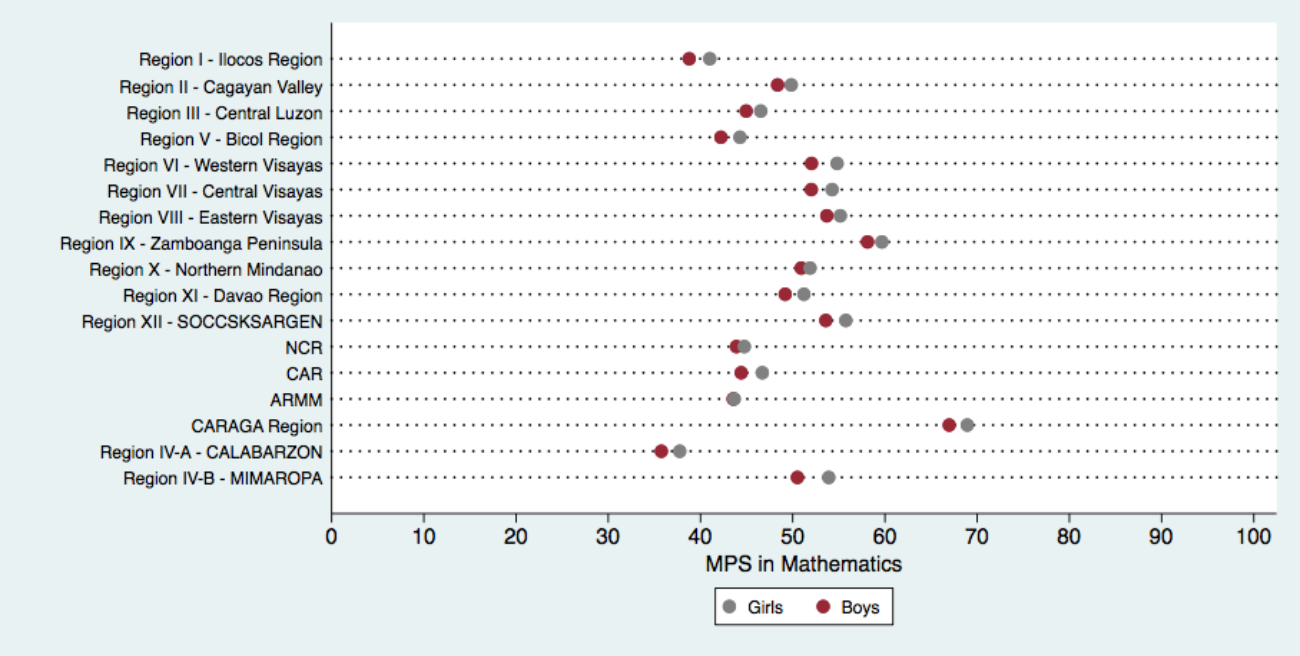
Note: Figure drawn using data from the Department of Education.

Figure 3.8: Mean percentage scores in Critical Thinking, by gender, Philippines, 2005 to 2018



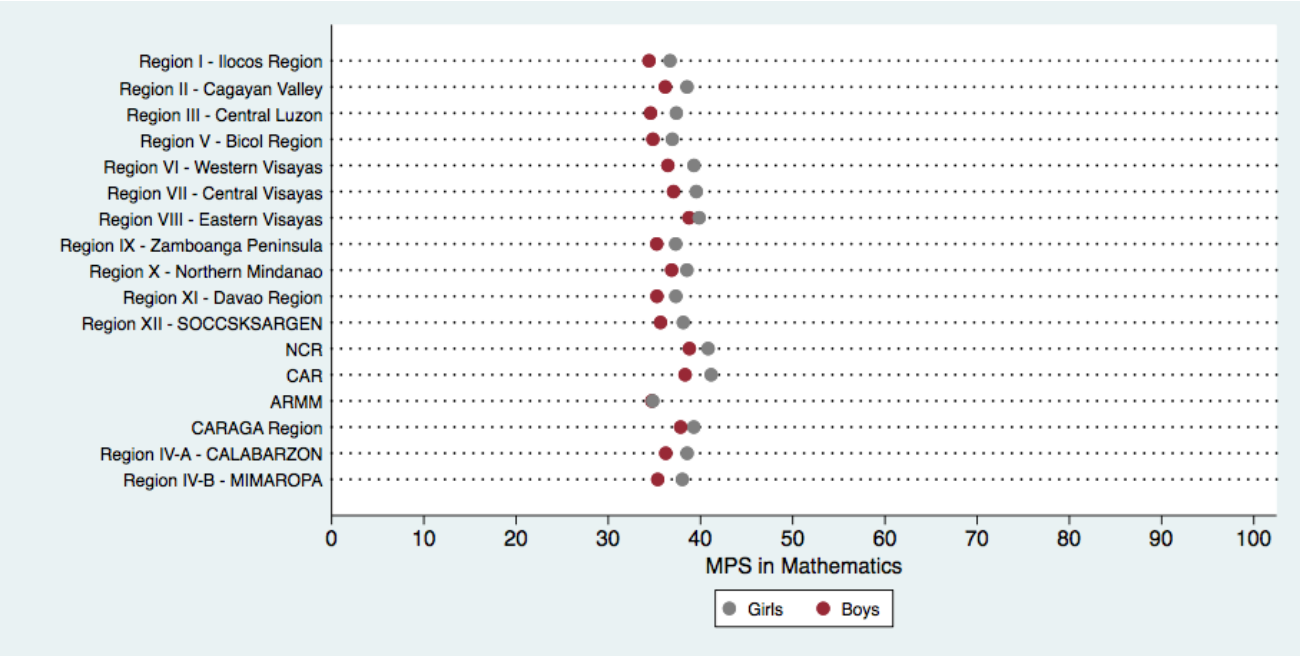
Note: Figure drawn using data from the Department of Education.

Figure 3.9: Overall mean percentage scores, by gender, Philippines, 2005 to 2018



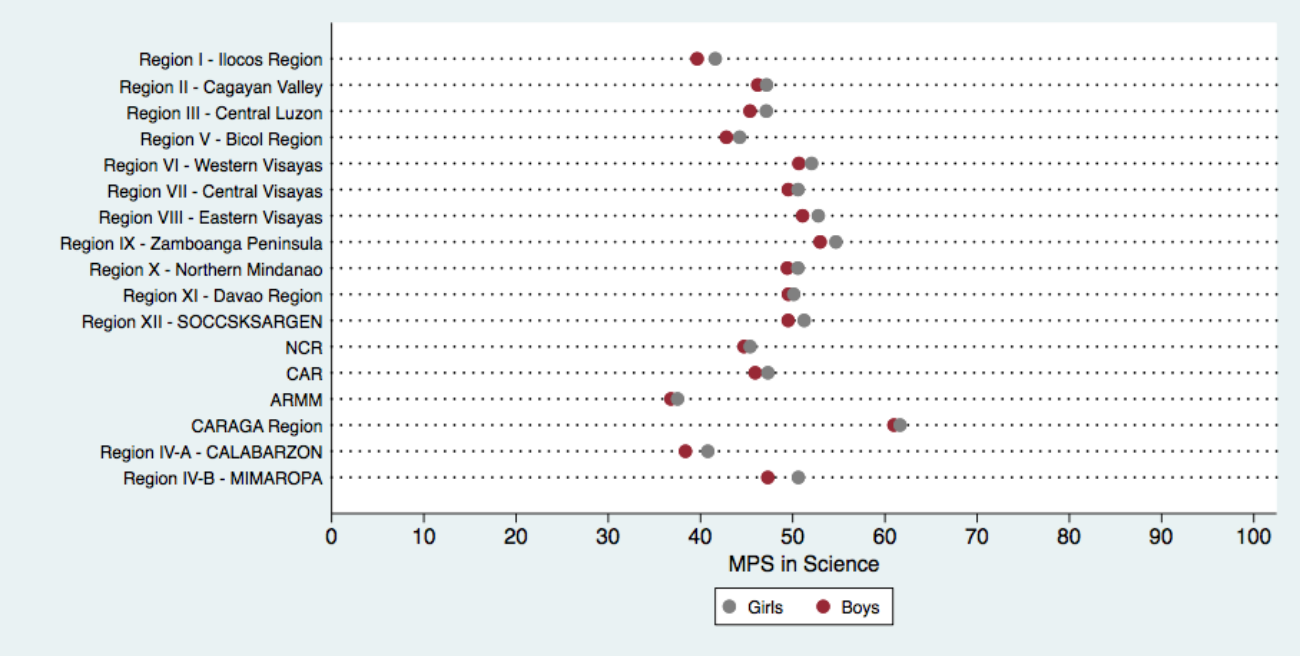
Note: Figure drawn using data from the Department of Education.

Figure 3.10: Mean percentage scores in Mathematics, by region and gender, Philippines, 2015



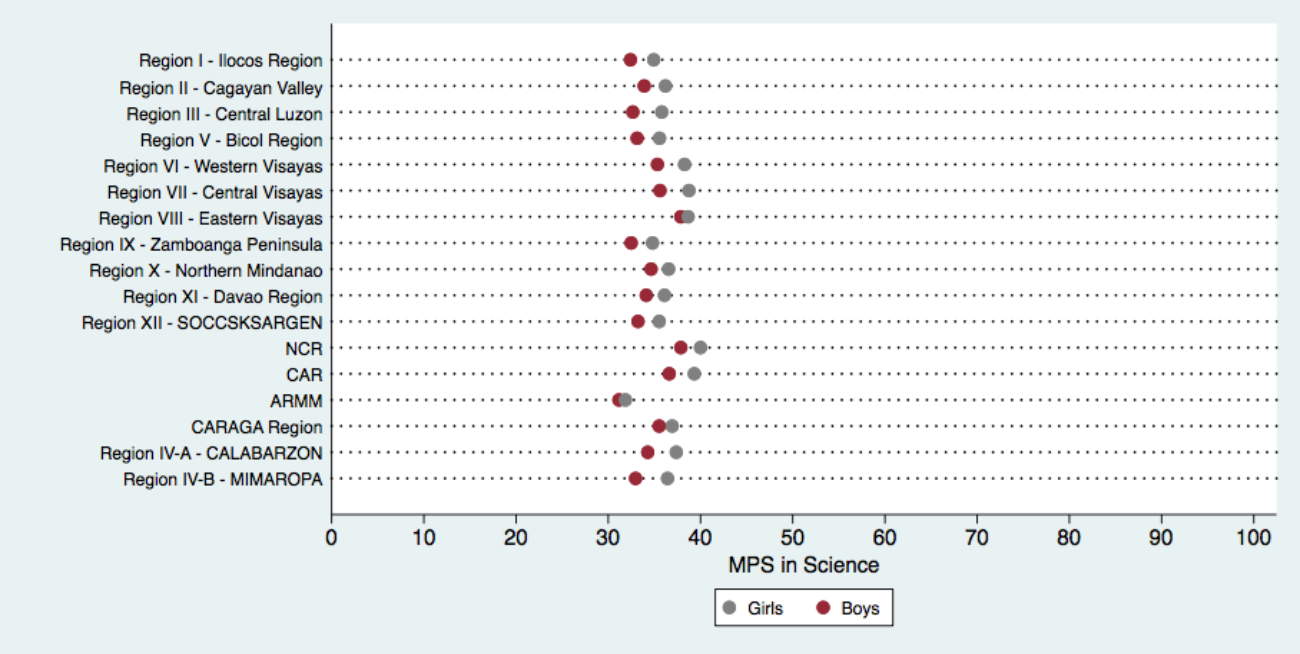
Note: Figure drawn using data from the Department of Education.

Figure 3.11: Mean percentage scores in Mathematics, by region and gender, Philippines, 2017



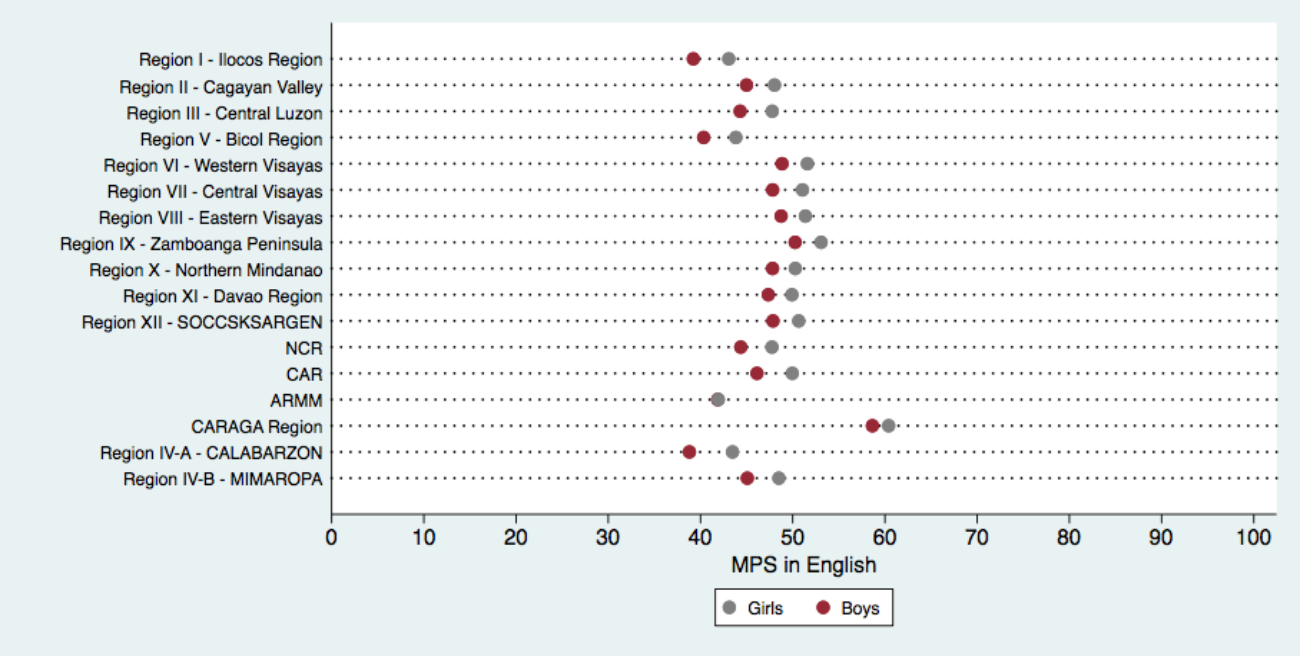
Note: Figure drawn using data from the Department of Education.

Figure 3.12: Mean percentage scores in Science, by region and gender, Philippines, 2015



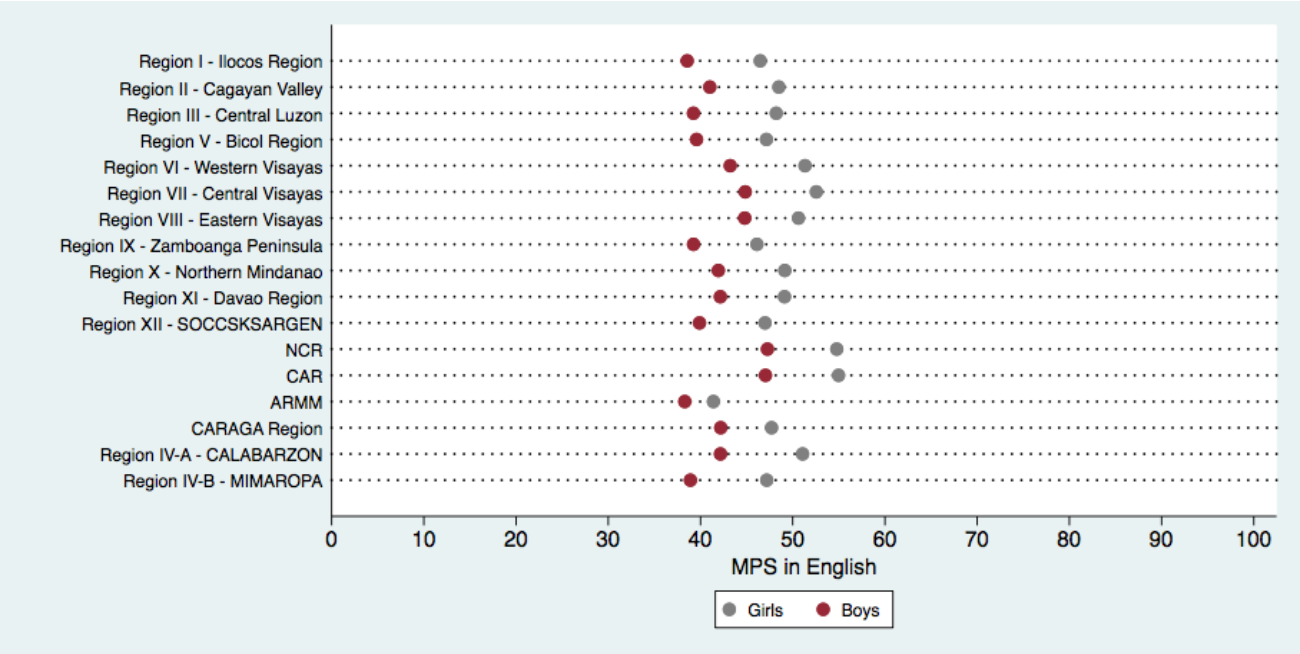
Note: Figure drawn using data from the Department of Education.

Figure 3.13: Mean percentage scores in Science, by region and gender, Philippines, 2017



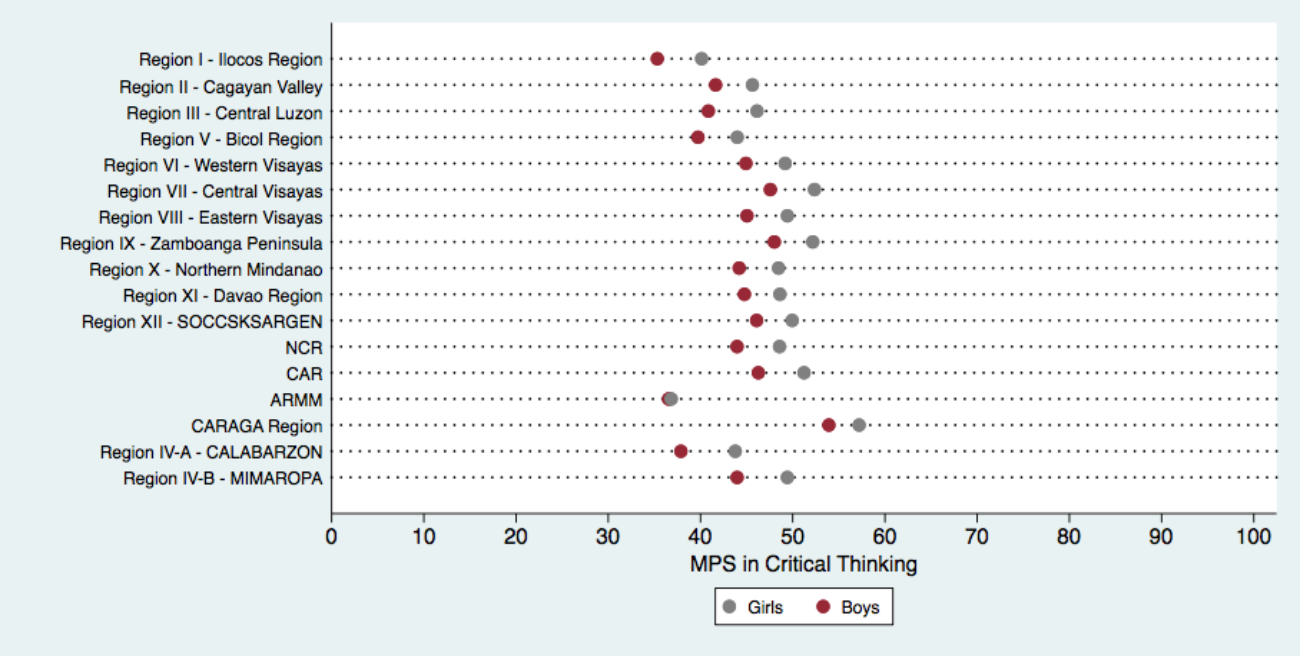
Note: Figure drawn using data from the Department of Education.

Figure 3.14: Mean percentage scores in English, by region and gender, Philippines, 2015



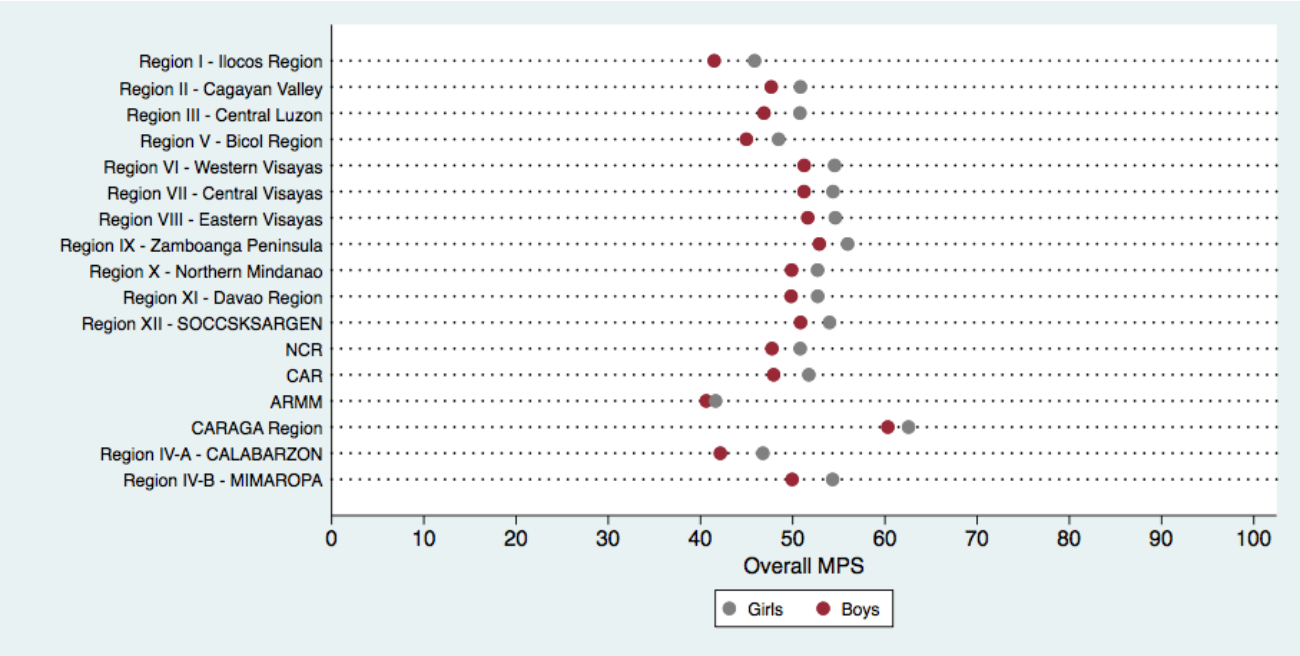
Note: Figure drawn using data from the Department of Education.

Figure 3.15: Mean percentage scores in English, by region and gender, Philippines, 2017



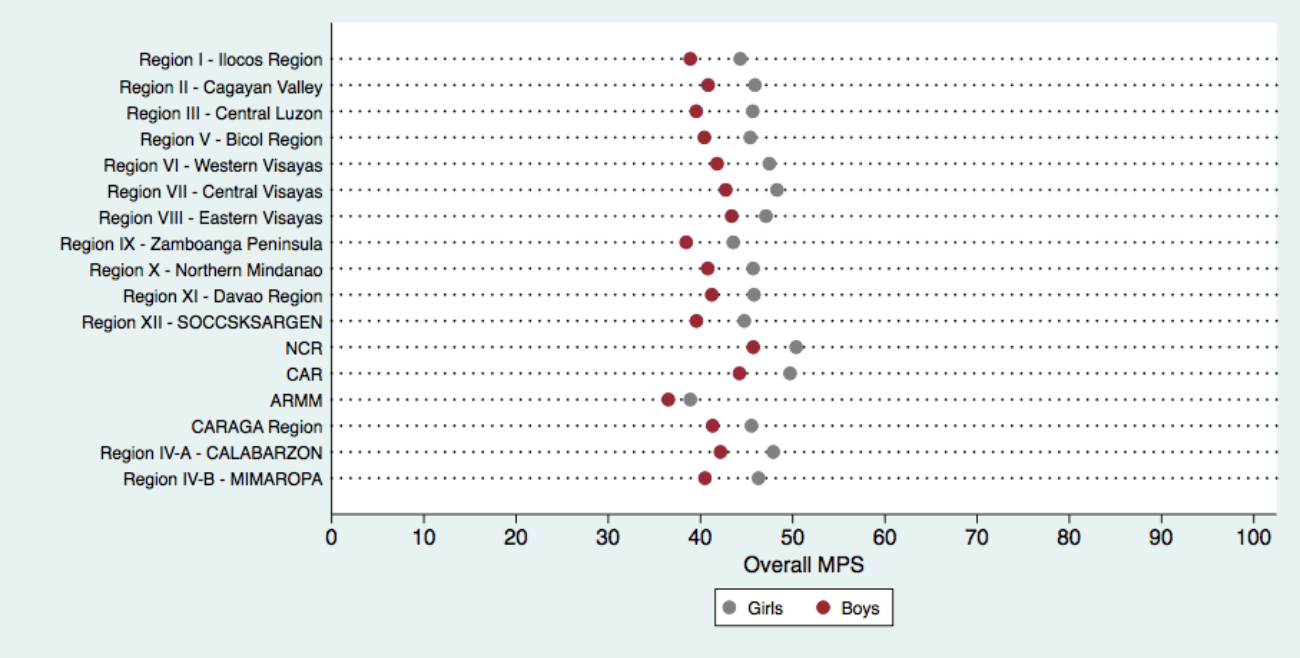
Note: Figure drawn using data from the Department of Education.

Figure 3.16: Mean percentage scores in Critical Thinking, by region and gender, Philippines, 2015



Note: Figure drawn using data from the Department of Education.

Figure 3.17: Overall mean percentage scores, by region and gender, Philippines, 2015



Note: Figure drawn using data from the Department of Education.

Figure 3.18: Overall mean percentage scores, by region and gender, Philippines, 2017

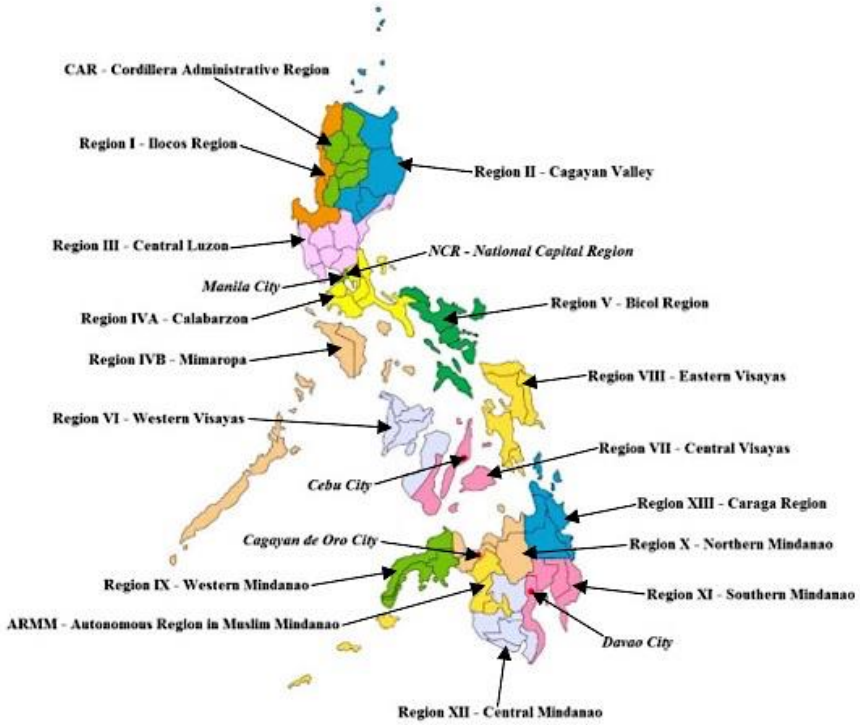
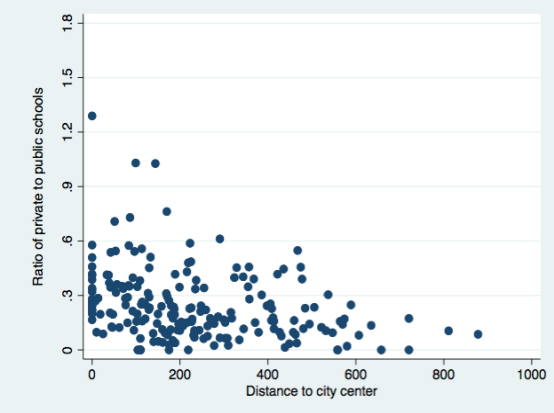
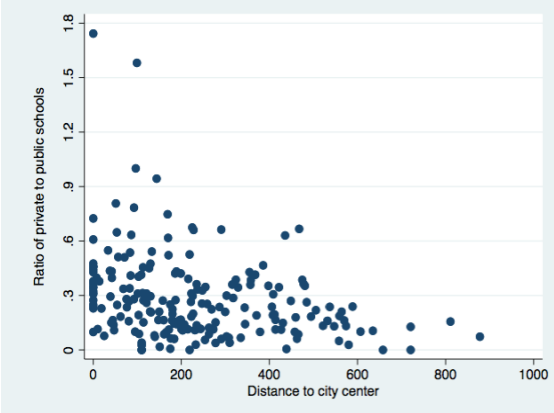


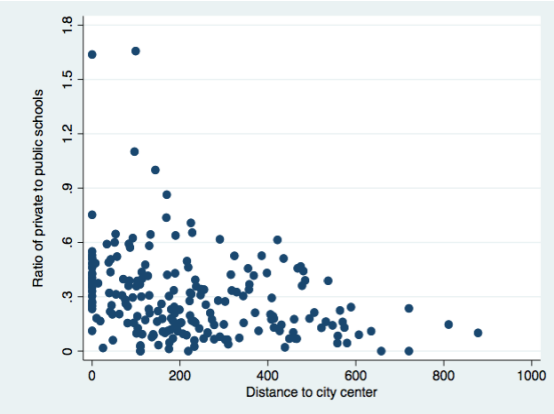
Figure 3.19: Philippine map, by region and major city center



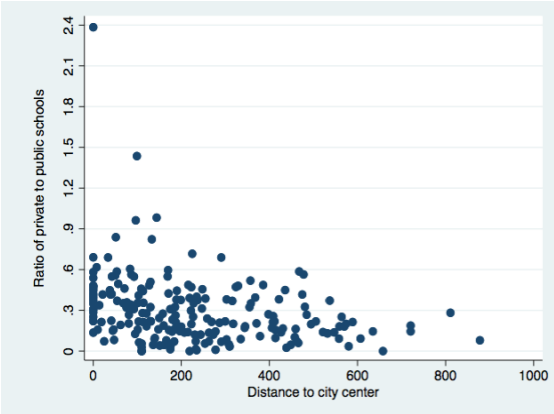
(A) Ratio of private to public schools and distance to city center, 2009



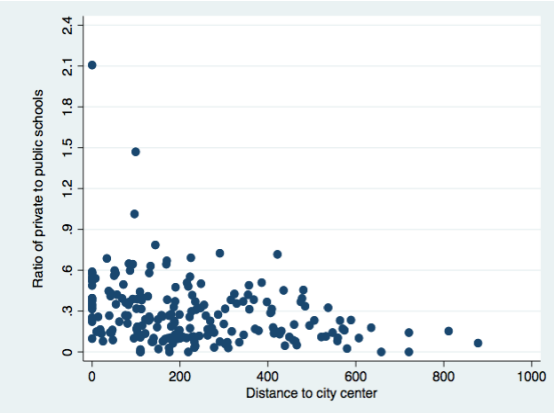
(B) Ratio of private to public schools and distance to city center, 2010



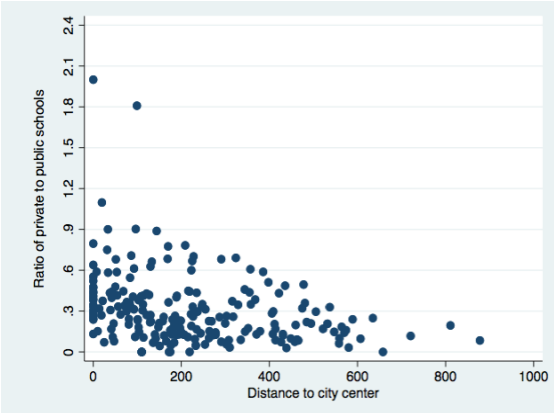
(C) Ratio of private to public schools and distance to city center, 2011



(D) Ratio of private to public schools and distance to city center, 2012

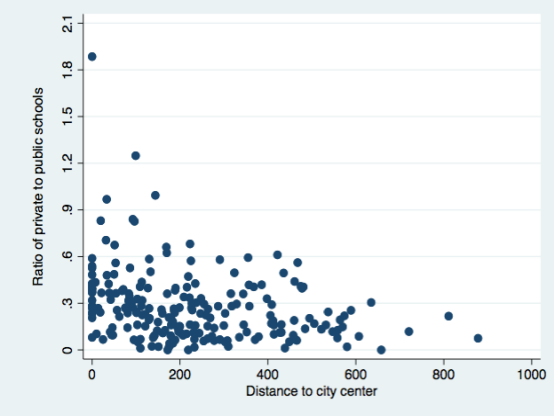


(E) Ratio of private to public schools and distance to city center, 2013

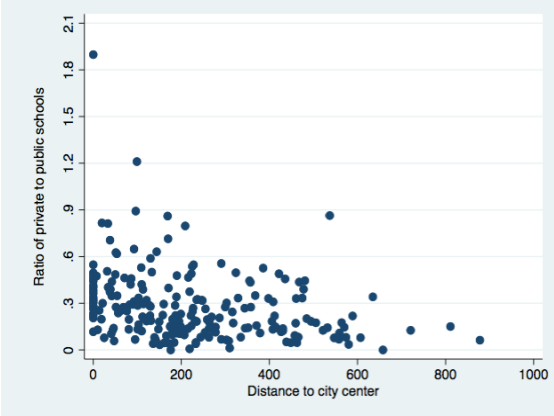


(F) Ratio of private to public schools and distance to city center, 2014

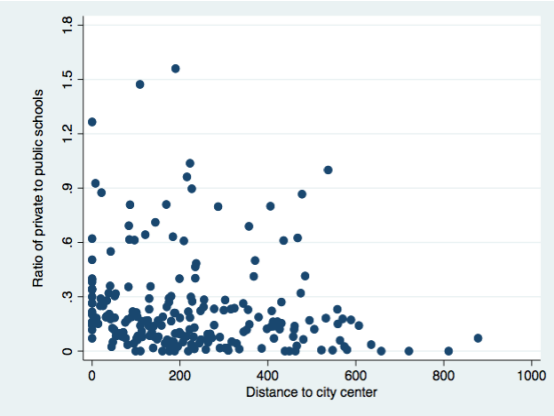
Figure 3.20: Ratio of private to public schools and distance to city center, by school division, Philippines, 2009-2018



(G) Ratio of private to public schools and distance to city center, 2015



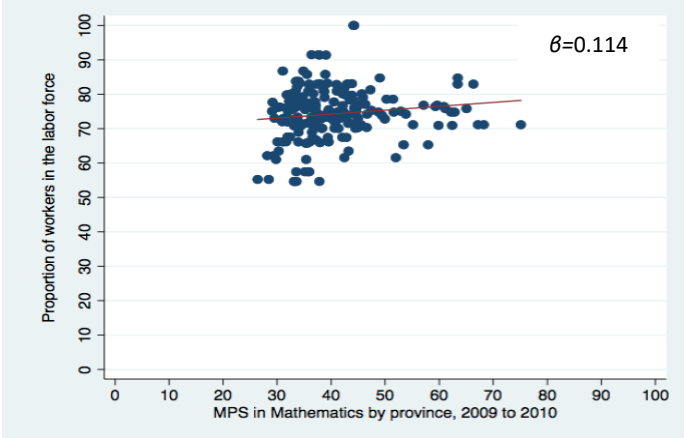
(H) Ratio of private to public schools and distance to city center, 2017



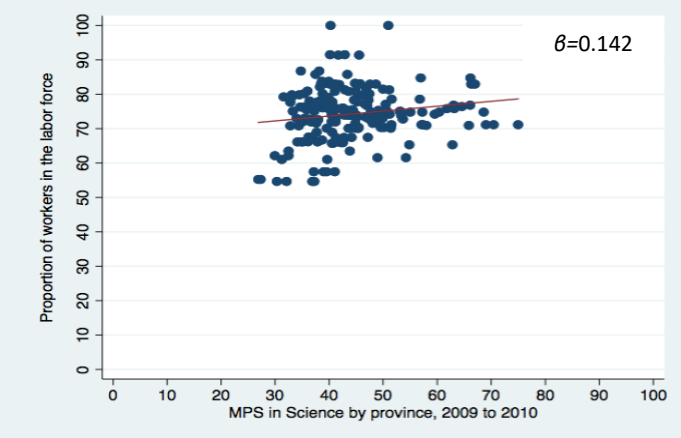
(I) Ratio of private to public schools and distance to city center, 2018

Note: Figure drawn using data from the Department of Education and Google Maps.

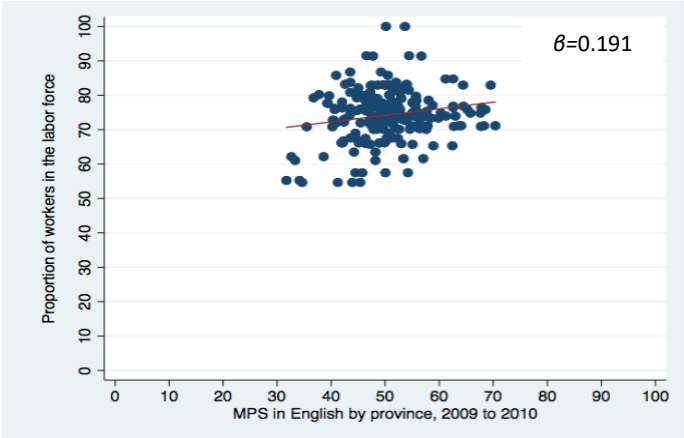
Figure 3.20: ***(Continued)***



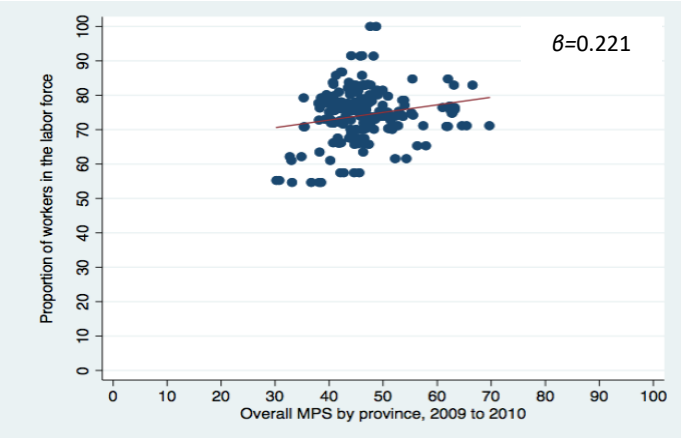
(A) MPS in Mathematics and proportion of employed



(B) MPS in Science and proportion of employed



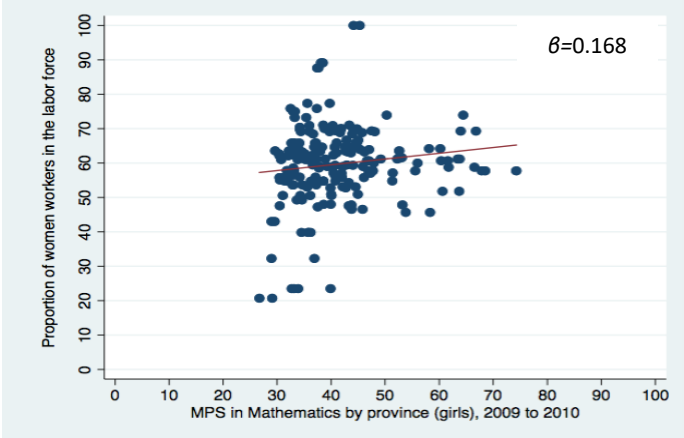
(C) MPS in English and proportion of employed



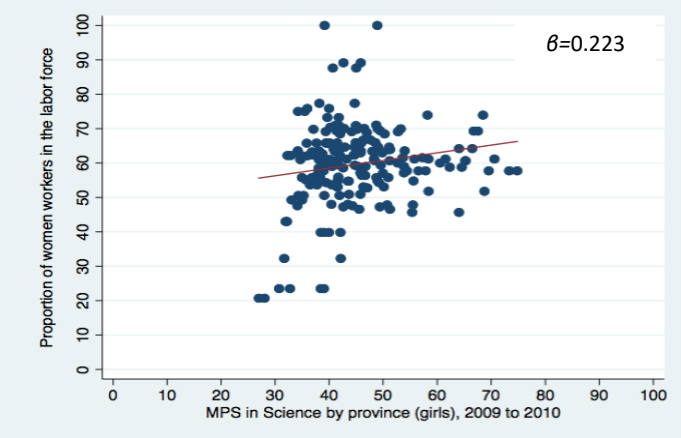
(D) Overall MPS and proportion of employed

Note: Figure drawn using data from the Annual Poverty Indicators Survey 2011 and the Department of Education.

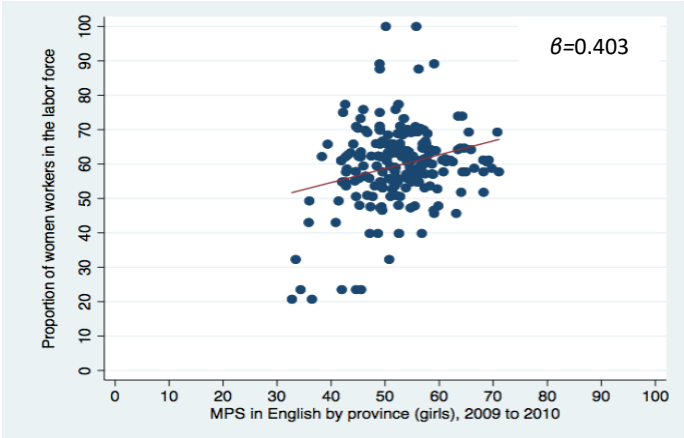
Figure 3.21: Provincial test scores (2009 and 2010) and proportion of employed among those in the labor force aged 15 to 64 (2011), Philippines



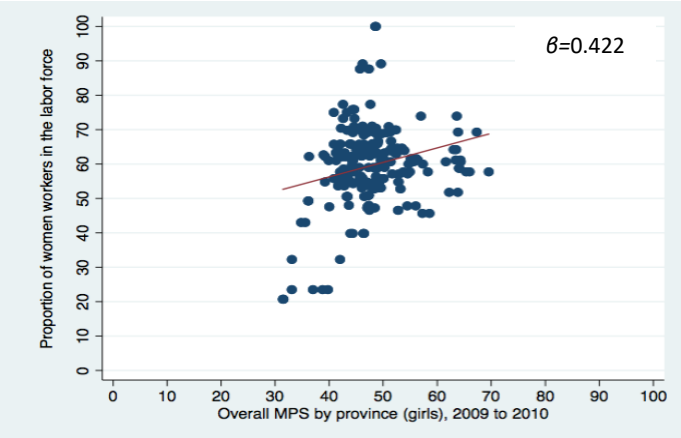
(A) Girls' MPS in Mathematics and proportion of employed women



(B) Girls' MPS in Science and proportion of employed women



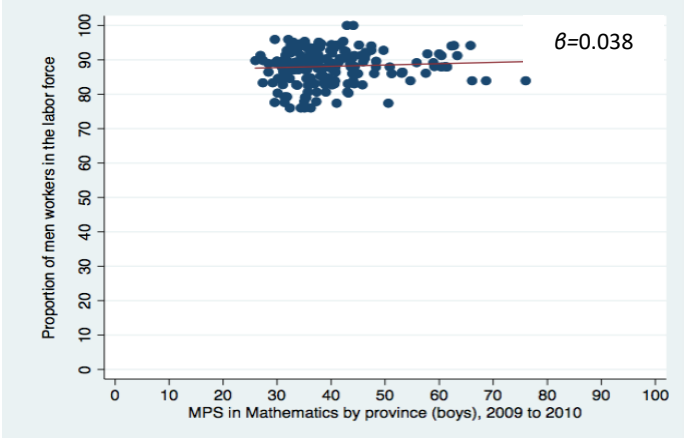
(C) Girls' MPS in English and proportion of employed women



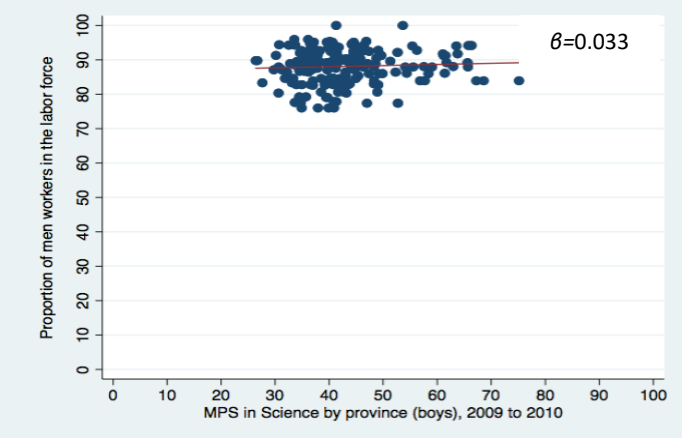
(D) Girls' overall MPS and proportion of employed women

Note: Figure drawn using data from the Annual Poverty Indicators Survey 2011 and the Department of Education.

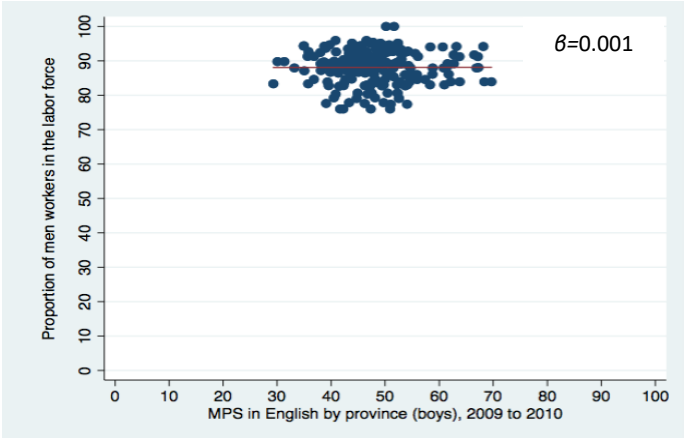
Figure 3.22: Provincial test scores (2009 and 2010) and proportion of employed women among women in the labor force aged 15 to 64 (2011), Philippines



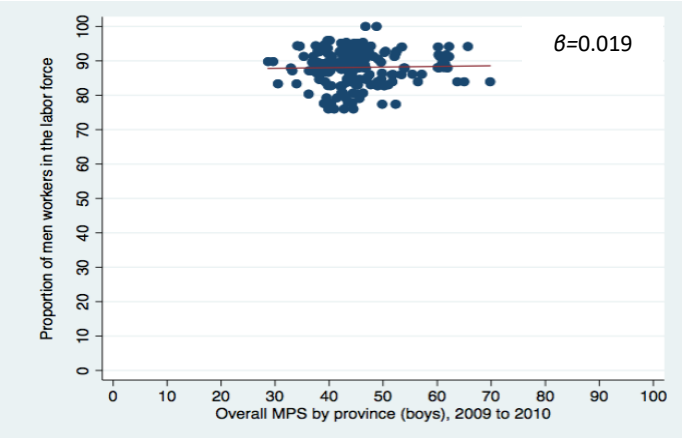
(A) Boys' MPS in Mathematics and proportion of employed men



(B) Boys' MPS in Science and proportion of employed men



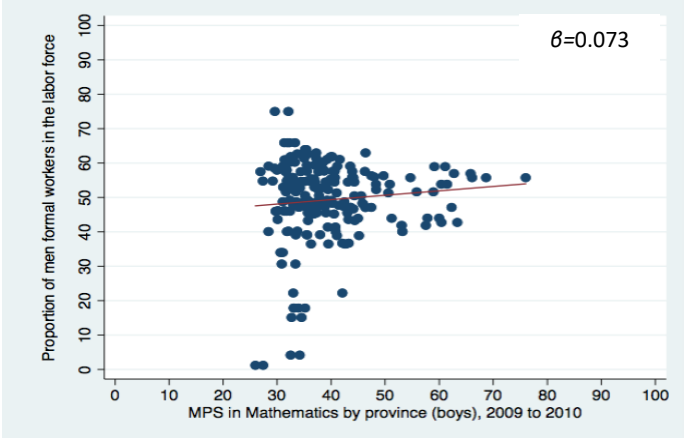
(C) Boys' MPS in English and proportion of employed men



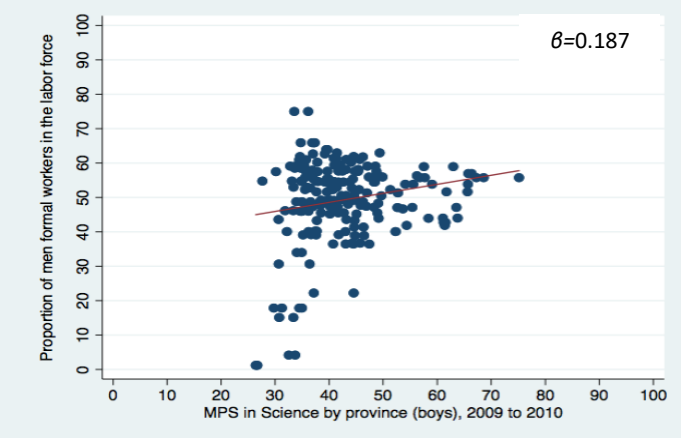
(D) Boys' overall MPS and proportion of employed men

Note: Figure drawn using data from the Annual Poverty Indicators Survey 2011 and the Department of Education.

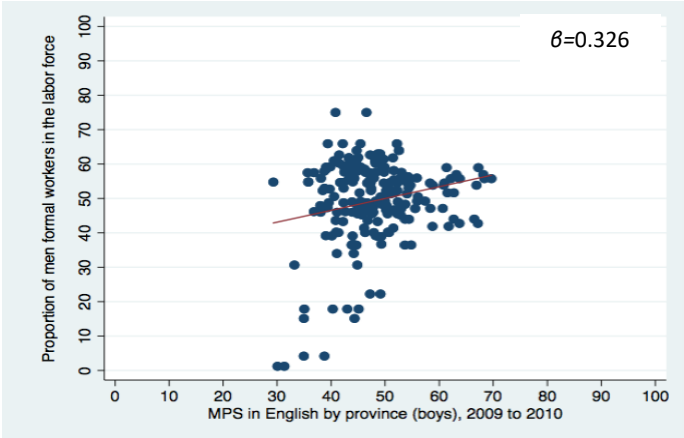
Figure 3.23: Provincial test scores (2009 and 2010) and proportion of employed men among men in the labor force aged 15 to 64 (2011), Philippines



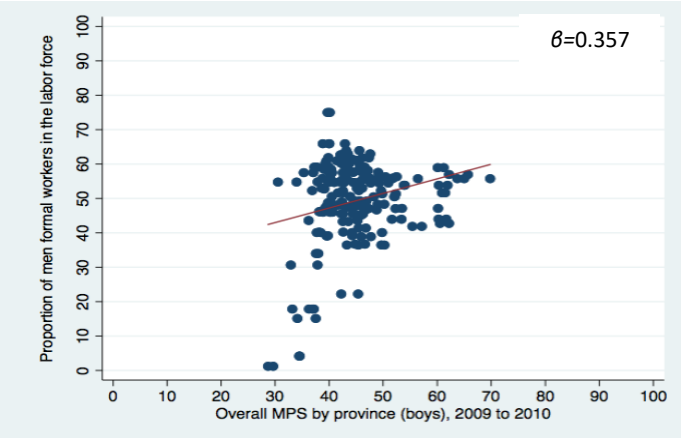
(A) MPS in Mathematics and proportion of formally employed



(B) MPS in Science and proportion of formally employed



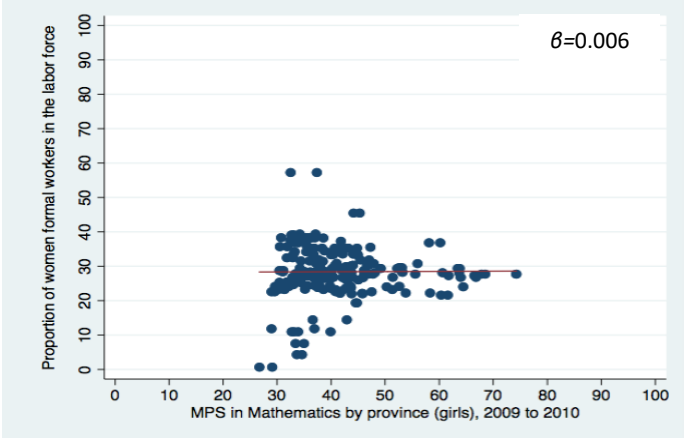
(C) MPS in English and proportion of formally employed



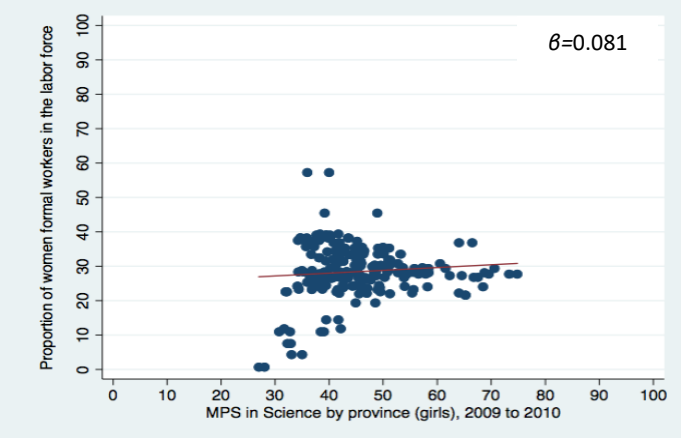
(D) Overall MPS and proportion of formally employed

Note: Figure drawn using data from the Annual Poverty Indicators Survey 2011 and the Department of Education.

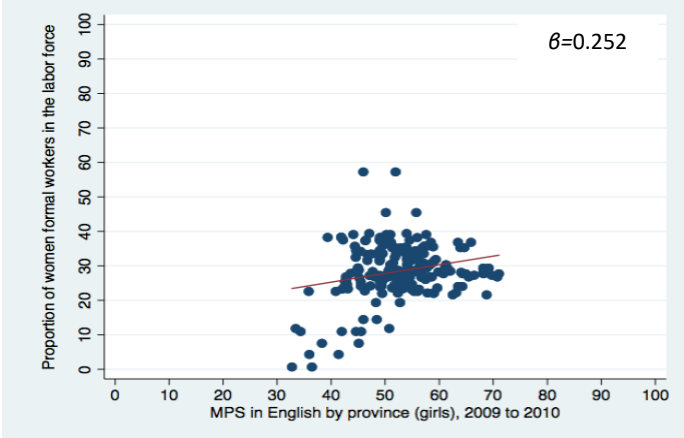
Figure 3.24: Provincial test scores (2009 and 2010) and proportion of formally employed among those in the labor force aged 15 to 64 (2011), Philippines



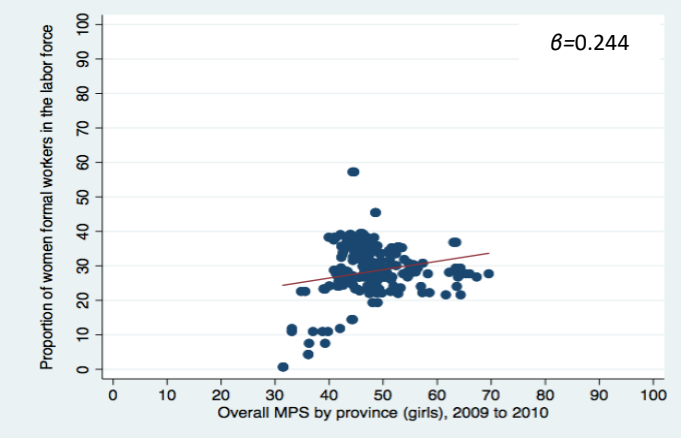
(A) Girls' MPS in Mathematics and proportion of formally employed women



(B) Girls' MPS in Science and proportion of formally employed women



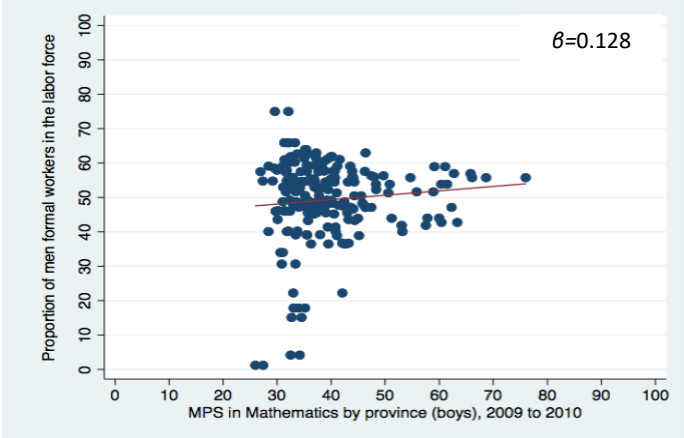
(C) Girls' MPS in English and proportion of formally employed women



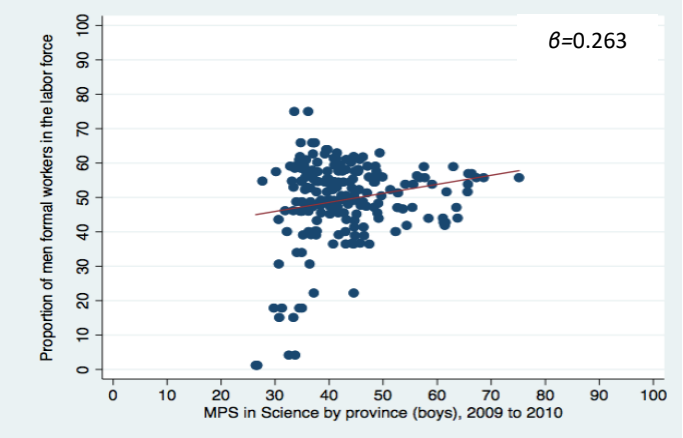
(D) Girls' overall MPS and proportion of formally employed women

Note: Figure drawn using data from the Annual Poverty Indicators Survey 2011 and the Department of Education.

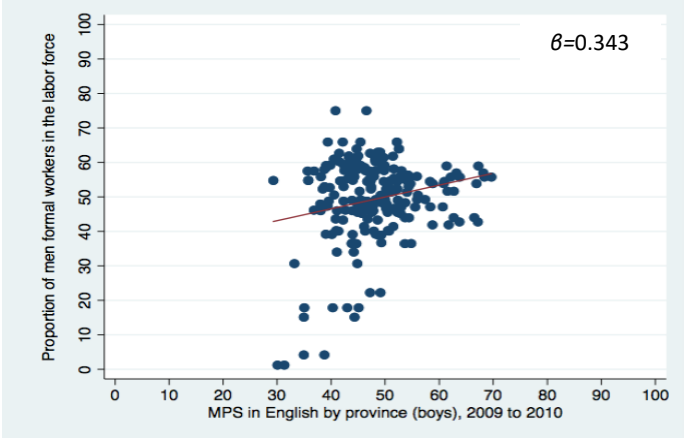
Figure 3.25: Provincial test scores (2009 and 2010) and proportion of formally employed women among women in the labor force aged 15 to 64 (2011), Philippines



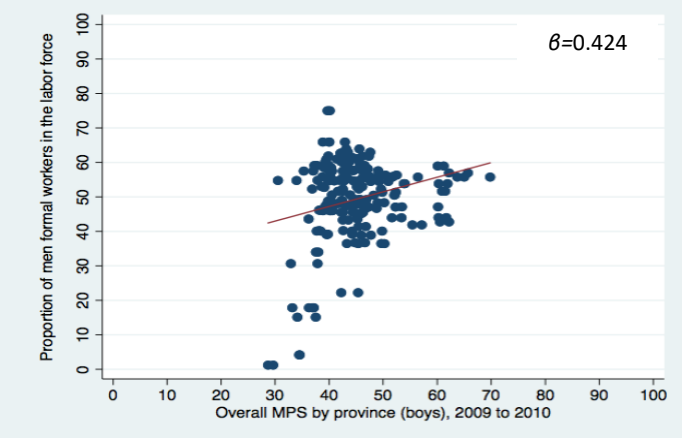
(A) Boys' MPS in Mathematics and proportion of formally employed men



(B) Boys' MPS in Science and proportion of formally employed men



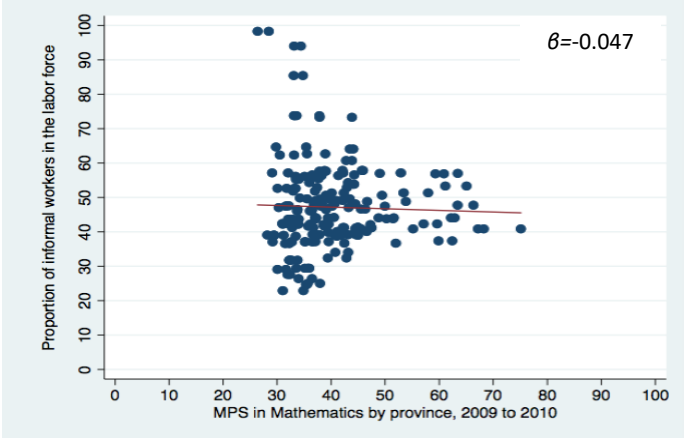
(C) Boys' MPS in English and proportion of formally employed men



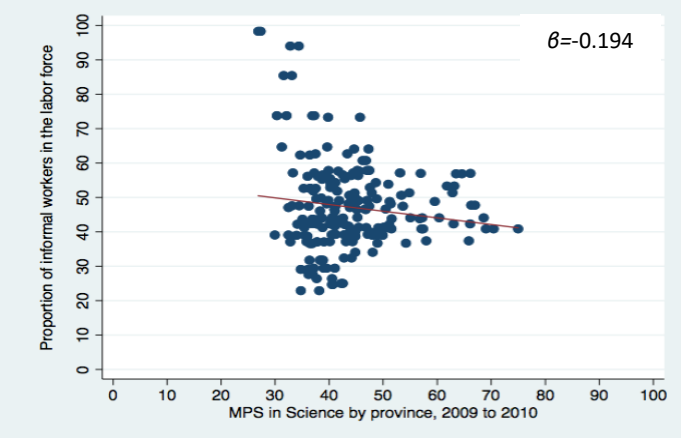
(D) Boys' overall MPS and proportion of formally employed men

Note: Figure drawn using data from the Annual Poverty Indicators Survey 2011 and the Department of Education.

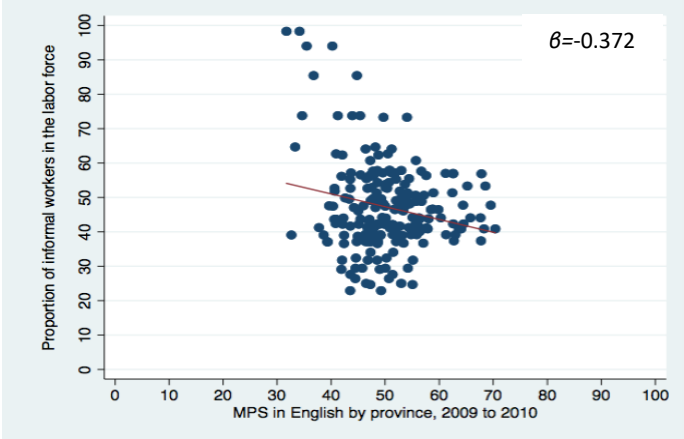
Figure 3.26: Provincial test scores (2009 and 2010) and proportion of formally employed men among men in the labor force aged 15 to 64 (2011), Philippines



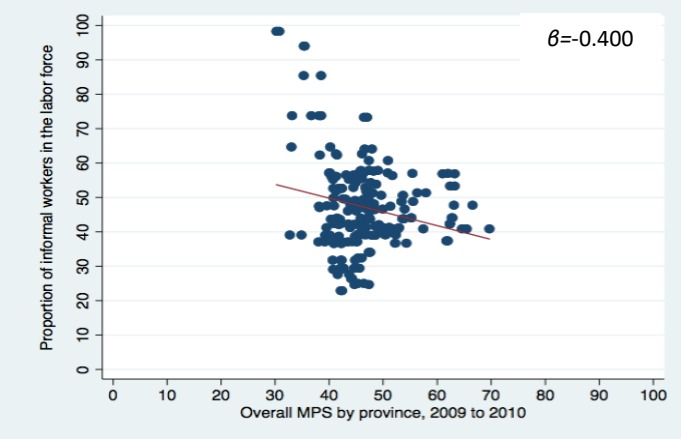
(A) MPS in Mathematics and proportion of informally employed



(B) MPS in Science and proportion of informally employed



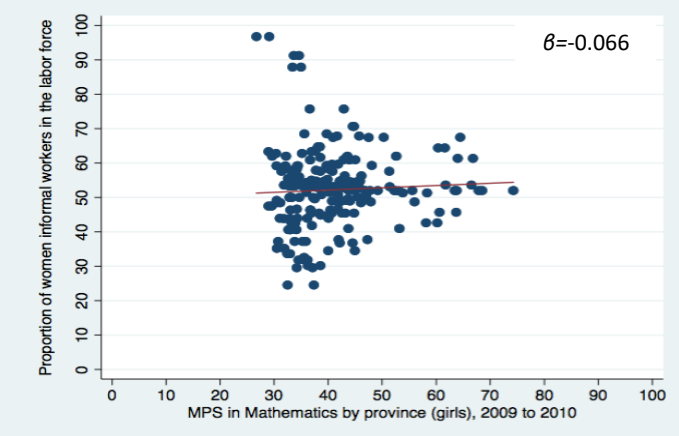
(C) MPS in English and proportion of informally employed



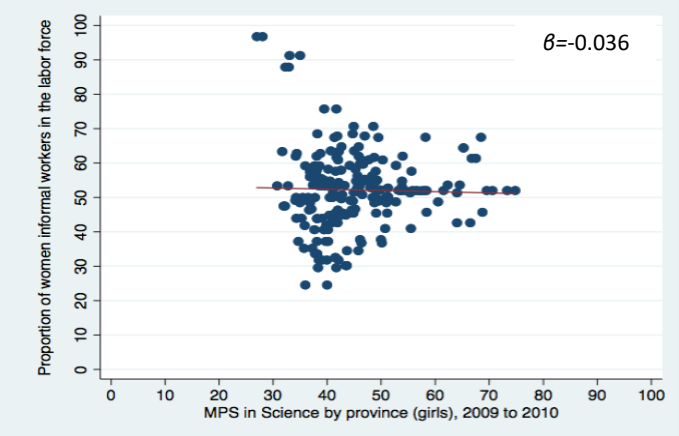
(D) Overall MPS and proportion of informally employed

Note: Figure drawn using data from the Annual Poverty Indicators Survey 2011 and the Department of Education.

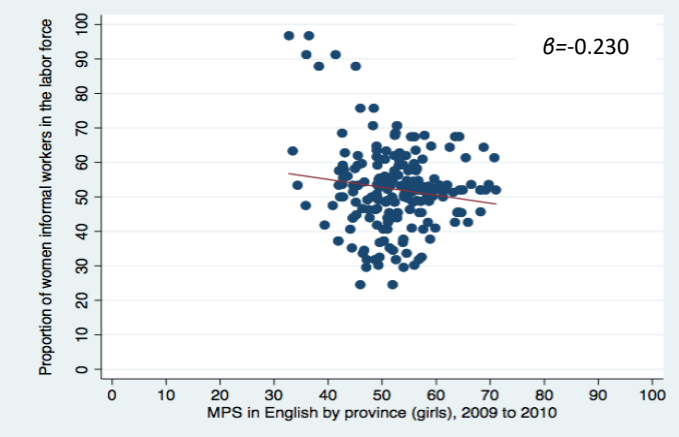
Figure 3.27: Provincial test scores (2009 and 2010) and proportion of informally employed among those employed in the labor force aged 15 to 64 (2011), Philippines



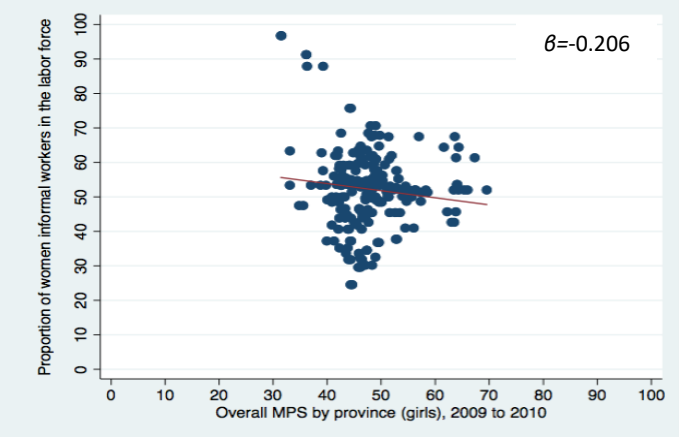
(A) Girls' MPS in Mathematics and proportion of informally employed women



(B) Girls' MPS in Science and proportion of informally employed women



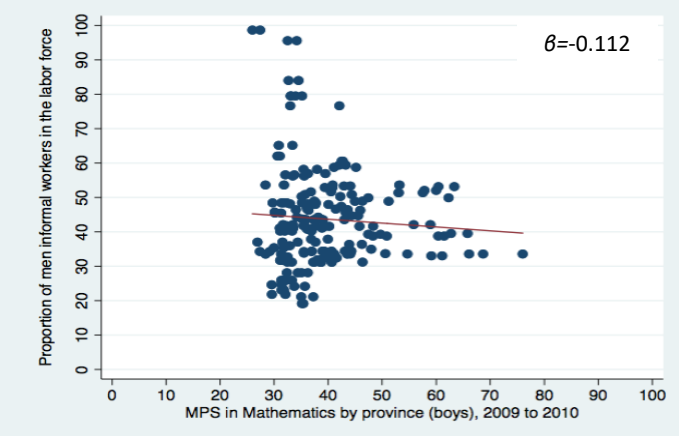
(C) Girls' MPS in English and proportion of informally employed women



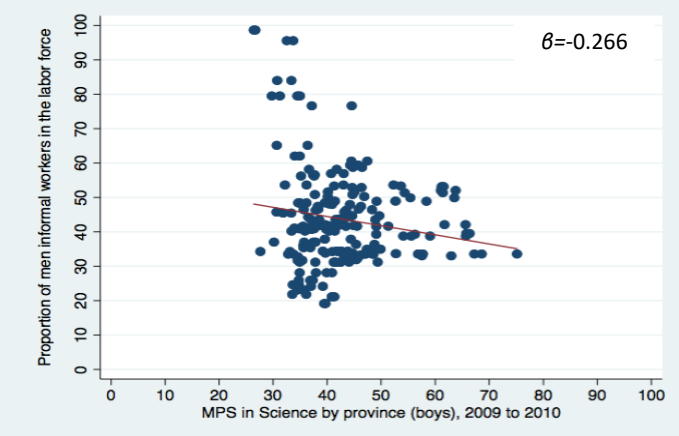
(D) Girls' overall MPS and proportion of informally employed women

Note: Figure drawn using data from the Annual Poverty Indicators Survey 2011 and the Department of Education.

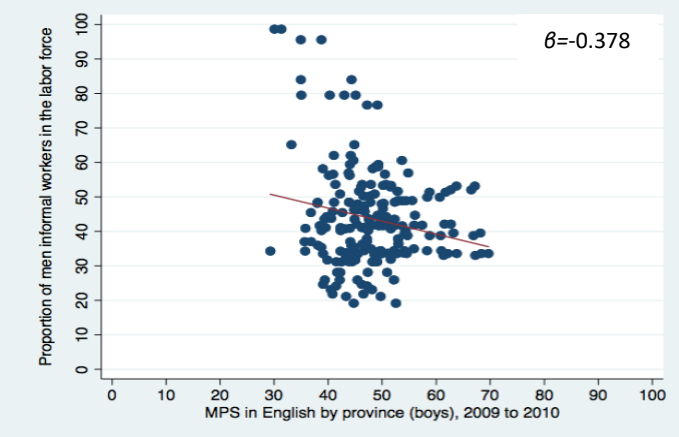
Figure 3.28: Provincial test scores (2009 and 2010) and proportion of informally employed women among employed women in the labor force aged 15 to 64 (2011), Philippines



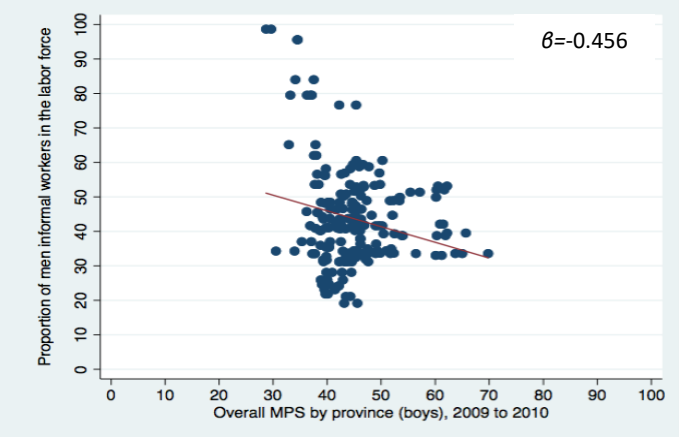
(A) Boys' MPS in Mathematics and proportion of informally employed men



(B) Boys' MPS in Science and proportion of informally employed men



(C) Boys' MPS in English and proportion of informally employed men



(D) Boys' overall MPS and proportion of informally employed men

Note: Figure drawn using data from the Annual Poverty Indicators Survey 2011 and the Department of Education.

Figure 3.29: Provincial test scores (2009 and 2010) and proportion of informally employed men among employed men in the labor force aged 15 to 64 (2011), Philippines

Tables

Table 3.1: Total number of National Achievement Tests takers, by gender, Philippines, 2005 to 2018

	Number of NAT takers	Percent
Girls	864,804	53.46
Boys	752,849	46.54
Total	1,617,653	100.00

Note: Estimates generated using data from the Department of Education.

Table 3.2: Overall mean percentage scores, by region, Philippines, 2005 to 2018

Region	2005	2008	2011	2014	2018
Region I - Ilocos Region	50.83	56.58	44.70	47.33	43.71
Region II - Cagayan Valley	47.29	44.08	45.51	52.91	45.85
Region III - Central Luzon	45.15	52.20	47.29	53.58	44.43
Region IV-A - CALABARZON	46.20	47.81	46.50	49.04	46.63
Region IV-B - MIMAROPA	49.89	50.70	48.08	56.39	44.71
Region V - Bicol Region	42.58	40.11	45.11	51.40	44.09
Region VI - Western Visayas	44.46	45.19	48.33	56.34	43.53
Region VII - Central Visayas	49.86	52.72	49.34	58.32	46.62
Region VIII - Eastern Visayas	58.57	65.16	59.73	59.40	45.48
Region IX - Zamboanga Peninsula	46.96	55.45	48.53	57.45	40.97
Region X - Northern Mindanao	46.37	47.30	49.32	55.13	45.67
Region XI - Davao Region	43.03	44.34	46.89	55.90	44.27
Region XII - SOCCSKSARGEN	43.81	46.68	48.18	54.11	41.72
NCR	45.16	43.84	47.54	55.12	48.87
CAR	46.68	48.68	47.09	54.35	48.08
ARMM	36.93	45.81	37.07	44.47	43.64
CARAGA Region	55.17	62.61	61.07	64.22	42.41
Total	46.84	49.15	47.92	53.79	45.12

Note: Estimates generated using data from the Department of Education.

Table 3.3: Overall mean percentage scores, by gender, Philippines, 2005 to 2018

Year	Girls	Boys	Total
2005	47.61	45.87	46.84
2006	48.46	45.44	47.10
2007	48.24	44.86	46.68
2008	50.34	47.80	49.15
2009	48.29	44.83	46.68
2010	47.00	43.97	45.58
2011	49.74	45.85	47.92
2012	50.59	47.09	48.96
2013	53.55	49.06	51.45
2014	55.84	51.49	53.79
2015	51.21	47.72	49.54
2017	46.75	41.53	44.31
2018	47.66	42.12	45.12
Total	49.84	46.25	48.17

Note: Estimates generated using data from the Department of Education.

Table 3.4: Difference in score means between boys and girls, by type of school and subject, Philippines, 2005 to 2018

Difference in MPS (girls-boys)	2005	2009	2012	2015	2018
Panel A. All schools (public and private)					
Mathematics	(n.a.)	1.47 ***	1.12 ***	1.91 ***	1.62 ***
Science	(n.a.)	2.31 ***	0.40 ***	1.53 ***	1.96 ***
English	(n.a.)	4.94 ***	4.00 ***	3.30 ***	7.47 ***
Overall	(n.a.)	3.46 ***	3.50 ***	3.49 ***	5.54 ***
Panel B. Public schools					
Mathematics	0.69 ***	1.27 ***	0.65 ***	1.68 ***	1.64 ***
Science	-0.38 ***	1.95 ***	0.13 ***	1.24 ***	2.05 ***
English	3.72 ***	4.42 ***	3.22 ***	2.74 ***	7.49 ***
Overall	1.74 ***	3.03 ***	2.91 ***	3.04 ***	5.57 ***
Panel C. Private schools					
Mathematics	(n.a.)	1.61 ***	2.16 ***	2.17 ***	1.64 ***
Science	(n.a.)	3.25 ***	0.87 ***	2.33 ***	1.55 ***
English	(n.a.)	7.44 ***	6.89 ***	5.51 ***	7.60 ***
Overall	(n.a.)	5.00 ***	5.39 ***	5.03 ***	5.51 ***

Note: Estimates generated using data from the Department of Education. There were no sample from private schools in 2005. The test of difference in means was conducted using the t-test for unequal variances (Welch correction). ∗∗∗, ∗∗, and ∗ indicate significance at the 1, 5, and 10 percent levels.

Table 3.5: OLS: Determinants of National Achievement Tests scores, by subject, Philippines, 2009 to 2018

Dependent variable: NAT scores	(1) Mathematics	(2) Science	(3) English	(4) Filipino	(5) Social Studies	(6) Critical Thinking	(7) Overall
Boy	-1.506***	-1.546***	-4.896***	-6.278***	-5.024***	-4.857***	-3.931***
	(0.037)	(0.031)	(0.032)	(0.026)	(0.031)	(0.049)	(0.025)
Public	6.180***	4.697***	-2.352***	0.931***	2.682***	-2.766***	2.128***
	(0.040)	(0.034)	(0.039)	(0.032)	(0.038)	(0.060)	(0.029)
R-squared	0.065	0.071	0.060	0.089	0.065	0.049	0.078
No. of observations	1,183,287	1,183,287	1,183,287	1,183,287	1,183,287	565,972	1,183,287

Note: Estimates generated using data from the Department of Education. Only years 2009 to 2018 have full sample of private and public schools. Control variables include regional dummies and exam year. Robust standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 3.6: First stage estimates (IV 2SLS): Effect of distance to city center on public and private schooling, Philippines, 2009 to 2018

Dependent variable: Public school	OLS	Probit
Distance	0.000***	0.001***
	(0.000)	(0.000)
Pseudo R-squared	0.0207	0.0211
No. of observations	1,183,287	1,183,287

Note: Estimates generated using data from the Department of Education. Only years 2009 to 2018 have full sample of private and public schools. Control variables include regional dummies and exam year. Robust standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 3.7: Second stage estimates (IV 2SLS): Determinants of National Achievement Tests scores, by subject, Philippines, 2009 to 2018

Dependent variable: NAT scores	(1) Mathematics	(2) Science	(3) English	(4) Filipino	(5) Social Studies	(6) Critical Thinking	(7) Overall
Boy	-1.150***	-1.323***	-5.013***	-6.636***	-5.263***	-5.323***	-3.981***
	(0.047)	(0.037)	(0.037)	(0.036)	(0.038)	(0.067)	(0.028)
Public	30.213***	19.756***	-10.263***	-23.214***	-13.441***	-35.288***	-1.209
	(1.466)	(1.163)	(1.177)	(1.113)	(1.192)	(2.041)	(0.892)
R-squared	-0.148	-0.048	0.028	-0.334	-0.071	-0.437	0.069
No. of observations	1,183,287	1,183,287	1,183,287	1,183,287	1,183,287	565,972	1,183,287

Note: Estimates generated using data from the Department of Education. Only years 2009 to 2018 have full sample of private and public schools. Control variables include regional dummies and exam year. Robust standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 3.8: Mean percentage scores of top science and remaining high schools, by subject and gender, Philippines, 2015

	Top science high schools					Remaining high schools				
	Mathematics	Science	English	Critical Thinking	Overall	Mathematics	Science	English	Critical Thinking	Overall
Girls	74.79	71.90	70.95	72.76	72.78	48.34	47.34	48.08	47.28	51.19
Boys	77.78	73.24	71.76	70.00	71.74	46.44	45.82	44.78	42.65	47.71
Total	75.96	72.42	71.26	71.68	72.37	47.43	46.61	46.51	45.06	49.53

Note: Estimates generated using data from the Department of Education. Overall MPS also includes Filipino and Social Studies. Top science high schools here include Philippine Science High School (various campuses), University of the Philippines Rural High School, Manila Science High School, Quezon Science High School, and Makati Science High School. Remaining high schools refer to the remaining regular science, public, and private high schools.

Table 3.9: OLS: Determinants of provincial-level National Achievement Tests scores, by gender, Philippines, 2010

Dependent variable: NAT scores in 2010	(1) Mathematics	(2) Science	(3) English	(4) Overall
Panel A. Sample: All provinces - girls and boys				
Proportion of households with electricity	0.505***	0.519***	0.445***	0.398***
	(0.163)	(0.168)	(0.129)	(0.125)
Proportion of households with computer	0.027	-0.020	0.056	-0.056
	(0.281)	(0.290)	(0.222)	(0.216)
Proportion of households with tv	-0.348**	-0.373**	-0.350***	-0.275**
	(0.144)	(0.148)	(0.113)	(0.110)
Proportion of households with telephone	-0.114	-0.012	0.148	0.039
	(0.175)	(0.180)	(0.138)	(0.134)
Proportion of households with radio	-0.153**	-0.141**	-0.112**	-0.118**
	(0.060)	(0.062)	(0.047)	(0.046)
Proportion of households with tube water in dwelling	0.008	0.004	0.009	0.003
	(0.053)	(0.055)	(0.042)	(0.041)
Proportion of households that own agricultural land	0.092	0.102*	0.082*	0.073
	(0.059)	(0.061)	(0.047)	(0.046)
Average years of schooling of women household heads	1.348*	1.845**	1.491**	1.460**
	(0.779)	(0.804)	(0.614)	(0.598)
Average years of schooling of men household heads	-2.201	-2.314	-1.327	-1.783
	(1.658)	(1.710)	(1.307)	(1.273)
R-squared	0.286	0.270	0.286	0.264
No. of observations	116	116	116	116

Table 3.9: ***(Continued)***

Dependent variable: NAT scores in 2010	(1) Mathematics	(2) Science	(3) English	(4) Overall
Panel B. Sample: All provinces - girls				
Proportion of households with electricity	0.487***	0.512***	0.419***	0.387***
	(0.168)	(0.172)	(0.128)	(0.126)
Proportion of households with computer	0.055	-0.052	0.010	-0.078
	(0.290)	(0.297)	(0.221)	(0.217)
Proportion of households with tv	-0.350**	-0.387**	-0.361***	-0.283**
	(0.148)	(0.151)	(0.113)	(0.111)
Proportion of households with telephone	-0.156	-0.046	0.135	0.013
	(0.180)	(0.184)	(0.137)	(0.134)
Proportion of households with radio	-0.151**	-0.141**	-0.115**	-0.120**
	(0.062)	(0.063)	(0.047)	(0.046)
Proportion of households with tube water in dwelling	0.009	0.007	0.010	0.004
	(0.054)	(0.056)	(0.042)	(0.041)
Proportion of households that own agricultural land	0.097	0.091	0.069	0.065
	(0.061)	(0.062)	(0.047)	(0.046)
Average years of schooling of women household heads	1.256	1.719**	1.462**	1.395**
	(0.802)	(0.821)	(0.612)	(0.600)
Average years of schooling of men household heads	-1.917	-2.059	-0.906	-1.462
	(1.706)	(1.746)	(1.301)	(1.276)
R-squared	0.277	0.254	0.281	0.255
No. of observations	116	116	116	116

Table 3.9: ***(Continued)***

Dependent variable: NAT scores in 2010	(1) Mathematics	(2) Science	(3) English	(4) Overall
Panel C. Sample: All provinces - boys				
Proportion of households with electricity	0.530***	0.528***	0.479***	0.414***
	(0.159)	(0.166)	(0.132)	(0.126)
Proportion of households with computer	0.001	0.013	0.101	-0.039
	(0.275)	(0.287)	(0.228)	(0.218)
Proportion of households with tv	-0.351**	-0.358**	-0.343***	-0.269**
	(0.140)	(0.146)	(0.116)	(0.111)
Proportion of households with telephone	-0.067	0.021	0.150	0.064
	(0.170)	(0.178)	(0.141)	(0.135)
Proportion of households with radio	-0.157***	-0.143**	-0.111**	-0.117**
	(0.059)	(0.061)	(0.048)	(0.046)
Proportion of households with tube water in dwelling	0.005	0.001	0.008	0.002
	(0.052)	(0.054)	(0.043)	(0.041)
Proportion of households that own agricultural land	0.087	0.116*	0.098**	0.082*
	(0.058)	(0.060)	(0.048)	(0.046)
Average years of schooling of women household heads	1.388*	1.951**	1.418**	1.471**
	(0.761)	(0.794)	(0.631)	(0.603)
Average years of schooling of men household heads	-2.436	-2.489	-1.544	-1.993
	(1.619)	(1.689)	(1.342)	(1.284)
R-squared	0.295	0.284	0.287	0.270
No. of observations	116	116	116	116

Note: Estimates generated using data from the Annual Poverty Indicators Survey 2008 and the 2010 NAT scores of the Department of Education. We use two-year lag in provincial characteristics (independent variables) since their effects on NAT scores more likely manifest in the succeeding years. We include other explanatory variables (proportion of households with cellular phone, proportion of households that received scholarship grants, proportion of households with member/s that experienced hunger, and average family income) but they yield insignificant results. Standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 3.10: OLS: Determinants of provincial-level National Achievement Tests scores, by gender, Philippines, 2015

Dependent variable: NAT scores in 2015	(1) Mathematics	(2) Science	(3) English	(4) Overall
Panel A. Sample: All provinces - girls and boys				
Proportion of households with electricity	0.245*	0.257**	0.192**	0.243***
	(0.131)	(0.099)	(0.078)	(0.079)
Proportion of households with computer	-0.202	-0.172*	-0.077	-0.128
	(0.130)	(0.098)	(0.077)	(0.078)
Proportion of households with tv	-0.237*	-0.227**	-0.173**	-0.197**
	(0.126)	(0.094)	(0.075)	(0.075)
Proportion of households with telephone	0.152	0.156	0.199**	0.161*
	(0.154)	(0.115)	(0.091)	(0.092)
Proportion of households with radio	0.021	0.024	0.029	0.005
	(0.060)	(0.045)	(0.035)	(0.036)
Proportion of households with tube water in dwelling	0.050	0.034	0.024	0.034
	(0.048)	(0.036)	(0.028)	(0.029)
Proportion of households that own agricultural land	0.173***	0.106**	0.100**	0.086**
	(0.065)	(0.048)	(0.038)	(0.039)
Average years of schooling of women household heads	0.184	0.421	0.213	0.207
	(0.592)	(0.444)	(0.351)	(0.354)
Average years of schooling of men household heads	0.921	0.389	0.144	0.446
	(1.188)	(0.891)	(0.706)	(0.712)
R-squared	0.235	0.210	0.177	0.208
No. of observations	114	114	114	114

Table 3.10: ***(Continued)***

Dependent variable: NAT scores in 2015	(1) Mathematics	(2) Science	(3) English	(4) Overall
Panel B. Sample: All provinces - girls				
Proportion of households with electricity	0.264*	0.263***	0.204***	0.249***
	(0.134)	(0.098)	(0.075)	(0.077)
Proportion of households with computer	-0.207	-0.170*	-0.067	-0.128*
	(0.132)	(0.097)	(0.075)	(0.076)
Proportion of households with tv	-0.248*	-0.229**	-0.173**	-0.193***
	(0.128)	(0.094)	(0.072)	(0.073)
Proportion of households with telephone	0.149	0.145	0.189**	0.148
	(0.157)	(0.115)	(0.088)	(0.090)
Proportion of households with radio	0.020	0.015	0.026	-0.002
	(0.061)	(0.045)	(0.034)	(0.035)
Proportion of households with tube water in dwelling	0.046	0.026	0.022	0.031
	(0.049)	(0.036)	(0.027)	(0.028)
Proportion of households that own agricultural land	0.172**	0.107**	0.089**	0.080**
	(0.066)	(0.048)	(0.037)	(0.038)
Average years of schooling of women household heads	0.103	0.389	0.179	0.177
	(0.602)	(0.443)	(0.340)	(0.346)
Average years of schooling of men household heads	1.297	0.660	0.418	0.736
	(1.209)	(0.889)	(0.682)	(0.695)
R-squared	0.235	0.208	0.173	0.210
No. of observations	114	114	114	114

Table 3.10: ***(Continued)***

Dependent variable: NAT scores in 2015	(1) Mathematics	(2) Science	(3) English	(4) Overall
Panel C. Sample: All provinces - boys				
Proportion of households with electricity	0.221*	0.248**	0.177**	0.236***
	(0.131)	(0.100)	(0.083)	(0.082)
Proportion of households with computer	-0.196	-0.173*	-0.093	-0.128
	(0.130)	(0.099)	(0.082)	(0.081)
Proportion of households with tv	-0.226*	-0.227**	-0.174**	-0.203**
	(0.125)	(0.096)	(0.079)	(0.079)
Proportion of households with telephone	0.157	0.171	0.217**	0.180*
	(0.153)	(0.118)	(0.097)	(0.096)
Proportion of households with radio	0.024	0.034	0.030	0.011
	(0.059)	(0.046)	(0.037)	(0.037)
Proportion of households with tube water in dwelling	0.055	0.041	0.024	0.037
	(0.048)	(0.037)	(0.030)	(0.030)
Proportion of households that own agricultural land	0.175***	0.105**	0.112***	0.091**
	(0.064)	(0.049)	(0.041)	(0.040)
Average years of schooling of women household heads	0.304	0.475	0.272	0.257
	(0.589)	(0.452)	(0.372)	(0.370)
Average years of schooling of men household heads	0.510	0.107	-0.146	0.149
	(1.184)	(0.908)	(0.747)	(0.744)
R-squared	0.231	0.210	0.183	0.205
No. of observations	114	114	114	114

Note: Estimates generated using data from the Annual Poverty Indicators Survey 2013 and the 2015 NAT scores of the Department of Education. We use two-year lag in provincial characteristics (independent variables) since their effects on NAT scores more likely manifest in the succeeding years. We include other explanatory variables (proportion of households with cellular phone, proportion of households that received scholarship grants, proportion of households with member/s that experienced hunger, and average family income) but they yield insignificant results. Standard errors in parentheses. ∗∗∗, ∗∗, and ∗ indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 3.11: OLS: Relationship between provincial test scores (2009 and 2010) and proportion of employed (2011), by gender, Philippines

Dependent variable: Proportion of employed (among those in the labor force aged 15 to 64)	(1)	(2)	(3)	(4)
Panel A. Sample: All provinces - women and men				
Provincial MPS in Mathematics	0.114*			
	(0.060)			
Provincial MPS in Science		0.142**		
		(0.059)		
Provincial MPS in English			0.191***	
			(0.071)	
Provincial Overall MPS				0.221***
				(0.076)
R-squared	0.018	0.028	0.034	0.040
No. of observations	202	202	202	202
Panel B. Sample: All provinces - women				
Provincial MPS in Mathematics (girls)	0.168*			
	(0.090)			
Provincial MPS in Science (girls)		0.223**		
		(0.090)		
Provincial MPS in English (girls)			0.403***	
			(0.109)	
Provincial Overall MPS (girls)				0.422***
				(0.117)
R-squared	0.017	0.029	0.064	0.061
No. of observations	202	202	202	202

Table 3.11: ***(Continued)***

Dependent variable: Proportion of employed (among those in the labor force aged 15 to 64)	(1)	(2)	(3)	(4)
Panel C. Sample: All provinces - men				
Provincial MPS in Mathematics (boys)	0.038			
	(0.038)			
Provincial MPS in Science (boys)		0.033		
		(0.038)		
Provincial MPS in English (boys)			0.001	
			(0.045)	
Provincial Overall MPS (boys)				0.019
				(0.048)
R-squared	0.005	0.004	0.000	0.001
No. of observations	202	202	202	202

Note: Estimates generated using data from the Annual Poverty Indicators Survey 2011 and the 2009 and 2010 NAT scores of the Department of Education. We use one-year and two-year lags in provincial NAT scores since their effects on employment more likely manifest in the succeeding years. Standard errors in parentheses. ∗∗∗, ∗∗, and ∗ indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 3.12: OLS: Relationship between provincial test scores (2009 and 2010) and proportion of formally employed (2011), by gender, Philippines

Dependent variable: Proportion of formally employed (among those in the labor force aged 15 to 64)	(1)	(2)	(3)	(4)
Panel A. Sample: All provinces - women and men				
Provincial MPS in Mathematics	0.073			
	(0.075)			
Provincial MPS in Science		0.187**		
		(0.074)		
Provincial MPS in English			0.326***	
			(0.088)	
Provincial Overall MPS				0.357***
				(0.094)
R-squared	0.005	0.031	0.065	0.067
No. of observations	202	202	202	202
Panel B. Sample: All provinces - women				
Provincial MPS in Mathematics (girls)	0.006			
	(0.062)			
Provincial MPS in Science (girls)		0.081		
		(0.062)		
Provincial MPS in English (girls)			0.252***	
			(0.074)	
Provincial Overall MPS (girls)				0.244***
				(0.080)
R-squared	0.000	0.009	0.055	0.045
No. of observations	202	202	202	202

Table 3.12: ***(Continued)***

Dependent variable: Proportion of formally employed (among those in the labor force aged 15 to 64)	(1)	(2)	(3)	(4)
Panel C. Sample: All provinces - men				
Provincial MPS in Mathematics (boys)	0.128			
	(0.095)			
Provincial MPS in Science (boys)		0.263***		
		(0.094)		
Provincial MPS in English (boys)			0.343***	
			(0.109)	
Provincial Overall MPS (boys)				0.424***
				(0.117)
R-squared	0.009	0.038	0.047	0.061
No. of observations	202	202	202	202

Note: Estimates generated using data from the Annual Poverty Indicators Survey 2011 and the 2009 and 2010 NAT scores of the Department of Education. We use one-year and two-year lags in provincial NAT scores since their effects on employment more likely manifest in the succeeding years. Standard errors in parentheses. ∗∗∗, ∗∗, and ∗ indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 3.13: OLS: Relationship between provincial test scores (2009 and 2010) and proportion of informally employed (2011), by gender, Philippines

Dependent variable: Proportion of informally employed (among those employed in the labor force aged 15 to 64)	(1)	(2)	(3)	(4)
Panel A. Sample: All provinces - women and men				
Provincial MPS in Mathematics	-0.047			
	(0.102)			
Provincial MPS in Science		-0.194*		
		(0.102)		
Provincial MPS in English			-0.372***	
			(0.121)	
Provincial Overall MPS				-0.400***
				(0.130)
R-squared	0.001	0.018	0.045	0.045
No. of observations	202	202	202	202
Panel B. Sample: All provinces - women				
Provincial MPS in Mathematics (girls)	0.066			
	(0.093)			
Provincial MPS in Science (girls)		-0.036		
		(0.093)		
Provincial MPS in English (girls)			-0.230**	
			(0.114)	
Provincial Overall MPS (girls)				-0.206*
				(0.122)
R-squared	0.003	0.001	0.020	0.014
No. of observations	202	202	202	202

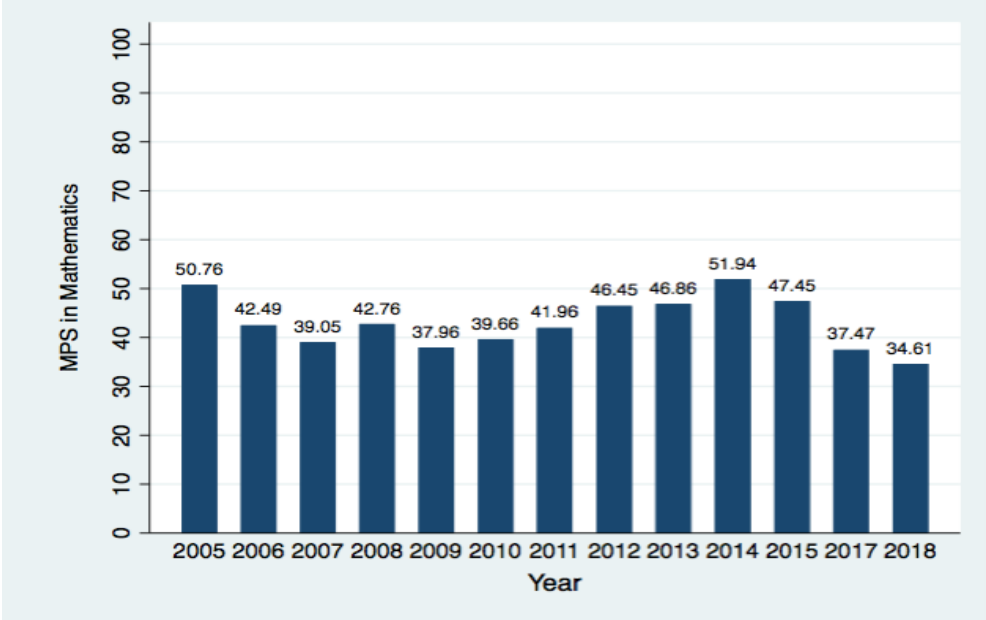
Table 3.13: ***(Continued)***

Dependent variable: Proportion of informally employed (among those employed in the labor force aged 15 to 64)	(1)	(2)	(3)	(4)
Panel C. Sample: All provinces - men				
Provincial MPS in Mathematics (boys)	-0.112			
	(0.114)			
Provincial MPS in Science (boys)		-0.266**		
		(0.113)		
Provincial MPS in English (boys)			-0.378***	
			(0.131)	
Provincial Overall MPS (boys)				-0.456***
				(0.141)
R-squared	0.005	0.027	0.040	0.049
No. of observations	202	202	202	202

Note: Estimates generated using data from the Annual Poverty Indicators Survey 2011 and the 2009 and 2010 NAT scores of the Department of Education. We use one-year and two-year lags in provincial NAT scores since their effects on employment more likely manifest in the succeeding years. Standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

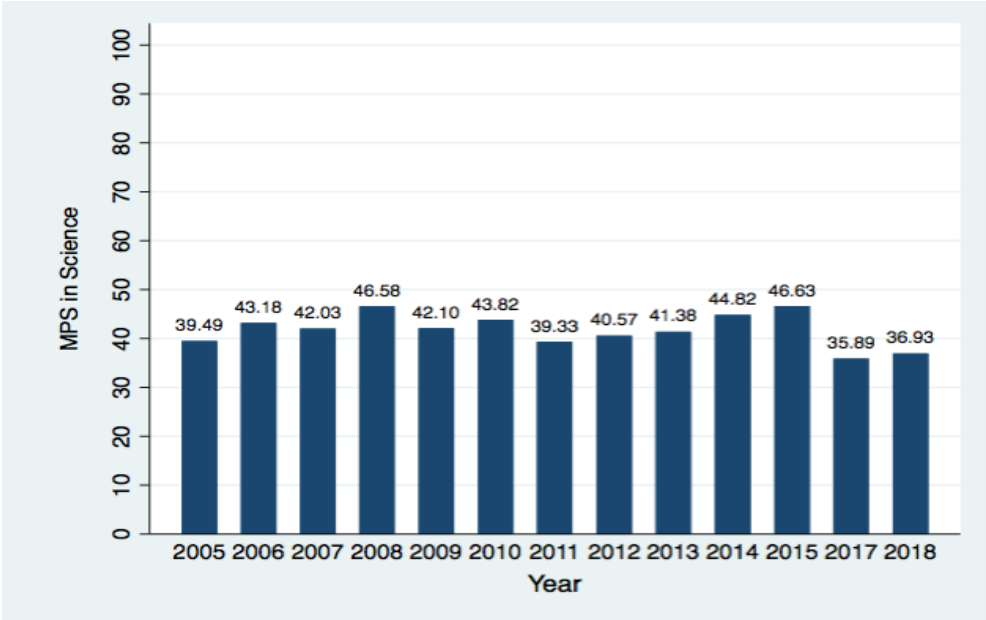
Appendices

Appendix Figures



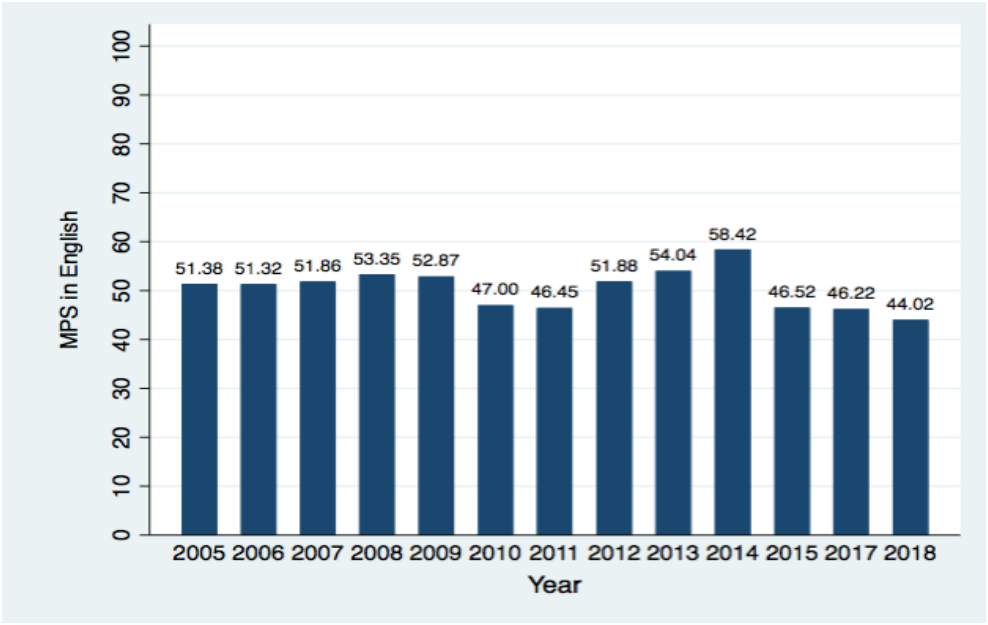
Note: Figure drawn using data from the Department of Education.

Appendix figure 3.1: Mean percentage scores in Mathematics, Philippines, 2005 to 2018



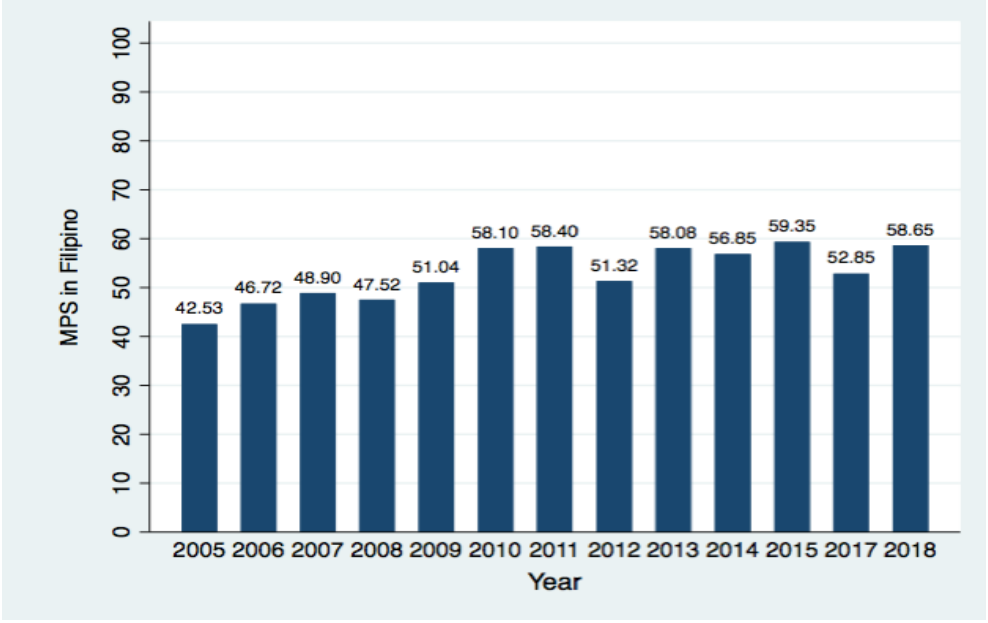
Note: Figure drawn using data from the Department of Education.

Appendix figure 3.2: Mean percentage scores in Science, Philippines, 2005 to 2018



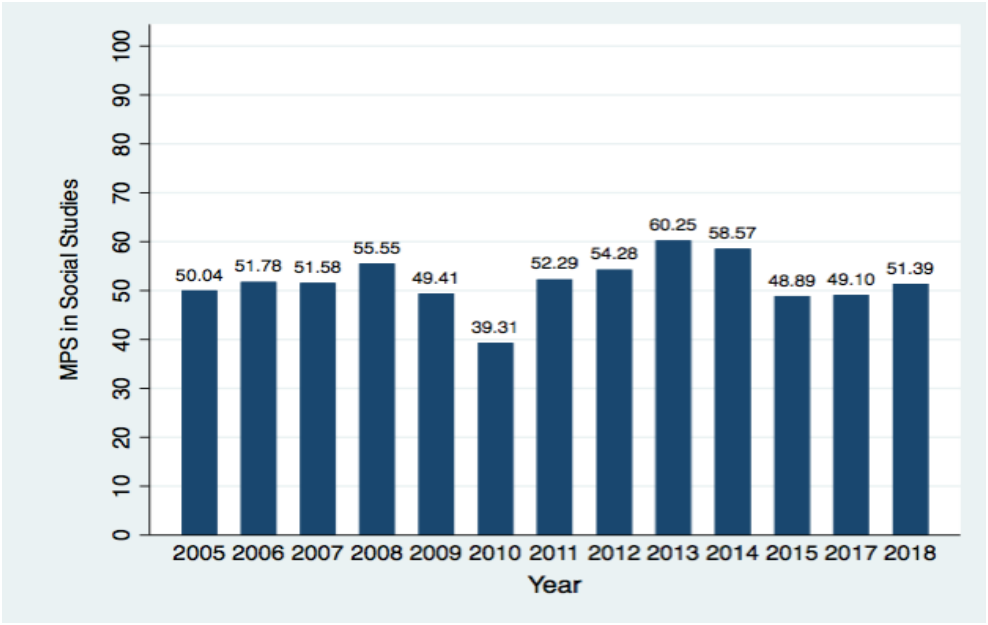
Note: Figure drawn using data from the Department of Education.

Appendix figure 3.3: Mean percentage scores in English, Philippines, 2005 to 2018



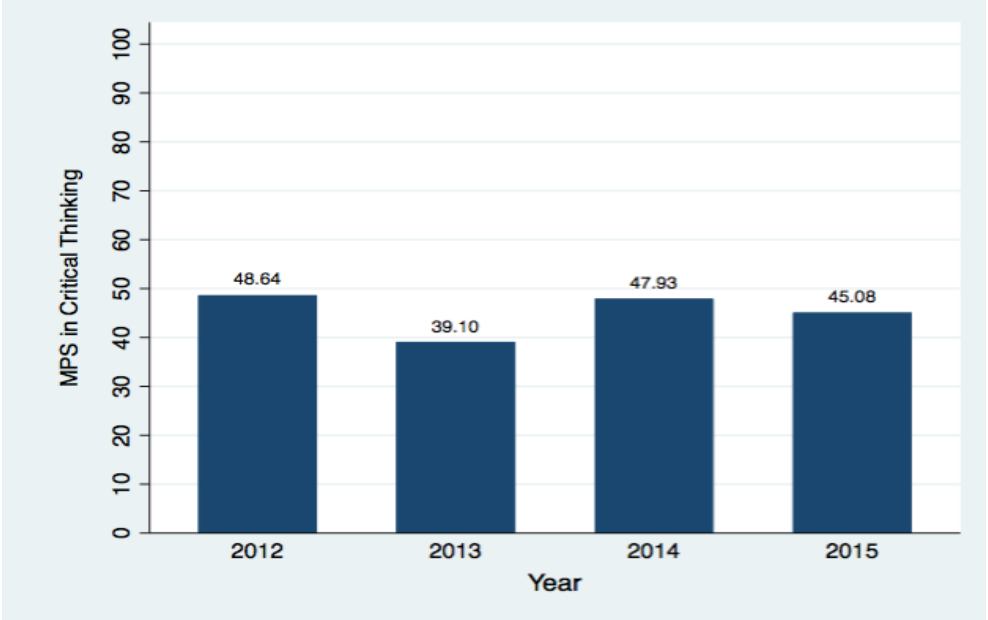
Note: Figure drawn using data from the Department of Education.

Appendix figure 3.4: Mean percentage scores in Filipino, Philippines, 2005 to 2018



Note: Figure drawn using data from the Department of Education.

Appendix figure 3.5: Mean percentage scores in Social Studies, Philippines, 2005 to 2018



Note: Figure drawn using data from the Department of Education.

Appendix figure 3.6: Mean percentage scores in Critical Thinking, Philippines, 2005 to 2018

Appendix Tables

Appendix table 3.1: Budget per student in public high schools, Philippine Science High Schools, and State Universities and Colleges, Philippines, 2015

	Budget	As % of total budget
Panel A. Public high schools		
Total (in PhP millions)	280,724	100.0
Personnel (in PhP millions)	194,331	69.2
Maintenance and other operating expenses (in PhP millions)	34,599	12.3
Capital outlay (in PhP millions)	51,794	18.5
Total budget per student	14,599	
Current budget per student	11,905	
Memorandum: Enrollment (thousand students)	19,299	
Panel B. Philippine Science High Schools		
Total (in PhP millions)	1,109	100.0
Personnel (in PhP millions)	371	33.5
Maintenance and other operating expenses (in PhP millions)	398	35.9
Capital outlay (in PhP millions)	341	30.7
Budget per student (target)	138,625	
Budget per actual student	170,799	
Current budget per student (target)	118,843	
Memoranda: Enrollment target (no. of students)	8,000	
Actual enrollment (no. of students), 2015	6,493	
Panel C. State Universities and Colleges		
Total (in PhP millions)	41,263	100.0
Personnel (in PhP millions)	22,644	54.8
Maintenance and other operating expenses (in PhP millions)	10,366	25.1
Capital outlay (in PhP millions)	8,254	20.0
Budget per student	29,141	
Current budget per student	23,312	
Memorandum: Enrollment (thousand students)	1,416	

Note: Compiled by Tan (2017) from the Department of Budget and Management, National Expenditure Program, 2015; National Statistics Office 2015 Statistical Yearbook; Philippine Science High School; and Commission on Higher Education.

Appendix table 3.2: Trends in International Mathematics and Science Study (TIMSS) ranking and scores, selected countries, Grade 8 pupils, 2003

Rank and Country	Mathematics	Rank and Country	Science
1. Singapore	605	1. Singapore	578
2. Korea	589	2. Taipei	571
3. Hong Kong	586	3. Korea	558
4. Taipei	585	4. Hong Kong	556
5. Japan	570	5-6. Japan	552
10. Malaysia	508	9-10. US	527
15. US	504	20. Malaysia	510
Average	467	Average	474
34. Indonesia	411	36. Indonesia	420
40. Morocco	387	39. Morocco	396
41. Philippines	378	42. Philippines	377
42. Botswana	366	43. Botswana	365
44. Ghana	276	44. Ghana	255
45. South Africa	264	45. South Africa	244

Note: Data from the IEA reports (2004), accessed from https://timssandpirls.bc.edu/PDF/t03_download/T03INTLMATRPT.pdf and https://timssandpirls.bc.edu/PDF/t03_download/T03INTLSCIRPT.pdf on 1 February 2020.

Appendix table 3.3: Programme for International Student Assessment (PISA) ranking and scores in Mathematics, selected countries, 15-year-old pupils, 2018

Rank	Country	Score
1	China (Beijing, Shanghai, Jiangsu, Zhejiang)	591
2	Singapore	569
3	Macao	558
4	Hong Kong, China	551
5	Taiwan	531
6	Japan	527
7	South Korea	526
8	Estonia	523
9	Netherlands	519
10	Poland	516
50	United Arab Emirates	435
51	Brunei	430
	Romania	430
	Montenegro	430
54	Kazakhstan	423
55	Moldova	421
56	Azerbaijan	420
57	Thailand	419
58	Uruguay	418
59	Chile	417
60	Qatar	414
61	Mexico	409
62	Bosnia and Herzegovina	406
63	Costa Rica	402
64	Jordan	400
	Peru	400
66	Georgia	398
67	North Macedonia	394
68	Lebanon	393
69	Colombia	391
70	Brazil	384
71	Argentina	379
	Indonesia	379
73	Saudi Arabia	373
74	Morocco	368
75	Kosovo	366
76	Panama	353
	Philippines	353
78	Dominican Republic	325

Note: Data from the OECD (2019), accessed from https://www.oecd.org/pisa/PISA%202018%20Insights%20and%20Interpretations%20FINAL%20PDF.pdf on 1 February 2020.

Appendix table 3.4: Programme for International Student Assessment (PISA) ranking and scores in Science, selected countries, 15-year-old pupils, 2018

Rank	Country	Score
1	China (Beijing, Shanghai, Jiangsu, Zhejiang)	590
2	Singapore	551
3	Macao	544
4	Estonia	530
5	Japan	529
6	Finland	522
7	South Korea	519
8	Canada	518
9	Hong Kong, China	517
10	Taiwan	516
50	Brunei	431
51	Jordan	429
52	Moldova	428
53	Romania	426
54	Thailand	426
	Uruguay	426
56	Bulgaria	424
57	Mexico	419
	Qatar	419
59	Albania	417
60	Costa Rica	416
61	Montenegro	415
62	Colombia	413
	North Macedonia	413
64	Argentina	404
	Brazil	404
	Peru	404
67	Azerbaijan	398
	Bosnia and Herzegovina	398
69	Kazakhstan	397
70	Indonesia	396
71	Saudi Arabia	386
72	Lebanon	384
73	Georgia	383
74	Morocco	377
75	Kosovo	365
	Panama	365
77	Philippines	357
78	Dominican Republic	336

Note: Data from the OECD (2019), accessed from https://www.oecd.org/pisa/PISA%202018%20Insights%20and%20Interpretations%20FINAL%20PDF.pdf on 1 February 2020.

Appendix table 3.5: Programme for International Student Assessment (PISA) ranking and scores in Reading, selected countries, 15-year-old pupils, 2018

Rank	Country	Score
1	China (Beijing, Shanghai, Jiangsu, Zhejiang)	555
2	Singapore	549
3	Macao	525
4	Hong Kong, China	524
5	Estonia	523
6	Canada	520
7	Finland	520
8	Ireland	518
9	South Korea	514
10	Poland	512
50	Cyprus	424
	Moldova	424
52	Montenegro	421
53	Bulgaria	420
	Mexico	420
55	Jordan	419
56	Malaysia	415
57	Brazil	413
58	Colombia	412
59	Brunei	408
60	Qatar	407
61	Albania	405
62	Bosnia and Herzegovina	403
63	Argentina	402
64	Peru	401
65	Saudi Arabia	399
66	North Macedonia	393
	Thailand	393
68	Azerbaijan	389
69	Kazakhstan	387
70	Georgia	380
71	Panama	377
72	Indonesia	371
73	Morocco	359
74	Kosovo	353
	Lebanon	353
76	Dominican Republic	342
77	Philippines	340

Note: Data from the OECD (2019), accessed from https://www.oecd.org/pisa/PISA%202018%20Insights%20and%20Interpretations%20FINAL%20PDF.pdf on 1 February 2020.

Appendix table 3.6: Programme for International Student Assessment (PISA) ranking and scores in Mathematics, Science, and Reading, selected countries, 15-year-old pupils, 2018

Rank	Country	Score
1	China (Beijing, Shanghai, Jiangsu, Zhejiang)	579
2	Singapore	556
3	Macao	542
4	Hong Kong, China	531
5	Estonia	525
6	Japan	520
7	South Korea	520
8	Canada	517
	Taiwan	517
10	Finland	516
50	Bulgaria	427
51	Moldova	424
52	Uruguay	424
53	Brunei	423
54	Montenegro	422
55	Albania	420
56	Jordan	416
	Mexico	416
58	Costa Rica	415
59	Qatar	413
60	Thailand	413
61	Colombia	405
62	Kazakhstan	402
	Azerbaijan	402
64	Bosnia and Herzegovina	402
65	Peru	402
66	Brazil	400
67	North Macedonia	400
68	Argentina	395
69	Georgia	387
70	Saudi Arabia	386
71	Indonesia	382
72	Lebanon	377
73	Morocco	368
74	Panama	365
75	Kosovo	361
76	Philippines	350
77	Dominican Republic	334

Note: Data from the OECD (2019), accessed from https://www.oecd.org/pisa/PISA%202018%20Insights%20and%20Interpretations%20FINAL%20PDF.pdf on 1 February 2020.

Appendix table 3.7: Proximity to major city centers, Philippines, by island group and school division

Island group	Nearest major city center	Division name	Distance (km)
Luzon	NCR	Alaminos City	247
		Batac City	468
		Candon City	344
		Dagupan City	219
		Ilocos Norte	506
		Ilocos Sur	368
		La Union	269
		Laoag City	485
		Pangasinan I (Lingayen)	223
		Pangasinan II (Binalonan)	199
		San Carlos City	210
		San Fernando City	269
		Urdaneta City	188
		Vigan City	406
		Batanes	658
		Cagayan	589
		Cauayan City	398
		Ilagan City	431
		Isabela	412
		Nueva Vizcaya	287
		Quirino	379
		Santiago City	357
		Tuguegarao City	481
		Angeles City	86.4
		Aurora	318
		Balanga City	121
		Bataan	129
		Bulacan	37.7
		Cabanatuan City	113
		Gapan City	95.2
		Mabalacat City	90.3
		Malolos City	42.3
		Meycauayan City	19.6
		Muñoz Science City	175
		Nueva Ecija	131
		Olongapo City	114
		Pampanga	81.1

Appendix table 3.7: ***(Continued)***

Island group	Nearest major city center	Division name	Distance (km)
		San Fernando City	71
		San Jose City	190
		San Jose Del Monte City	33.6
		Tarlac	130
		Tarlac City	130
		Zambales	255
		Albay	458
		Camarines Norte	345
		Camarines Sur	414
		Catanduanes	580
		Iriga City	422
		Legaspi City	478
		Ligao City	463
		Masbate	570
		Masbate City	574
		Naga City	386
		Sorsogon	607
		Sorsogon City	532
Luzon	NCR	Tabaco City	466
		Caloocan City	0
		Las Piñas City	0
		Makati City	0
		Malabon / Navotas	0
		Malabon City	0
		Mandaluyong City	0
		Manila	0
		Marikina City	0
		Muntinlupa City	0
		Navotas City	0
		Parañaque City	0
		Pasay City	0
		Pasig City	0
		Pasig City / San Juan	0
		Quezon City	0
		San Juan City	0
		Taguig / Pateros	0
		Valenzuela City	0

Appendix table 3.7: ***(Continued)***

Island group	Nearest major city center	Division name	Distance (km)
Luzon	NCR	Abra	0
		Apayao	0
		Baguio City	0
		Benguet	0
		Ifugao	0
		Kalinga	0
		Mt. Province	0
		Tabuk City	0
		Antipolo City	13.7
		Bacoor	33.2
		Batangas	82.8
		Batangas City	109
		Cabuyao	51.5
		Calamba City	53.5
		Cavite	56.7
		Cavite City	41
		Dasmariñas	50.1
		Imus	31.6
		Laguna	103
		Lipa City	84.9
		Lucena City	133
		Quezon	187
		Rizal	41.9
		San Pablo City	83.7
		Sta. Rosa City	51.3
		Tanauan City	68.4
		Tayabas City	142
		Calapan City	184
		Marinduque	158
		Occidental Mindoro	522
		Oriental Mindoro	237
		Palawan	878
		Puerto Princesa City	811
		Romblon	263

Appendix table 3.7: ***(Continued)***

Island group	Nearest major city center	Division name	Distance (km)
Visayas	Cebu City	Aklan	409
		Antique	460
		Bacolod City	216
		Bago City	195
		Cadiz City	215
		Capiz	303
		Escalante City	136
		Guimaras	140
		Himamaylan	166
		Iloilo	291
		Iloilo City	291
		Kabankalan City	180
		La Carlota City	176
		Negros Occidental	150
		Passi City	278
		Roxas City	324
		Sagay City	151
		San Carlos City	127
		Silay City	231
		Bais City	161
		Bayawan City	233
		Bogo City	96.6
		Bohol	75.6
		Carcar City	39.1
		Cebu	0

Appendix table 3.7: ***(Continued)***

Island group	Nearest major city center	Division name	Distance (km)
Visayas	Cebu City	Cebu City	0
		Danao City	47.3
		Dumaguete City	169
		Guihulngan	104
		Lapu-Lapu City	18.6
		Mandaue City	7.6
		Naga City - R7	24.8
		Negros Oriental	184
		Siquijor	171
		Tagbilaran City	92.7
		Talisay City	228
		Tanjay City	199
		Toledo City	46.2
		Baybay City	254
		Biliran	233
		Borongan City	449
		Calbayog City	431
		Catbalogan City	371
		Eastern Samar	427
		Leyte	197
		Maasin City	329
		Northern Samar	547
		Ormoc City	200
		Samar (Western)	310
		Southern Leyte	358
		Tacloban City	259

Appendix table 3.7: ***(Continued)***

Island group	Nearest major city center	Division name	Distance (km)
		Dapitan City	273
		Dipolog City	300
		Isabela City	558
		Pagadian City	227
		Zamboanga City	495
		Zamboanga Del Norte	335
		Zamboanga Del Sur	244
		Zamboanga Sibugay	414
		Bukidnon	112
		Cagayan De Oro City	0
		Camiguin	121
		El Salvador City	21.3
		Gingoog City	101
		Iligan City	92.5
		Lanao Del Norte	186
		Malaybalay City	101
		Misamis Occidental	189
		Misamis Oriental	10
		Oroquieta City	189
		Ozamis City	160
		Tangub City	172
Mindanao I	Cagayan de Oro City	Valencia City	144
		Basilan	559
		Lamitan	537
		Lanao Del Sur I-A	110
		Lanao Del Sur I-B	110
		Lanao Del Sur II-A	110
		Lanao Del Sur II-B	110
		Maguindanao I	235
		Maguindanao II	235
		Marawi City	99.2
		Sulu I	721
		Sulu II	721
		Tawi-Tawi	635
		Agusan Del Norte	175
		Butuan City	180
		Cabadbaran City	209
		Dinagat Island	439
		Siargao	219
		Surigao City	303
		Surigao Del Norte	308
		Surigao Del Sur	278
		Tandag City	352

Appendix table 3.7: ***(Continued)***

Island group	Nearest major city center	Division name	Distance (km)
		Compostela Valley	139
		Davao City	0
		Davao Del Norte	80.7
		Davao Del Sur	0
		Davao Oriental	263
		Digos City	62
		Island Garden City of Samal	44.3
		Mati City	179
		Panabo City	54.3
		Tagum City	76.4
Mindanao II	Davao City	Cotabato City	225
		General Santos City	148
		Kidapawan City	114
		Koronadal City	203
		North Cotabato	103
		Sarangani	207
		South Cotabato	222
		Sultan Kudarat	226
		Tacurong City	170
		Agusan Del Sur	166
		Bayugan City	264
		Bislig City	223

Note: Adapted from Quimba (2016). Distance (in kilometers) means distance to the nearest major city center via the fastest possible route based on Google Maps.

Chapter 4

Conclusions and Policy Implications

4.1. Overview and main findings

The education sector of the Philippines continues to face challenges that are similar to the rest of the developing world. These include gender gaps in education and labor market outcomes and consistently low learning performance. This dissertation showed that secondary education policies positively affected schooling attainment. However, disparities in learning levels, employment outcomes, and returns to education between girls and boys remained apparent.

4.1.1. Main issues in the education and labor market sector

Despite the rising rates of global and national school participation, data reveal that enrollment tends to fall as children enter secondary and tertiary school. Likewise, gaps in enrollment between genders and income groups are evident. Reports also show that the rise in enrollment does not necessarily lead to improvements in test scores. The Philippines face consistently low learning outcomes. In fact, Filipino students exhibit poor ranking and performance in both international (i.e., Trends in International Mathematics and Science Study [TIMSS] and Programme for International Student Assessment [PISA]) and local standardized exams (i.e., National Achievement Test [NAT]). Additionally, data reveal apparent gender gaps in test scores in favor of girls across critical subject areas (Mathematics, Science, and English). These indicate that the Philippines is currently facing a learning crisis.

Such phenomenon indicates that the Filipinos continue to face challenges in achieving the Sustainable Development Goal 4 which aims to ensure inclusive and equitable quality education for all individuals from 2015 to 2030. Further, inequities in the labor market persist due to variation in skills gained from schooling and labor market imperfections. Data from the Labor Force Surveys show that men tend to participate more in the formal job market, while women work in informal, vulnerable job sectors even if women have higher learning achievements than men.

4.1.2. Objectives and main findings of the study

In the first analytical chapter (Chapter 2), we evaluated the effect of two significant secondary education reforms (R.A. 6655 and R.A. 6728) in the late 1980s. The two policies eliminate or subsidize school fees in public and private schools, allowing parents to send their children to school at a minimal cost. The chapter used a quasi-experimental technique called the regression discontinuity design to compare schooling attainment between policy beneficiaries and non-beneficiaries and explore the effect of schooling on labor market outcomes (i.e., formal and informal employment and individual income).

To our knowledge, no rigorous impact assessment of R.A. 6655 and R.A. 6728 had been conducted in the Philippines. We hypothesized that free and subsidized secondary education are expansionary educational reforms that promote school participation, increase educational attainment, raise the probability of being employed, and improve income.

In Chapter 2, we found that the treatment group (composed of those who were exposed to the policies) has significantly more years of schooling than the control group (composed of those who were not exposed to the policies). This is true across various specifications and bandwidths, which means that the policies indeed helped improve schooling attainment. In general, women have more years of schooling than men before and after program implementation. We also observed that years of schooling significantly increases the probability of being formally employed and decreases the chances of being informally employed (though the results are not statistically significant). We noted some mechanisms that could possibly contribute to this weak correlation between schooling and employment. These include labor market contraction, low labor demand, labor market imperfections, individual's choice to be unemployed, and poor skills training in schools. In terms of income, we showed that schooling generally leads to an increase in earnings. However, our analysis by sector and gender revealed that returns to education are statistically significant only among informally employed women and formally employed men. The heterogeneity of our findings indicates the existence of labor market imperfections that are not favorable to women's labor market participation. Evidently, women are at a disadvantage in employment due to more time spent in domestic and care work, lower access to land and credit, and market and institutional failures.

Given the results from Chapter 2, we fail to reject our hypotheses that the policies increase educational attainment and that schooling leads to higher income. However, we reject our hypothesis that schooling improves employment possibility.

We conclude that the secondary education reforms of the late 1980s improved schooling attainment but did not necessarily result to equal labor market outcomes across sectors and between genders. Our findings highlighted the significant effect of schooling

on the earnings of women in the informal sector and men in the formal sector, indicating gender segregation in employment and the need to expand formal sector work opportunities for women.

The second analytical chapter (Chapter 3) focuses on the learning outcomes of Filipino children. We explored the differences in academic performance of girls and boys, the household-related factors that affect their test scores, and the downstream impact of test scores on the proportion of working age individuals who are employed, formally employed, and informally employed at the provincial-level. The chapter utilized ordinary least squares (OLS) and two-stage least squares (2SLS) regressions.

We presented three hypotheses. First, gender remains to be an important factor in determining test scores, with girls performing better than boys. Second, household-level characteristics (such as infrastructure and parental background) affect learning outcomes. Lastly, despite higher test scores among girls, labor market outcomes tend to favor boys.

In Chapter 3, empirically, we found that girls were way ahead of boys in Mathematics, Science, and English skills. We proved this using data from the National Achievement Test (NAT) scores from 2005 to 2018. Previous literature showed that, indeed, boys tend to have lower motivation to study, lack personal interest, are more prone to peer pressure and vices (i.e., smoking, drinking, and playing gadgets), and are affected by norms and traditions of needing to work (i.e., in the farm) at an early age. Further, we reported that household and parental characteristics, such as access to electricity, agricultural land ownership, mother's schooling attainment, ownership of TV, and ownership of radio, significantly affect NAT scores. Specifically, electrification, land assets, and mother's skills were positively associated with student performance, while the opposite is true for household ownership of TV and radio. These findings are consistent

with previous studies in other countries. In our next analyses, we estimated the effect of test scores on provincial employment levels. In the case of test scores and formal employment, the correlations are higher among men than among women. This means that men are more likely to work in the formal sector, despite having lower test scores than women. We emphasized that higher Science scores were not significantly correlated with formal employment of women, indicating that women appear to be less represented in occupations involving scientific skills. In terms of informal work, exam performance does not significantly (or only weakly) affect the proportion of informally employed women, whereas test scores significantly decrease the proportion of informally employed men. Evidently, women's better academic performance does not necessarily lead to lower participation in informal employment. In contrast, men are less likely to work in the informal sector as their scores increase.

Given the results from Chapter 3, we fail to reject our three hypotheses that gender is an important factor in determining test scores, household-level variables affect learning outcomes, and labor market outcomes tend to favor boys despite better school performance among girls.

We conclude that though girls outperform boys academically, employment outcomes tend to favor men. As discussed in Chapter 2, women continue to face labor market imperfections, leading them to settle in low-skilled informal work. Thus, women need protection in vulnerable occupations and more opportunities to enter formal work. In addition, household characteristics tend to dictate school performance as well. We proved that girls' and boys' scores respond either positively or negatively to certain household infrastructure and parental characteristics. In relation to policy-making, electrification programs, promotion of educational TV shows, protection of family rights

to asset ownership, and support for women's education could contribute to better student performance.

4.2. Policy implications

Based on the main findings of the study, we present a 5-point policy strategy to address the observed gender disparities in schooling, learning, and labor market outcomes.

Targeted policies on schooling. The government could continue to implement or support secondary education policies that lower the cost of schooling. However, given that enrollment rate tends to decrease from primary to secondary school, policies can be modified to specify groups to be targeted (i.e., boys from poorest rural areas). The Philippines could likewise introduce more coherent programs on school-labor market linkages that ensure the participation of women graduates in male-dominated sectors, especially in wage or salaried employment.

Interventions for women workers. To help expand women's opportunities in the formal sector, the government could establish gender employment quotas in selected occupations, provide day care services, and encourage men to assist in domestic and care work. Alternatively, it could craft policies that strengthen the social protection or insurance of workers in the informal sector, where a lot of women are employed.

School initiatives on enhancing learning. In terms of improving the quality of education, the government could encourage schools to adapt the best practices and steps taken by other countries. Schools could implement programs that enhance boys' schooling and learning, such as adjusting the level of instruction based on boys' needs, developing more interactive teaching methods to keep boys motivated in studying (i.e.,

activity-based learning approach), encouraging boys to communicate more with the teachers, increasing the number of male instructors, and raising awareness on the negative effects of vices and gadgets on study habits. The schools could likewise encourage parents to prioritize boys' schooling and learning by informing them of the long-term benefits of education and adverse effects of child labor. The DepEd has recently released a statement emphasizing some key reforms to improve the skills of Filipino students. This came as a response to the low scores of Filipino participants in the PISA 2018[71].

Infrastructure improvements and institutional changes. From a macroeconomic standpoint, the government could expand electrification in rural areas, create educational TV shows that teach, for instance, Science and Mathematics in an interactive way, protect family's rights on asset ownership, promote policies that support mothers' schooling (i.e., conditional cash transfer programs that target girls) as these measures were shown to improve children's test scores. Indeed, the Philippines needs to explore more creative solutions to eliminate learning poverty.

Promotion of a multi-sectoral approach. The study further recommends a holistic approach in dealing with the gender disparities in educational and employment outcomes. This is vital in implementing the first 4 strategies that we mentioned above. A multi-sectoral approach involves the participation of the government, school administrations, industries, and other stakeholders in improving education access and quality, increasing the demand for skills, balancing labor market participation of women and men in various sectors, evaluating market signals, and addressing labor market imperfections.

[71] See https://www.deped.gov.ph/2019/12/04/statement-on-the-philippines-ranking-in-the-2018-pisa-results/, accessed on 20 February 2020.

4.3. Directions for future research

Taken as a whole, this dissertation demonstrated the developments and challenges in the Philippine basic education system and labor market sector. It could be utilized by researchers from other countries who are interested in evaluating the gender-based impact of education policies on various outcomes (i.e., schooling attainment, employment, and income) and exploring the learning achievements of girls and boys as a means to develop relevant policies and solutions.

On a final note, we mention that this dissertation opens doors for further research, as our analyses were limited to the data available at the time of study. We recommend using more recent datasets once they become available, investigating and comparing other subgroups of the population (i.e., low-income vs. high-income), utilizing other econometric techniques such as the regression kink design and difference-in-differences, and applying the same quasi-experimental methods in evaluating more current education policies such as the K to 12 program and free public tertiary education. We also highlight the need to improve the collection and organization of Philippine sex-disaggregated data at the municipal, provincial, and regional levels.

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