Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

[Research Full Article]

# Gender-Preferential Intergenerational Patterns in Primary Educational Attainment: An Econometric Approach to a Case in Rural Mindanao, the Philippines

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*Abstract*

This study investigates the factors determining children's educational attainment, focusing on gender-differential intergenerational patterns, by employing a case study from rural Mindanao. The result mainly shows, unlike general trends in developing countries, educational attainment is more favorable for girls; maternal education level is equally associated with daughters' and sons' education levels, and paternal education level is preferentially favorable to their sons. To reduce the disparity, suggestions include providing boy-specific interventions to enhance the magnitude of the father–son educational virtuous circle and comparing the magnitude of gender-equal maternal and boy-preferential paternal education influences to specify which effect is larger.

*Keywords*: Gender-preferential intergenerational patterns; Elementary education; Delays in schooling; Limited dependent variable regression; Rural Mindanao; Philippines

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Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

# 1 Introduction

The role and significance of education in development cannot be overly emphasized. Education has long been granted a central role in international development. Simultaneously, insufficient demand for education in developing economies despite expected returns has been an issue of concern (Jimenez and Sawada, 2001; Maholmes and King (Eds), 2012). Demand patterns can always vary not only at the individual level but also across social groups and strata. Despite the abundant literature demonstrating positive evidence regarding education and development in developing countries, it is therefore worthy of exploring why one group receives less education than others.

This study specifically focuses on intergenerational gender-differential patterns of education as an element of the disequilibrium or inequality issues. With regard to gender and education in developing countries, international gender-focused education cooperation has specifically targeted girls' and women's education (Tembon and Fort, 2008; Unterhalter, 2010; Nguyen and Scripter, 2013). Certainly, the essentiality and centrality of problems with girls' and women's education cannot be overemphasized, but issues concerning boys' and men's educational attainment should not be ignored (Jha et al. 2012; Heyneman and Stern, 2015: for the Philippine case, see Miralao 2008)[1]. Regarding gender-differential issues in education, it is also important to consider intergenerational factors or parent-child relations (Alderman and King, 1998; UNICEF, 2003; Gorman-Smith et al., 2012; Bhagowati, 2014). Although quite a few countries suffer from insufficient girl's education, other countries show a pattern of gender parity inverted from the global trend of disadvantaged girls.[2] Accordingly, perspectives looking at both genders are necessary as issues pertaining to boys' and men's education have formed the focus of the *Education for All (EFA) Global Monitoring Report 2003/04*.

The Philippines, the country on which this study focuses, is one such country. It received praises for its ability to achieve a relatively high standard of educational attainment compared to other developing countries in the 1980s (Nakanishi, 1990; Tomas, 2013). Subsequently, coming into harmony with the international movement toward EFA, the country's primary education sector became a focus for expansion and improvement. Philippine primary[3] education became free and compulsory in accordance with a new

[1] Miralao (2008) calls this issue a "boy crisis."

[2] For terminological differences between gender parity and gender equality, see Chisamaya *et al.* (2012).

[3] In the Philippines context, grades 1–4 are known as primary schools while grades 5–6 are known

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

constitution resolved in 1986 and ratified in 1987 under the Corazon Aquino administration (Ichikawa, 1999; Tanodra, 2003; Tomas, 2013). [4] Traditionally, girls and women in the Philippines seem to have been educated relatively well, unlike in some other developing countries where providing girl's education has been a great challenge.

In turn, the Philippines has long suffered from poverty, prevailing images of which can be its slums or the Smoky Mountain. However, recent development studies have revealed that poverty has begun to ease, partially due to the contribution of education in poverty alleviation in rural areas (Maluccio, 1998; Estudillo *et al*., 2008; Estudillo *et al*., 2009), which are home to a sizeable percentage of poor and potential poor people. This may seem like small inroads when considering the Philippines' development and poverty issues. However, the implications and impact of these improvements are more widespread. The urban poor, seemingly a symbol of poverty in this country, are linked to the rural poor, which is one trigger for emigration from rural to urban areas. Even in the 1990s, the importance of rural development had been recognized (Nakanishi, 1991). Therefore, targeting rural areas and education is necessary (Otsuka and Sakurai, 2007) not only for improving rural areas, but also for the possible knock-on effects on urban poverty. As will be discussed in the next section, this study examines the case of rural Mindanao, a place where education is a social challenge and an area that has been relatively less examined in the literature.

# 2 Literature Review

## *2.1 Girls' or Boys' Favorableness in Education?*

In 2000, the Dakar Framework for Action declared goals of "eliminating gender disparities in primary and secondary education by 2005, and achieving gender equality in education by 2015, with a focus on ensuring girls' full and equal access to and achievement in basic education of good quality" (UNESCO, 2000: 8). This made girls' education a core concern in educational development. Goals 2 and 3 of the Millennium Development Goals (MDGs) issued in 2000 also focused on this issue. Since then, international gender-focused education cooperation has examined girls' and women's education, particularly in South

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as intermediate school. However, to follow the international usage of the word, we call both as "primary education" in this paper.

[4] For example, in the period 1986–1994, total public expenditure on education rose from 2% to 3% of GDP (Jimenez and Sawada, 2001).

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

Asia or sub-Saharan Africa where male supremacy is predominant (Kabeer, 2001; Unterhalter, 2010). The issue's centrality has been reinforced by literature revealing the significant social and individual returns from women's education (Psacharopoulos and Woodhall, 1985; Herz *et al*., 1991; King and Hill, 1993; Psacharopoulos, 1994).

However, despite the centrality of these issues, holistic perspectives toward not only girls but also boys are required. Yet, in the field of international education cooperation, boys' education has been less examined (Heyneman and Stern, 2015). Certainly, some literature has examined the issue holistically, such as Weaver-Hightower (2003), who deals mainly with such advanced or industrialized economies as the US, noting that "[…] this[5] was the situation 'until recently.' Beginning roughly in the mid-1990s, a distinct and growing shift toward examining boys' education has occurred internationally in research on gender and schooling" (Weaver-Hightower, 2003: 472). Heyneman and Stern (2015) find that there is a male disadvantage on the basis of pedagogical output and performance data in wealthy industrial democratic counties, i.e., OECD countries, and further add that the reversed gender bias in developing countries will also be a critical issue in the field of international education development in the near future.

Despite the emerging importance of reversed-gender-related studies in developing countries, relatively few references exploring this perspective in a developing country context have been found. UNICEF (2003) showed a similar motivation for development issues. UNESCO (2006) examined the issue of boys' dropping out of school. Boys, like girls, are assigned gender roles, such as family breadwinner. Boys' issues are not simply the opposite of girls' problems, as boys' relations to parents and their expected roles vary across societies (the situation holds true for girls as well). A recent study by Jha et al. (2012) examines the boys' issue in secondary education in selected developing countries such as Jamaica, Brazil, the United Arab Emirates, Samoa, Lesotho, and Bangladesh.[6] Jha et al. (2012) open the door for and attract public concern of the reversed-gender-related issue in developing countries. In theory, intergenerational or parent–child relations in human capital investment are critical in shaping gender differentiation, as parental expectations and perceptions toward children of different genders are not identical. In addition, in parent–child relations, parenting varies by gender in the educational context (Alderman

[5] The "this" in the citation, as comprehended by the author, would indicate an environment where girls' education is regarded as central or important.

[6] The Philippines is not covered by Jha et al. (2012). For the Philippine case, see Milarao (2008). Compared with secondary level as examined in Jha et al. (2012), the gender gap existing in the early education stage such as the elementary level may be enhanced at later stages such as the secondary and tertiary levels (Yamauchi and Liu, 2013).

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and King, 1998; Gorman-Smith et al., 2012; Bhagowati, 2014). This study will investigate intergenerational patterns of parental and child educational attainment, focusing on their interactions.

### *2.2 Philippines-Specific Literature*

Educational attainment in the Philippines is seen as gradually worsening, in spite of its past effectiveness and high standards (Symaco, 2013). Philippine educational attainment has gradually stagnated (Okabe, 2013), though some have called it a "setback" rather than "stagnation" (Caoli-Rodriguez, 2007; David *et al*., 2009). Caoli-Rodriguez (2007) and Symaco (2013) predicted the near impossibility of achieving the MDGs concerning education by 2015. Balisacan (2003) indicated that the cohort survival rates in public primary and secondary education barely increased during the 1980s and 1990s (Balisacan, 2003: 289).

Both access to education and the educational progress of students in the Philippines seem to have faltered. David *et al*. (2009) mentioned the lower levels of educational attainment by boys and men compared to girls and women. Learning performance and scores on national academic achievement tests also show clear gender disparities that are unfavorable for boys. They state that empirical studies to examine the background and current situation of the lack of educational achievement by boys and men are needed. For example, if repetition and dropout rate are high, the educational system's internal efficiency may suffer, even though initial enrollments are high in each period.[7]

Some empirical literature has been reviewed. Estudillo *et al.* (2001) used data from a microsurvey conducted in rural Central Luzon to investigate the gender-differentiated pattern between schooling and land inheritance. Their results revealed that education levels showed sustained improvements over several generations and that girls/women were more apt to receive education, that is, human capital, while men were more likely to receive land, that is, physical capital. These gender-differentiated patterns as reflecting the relative comparative advantages for each gender in terms of engaging in the agricultural or nonagricultural sector; women, who have their comparative advantage in the nonagricultural sector, are more likely to be enrolled in education.

Similarly, Otsuka *et al.* (2003) conducted an empirical analysis regarding the importance of income, especially nonagricultural income, and asset such as land on education investment, and concluded that mitigating credit and financial constraints is necessary.

[7] In the Philippines, this problem has long been termed "out-of-school children."

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

Takahashi and Otsuka (2009) used a different dataset and also determined that women have a higher level of education than men.

Using microdata covering wider areas (i.e., Luzon and Visayas), Yamauchi and Tiongcob (2013) examine the behavioral determinants of women's higher educational progression, and succeed in rationalizing the phenomenon from pecuniary perspectives; their study identifies the female advantage in education as related to women's disadvantages in the labor market (e.g., wage disparity relative to men) and to parents' strategies for their lifetime welfare maximization (or optimization). Although married daughters are less likely to reside with their parents after marriage, married daughters are believed to support their parents more than married sons in the Philippine normative context (Yamauchi and Tiongcob, 2013: 203–04). These studies indicate that the female-favorable result is robust in Luzon, the Philippines.

### 2.3 *Repetition, Dropout, and Internal Efficiency of Education*

As previously discussed, the school enrollment ratio in the Philippines has been relatively high, but high enrollment does not always indicate efficiency (Balisacan, 2003), and access to education has experienced setbacks. High repetition or drop out reduces internal efficiency in education.

Repetition and dropouts result in discrepancies in educational progress among groups.. Out of the literature examining the determinants of delays in education in developing countries, Randall and Anderson (1998) examined Latin American countries; Glewwe and Jacoby (1995) looked at poverty and nutrition in Ghana; Yamano *et al.* (2001) focus on the association between household income, education expenditures, family-wide education level, and universal primary education policy in Uganda; and Miwa (2008) explores poverty and malnutrition in Cambodia.

In Philippine-centric case studies, however, except for the above studies dealing with Central Luzon rural villages, relevant studies taking a quantitative approach are rare. Apart from these above quantitative and econometric analyses, Bouis *et al.* (1998) conducted anthropological surveys and interviews with *barangay*[8] leaders and adults, more than a few of whom are parents as well. According to their research, interviewees cited the dropout problem as the reason for delays in schooling, and added that boys and men are more likely to experience it.

[8] *Barangay* is the lowest level of administration in the Philippines.

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This type of research has the advantage of explaining qualitative or descriptive reasons for the phenomenon. Interviewees attributed the male bias in frequency of dropout status to the fact that boys are criticized for being less responsible and are seen as being prone to "vices" (for example, drinking), overly fond of "roaming around" and "playing with their *barkada*"[9] (Bouis *et al.*, 1998: 22)[10]. Interviewees did not claim economic reasons for children dropping out, such as having to get a job or work on the farm. In fact, they responded that children dropped out due to being "sick," "ashamed," "a slow learner," "had lost interest in schooling," "played hooky from school," "influenced by his *barkada*," "did not like school and teachers," and "played too much" (Bouis *et al.*, 1998: 22–23). This field survey was conducted in the same area as the dataset used in this present study, i.e., Mindanao Island, but those results were subjective and non-quantitative. The field survey based on interviews with *barangay* leaders and parents revealed that parents neither wanted their children to work nor thought that it would help if their children stopped schooling. Rather, it indicates circumstances where dropouts occur due to perceptual reasons such as parents or children losing interest in school and parents claiming that the boys' dispositions are responsible.

However, before laying the onus for dropping out on dispositions, the associated socioeconomic factors should also be examined quantitatively. Such socioeconomic and personal characteristics are motivated by another context in the sociology of education—in developing countries, though it has long been assumed that a school's characteristics have a large impact on education outcomes, a larger role for student-specific characteristics has lately been revisited (Huang, 2010).[11]

### *2.4 Motivation Acquired from Literature Reviewed*

The literature reviewed has identified that girls are more educated than boys in the

[9] *Barkada* means peer group, sometimes translated as "gang".
[10] Interestingly, aside from this perspective, Bouis *et al*. (1998: 22) posits an economic rationale that boys have more opportunities in rural settings, which may motivate boys to quit schooling as soon as they find a job or income-generating activities. Furthermore, boys may perceive schooling as having a lower payoff since they expect to become farmers, which requires less education. This may be the case from an economics perspective (Chang, 2014: chap. 10).
[11] According to Huang (2010), the idea is termed the HL (Heyneman-Loxley) effect. In the Philippine context using Cebu data, Huang (2010) sheds more light on student-level factors by revisiting the HL effect; although not based on the education production function approach, its insights regarding how to view supply- and demand-side attributes are informative.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

Philippines, and some have rationalized the background of this disparity. This study focuses on limited geographic coverage and unitary treatment of parents that are found in the literature reviewed.

With regard to geographic coverage, Takayama *et al*. (2010), analyzing rural poverty dynamics from a statistical approach, utilized evidence from Mindanao Island, a less-examined and relatively underdeveloped area[12]. They rationalized education as one of the key factors to eliminate poverty; however, education, as a factor, is less studied in Mindanao island compared with that in Luzon island. With regard to the unitary treatment of parental decisions, recent perspectives focus more on differential patterns by parental gender (Alderman and King, 1998). Relatively little is known about such patterns, which potentially determine children's differentiation in educational attainment.

The remainder of this study is structured as follows: Section 3 explains the dataset and the surveyed area. Section 4 describes the current situation and provides basic information on the Philippine education system, including information specific to the surveyed province. Section 5 explains the empirical analysis. Section 6 presents the results, and Section 7 concludes the study.

# 3 Dataset and Surveyed Area

### *3.1 Bukidnon Panel Data Survey*

This study utilizes the Bukidnon Panel Data Survey (BPDS); specifically, this paper makes use of the 2003/04 data set (IFPRI, 2008). BPDS is a household survey conducted in Bukidnon Province, Northern Mindanao Region (Region X), the Philippines (Figure 1).[13]

***==Figure 1 about here==***

The survey was conducted by the IFPRI and the Research Institute for Mindanao Culture, Xavier University. The first survey in 1984-85 was intended to gather information on food

[12] Nakanishi (2001) adds that, unlike rice-cropping regions located mainly in Luzon Island, non-rice-cropping regions received fewer benefits from the Green Revolution. This leads to a qualitative difference between Luzon regions (especially in central Luzon) and other areas where rice cropping is not as commonly practiced. According to Nakanishi's classification, the study area, Bukidnon, would belong to a non-rice-cropping region.

[13] For basic information on the survey, see also Bouis and Haddad (1990) and Scott and Quisumbing (2007).

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

and nonfood expenditures, agricultural production, and other socioeconomic attributes. The survey sampled 29 communities from the southern half of the landlocked province of Bukidnon. Around 20 years after the first survey was conducted, the 2003 and 2004 rounds were conducted. The data cover topics similar to those in the 1984/5 survey.

The original survey aimed to examine agricultural commercialization effects on consumption, expenditure, nutrition, and household welfare. In 1977, Bukidnon saw the opening of the sugar mill company, called Bukidnon Sugar Company (BUSCO). This provided farmers with the option to commercialize their farms by switching from subsistence corn production to sugar production. Farmers' choices depended on their proximity to the sugar mill. The initial sample included 510 households, although 448 households were interviewed in all four rounds.

The original case study (Bouis and Haddad, 1990) examined the effects of the shift from subsistence corn production to sugarcane following the BUSCO sugar mill construction. In 1992, 352 of the original 448 households were re-interviewed as part of a study focusing on adolescents (Bouis *et al*., 1998). The 1992 survey included only one round of data collection and used a condensed survey instrument.

*3.2 Description of the Sample*

BPDS contains data subsets arranged by topic such as household demographics, agricultural production, education, income, assets, shocks, etc. By topic, the subset samples differ slightly across subsets; e.g., the women's reproduction-history subset contains data from adult women and the education subset contains data on children, whereas the basic unit of analysis is the household head or the household itself (see also Scott and Quisumbing, 2007).

In order to focus on primary educational attainment, the education subset is used as master data. This subset comprises all co-resident children in all surveyed households and contains information on education such as highest grade completed in that sample. The regression analysis dataset is formed by merging other subsets to the master data subset so the master data contain individual-level, household-level, and region-specific variables as explained in subsections 5.2–5.3.

To observe gender-related heterogeneity, all children, regardless of gender, are in principle chosen. Children's ages range from school-age to above (i.e., adult, or too old), as long as they are children of the household head and his/her spouse. From this sample of "children," the sample for analysis is further chosen as described below.

First, the education data subset indicates whether or not the child attended school within

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the past 12 months (regardless of age). In order to avoid including "noneligible" or "too-old" children (contextually including adults) into the sample for analysis, a restriction is imposed regarding age when regressed, i.e., ages must be older than six and younger than 12 (see also equation 1 and its explanation). However, if this restriction is applied simply by rule, children whose ages are older than expected, but who are nevertheless in the primary education stage being sampled, might be excluded.

Second, to avoid this possibility, children who attended school within the past 12 months are included in the sample even if they seem to be "overage." The sample therefore contains "overage" children. Ideally, households should have been asked directly whether the child currently attended school, but were not. Accordingly, the author utilized these two criteria to choose the sample children. As shown in Table 2, the number of children included in the sample is 327.

# 4 Outline of Education in the Philippines and Survey Area

## *4.1 Nationwide Overall Conditions*

Basic education in the Philippines followed a 6-4-4 system, i.e., six years for primary education, four years for secondary education, and four years (in general) for higher education[14] (Table 1). Children formerly entered primary school at age seven, but this changed to age six in 1995 (Ichikawa, 1999: 252). The trend since 1990 is confirmed by Figure 2, which utilizes data from the World Bank's EdStats.

***==Table 1 about here==***

A new constitution in 1987 set down the subsequent educational policy and made primary education free and compulsory. Secondary education became free as well through the Free Public Secondary Act of 1988. In accordance with EFA, the Philippines designed its own EFA Philippine Plan of Action 1991–2000, and the Department of Education formulated the Schools First Initiative to expand the school improvement movement through community participatory school management, and laid down the Basic Education Sector Reform Agenda for promoting continuous basic education and learning (Yonemura and Tamagake, 2003).

[14] This was the case during the year when the data were gathered. Since 2012, however, the Philippines has established a K to 12 program. See Okabe (2013) for details.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

***==Figure 2 about here==***

*4.2 Summary of Education in Bukidnon*

According to the census by the National Statistics Office (NSO), out of the population aged five years or older, the proportion of people currently attending or having graduated from primary education is 53.90% (56.65% for males and 50.97% for females), the proportion for secondary education is 22.63% (20.91% for males and 24.46% for females), and the proportion of degree holders is 1.82% (1.40% for males, 2.27% for females) in 2000 (NSO, 2003). Girls and women comprise a higher proportion than men. These figures included adults who concluded their education at the primary or secondary level. The portions of the school-age population are shown in Figures 3–4. The proportion of primary school-aged children occurs in the late 80s%, with a peak of 95% for the age of 11. The proportion of secondary school-aged children, in turn, is 40s%, with a peak of 50% for age 16. The gender pattern that women have higher attainment at all education levels can be clearly seen.

***==Figure 3–4 about here==***

Figure 3 shows information by age. However, in keeping with the central research question of this study, a grade-one child who is much older than usual grade-one children may be counted equally compared to other children, with no weighting. Accordingly, let us examine the proportion of grade 5-6 completion in primary education (Figure 5). This figure shows a considerable number of students continuing to attend primary education though they had already reached the right age for enrolling in secondary education (high school), but this number decreases as age increases. Interestingly, the proportions of males and females flip at the tipping point occurring at the ages 13-14. Compared to men, in primary education, women attain higher grades relatively faster than men, and even the women with delays in schooling attain those grades faster than men.

***==Figure 5 about here==***

The overall educational situation in Bukidnon, the Philippines, is presented in *Philippine Human Development Index Report 2000*, which conducted comparative analyses at a nationwide level. According to the report, the Province of Bukidnon is ranked in the

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lowest ten provinces in basic educational attainment (National Statistical Coordination Board (NSCB), 2002). The lowest province, ranked 77, is Sulu, followed by Sarangani (76), Maguindanao (75), and Bukidnon (74). Furthermore, although Bukidnon was ranked 64 in 1994, its rank dropped to 76 in 1997 and had only recovered up to 74 in 2000 (NSCB 2002: 17). In particular, Bukidnon's recent yearly drops should be seen in the context of its steady position at rank 64 through 1994. In addition, the cohort survival (Figure 6) and dropout (Figure 7) rates show Bukidnon's consistent low educational attainment compared not only to Luzon island areas but also Mindanao Island areas and the Northern Mindanao Region as a whole.

***==Figures 6–7 about here==***

In the nationwide context, more than a few regions and areas in the Philippines succeeded in improving access to education following the Philippine government's response to international development policies prioritizing education. However, the descriptive statistics information implies that Bukidnon has been overtaken by other regions and areas. According to Mesa (2007), who compared the average years of education and inequality index (Gini coefficient), Bukidnon was ranked in the lowest three in terms of fewest years of education and ranked in the lowest four in terms of the level of inequality. Similar trends in survival and dropout rates were observed, as shown in Figures 6–7.

On Mindanao Island, the Province of Sulu ranked nearly worst in human development and educational attainment. In this province, predominantly Muslim, the people have long suffered from conflict and violence in addition to socioeconomic underdevelopment and poverty. In contrast, the Province of Bukidnon, being located in the Northern Mindanao Region, is not necessarily connected to Muslim conflicts and the resulting social insecurity. Education in Bukidnon has nonetheless faced challenges. To determine the association between schools and regional conditions, disaggregate analyses should be informative and contributive (Mesa, 2007).

# 5 Empirical Analyses

## *5.1 Dependent Variable and Regression Model*

To determine the association between individual- and household-level characteristics

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as well as region-specific effects, we conduct a regression analysis to calculate the significance and signs on the coefficients of each dependent variable.

Let the number of years delay in schooling experienced by pupil $i$ be denoted as $\Delta A_i$, and defined as

$$\Delta A_i = \begin{cases} A_{1i} - A_{2i} & \text{if} \quad 6 \le Age_i \le 12, \\ (A_{1i} - A_{2i}) + (Age_i - 12) & \text{if} \quad Age_i = 13, \\ (A_{1i} - A_{2i}) + (Age_i - 13) & \text{if} \quad Age_i \ge 14, \end{cases} \tag{1}$$

where $A_{1i}$ is the ideal year of schooling calculated from $Age_i$, the pupil $i$'s age; and $A_{2i}$ is the real year of schooling when the research was conducted.[15] The case of no delay in schooling means $A_{1i} = A_{2i}$ and $\Delta A_i = 0$.

Here, by the way, we have to ask ourselves a normative question before calculating $\Delta A$. In the Philippines, education is mandatory only at the primary stage. No other educational stage is mandatory, although public secondary education is free (in principle). Considering the norm of MDGs, ideally all children are expected to complete primary education; however, secondary and tertiary educations are neither compulsory nor should be attained by all people even in developed countries. Therefore, the analysis in this study is confined to primary education.[16]

Usually, children are expected to enter primary schools at the age of six. Ideally, the completed year will be year one at the age of seven, grade six at the age of 13 at the end of primary education, and year 10 at the age of 17 when secondary education is completed. The sample includes pupils aged older than 13. Therefore, for those pupils, the difference between age of 13 and the real age is adjusted. Figure 8 is a histogram of $\Delta A_i$ by age and by gender.

[15] As explained in Section 4.1, children formerly entered primary school at age seven, but this changed to age six in 1995 (Ichikawa, 1999; Tomas, 2013). The Philippine Department of Education (DepED) directed that children who are six years old before the commencement of classes in the beginning of June are eligible to enroll in grade one of primary school (for details, see the DepEd's website: http://www.deped.gov.ph/orders?f[0]=field_classification%3A224). The construction of the variable *Age* follows this principle: the age of children was the age considered at the time of data collection in the fall of 2003 (IFPRI, 2008). For example, children who were five years old when schools opened (who were not eligible to enroll then) and turned six before the data collection in the fall of 2003 were reported as six years old despite being a year younger. Therefore, to adjust this gap, one year is subtracted for the children born during the period between them.

[16] Future research will analyze factors apart from delay analysis for secondary and tertiary education.

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***==Figure 8 about here==***

Assume the functional relation $A(\cdot)$ of $\Delta A_i$ as

$$\Delta A_i = A(\boldsymbol{X_1}_i, \boldsymbol{X_2}_i, \boldsymbol{S}_i) + u_i,$$

where $\boldsymbol{X_1}$ is a vector of pupils' individual characteristics and attributes, including a gender dummy variable taking the value of one if the $i$-th pupil is a girl and zero otherwise; $\boldsymbol{X_2}$ is a vector of the characteristics and attributes of the pupil's household and family; $\boldsymbol{S}_i$ is a vector of supply-side school variables. Then, we derive the multiple regression models as

$$\Delta A_i = \beta_0 + \boldsymbol{X_{1i}}\boldsymbol{\beta_1} + \boldsymbol{X_{2i}}\boldsymbol{\beta_2} + \boldsymbol{S}_i\boldsymbol{\delta} + \eta + \varepsilon_i, \tag{2}$$

where $\beta_0$ is an intercept, and $\boldsymbol{\beta}$'s and $\boldsymbol{\delta}$ are the coefficients to be estimated. The error term $u_i$ is divided into two terms: $\eta$ for a region-specific effect for unobserved regional heterogeneity and $\varepsilon_i$ as an idiosyncratic disturbance term, that is, $u_i = \eta + \varepsilon_i$.

### *5.2 Independent Variables*

For $\boldsymbol{X_1}$, the following characteristics and attributes of pupil and students are used: age and age square; a dummy of minority language, which takes the value of one if speaking a language other than Tagalog (an official language of the Philippines) or Cebuano (the lingua franca in Northern Mindanao); pupil's BMI (a proxy of pupil's health and nutrition); the pupil's period of labor experience; and the interaction term with the gender dummy.

For $\boldsymbol{X_2}$, the following characteristics and attributes of households and families are used: number of brothers and/or sisters;[17] shock-experience dummies that take a value of one if shocks caused by weather and military presence were experienced; a savings account dummy variable taking the value 1 if the household has at least one savings account; a

[17] This variable would imply the household size and the probability of competition for educational opportunities.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

dummy of credit constraints;[18] social network size;[19] parental educational attainments; and dummy variables, representing absence of a father and/or mother, taking the value of one if the household head or spouse live away from the household, respectively.[20] Furthermore, income variables are introduced: per capita income, per capita amount of remittances received, and their interaction terms with the gender dummy. Here, however, we have to consider the possibility that the coefficients of income variables have an endogeneity bias. Accordingly, the endogeneity may also be present for the coefficient of pupil's labor.

To mitigate these endogeneity biases, one resolution is to use two-step least squares estimation using instrument variables (IVs). The author tried the IV estimation, but the possibility of a weak-instrument problem could not be rejected, and so the asset variables (owned and rented-in land, dummy variables of taking a value of one if the household has bikes and cars, respectively, and dummy variables taking a value of one if the household is non-electrified and has no running water) are introduced instead of income variables. Some of these variables, in addition, interacted with the gender dummy.

For $S$, included variables are the dummy indicating whether the student has benefited from the one-year change in primary school entrance age (see subsection 4.1) and the school-lunch and -snack variables. The entrance-age change indicator variable is assumed to be a determinant revealing the policy effect of the change in primary education entrance age. Children who entered primary school in or after 1995 are thought to have enjoyed a change in all years of primary education. Examining these variables allows us to learn whether or not such educational system changes contribute to pupils' educational attainment, as well as control, if only slightly, for supply-side heterogeneity. Finally, a municipality-specific effect, $\eta$, is introduced to a set of independent variables to control for unobserved region-specific heterogeneities.

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[18] This dummy variable takes a value of one if the household head has been both refused by moneylenders and incapable of borrowing needed money from other moneylenders or his relatives.
[19] Social network is regarded here as the number of friends and acquaintances upon whom the household head can rely in an emergency.
[20] This information should be related to the gender patterns of association between parental and children's education. Furthermore, the sample contained few households where their head and spouse live away, and children belonging to those households are all boys. Therefore, the heterogeneity of this variable in relation to gender cannot be tested since interaction terms cannot be made.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

*5.3 Basic Information from Descriptive Statistics*

Before talking about the regression analysis and estimation, let us confirm the basic information from a set of dependent and independent variables from the descriptive statistics (Table 2). On average, the children in the sample have a schooling delay of 1.1 years and completed 2.7 years of schooling. The average age is 9.8 and 52% of the sample is female. No more than approximately 2-3% of the children in the sample speak languages other than Tagalog and Cebuano.

The children in the sample, on average, have experienced labor for 0.13 years. On average, each child has 2–3 siblings for each gender. About a half of households in the sample have experienced a negative shock, one-quarter of households have a saving account, one-fifth of households have experienced being refused credit, and the size of the social network (which includes friends, relatives, and acquaintances upon whom the household can rely) is on average two people per household.

Regarding parental education level, the average paternal education is primary school level plus one additional year of secondary education and average maternal education is around one year longer than the father's. Few households have both the head and spouse living away. Although inclusion of a dummy variable indicating whether or not a household has a single head was attempted, few single-headed households are in the data, and none in the sample for analysis. This absence could reflect the Philippines' religious background as a devoutly Christian country (exceptional in Southeast Asia), where divorce is religiously and culturally taboo. The studied area, Bukidnon, is a Christianity-prevalent region.

For income variables, the log of per capita income and the log of per capita remittance received are used for estimation, and asset variable statistics, in turn, show that mobile facilities such as motorbikes and cars are a type of rare asset that is seemingly not affordable for average households. One-third and one-half of households are not electrified and do not have water pipe inside the house, respectively. Households in the sample seem to show some typical characteristics of rural poverty.

Regarding supply-side variables, approximately 97.5% of children belong to the generation benefiting from the one-year institutional change in primary school entrance-age. Since that change was implemented in 1995, children born six years previously to 1995 (i.e., born in or after 1989) have benefited. Therefore, almost all students are in the benefiting generation, whereas a few overage students are not. Age-related variables such age, age square, and BMI are controlled, with these variables used to estimate policy effects of the entrance-age change. In turn, for provisions of food, around 32.1% have

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

received snacks and 18.0% have received lunches from schools (i.e., the number of those who have received lunches is smaller.)

***==Table 2 about here==***

*5.4 Estimation Method*

Usually, to estimate the regression model such as equation (2), ordinary least squares (OLS) method is used. Theoretically, however, the dependent variable, $\Delta A$, does not take a value less than zero. In other words, the dependent variable is censored at the value of zero, i.e., $\Delta A \geq 0$ or $\Delta A$ is a limited dependent variable. Estimation of equation (2) by OLS can be inappropriate. The econometric background is that the least-square method assumes linearity, but with a censored dependent variable, the linearity assumption is violated (Amemiya, 1985: 362), which can cause a downward bias in OLS estimators. Another standard method is the Tobit model, which can be classified into five types (Amemiya, 1985: chap. 10).[21] This study utilizes what Amemiya classified as the Type I Tobit model because the independent variables are observed even when a dependent variable takes the value of zero. The model is rewritten as below by introducing a latent variable.

First, let the latent variable of $\Delta A$ be denoted as $\Delta A^*$, and the latent variable is regressed as the same set of independent variables as in equation (2):

$$\Delta A_i^* = \beta_0 + \boldsymbol{X_{1i}\beta_1} + \boldsymbol{X_{2i}\beta_2} + \boldsymbol{S_i\delta} + \eta + \varepsilon_i. \tag{3}$$

In this setting, the true dependent variable $\Delta A$ is equal to $\Delta A^*$ if $\Delta A^*$ takes a nonnegative value, and $\Delta A$ is equal to zero if $\Delta A^*$ takes a negative value including the value of zero. For the Type I Tobit model, the estimation is the maximum likelihood (ML) method. The Tobit model is written as follows:

$$\Delta A_i = \begin{cases} \Delta A_i^* & \text{if} \quad \Delta A_i^* > 0, \\ 0 & \text{if} \quad \Delta A_i^* \leq 0. \end{cases} \tag{4}$$

[21] For example, Type I Tobit is used for a censored model whereas Type II is used for a selection model. See Amemiya (1985: ch. 10) for details.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

### *5.5 Robustness Checks*

#### 5.5.1 Addition of interaction terms with gender dummy

To consider whether the results are robust, the author adds four supplementary steps. First the interaction terms of the gender dummy variable, as discussed before, are added to the other individual and household characteristics. This enables more detailed comparison of the magnitude of and relation to each gender with respect to other independent characteristics variables.

#### 5.5.2 Estimation of Education Years Completed as a Dependent Variable

The second step is to add not only the $\Delta A$ but also the number of school years completed, i.e., $A_2$, to the equations (2) and (3) as the dependent variable. Doing this reveals whether or not the coefficient estimates qualitatively show the same results.

#### 5.5.3 Application of Count Data Framework—Poisson Regression

The third step is to employ another regression framework—Poisson regression. The distribution form of dependent variable $\Delta A_i$ (Figure 8) appears to take on integer numbers beginning from the value of zero, such as 0, 1, 2,…, and to have a high density in accordance with the value of zero. For this type of dependent variable, the Poisson rather than the Tobit model is recommended for the regression. The model is termed "the count data model" and assumes that the dependent variable follows the Poisson distribution:

$$\Pr(\Delta A = a) = \frac{\exp(-\mu)\mu^a}{a!}, \qquad \text{where } a = 0, 1, 2, \cdots, \tag{5}$$

where $\mu$ in equation (5) is the intensity term. Under the Poisson distribution, we have the following property called the equidispersion property of the Poisson distribution (Cameron and Trivedi 2005):

$$\mathrm{E}(\Delta A) = \mu,$$
$$\mathrm{V}(\Delta A) = \mu.$$

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

From the equidispersion property, the Poisson model can be expressed as:

$$\mu_i = \exp(\boldsymbol{X\beta_P}), \qquad i = 1, 2, \cdots, \tag{6}$$

where $\boldsymbol{X\beta_P}$ is the linear combination of the same regressors as in equations (2) or (3) with coefficients newly estimated specifically for the new model.[22] The most natural estimator is ML. The maximization problem of the log-likelihood function is:

$$\max_{\boldsymbol{\beta_P}} \ln L = \sum_{i=1} (\Delta A_i \boldsymbol{X\beta_P} - \exp(\boldsymbol{X\beta_P}) - \ln \Delta A_i!). \tag{7}$$

The Poisson MLE, $\widehat{\boldsymbol{\beta_P}}$, is the solution corresponding to the first-order condition for maximum likelihood

$$\frac{\partial \ln L}{\partial \boldsymbol{\beta_P}} = \sum_{i=1} (\Delta A_i - \exp(\boldsymbol{X\beta_P}))\boldsymbol{X} = \boldsymbol{0}.$$

Although the interpretation of the coefficients estimated in linear models is the marginal numerical effect in accordance with a one-unit change in the corresponding independent variable, the Poisson model is, like other limited dependent-variable models such as Tobit, so nonlinear that we cannot interpret the coefficients in the same way, as the values shown in Table 4 are only the coefficients and do not include the marginal effects. Here, similar to the Tobit estimation, only the statistical significance, signs (negative or positive), and magnitude relations are informative.

Unlike the assumptions made under Tobit estimation, Poisson estimations are considered more sensitive to minor increases and decreases in a set of regressors if the dependent variable comprises count data. Indeed, the histogram of the dependent variable shows that the distribution is localized in $\Delta A$'s value of zero and in the area of smaller integer numbers. Then, using the Poisson estimation, we will check (1) the eligibility of the utilized Poisson regression model by the chi-square ($\chi^2$) test with its null hypothesis $H_0$: the dependent variable, $\Delta A$, follows the Poisson distribution, and (2) whether the result produced by the Tobit estimation is qualitatively similar to the result yielded by the Poisson estimation.

[22] Identically, regression equation (6) can be also written as $\ln\mu_i = \boldsymbol{X\beta_P}$.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

#### 5.5.4 Estimation with a Household-Specific Effect to Control for Household-specific Heterogeneity

The fourth step is adding a household-specific effect in the estimation, intended to mitigate the possibility of endogeneity and to take into account unobserved heterogeneity, including household-specific slight difference of data collection timing. Tobit estimation of equations (2)–(4) may raise the possibility of endogeneity. To control for omitted variables and unobserved heterogeneity from the household-level environment, the model is rewritten with additional term $\nu_H$ as

$$\Delta A_i = \beta_{H0} + \boldsymbol{X_{1i}\beta_{H1}} + \boldsymbol{X_{2i}\beta_{H2}} + \boldsymbol{S_i\delta_H} + \nu_H + \eta_H + \epsilon_i, \tag{8}$$

where $\beta_{Hk}$ $(k = 0, 1, 2)$ and $\boldsymbol{\delta_H}$ are the newly estimated coefficients and $\eta_H$ is the region-specific effect. The error term in the Tobit model is now divided: $\nu_H$ is a term of household-specific effects, and $\epsilon$ is an idiosyncratic error term.

In order to avoid the incidental parameter problem, nonlinear estimations such as Tobit and Poisson ML estimations are not used. Thus, the ordinary linear regression model is applied. The standard error utilized is household-cluster. After taking these steps, whether or not the results yielded by the estimation with household-specific effects is qualitatively the same as that yielded by the estimation without these effects, i.e., equations (3) and (4), is examined.

# 6 Results

Table 3 shows the regression table. Interpretations are based on the association with the main dependent variable, the delay in education, *nisi aliter notetur*.

***==Table 3 about here==***

## *6.1 Individual Backgrounds*

While age is not statistically significant in relation to the dependent variable of delays in schooling, it is positively and statistically significant in terms of the dependent variable of years completed, and the age square (*age*$^2$) is negatively and statistically

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

significant in relation to the years of education completed. This means that $\frac{\partial A_{2i}}{\partial(age)} > 0$ and $\frac{\partial^2 \Delta A_i}{\partial(age)^2} < 0$, implying that years completed increase as age increases and at the same time the marginal increase in years completed is declining. The purpose of including the age variable in regression equations is to control for age effects, to reveal the magnitude of other variables. BMI is statistically negatively significant to the years of educational delay, and positively significant in terms of years completed as well, albeit controlling for age; it may show the possibility that the BMI is a proxy of nonage attributes such as health and nutrition, which associates robustly with educational attainment.

As hypothesized regarding gender variables, girls complete more years of education and experience fewer delays in schooling than boys [cf. gender effect isolated, see columns (3)–(4) and (7)–(8)]. Though the models' coefficients including interaction terms of gender with other variables [columns (1)–(2) and (5)–(6)] became insignificant with regard to an isolated gender dummy variable, the effect is thought to be diluted by other gender interaction terms.

On the other hand, from descriptive statistics information, we find that few children at the primary education stage experience(d) labor, for which education can be a substitute. The variable of the length of time children experienced labor is significant statistically and the coefficient's sign is unfavorable to both educational attainment dependent variables. However, the interaction term with the gender dummy variable is positively statistically significant in relation to the delay of schooling and negatively to the completed years of schooling, and moreover, the estimated coefficient's absolute value is larger. This interaction-term result implies that girls who experience(d) labor are more associated with both a delay in schooling and fewer completed years of schooling compared to boys.[23]

[23] In this context, based on the estimation result, the author can mention only the association (correlation) but cannot identify causality. Decision-making regarding labor and education may be made simultaneously. In this case, the coefficient may include a simultaneity bias, one type of endogeneity bias. To examine possible causal inference between labor and education, the bias needs to be treated in an econometrically appropriate manner by, e.g., the instrumental variable method. For the endogeneity bias in this case, the author used the 2SLS method in estimates, with its instrument variable of experienced shock, where the exclusion restriction is that the experienced shock, such as weather and military shocks, can effect education variables only via income and labor variables. However, the *F*-statistic of the first-stage estimation was smaller than rule of thumb, so we could not reject the weak-instrument problem. Estimations that are better able to treat endogeneity bias will be needed in future studies.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

### 6.2 *Family Backgrounds*

Among the shock dummy variables, the military shock dummy shows a positive association with delays in schooling and a negative association with the number of school years completed. The result of the equation containing interaction terms with the gender dummy reports the same association with regard to the number of education years completed. These estimation results show that the influence of shock status is related to schooling variables albeit at a relatively weak level of statistical significance (more than 5%).

Next, credit constraints, indicated by loan refusal experience, shows the expected association with educational delays. The estimation result of the social network variable shows that larger networks are associated with fewer delays but not associated with schooling completed. Next, let us examine parents' educational attainment levels. First, the maternal education level negatively influences schooling delays and positively impacts the completed years of schooling in the estimation without gender interaction terms. The paternal education level shows a similar result with delays in schooling, yet the parental education alone is statistically more robust in maternal education level than in paternal. In addition, seeing the models (1)–(2) and (5)–(6) where their interaction terms on the children's gender dummy are added, although paternal education level itself is negative to the delay and positively significant in relation to the completed years of schooling, the interaction terms of paternal education with the girl dummy variable show the opposite relation.

These findings imply that the level of paternal education preferentially and favorably influences the level of his same-gender children, that is, sons, because the magnitude of interaction is larger than that on paternal education alone. In contrast, maternal education alone is negatively significant in terms of the delay in schooling and positively significant in relation to number of school years completed [in columns (3)–(4) and (7)–(8)]; however, in models with interaction terms, both maternal education itself and its interaction terms with the girl dummy are insignificant. This implies that, unlike paternal education, maternal education equally influences children regardless of their gender. As shown, when the absence of a father is positively associated with the delay in the number of years of education and negatively associated with the years completed, the results of parental education levels are consistently robust even after controlling for the absence of the father/mother.

The income variables do not alone show significant results [columns (3) and (7)], while interaction-term coefficients are favorable to girls [columns (1) and (5)]. Like child labor,

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

it is usually assumed that income and education are simultaneously determined so that a causal relationship cannot be specified within the analysis of this study due to the possibility of endogeneity (simultaneity) bias. In turn, the explanation power of asset variables disappears, whereas the rented-in land variable possibly implies a girl-friendly association with educational attainment.

### *6.3 Supply-Side School Attributes*

Regarding the impact of the entrance-age change policy, it is negatively significant to delays in education but positively significant to the number of years completed. These results imply that, even after controlling for related attributes such as age, age squared, and BMI, pupils who benefited from the policy were able to complete more years of education and experience fewer delays. Provisions of school snacks and lunches also exerted the same favorable impacts on educational attainment, regardless of delays or number of completed years. These results imply that, even after controlling for other characteristics, those pupils who enjoy school food provisions can complete more years of education and experience fewer delays.

### *6.4 Comparison of the Results in Robustness Checks*

As noted in subsection 5.5.3, the Poisson regression as well as the Tobit regression is estimated. The results are shown in Table 4. Comparing Tables 3 and 4, it is seen that the statistical significance, the signs of the coefficients, and the magnitude relations are almost identical. This result shows that the alternative estimation model (Poisson regression) delivers quantitatively similar findings compared with the Tobit estimation model. The main differences found between the results presented in Tables 3 and 4 are as follows: (1) age (*Age*) is statistically positively significant and age squared (*Sqage*) is negatively significant in relation to both the years delayed and years completed; (2) the dummy variable of father's absence turns to be more robustly positively significant to the number of delay years and negatively significant to years completed, whereas the dummy variable of mother's absence is not robust; and (3) significances of income variables interacted with girl dummy are reinforced and significances emerge for some asset variables (ownership of a car and whether the house is electrified) in relation to the years completed.

These new results derived using the Poisson regression imply that (a) older pupils

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

tend to experience delays more frequently and, at the same time, also attain more years in primary education but the slopes are diminishing; (b) fathers living away from the household is unfavorably associated with educational attainment in terms of both number of years delayed and completed; and (c) affordability still matters as indicated by the results not only for income but also the asset variable's explanation for the attempts to mitigate the endogeneity of income variables with education.

Further to the Poisson estimation, to utilize additional control variables, we estimated the model with a household-specific effect term by isolating the error term $u$. This result is almost identical to the Tobit and Poisson estimations without the household-specific effect term. The main changes include: (1) the dummy variable of speaking Ilocano ($D_{Ilokano}$) becomes positively significant to the years delayed and negatively significant to the years completed; (2) positive significances emerge for the dummy variable of weather shock experience (*D_Wshock*) in relation to years of delays and for the dummy of military shock experience (*D_Mshock*) for both dependent variables, whereas the military-presence shock seems unfavorable for girls; (3) social capital (*SC*) becomes insignificant to both dependent variables; (4) the dummy variable of father's absence (*Fat_ab*) remains significant but its robustness decreases compared to Poisson estimators; and (5) the interaction term of log per capita income and gender dummy ($\log Y \times D_g$) also becomes insignificant to both dependent variables, but the interaction term of log per capita remittance and gender dummy ($\log R \times D_g$) becomes negatively significant to education years completed (but not significant to years delayed).

These new results derived using the estimation with household-specific effect imply that (a) although the indicator of speaking a minor language remained insignificant both in Tobit and Poisson estimations, this attribute may be associated unfavorably with educational attainment; (b) shock variables would be unfavorably associated with educational attainment; (c) the significance of association between social network and educational attainment here decreases; (d) the absence of fathers remains unfavorable for their children's educational attainment; and (e) the correlation of income with attainment of education is unsteady.

However, overall, we can confirm that the results of the robustness checks, especially regarding intergenerational gender-preferential patterns, are confirmed.[24]

[24] In addition, the Poisson model's goodness of fit is statistically tested. The chi-square test under the null hypothesis that the dependent variables follow a Poisson distribution shows that $\Pr > \chi^2$ for all models in Table 4 are insignificant, i.e., we cannot reject the null hypothesis. Thus, the fitness of Poisson model is good statistically. See Table 4.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

***==Tables 4–5 about here==***

# 7 Discussions

This study's main focus has been gender and educational attainment in the Philippines. The results reveal that, even after controlling for specified individual and household characteristics as well as region-specific and household-specific effects, a significant gender-specific differential pattern remains evident. Girls experience fewer delays in primary education and complete it at greater rates than boys. This finding is robust for both dependent variables: number of years delayed and years completed. This result implies that boys face disadvantages in education compared to girls, as existing literature has revealed (Illo, 1997; Bouis *et al*., 1998; Otsuka, Estudillo, and Sawada, 2003; David *et al*., 2009; Bhagowati, 2014, among others).

In contrast, by considering parental education and its interactions with gender, a different story appears. Maternal education influences children's educational attainment equally regardless of the child's gender. However, paternal education does not influence child educational attainment in the same manner. Paternal education seems to positively influence the attainment of education of "same-gender" children, that is, sons.

However, whether a father lives in or away from the household shows interesting results. An absent father is unfavorable for his children's educational attainment (Gorman-Smith et al., 2012). Although a mother's absence shows a non-robust result, a father's absence is consistent across all estimations.[25] However, as the sample contains few households whose head lives away, the sample only contains boys belonging to such households, meaning we cannot see the interaction or gender-differential impact of this attribute. Information on parental co-residence may add credibility to the results if one can distinguish whether this is not the driving force behind the father–son results. [26]

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[25] Although this is beyond the scope of this study, the following points will be informative. The finding in Mclay and Lucero-Prinso III (2012) considers the presence of a father in the household, particularly when the mother works abroad and is absent. In the mother's absence, the father would control all household decisions. Although it is said that gender equality has been relatively accomplished in the Philippines, Bhagowati (2014) indicates that there is "male chauvinism" in the Philippines. A hypothetical interpretation may be that this chauvinism and fatherhood might be more explicit when the mother is absent. Apart from economics and pedagogy, a psychological perspective such as that of Tomas (2013) points to the role of the father in the development of children in a manner qualitatively different from that of mother.

[26] The author is grateful for this insightful suggestion given by one of the anonymous reviewers.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

If this paternal effect is bigger than the maternal one, then the boy-unfriendly gender bias shall be mitigated, but it cannot be gauged without quantitative comparing the magnitudes of the education effect by each parent. However, it can be stated at least that in primary school, mothers have a robustly positively influence upon their children's education regardless of their gender. That is, mothers' higher educational attainment, passed on to their daughters, weighs more heavily overall than the father's influence on sons. However, the father-son preferential relation analyzed in this study would be a potential to mitigate the current gender gap unfavorable for boys in future if the magnitude can be enlarged, *ceteris paribus*.

Therefore, after controlling for other individual and household socioeconomic characteristics as well as for region-specific and household-specific effects, gender-specific differential patterns persist in educational attainment, as revealed by two variables, namely years delayed and years completed in primary education. To reduce the gender gap, it would be necessary to increase the magnitude of the "father–son" educational virtuous circle. Accordingly, boys-specific interventions and policies will be needed.

Now, let us focus on other characteristics. When making decisions on education investment, it is certain that affordability, as determined by income and assets as well as shocks, can matter. The results of the analysis conducted in this study reveal a positive association between affordability and educational attainments and the unfavorable effect of negative shocks upon education investment, especially among the poor, all of which are consistent with the literature, although robustness checks indicate that the stability of the coefficients' significances are open to dispute. Moreover, social network density is positively correlated with education (whether to delays or completed years), implying that certain mechanisms or utilities of the community's social network work positively with the resident children's education. In sum, those characteristics representing what we call "vulnerability" remain obstacles to educational attainment but, at the same time, these vulnerability-related characteristics seem to be less of a problem as long as limiting to free and compulsory primary education. Exploring education-related decision-making and demand-side behavior of students and households in secondary and further education is increasingly essential.

Supply-side characteristics are also of importance. Supply-side services may improve pupils' educational progress: the change to primary school entrance age in 1995 has had a robustly favorable effect upon educational attainment, even after controlling for age, age square, and BMI—the time- and age-related factors, and the provision of school snacks and lunches, that will help those pupils and students attain high educational achievement and reduce delays in schooling that may cause lifelong welfare inefficiencies. Language

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

also matters, according to the results. The Philippines has set Tagalog and English as its official languages, and public education uses them as mediums of instruction (Tanodra 2003; Tomas 2013). However, the country is so multi-linguistic that the minor-tongue speakers may suffer in terms of school progress. The ongoing overhaul of the Philippine basic education system seems to be tackling this limitation. Further observatory studies are needed to examine efficient learning and school progression over the full range of ethnicities.

In sum, the "father–son" favorable association in terms of educational attainment has rarely been found or discussed. The manner in which existing literature has explained the background of the Philippines' characteristic "female-favorable" pattern of educational attainment (i.e., the opposite pattern to that found in most developing countries, where promotion and dissemination of education to girls/females is crucial) is, for example, to point out the intra-gender comparative advantage in engaging in agricultural or nonagricultural sectors, differentiation in inheritance of physical or human capital, or otherwise, the boy-specific propensity to play truant (thus simply laying the onus on the boy's disposition) [27]. However, although girls are seen as enjoying education more than boys even after controlling for other factors, it is potentially of great importance to pay attention to the gender-differentiated intergenerational patterns of education—i.e., the "father–son" association when considering how to mitigate gender inequalities in education in the Philippines, or at least the Bukidnon and similar provinces. Encouraging boys' education can potentially equalize the current gender gap over generations.

Lastly, let us discuss future research directions and this study's limitations. First, we have to consider the problem of expanding the delay analysis framework to the higher educational stages. The concept of delay is normative because it uses the initial standard to measure the size of delay. Primary education is mandatory and compulsory in the Philippines, meaning this type of normative analysis is applicable. However, for educational stages higher than secondary education, the applicability of normative analysis is unclear. A different type of framework should be introduced to explore the

[27] Although this is beyond the scope of this study, the following points are mentioned for reference. Surprisingly, Miralao (2008) points out by showing aggregated tables of school performance by gender in schools found in Muslim-living regions in Mindanao, called *madrasah*, that female performance is higher there as well. Initial conditions in terms of agriculture and land that these regions had should be quite different from those in Luzon villages, where the literature found land–education compensation by gender. Though Miralao (2008) just shows some aggregated statistical tables and did not conduct any empirical analyses, it is worthwhile to note the higher school performance of female students in *madrasah*s.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

impact of secondary and tertiary education. Second, the analysis within this article is purely a static analysis. Additional dynamic consideration is therefore required. Third, it is necessary to deal with endogeneity for certain endogenous-looking variables such as income and child labor. This study includes few resolutions for endogeneity bias. The author should expand the scope of the analysis to widen its applicability to other educational stage as well.

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# APPENDIX: Interaction-term Interpretation

This appendix briefly reviews the interpretation of the estimation results of the regression including interaction term(s). Let $Y$, $x$, $\boldsymbol{X}$, and $u$ be denoted as the output variable, interest variable, a vector of other regressors, and disturbance term, respectively, and let us denote $\alpha_0$, $\alpha_1$, and $\boldsymbol{\beta}$ as the intercept, the coefficient of $x$, and the coefficient vector of $\boldsymbol{X}$, respectively. The regression equation is written as

$$Y = \alpha_0 + \alpha_1 x + \boldsymbol{X}\boldsymbol{\beta} + u.$$

Considering a dummy variable taking zero or one, $D$, the interaction term $xD$, and its coefficient $\alpha_2$, the regression equation can be rewritten as follows:

$$Y = \alpha_0 + \alpha_1 x + \alpha_2 (xD) + \boldsymbol{X}\boldsymbol{\beta} + u.$$

Calculating this rewritten equation,

$$\begin{aligned} Y &= \alpha_0 + \alpha_1 x + \alpha_2 (xD) + \boldsymbol{X}\boldsymbol{\beta} + u, \\ &= \alpha_0 + (\alpha_1 + \alpha_2 D)x + \boldsymbol{X}\boldsymbol{\beta} + u. \end{aligned}$$

If $D$ takes the value zero, then the equation becomes

$$Y = \alpha_0 + \alpha_1 x + \boldsymbol{X}\boldsymbol{\beta} + u,$$

and if $D$ takes the value one, then it becomes

$$Y = \alpha_0 + (\alpha_1 + \alpha_2)x + \boldsymbol{X}\boldsymbol{\beta} + u.$$

In the case where $\alpha_1$ is statistically insignificant, i.e., we cannot reject the $H_{0:}$ $\alpha_1 = 0$, and $\alpha_2$ is significant, i.e., we can accept the $H_{1:}$ $\alpha_2 \neq 0$, the regression equation is rewritten as follows:

$$Y = \alpha_0 + \alpha_2 x + \boldsymbol{X}\boldsymbol{\beta} + u,$$

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

for a sample taking $D = 1$. Similarly, in the case where $\alpha_1$ is statistically significant, i.e., we can accept $H_1$: $\alpha_1 \neq 0$, and also $\alpha_2$ is significant, i.e., we can accept $H_1$: $\alpha_2 \neq 0$, the regression equation can be rewritten as follows:

$$Y = \alpha_0 + (\alpha_1 + \alpha_2)x + \boldsymbol{X\beta} + u,$$

for a sample taking $D = 1$. Comparing these two equations, regardless of $\alpha_1$'s significance, the interpretation of $\alpha_2$ shall be an additional effect (not predetermined as being positive or negative) of $D = 1$. Now let us assume that $D$ is the indicator of gender, where $D = 0$ means boys and $D = 1$ means girls, and then $\alpha_2$ shall be interpreted as the additional effect attributable to being a girl rather than a boy.

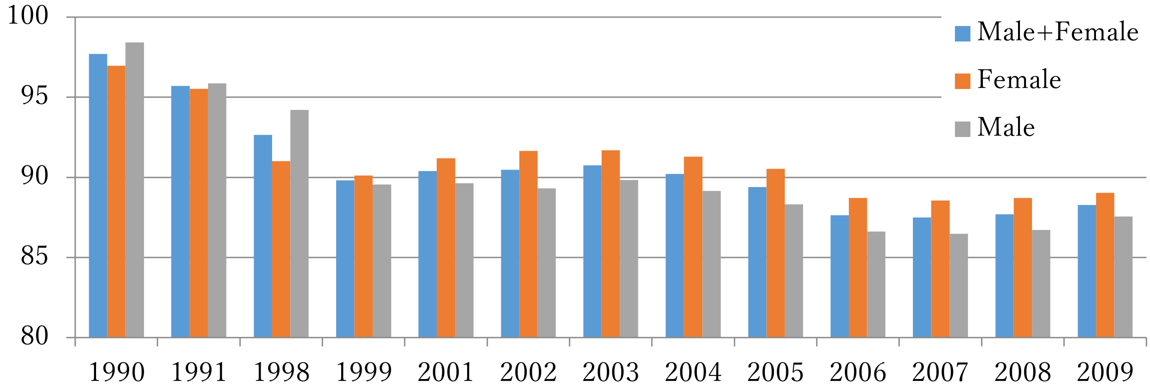
Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

## *Acknowledgement*

I am deeply grateful for two anonymous referees and the handling editor of the *International Journal of Educational Development* for their helpful suggestions. The dataset used for this study's quantitative analysis was provided by the International Food Policy Research Institute (IFPRI). In 2010, the author was advised by Dr. Jun Goto regarding data use. Use of the map of Province of Bukidnon (Figure 1) in this study was kindly allowed by Mr. Nao Takayama, who is a corresponding author of and published the map in Takayama et al. (2010), and by the Japanese Journal of Southeast Asian Studies, Kyoto University. The author is very grateful to IFPRI and to all those persons and institutions providing assistances and permissions. The author is indebted to the two anonymous referees and Drs. Tomohiro Machikita and Takeshi Aida for their dedicated contributions of substantial and detailed comments and critiques; if not for their comments, the author would not have been able to complete this study. The author is grateful for the heartfelt encouragement and advice from Professors Toru Nakanishi, Yasuyuki Sawada, Yuto Kitamura, Waka Aoyama, Kazuo Kuroda, Mikiko Nishimura, Ryuichi Tanaka, and Dennis Dado Trinidad. This study is partly based on a presentation given at the APL Seminar, held at IDE on November 26, 2012. The author's thanks go to all seminar participants and, among others, to Drs. Kenmei Tsubota, a then-organizer who encouraged me of this study; Yuya Kudo, a moderator at the seminar who offered insightful comments; and Momoe Makino, a participant who provided intriguing and rigorous suggestions and critiques. The author also thanks Drs. Takahiro Fukunishi, Kazushi Takahashi, Yuko Nakano, and my colleagues (Ms. Maki Aoki and Mr. Noburu Yoshida, among others) for their encouragements and advice. Yet, any remaining errors are solely the author's. The opinions expressed within this study do not reflect those of any of the author's affiliations or of anyone except the author.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

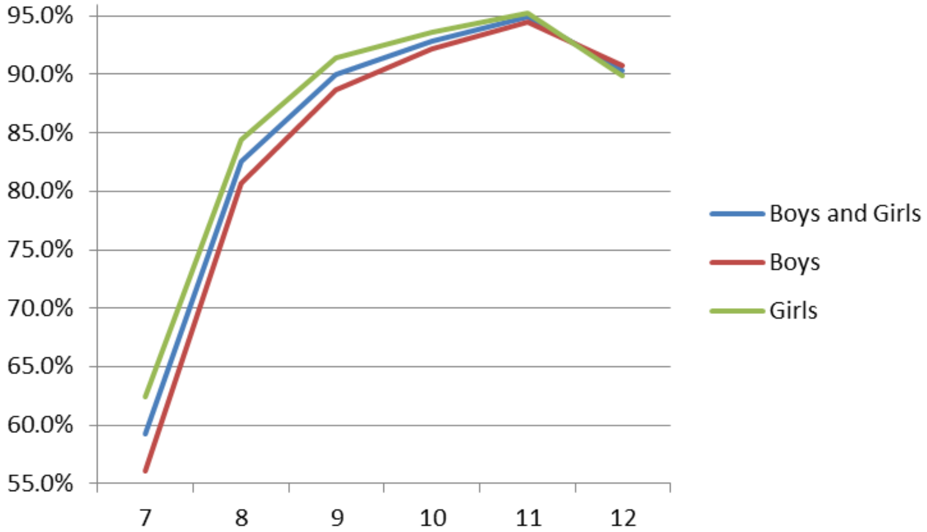
Fig. 1. Enrollment Ratio of the Philippine Primary Education
(Blue Bar = Gross, Red Bar = Net)




Source: World Development Indicator (various years)

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

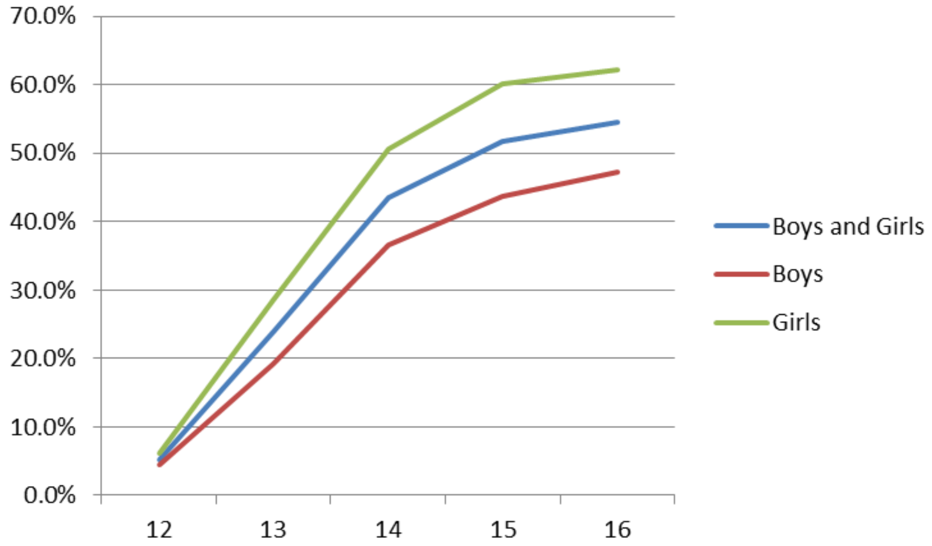
Fig. 2. Proportion of Primary-Education-Enrolling Population, Bukidnon, 2000




Source: NSO (2003).

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

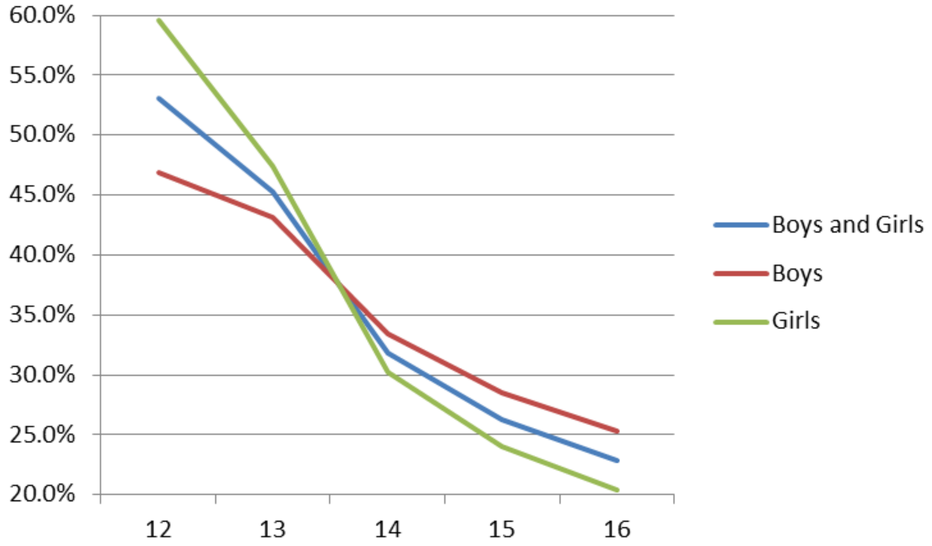
Fig. 3. Proportion of Secondary-Education-Enrolling Population, Bukidnon, 2000




Source: NSO (2003).

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

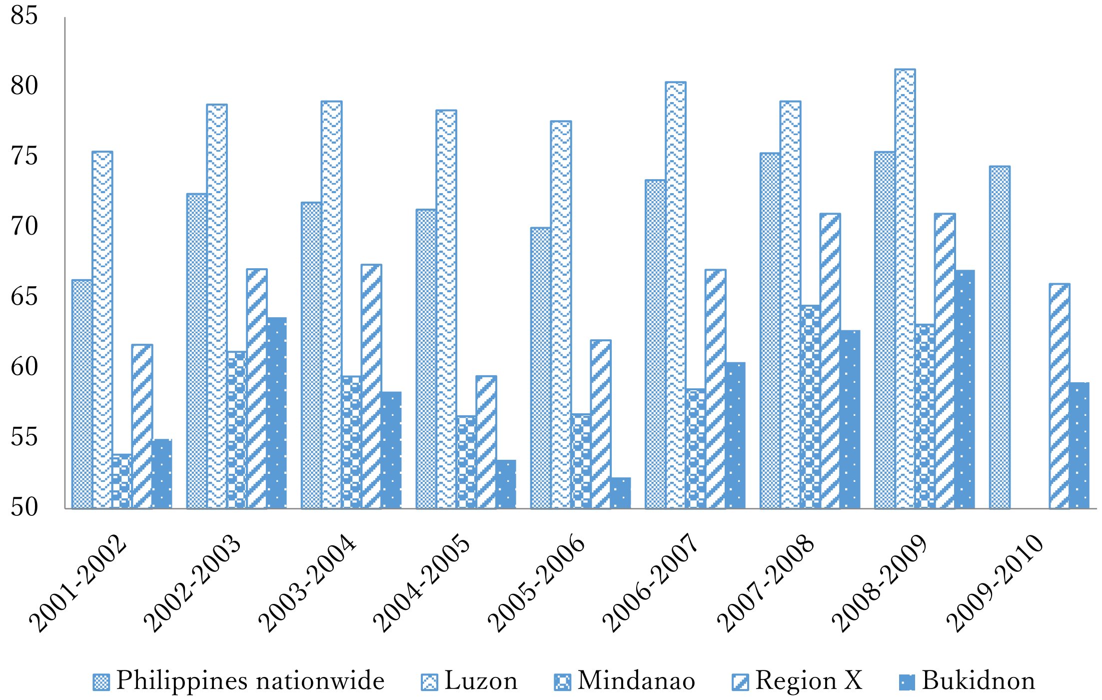
Fig. 4. Proportion of Population Completed 5-6th Grades in Primary Education, Bukidnon, 2000




Source: NSO (2003).

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

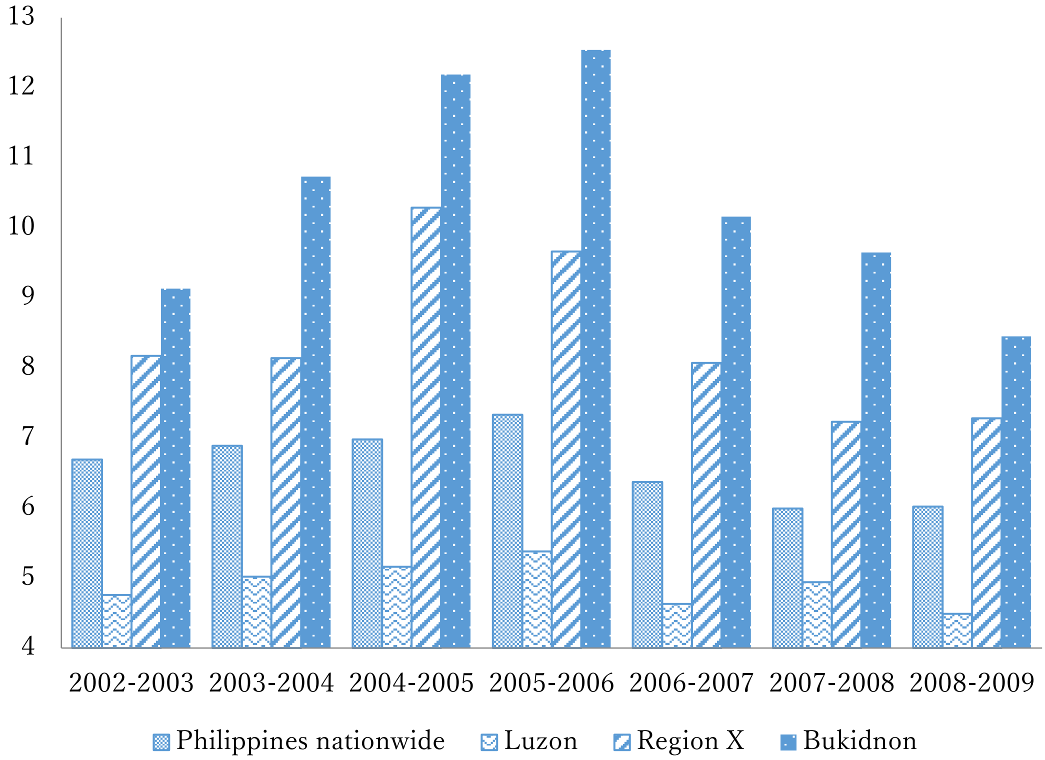
Fig. 5. Cohort Survival Rate by Region, Primary Education, The Philippines




Source: Mindanao Development Authority.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

Fig. 6. Dropout Rate by Region, Primary Education, The Philippines

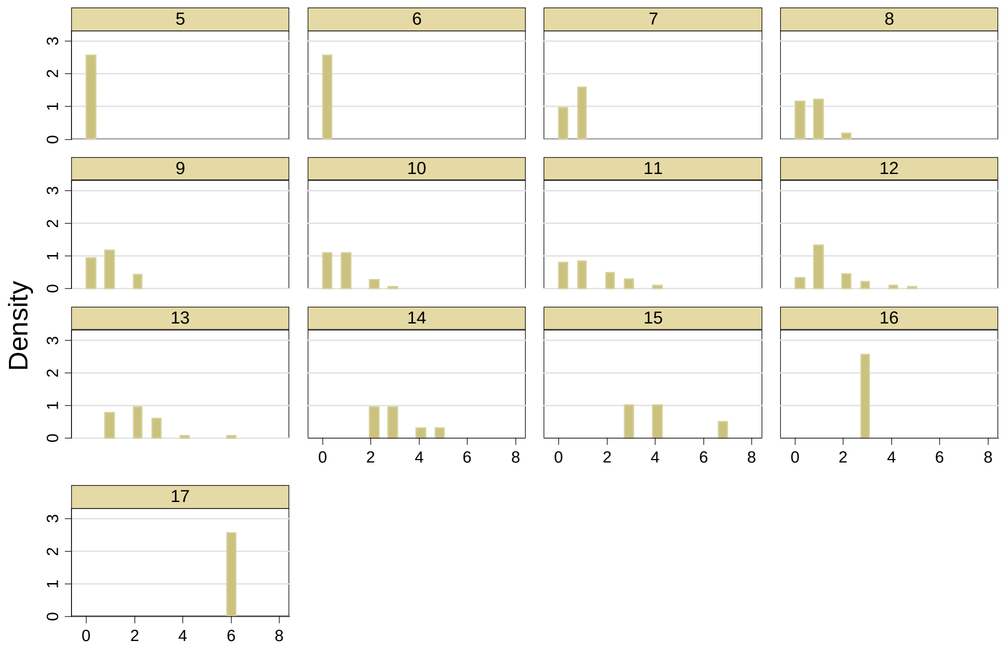



Source: Mindanao Development Authority.

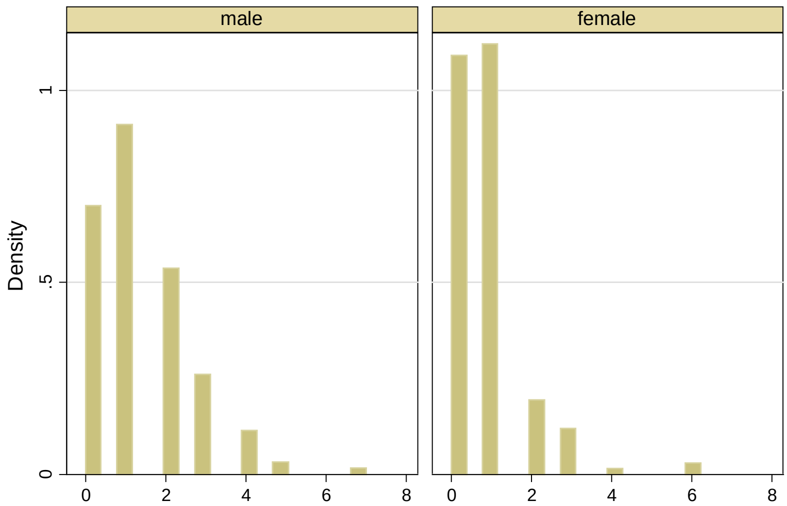
Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

Fig. 7. Distribution of delayed years in Primary Education
(horizontal axis: delayed year; vertical axis: proportion)

1) By age




2) By gender




Source: Author's calculation by IFPRI (2008).

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

TABLE 1
Philippine Education System
(at the time of research)

| Age | ~5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Preschool | | | | | | | | | | | | | | | |
| Primary† | | | | | | | | | | | | | | | |
| Secondary* | | | | | | | | | | | | | | | |
| Tertiary | | | | | | | | | | | | | | | |

† Entrance age had been seven until 1995, but changed to six after then.
* Recently, the education system of the Philippines is under reform (Okabe 2013), which is to expand secondary education from four years to six years. However, the analysis in this study regards it as four-year stage due to the research time.

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

TABLE 2
Descriptive Statistics

| Variables | Descriptions | Mean | Standard Deviation |
|---|---|---|---|
| Dependent variable: | | | |
| $\Delta A$ | years of schooling in delay | 1.076687 | 1.17025 |
| $A_2$ | years of schooling completed | 2.721713 | 1.869743 |
| Independent variables: | | | |
| Individual characteristics ($\boldsymbol{X}_1$): | | | |
| *Age* | age | 9.7584 | 2.4090 |
| *Sqage* | squared age | 101.0122 | 48.1829 |
| *D_g* | 1 if girl | 0.5199 | 0.5004 |
| *BMI* | BMI | 15.4410 | 1.9401 |
| *D_Ilongo* † | 1 if speaking Ilongo as first language | 0.0122 | 0.1101 |
| *D_Ilokano* † | 1 if speaking Ilokano as first language | 0.0061 | 0.0781 |
| *D_Waray* † | 1 if speaking Waray as first language | 0.0061 | 0.0781 |
| *PW* | Years ago when paid work began | 0.1284 | 0.6330 |
| *PW×D_g* | *PW×D_g* | 0.0459 | 0.4006 |
| Household characteristics ($\boldsymbol{X}_2$): | | | |
| *Numson* | number of son | 2.8471 | 1.9284 |
| *Numdau* | number of daughter | 2.4434 | 1.7238 |
| *Numson×D_g* | *Numson×D_g* | 1.2477 | 1.7731 |
| *Numdau×D_g* | *Numson×D_g* | 1.5199 | 1.8598 |
| *D_Wshock* | 1 if experienced weather shick | 0.5321 | 0.4997 |
| *D_Wshock×D_g* | *D_Wshock×D_g* | 0.2966 | 0.4575 |
| *D_Mshock* | 1 if experienced millitary-presence shock | 0.0183 | 0.1344 |
| *D_Mshockf×D_g* | *D_Mshockf×D_g* | 0.0153 | 0.1229 |
| *Sav* | 1 if household has a saving account | 0.2370 | 0.9379 |
| *Sav×D_g* | *Sav×D_g* | 0.1743 | 0.8353 |
| *D_Refu* | 1 if hh head experienced refused of credit | 0.1896 | 0.3926 |
| *D_Refu×D_g* | *D_Refu×D_g* | 0.1009 | 0.3017 |
| *SC* | social capital (no. of person) | 1.9702 | 1.2399 |
| *Fated* | years of schooling of father | 6.8563 | 3.3790 |
| *Momed* | years of schooling of mother | 7.5566 | 3.0258 |
| *Fated×D_g* | *Fated×D_g* | 3.7095 | 4.4035 |
| *Momed×D_g* | *Momed×D_g* | 4.0398 | 4.4771 |
| *Fat_ab* ‡ | 1 if household head lives away from household | 0.0031 | 0.0553 |
| *Mom_ab* ‡ | 1 if household spouse lives away from household | 0.0031 | 0.0553 |
| Income: | | | |
| log *Y* | log per capita income | 7.4846 | 2.5633 |
| log *Y×D_g* | log *Y×D_g* | 4.0383 | 4.2421 |
| log R | log per capita remmittance | 3.5450 | 2.8901 |
| log *R×D_g* | log *R×D_g* | 1.8585 | 2.7779 |
| Asset: | | | |
| *OL* | Owned land (h) | 90.8087 | 171.1786 |
| *TL* | Rented-in land (h) | 108.8434 | 139.7132 |
| *OL×D_g* | Owned land ×*D_g* | 62.7977 | 152.2145 |
| *TL×D_g* | Rented-in land × *D_g* | 56.8058 | 128.1023 |
| *D_mot* | 1 if have motorbike | 0.1560 | 0.3634 |
| *D_car* | 1 if have car | 0.0306 | 0.1724 |
| *D_nonelec* | 1 if nonelectrified house | 0.3150 | 0.4652 |
| *D_nopipe* | 1 if non water piped house | 0.5138 | 0.5006 |
| Supply-side school variables ($\boldsymbol{S}$) | | | |
| *Inst_change* | 1 if generation that benefitted from institutional change of entrace age to primary schools | 0.9755 | 0.1547 |
| *D_Snack* | 1 if received school snack | 0.3211 | 0.4676 |
| *D_Lunch* | 1 if received school lunch | 0.1804 | 0.3851 |

No. of obserbation = 327 (except the number of $\Delta A$ 's observation 326).

† Reference of the dummies is the category of speaking Cebuano or Tagalog.

‡ In the household where each of parent lives away there are only boys, so gender-interactions with these variables are not used.

Source: Author's calculation by IFPRI (2008).

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

TABLE 3

Result of Delay Analysis (Tobit estimation)

| Variables | Dependent Variable = $\Delta A$ | | | | Dependent Variable = $A_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | w/ Gender Interaction | | w/o Gender Interaction | | w/ Gender Interaction | | w/o Gender Interaction | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Individual characteristics ($X_1$): | | | | | | | | |
| *Age* | 0.2232 | 0.3026 | 0.1469 | 0.1903 | 1.4994 | 1.5191 | 1.6211 | 1.6161 |
| | [0.23] | [0.23] | [0.24] | [0.23] | [0.24]*** | [0.24]*** | [0.24]*** | [0.24]*** |
| *Sqage* | 0.0054 | 0.0005 | 0.009 | 0.0062 | -0.0356 | -0.0358 | -0.0414 | -0.0407 |
| | [0.01] | [0.01] | [0.01] | [0.01] | [0.01]*** | [0.01]*** | [0.01]*** | [0.01]*** |
| *D_g* | -0.2862 | -0.6221 | -0.4668 | -0.4434 | 0.2755 | 0.748 | 0.394 | 0.3639 |
| | [0.68] | [0.61] | [0.14]*** | [0.14]*** | [0.55] | [0.50] | [0.12]*** | [0.12]*** |
| *BMI* | -0.1174 | -0.0875 | -0.1057 | -0.0897 | 0.1031 | 0.0942 | 0.0979 | 0.0861 |
| | [0.05]** | [0.04]** | [0.04]** | [0.04]** | [0.03]*** | [0.03]*** | [0.03]*** | [0.03]*** |
| *D_Ilongo* | -0.0258 | 0.0266 | 0.1625 | 0.3729 | -0.0484 | -0.1344 | -0.0741 | -0.198 |
| | [0.58] | [0.58] | [0.58] | [0.59] | [0.34] | [0.32] | [0.30] | [0.31] |
| *D_Ilokano* | 0.7185 | 0.41 | 0.6736 | 0.4619 | -0.5488 | -0.2401 | -0.484 | -0.2623 |
| | [0.72] | [0.71] | [0.71] | [0.72] | [0.61] | [0.61] | [0.61] | [0.61] |
| *D_Waray* | 0.0391 | -0.2464 | -0.1278 | -0.2717 | 0.1371 | 0.554 | 0.3186 | 0.5499 |
| | [0.43] | [0.44] | [0.42] | [0.44] | [0.29] | [0.33]* | [0.29] | [0.33]* |
| *PW* | 0.0544 | 0.0459 | 0.2163 | 0.2256 | -0.0611 | -0.0322 | -0.2023 | -0.1947 |
| | [0.14] | [0.13] | [0.12]* | [0.12]* | [0.13] | [0.12] | [0.11]* | [0.12]* |
| *PW×D_g* | 0.3775 | 0.4457 | | | -0.3508 | -0.4014 | | |
| | [0.18]** | [0.16]*** | | | [0.16]** | [0.15]*** | | |
| Household characteristics ($X_2$): | | | | | | | | |
| *Numson* | 0.0638 | 0.052 | 0.0307 | 0.0363 | -0.0399 | -0.0282 | -0.032 | -0.0356 |
| | [0.05] | [0.05] | [0.04] | [0.04] | [0.04] | [0.05] | [0.03] | [0.03] |
| *Numdau* | 0.0548 | 0.0739 | 0.0589 | 0.0612 | -0.0216 | -0.0373 | -0.0233 | -0.0285 |
| | [0.07] | [0.06] | [0.05] | [0.04] | [0.06] | [0.05] | [0.04] | [0.04] |
| *Numson×D_Girls* | -0.0664 | -0.0222 | | | 0.0159 | -0.0186 | | |
| | [0.07] | [0.08] | | | [0.06] | [0.06] | | |
| *Numdau×D_Girls* | 0.0016 | -0.0381 | | | -0.0025 | 0.0135 | | |
| | [0.09] | [0.08] | | | [0.07] | [0.07] | | |
| *D_Wshock* | 0.0125 | 0.032 | 0.1022 | 0.1027 | -0.0201 | -0.0371 | -0.0748 | -0.0816 |
| | [0.20] | [0.20] | [0.14] | [0.14] | [0.18] | [0.17] | [0.12] | [0.11] |
| *D_Wshock×D_g* | 0.1467 | 0.1605 | | | -0.1082 | -0.1341 | | |
| | [0.27] | [0.27] | | | [0.22] | [0.22] | | |
| *D_Mshock* | 0.1365 | 0.124 | 0.3922 | 0.5508 | 0.2062 | 0.1992 | -0.2711 | -0.409 |
| | [0.38] | [0.42] | [0.30] | [0.27]** | [0.29] | [0.33] | [0.24] | [0.23]* |
| *D_Mshockf×D_g* | 0.3018 | 0.281 | | | -0.5875 | -0.6904 | | |
| | [0.51] | [0.47] | | | [0.40] | [0.37]* | | |
| *Sav* | -0.0193 | 0.0008 | -0.1024 | -0.0502 | 0.1339 | 0.1158 | 0.0373 | -0.0129 |
| | [0.17] | [0.14] | [0.08] | [0.09] | [0.15] | [0.12] | [0.06] | [0.06] |
| *Sav×D_g* | -0.1114 | -0.0909 | | | -0.103 | -0.1422 | | |
| | [0.19] | [0.17] | | | [0.16] | [0.12] | | |
| *D_Refu* | 0.2644 | 0.1899 | 0.3295 | 0.3669 | -0.1175 | -0.0286 | -0.2026 | -0.1868 |
| | [0.24] | [0.24] | [0.19]* | [0.20]* | [0.22] | [0.22] | [0.17] | [0.18] |
| *D_Refu×D_g* | 0.1223 | 0.265 | | | -0.1265 | -0.2046 | | |
| | [0.35] | [0.36] | | | [0.32] | [0.32] | | |
| *SC* | -0.1055 | -0.1023 | -0.0918 | -0.0974 | 0.0368 | 0.031 | 0.029 | 0.0319 |
| | [0.05]** | [0.05]** | [0.05]* | [0.05]** | [0.03] | [0.03] | [0.03] | [0.03] |
| *Fated* | -0.1029 | -0.1109 | -0.0437 | -0.0434 | 0.0794 | 0.0896 | 0.0237 | 0.0244 |
| | [0.04]** | [0.04]*** | [0.02]* | [0.02]* | [0.03]** | [0.03]*** | [0.02] | [0.02] |
| *Momed* | -0.0426 | -0.0413 | -0.071 | -0.0738 | 0.0401 | 0.0343 | 0.0686 | 0.0671 |
| | [0.04] | [0.05] | [0.03]** | [0.03]** | [0.04] | [0.04] | [0.02]*** | [0.02]*** |
| *Fated×D_g* | 0.1125 | 0.1303 | | | -0.0957 | -0.1078 | | |
| | [0.05]** | [0.05]** | | | [0.04]** | [0.04]*** | | |
| *Momed×D_g* | -0.0403 | -0.0567 | | | 0.0294 | 0.0369 | | |
| | [0.06] | [0.06] | | | [0.05] | [0.05] | | |

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

TABLE 3

Result of Delay Analysis (Cont.)

| Variables | Dependent Variable = $\Delta A$ | | | | Dependent Variable = $A_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | w/ Gender Interaction | | w/o Gender Interaction | | w/ Gender Interaction | | w/o Gender Interaction | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Fat_ab* | 0.7571 | 0.3256 | 0.3713 | 0.3278 | -0.6328 | -0.2379 | -0.2889 | -0.2231 |
| | [0.42]* | [0.30] | [0.38] | [0.30] | [0.35]* | [0.25] | [0.31] | [0.25] |
| *Mom_ab* | -0.3278 | -0.6277 | -0.1998 | -0.2487 | -0.0839 | 0.1057 | 0.3963 | 0.4954 |
| | [0.71] | [0.54] | [0.41] | [0.38] | [0.65] | [0.45] | [0.29] | [0.29]* |
| log *Y* | 0.0486 | | 0.0137 | | -0.0489 | | -0.0126 | |
| | [0.03] | | [0.03] | | [0.03]* | | [0.02] | |
| log *Y×D_g* | -0.1052 | | | | 0.1001 | | | |
| | [0.05]** | | | | [0.04]** | | | |
| log *R* | -0.0121 | | 0.0154 | | 0.0066 | | -0.0095 | |
| | [0.04] | | [0.03] | | [0.03] | | [0.02] | |
| log *R×D_g* | 0.0653 | | | | -0.0327 | | | |
| | [0.05] | | | | [0.04] | | | |
| *OL* | | 0 | | 0.0003 | | -0.0008 | | -0.0003 |
| | | [0.00] | | [0.00] | | [0.00] | | [0.00] |
| *TL* | | 0.0006 | | -0.0008 | | -0.0011 | | 0.0001 |
| | | [0.00] | | [0.00] | | [0.00] | | [0.00] |
| *OL×D_g* | | 0.0001 | | | | 0.0009 | | |
| | | [0.00] | | | | [0.00] | | |
| *TL×D_g* | | -0.0027 | | | | 0.0018 | | |
| | | [0.00]** | | | | [0.00]** | | |
| *D_mot* | | -0.3095 | | -0.3413 | | 0.2657 | | 0.2741 |
| | | [0.22] | | [0.22] | | [0.18] | | [0.17] |
| *D_car* | | -0.5456 | | -0.3602 | | 0.3183 | | 0.2656 |
| | | [0.40] | | [0.42] | | [0.25] | | [0.26] |
| *D_noelec* | | 0.0584 | | 0.0356 | | -0.203 | | -0.1523 |
| | | [0.17] | | [0.17] | | [0.14] | | [0.14] |
| *D_nopipe* | | 0.1496 | | 0.1189 | | -0.0681 | | -0.0772 |
| | | [0.15] | | [0.16] | | [0.13] | | [0.13] |
| Supply-side school variables: | | | | | | | | |
| *Inst_change* | -1.4228 | -1.3559 | -1.2782 | -1.2219 | 1.8875 | 1.8502 | 1.7708 | 1.7139 |
| | [0.55]** | [0.57]** | [0.61]** | [0.62]** | [0.55]*** | [0.55]*** | [0.59]*** | [0.58]*** |
| *D_Snack* | -0.3034 | -0.3187 | -0.3554 | -0.3565 | 0.2317 | 0.227 | 0.2724 | 0.2632 |
| | [0.16]* | [0.16]* | [0.16]** | [0.16]** | [0.13]* | [0.13]* | [0.13]** | [0.13]** |
| *D_Lunch* | -0.4585 | -0.4076 | -0.4692 | -0.4549 | 0.2752 | 0.179 | 0.2757 | 0.2252 |
| | [0.21]** | [0.22]* | [0.20]** | [0.21]** | [0.15]* | [0.17] | [0.15]* | [0.16] |
| Region-specific effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Intercept | 2.5369 | 1.9357 | 2.6223 | 2.3455 | -12.8457 | -12.9242 | -13.2563 | -13.0445 |
| | [1.41]* | [1.39] | [1.36]* | [1.36]* | [1.32]*** | [1.35]*** | [1.29]*** | [1.35]*** |
| σ-constant | 1.0061 | 0.9954 | 1.0406 | 1.03 | 0.8638 | 0.8576 | 0.8917 | 0.8817 |
| | [0.06]*** | [0.06]*** | [0.06]*** | [0.06]*** | [0.05]*** | [0.05]*** | [0.05]*** | [0.05]*** |
| Pseudo $R^2$ | 0.2586 | 0.2686 | 0.2418 | 0.2497 | 0.421 | 0.4252 | 0.4075 | 0.4132 |
| Log-likelihood | -374.05 | -368.989 | -382.529 | -378.537 | -383.561 | -380.759 | -392.509 | -388.721 |
| No. of obs. | 326 | 326 | 326 | 326 | 327 | 327 | 327 | 327 |

Notes: (1) Robust standard errors are in brackets.

(2) *, **, and *** means statistical significance at the level of 10%, 5%, and 1%, respectively.

Source: Author's calculation by IFPRI (2008).

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

# TABLE 4

## Result of Delay Analysis (Poisson estimation)

| Variables | Dependent Variable = $\Delta A$ | | | | Dependent Variable = $A_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | w/ Gender Interaction | | w/o Gender Interaction | | w/ Gender Interaction | | w/o Gender Interaction | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Individual characteristics ($\boldsymbol{X_1}$): | | | | | | | | |
| *Age* | 0.5012 | 0.5387 | 0.408 | 0.4108 | 1.3397 | 1.3571 | 1.3688 | 1.3726 |
| | [0.16]*** | [0.15]*** | [0.16]** | [0.16]*** | [0.13]*** | [0.13]*** | [0.13]*** | [0.13]*** |
| *Sqage* | -0.0126 | -0.0151 | -0.0083 | -0.0088 | -0.0501 | -0.0507 | -0.0515 | -0.0516 |
| | [0.01]* | [0.01]** | [0.01] | [0.01] | [0.01]*** | [0.01]*** | [0.01]*** | [0.01]*** |
| *D_g* | 0.0748 | -0.5576 | -0.3533 | -0.3355 | 0.1098 | 0.246 | 0.1498 | 0.1297 |
| | [0.48] | [0.41] | [0.09]*** | [0.10]*** | [0.19] | [0.17] | [0.04]*** | [0.04]*** |
| *BMI* | -0.0769 | -0.0596 | -0.0612 | -0.052 | 0.0295 | 0.0298 | 0.0319 | 0.0298 |
| | [0.03]** | [0.03]** | [0.03]** | [0.03]* | [0.01]*** | [0.01]*** | [0.01]*** | [0.01]*** |
| *D_Ilongo* | -0.1612 | -0.0303 | 0.0355 | 0.1944 | -0.0431 | -0.0701 | 0.034 | 0.0044 |
| | [0.54] | [0.51] | [0.51] | [0.50] | [0.17] | [0.14] | [0.09] | [0.10] |
| *D_Ilokano* | 0.5236 | 0.2866 | 0.5008 | 0.3178 | -0.188 | -0.0745 | -0.178 | -0.0853 |
| | [0.48] | [0.48] | [0.48] | [0.48] | [0.18] | [0.18] | [0.19] | [0.19] |
| *D_Waray* | 0.0118 | -0.1407 | -0.0305 | -0.0404 | 0.0211 | 0.196 | 0.0916 | 0.1993 |
| | [0.29] | [0.28] | [0.26] | [0.27] | [0.11] | [0.13] | [0.11] | [0.13] |
| *PW* | -0.0078 | -0.0095 | 0.0651 | 0.0677 | -0.0018 | 0.0088 | -0.0306 | -0.0306 |
| | [0.06] | [0.05] | [0.05] | [0.06] | [0.04] | [0.03] | [0.03] | [0.03] |
| *PW×D_g* | 0.1964 | 0.2433 | | | -0.0653 | -0.0858 | | |
| | [0.08]** | [0.08]*** | | | [0.06] | [0.06] | | |
| Household characteristics ($\boldsymbol{X_2}$): | | | | | | | | |
| *Numson* | 0.0279 | 0.014 | 0.0099 | 0.0112 | -0.0127 | -0.0098 | -0.005 | -0.0042 |
| | [0.03] | [0.03] | [0.02] | [0.02] | [0.01] | [0.02] | [0.01] | [0.01] |
| *Numdau* | 0.0371 | 0.0438 | 0.0358 | 0.0394 | -0.0114 | -0.016 | -0.0145 | -0.017 |
| | [0.04] | [0.03] | [0.03] | [0.03] | [0.02] | [0.02] | [0.01] | [0.01] |
| *Numson×D_Girls* | -0.0243 | 0.0185 | | | 0.0184 | 0.0134 | | |
| | [0.05] | [0.05] | | | [0.02] | [0.02] | | |
| *Numson×D_Girls* | 0.0032 | -0.0148 | | | -0.0112 | -0.0096 | | |
| | [0.06] | [0.05] | | | [0.02] | [0.02] | | |
| *D_Wshock* | 0.011 | -0.0026 | 0.0819 | 0.0631 | -0.0187 | -0.0348 | -0.0388 | -0.046 |
| | [0.12] | [0.12] | [0.10] | [0.09] | [0.06] | [0.06] | [0.04] | [0.04] |
| *D_Wshock×D_g* | 0.1861 | 0.2192 | | | -0.0302 | -0.0247 | | |
| | [0.18] | [0.18] | | | [0.08] | [0.07] | | |
| *D_Mshock* | -0.0302 | 0.0908 | 0.1279 | 0.1926 | 0.1378 | 0.125 | -0.0865 | -0.1214 |
| | [0.27] | [0.28] | [0.19] | [0.19] | [0.11] | [0.13] | [0.08] | [0.08] |
| *D_Mshockf×D_g* | 0.2334 | 0.1317 | | | -0.2615 | -0.263 | | |
| | [0.33] | [0.33] | | | [0.14]* | [0.15]* | | |
| *Sav* | -0.0465 | -0.0388 | -0.123 | -0.0922 | 0.0745 | 0.0825 | 0.0069 | -0.005 |
| | [0.14] | [0.11] | [0.08] | [0.08] | [0.08] | [0.06] | [0.02] | [0.02] |
| *Sav×D_g* | -0.0968 | -0.0702 | | | -0.0655 | -0.0905 | | |
| | [0.17] | [0.14] | | | [0.08] | [0.07] | | |
| *D_Refu* | 0.14 | 0.1149 | 0.1743 | 0.2105 | -0.0354 | -0.0188 | -0.0505 | -0.0519 |
| | [0.14] | [0.14] | [0.12] | [0.13] | [0.08] | [0.08] | [0.06] | [0.06] |
| *D_Refu×D_g* | 0.0765 | 0.1537 | | | -0.0456 | -0.049 | | |
| | [0.22] | [0.24] | | | [0.11] | [0.11] | | |
| *SC* | -0.0883 | -0.0854 | -0.0691 | -0.0743 | 0.0233 | 0.0204 | 0.02 | 0.0205 |
| | [0.04]** | [0.04]** | [0.04]* | [0.04]* | [0.01]** | [0.01]* | [0.01]* | [0.01]* |
| *Fated* | -0.0543 | -0.0692 | -0.0303 | -0.0338 | 0.0278 | 0.031 | 0.01 | 0.0108 |
| | [0.02]** | [0.02]*** | [0.02]* | [0.02]** | [0.01]** | [0.01]*** | [0.01]* | [0.01]* |
| *Momed* | -0.027 | -0.026 | -0.0509 | -0.0513 | 0.0129 | 0.0085 | 0.0192 | 0.0168 |
| | [0.03] | [0.03] | [0.02]** | [0.02]** | [0.01] | [0.01] | [0.01]** | [0.01]** |
| *Fated×D_g* | 0.0646 | 0.0862 | | | -0.031 | -0.0339 | | |
| | [0.03]** | [0.03]*** | | | [0.01]** | [0.01]** | | |
| *Momed×D_g* | -0.0489 | -0.0486 | | | 0.0056 | 0.0097 | | |
| | [0.04] | [0.04] | | | [0.02] | [0.02] | | |

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

TABLE 4

Result of Delay Analysis (Poisson estimation) (Cont.)

| Variables | Dependent Variable = *ΔA* | | | | Dependent Variable = $A_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | w/ Gender Interaction | | w/o Gender Interaction | | w/ Gender Interaction | | w/o Gender Interaction | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Fat_ab* | 0.6188 | 0.3408 | 0.4149 | 0.368 | -0.2525 | -0.1382 | -0.1694 | -0.1293 |
| | [0.28]** | [0.18]* | [0.25] | [0.18]** | [0.12]** | [0.09] | [0.11] | [0.09] |
| *Mom_ab* | -0.3036 | -0.4298 | -0.0166 | -0.0928 | -0.1286 | -0.1707 | 0.1671 | 0.1548 |
| | [0.56] | [0.44] | [0.34] | [0.33] | [0.34] | [0.24] | [0.09]* | [0.09] |
| log *Y* | 0.0412 | | 0.0171 | | -0.0172 | | -0.0095 | |
| | [0.02]* | | [0.02] | | [0.01]* | | [0.01] | |
| log *Y×D_g* | -0.0921 | | | | 0.033 | | | |
| | [0.04]** | | | | [0.02]** | | | |
| log *R* | -0.0025 | | 0.0061 | | -0.0013 | | -0.0042 | |
| | [0.02] | | [0.02] | | [0.01] | | [0.01] | |
| log *R×D_g* | 0.0341 | | | | -0.0071 | | | |
| | [0.03] | | | | [0.01] | | | |
| *OL* | | 0.0004 | | 0.0003 | | -0.0002 | | -0.0001 |
| | | [0.00] | | [0.00] | | [0.00] | | [0.00] |
| *TL* | | 0.0004 | | -0.0003 | | -0.0003 | | 0.0001 |
| | | [0.00] | | [0.00] | | [0.00] | | [0.00] |
| *OL×D_g* | | -0.0002 | | | | 0.0002 | | |
| | | [0.00] | | | | [0.00] | | |
| *TL×D_g* | | -0.0018 | | | | 0.0005 | | |
| | | [0.00]** | | | | [0.00] | | |
| *D_mot* | | -0.2576 | | -0.2601 | | 0.0314 | | 0.0388 |
| | | [0.17] | | [0.17] | | [0.06] | | [0.06] |
| *D_car* | | -0.2435 | | -0.0727 | | 0.162 | | 0.1322 |
| | | [0.37] | | [0.40] | | [0.09]* | | [0.09] |
| *D_noelec* | | 0.0822 | | 0.0285 | | -0.0846 | | -0.0775 |
| | | [0.10] | | [0.10] | | [0.05]* | | [0.05] |
| *D_nopipe* | | 0.1185 | | 0.1154 | | -0.0422 | | -0.0444 |
| | | [0.10] | | [0.11] | | [0.04] | | [0.04] |
| Supply-side school variables: | | | | | | | | |
| *Inst_change* | -0.4367 | -0.3901 | -0.3059 | -0.245 | -0.0071 | -0.0158 | -0.0339 | -0.0596 |
| | [0.20]** | [0.21]* | [0.20] | [0.21] | [0.16] | [0.17] | [0.17] | [0.17] |
| *D_Snack* | -0.2334 | -0.2039 | -0.2291 | -0.2354 | 0.093 | 0.0803 | 0.0983 | 0.093 |
| | [0.11]** | [0.12]* | [0.11]** | [0.12]** | [0.04]** | [0.04]* | [0.04]** | [0.04]** |
| *D_Lunch* | -0.3603 | -0.2891 | -0.373 | -0.3351 | 0.156 | 0.1237 | 0.1543 | 0.1372 |
| | [0.13]*** | [0.15]** | [0.13]*** | [0.14]** | [0.06]*** | [0.06]** | [0.05]*** | [0.06]** |
| Region-specific effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Intercept | -1.3991 | -1.5595 | -1.1435 | -1.1879 | -8.1371 | -8.2419 | -8.2495 | -8.2374 |
| | [0.95] | [0.91]* | [0.93] | [0.92] | [0.66]*** | [0.66]*** | [0.65]*** | [0.65]*** |
| Goodness of fitness: Pr>$\chi^2$ $H_0$: Depemdemt variable~Po | 0.999 | 0.999 | 0.999 | 0.999 | 1.000 | 1.000 | 1.000 | 1.000 |
| Pseudo $R^2$ | 0.2399 | 0.2452 | 0.2288 | 0.2332 | 0.3012 | 0.3023 | 0.2981 | 0.2996 |
| Log-likelihood | -346.549 | -344.135 | -351.611 | -349.616 | -468.163 | -467.389 | -470.26 | -469.193 |
| No. of obs. | 326 | 326 | 326 | 326 | 327 | 327 | 327 | 327 |

Notes: (1) Robust standard errors are in brackets.

(2) *, **, and *** means statistical significance at the level of 10%, 5%, and 1%, respectively.

Source: Author's calculation by IFPRI (2008).

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

TABLE 5

Result of Delay Analysis (Linear regression, with household-specific effect)

| Variables | Dependent Variable = $\Delta A$ | | | | Dependent Variable = $A_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | w/ Gender Interaction | | w/o Gender Interaction | | w/ Gender Interaction | | w/o Gender Interaction | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Individual characteristics ($\boldsymbol{X}_1$): | | | | | | | | |
| *Age* | -0.1783 | -0.1435 | -0.2118 | -0.2093 | 0.8296 | 0.7966 | 0.8629 | 0.8558 |
| | [0.14] | [0.14] | [0.14] | [0.14] | [0.15]*** | [0.16]*** | [0.16]*** | [0.16]*** |
| *Sqage* | 0.0201 | 0.0179 | 0.0215 | 0.0211 | -0.0041 | -0.002 | -0.0054 | -0.0048 |
| | [0.01]*** | [0.01]** | [0.01]*** | [0.01]*** | [0.01] | [0.01] | [0.01] | [0.01] |
| *D_g* | -0.5051 | -0.5282 | -0.3125 | -0.3037 | 0.4743 | 0.5943 | 0.288 | 0.2721 |
| | [0.45] | [0.43] | [0.09]*** | [0.09]*** | [0.47] | [0.44] | [0.10]*** | [0.10]*** |
| *BMI* | -0.073 | -0.0593 | -0.0668 | -0.0592 | 0.0936 | 0.0815 | 0.0853 | 0.078 |
| | [0.03]** | [0.03]* | [0.03]** | [0.03]** | [0.03]*** | [0.03]*** | [0.03]*** | [0.03]*** |
| *D_Ilongo* | -0.1454 | -0.1608 | -0.0911 | -0.0264 | -0.0179 | -0.0252 | -0.0279 | -0.1023 |
| | [0.24] | [0.25] | [0.21] | [0.21] | [0.25] | [0.26] | [0.21] | [0.21] |
| *D_Ilokano* | 0.4728 | 0.3784 | 0.4364 | 0.352 | -0.4514 | -0.2904 | -0.4157 | -0.2642 |
| | [0.18]** | [0.19]** | [0.18]** | [0.19]* | [0.20]** | [0.21] | [0.20]** | [0.21] |
| *D_Waray* | 0.0905 | -0.0876 | -0.0882 | -0.1913 | -0.0138 | 0.1761 | 0.1807 | 0.2827 |
| | [0.25] | [0.30] | [0.26] | [0.31] | [0.25] | [0.31] | [0.26] | [0.31] |
| *PW* | 0.071 | 0.0721 | 0.2128 | 0.2156 | -0.0801 | -0.0778 | -0.2309 | -0.2286 |
| | [0.14] | [0.14] | [0.11]* | [0.11]* | [0.14] | [0.14] | [0.12]** | [0.12]* |
| *PW×D_g* | 0.3395 | 0.3615 | | | -0.3793 | -0.3962 | | |
| | [0.19]* | [0.18]** | | | [0.19]** | [0.18]** | | |
| Household characteristics ($\boldsymbol{X}_2$): | | | | | | | | |
| *Numson* | 0.0442 | 0.0423 | 0.0301 | 0.0308 | -0.0308 | -0.031 | -0.0288 | -0.0306 |
| | [0.05] | [0.05] | [0.03] | [0.03] | [0.05] | [0.05] | [0.03] | [0.03] |
| *Numdau* | 0.0364 | 0.052 | 0.0274 | 0.0304 | -0.0349 | -0.0465 | -0.0226 | -0.0256 |
| | [0.06] | [0.05] | [0.04] | [0.04] | [0.06] | [0.05] | [0.04] | [0.04] |
| *Numson×D_Girls* | -0.023 | -0.0087 | | | 0.0021 | -0.0123 | | |
| | [0.06] | [0.06] | | | [0.05] | [0.06] | | |
| *Numdau×D_Girls* | -0.0222 | -0.0476 | | | 0.0191 | 0.0406 | | |
| | [0.06] | [0.06] | | | [0.06] | [0.06] | | |
| *D_Wshock* | 0.1132 | 0.1223 | 0.1666 | 0.1797 | -0.0933 | -0.0858 | -0.1337 | -0.1377 |
| | [0.16] | [0.16] | [0.11] | [0.11]* | [0.17] | [0.17] | [0.12] | [0.11] |
| *D_Wshock×D_g* | 0.0507 | 0.0858 | | | -0.0402 | -0.0896 | | |
| | [0.18] | [0.18] | | | [0.18] | [0.19] | | |
| *D_Mshock* | 0.1273 | -0.0586 | 0.2935 | 0.3695 | -0.0449 | 0.0864 | -0.3432 | -0.4607 |
| | [0.22] | [0.29] | [0.23] | [0.20]* | [0.24] | [0.31] | [0.24] | [0.21]** |
| *D_Mshockf×D_g* | 0.1839 | 0.3847 | | | -0.3645 | -0.5716 | | |
| | [0.27] | [0.28] | | | [0.26] | [0.29]** | | |
| *Sav* | -0.0261 | -0.0237 | -0.0436 | -0.0191 | 0.0947 | 0.0684 | 0.0286 | -0.0049 |
| | [0.10] | [0.09] | [0.04] | [0.05] | [0.16] | [0.14] | [0.06] | [0.06] |
| *Sav×D_g* | -0.0394 | -0.011 | | | -0.0559 | -0.0674 | | |
| | [0.11] | [0.10] | | | [0.17] | [0.15] | | |
| *D_Refu* | 0.1785 | 0.1204 | 0.2248 | 0.2333 | -0.1878 | -0.1203 | -0.2319 | -0.2403 |
| | [0.21] | [0.21] | [0.16] | [0.17] | [0.21] | [0.22] | [0.17] | [0.19] |
| *D_Refu×D_g* | 0.0475 | 0.1068 | | | -0.0254 | -0.1081 | | |
| | [0.27] | [0.27] | | | [0.26] | [0.27] | | |
| *SC* | -0.0324 | -0.0272 | -0.0279 | -0.0282 | 0.0279 | 0.0245 | 0.0264 | 0.0269 |
| | [0.03] | [0.03] | [0.03] | [0.03] | [0.03] | [0.03] | [0.03] | [0.03] |
| *Fated* | -0.0767 | -0.077 | -0.0317 | -0.0311 | 0.081 | 0.0802 | 0.031 | 0.0293 |
| | [0.03]** | [0.03]** | [0.02]* | [0.02]* | [0.03]** | [0.03]** | [0.02] | [0.02] |
| *Momed* | -0.0272 | -0.0261 | -0.045 | -0.0447 | 0.0373 | 0.0381 | 0.0646 | 0.0635 |
| | [0.04] | [0.04] | [0.02]* | [0.02]* | [0.04] | [0.04] | [0.02]*** | [0.03]** |
| *Fated×D_g* | 0.0779 | 0.0833 | | | -0.0846 | -0.0892 | | |
| | [0.03]** | [0.03]** | | | [0.03]** | [0.04]** | | |
| *Momed×D_g* | -0.0163 | -0.026 | | | 0.0277 | 0.0317 | | |
| | [0.04] | [0.04] | | | [0.04] | [0.04] | | |

Published version appeared in *International Journal of Educational Development*, Volume 46, January 2016, Pages 125–142, https://doi.org/10.1016/j.ijedudev.2015.10.006

TABLE 5

Result of Delay Analysis (Linear regression, with household-specific effect) (Cont.)

| Variables | Dependent Variable = $\Delta A$ | | | | Dependent Variable = $A_2$ | | | |
|---|---|---|---|---|---|---|---|---|
| | w/ Gender Interaction | | w/o Gender Interaction | | w/ Gender Interaction | | w/o Gender Interaction | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Fat_ab* | 0.6344 | 0.333 | 0.4304 | 0.3754 | -0.5597 | -0.2427 | -0.2956 | -0.2705 |
| | [0.32]** | [0.24] | [0.29] | [0.24] | [0.33]* | [0.23] | [0.29] | [0.24] |
| *Mom_ab* | -0.285 | -0.4664 | -0.3853 | -0.4045 | -0.0092 | 0.3012 | 0.4319 | 0.5221 |
| | [0.47] | [0.39] | [0.24] | [0.24]* | [0.66] | [0.58] | [0.28] | [0.29]* |
| log *Y* | 0.0289 | | 0.0146 | | -0.0269 | | -0.0077 | |
| | [0.02] | | [0.02] | | [0.03] | | [0.02] | |
| log *Y×D_g* | -0.044 | | | | 0.0552 | | | |
| | [0.03] | | | | [0.04] | | | |
| log R | -0.0124 | | 0.0121 | | 0.0236 | | -0.0074 | |
| | [0.03] | | [0.02] | | [0.03] | | [0.02] | |
| log *R×D_g* | 0.0489 | | | | -0.0571 | | | |
| | [0.03] | | | | [0.03]* | | | |
| *OL* | | 0 | | 0.0002 | | 0 | | -0.0001 |
| | | [0.00] | | [0.00] | | [0.00] | | [0.00] |
| *TL* | | 0.0005 | | -0.0002 | | -0.0004 | | 0.0002 |
| | | [0.00] | | [0.00] | | [0.00] | | [0.00] |
| *OL×D_g* | | 0.0003 | | | | -0.0001 | | |
| | | [0.00] | | | | [0.00] | | |
| *TL×D_g* | | -0.0012 | | | | 0.0011 | | |
| | | [0.00] | | | | [0.00] | | |
| *D_mot* | | -0.1549 | | -0.1559 | | 0.2139 | | 0.2183 |
| | | [0.17] | | [0.16] | | [0.19] | | [0.18] |
| *D_car* | | -0.2534 | | -0.1836 | | 0.2795 | | 0.2376 |
| | | [0.21] | | [0.23] | | [0.23] | | [0.24] |
| *D_noelec* | | 0.0628 | | 0.0509 | | -0.0784 | | -0.0566 |
| | | [0.14] | | [0.14] | | [0.15] | | [0.15] |
| *D_nopipe* | | 0.0717 | | 0.0613 | | -0.1062 | | -0.1012 |
| | | [0.12] | | [0.13] | | [0.13] | | [0.14] |
| Supply-side school variables: | | | | | | | | |
| *Inst_change* | -1.1329 | -1.0828 | -0.9542 | -0.8972 | 2.2726 | 2.2394 | 2.09 | 2.0542 |
| | [0.58]* | [0.61]* | [0.66] | [0.67] | [0.56]*** | [0.59]*** | [0.64]*** | [0.65]*** |
| *D_Snack* | -0.2467 | -0.2787 | -0.3076 | -0.31 | 0.2467 | 0.2653 | 0.3096 | 0.2995 |
| | [0.13]** | [0.13]** | [0.13]** | [0.13]** | [0.13]* | [0.14]* | [0.14]** | [0.14]** |
| *D_Lunch* | -0.2919 | -0.2745 | -0.3044 | -0.2975 | 0.2646 | 0.2146 | 0.2664 | 0.2385 |
| | [0.15]* | [0.16]* | [0.16]* | [0.17]* | [0.17] | [0.18] | [0.17] | [0.18] |
| Household-specific effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Region-specific effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Intercept | 3.9209 | 3.569 | 3.7154 | 3.6522 | -9.7061 | -9.3497 | -9.4752 | -9.3179 |
| | [1.03]*** | [1.07]*** | [0.96]*** | [1.00]*** | [1.09]*** | [1.13]*** | [1.03]*** | [1.09]*** |
| No. of obs. | 326 | 326 | 326 | 326 | 327 | 327 | 327 | 327 |

Notes: (1) Standard errors (household clustered) are in brackets.

(2) *, **, and *** means statistical significance at the level of 10%, 5%, and 1%, respectively.

Source: Author's calculation by IFPRI (2008).