Chapter 11
Gender Difference in Households' Expenditure on Higher Education: Evidence from Mongolia

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Abstract The existing evidence suggests that there is a reverse gender gap in higher education in Mongolia. Prior studies on the reverse gender gap in education were based on the gross enrolment rates and did not delve deeper in terms of using empirical data analyzed over an extended time-period. This paper investigates gender bias in the households' expenditure on higher education and tracks changes over the ten-year period from 2008 to 2018 using empirical data. In this regard, this study examines the factors and determinants responsible for the gender bias in the households' expenditure on higher education. To address these questions, the study employs the Engel Curve approach (unconditional educational expenditure) and Hurdle model, which estimates bias in the enrolment decisions and bias in the conditional educational expenditure, both at the household and individual level in 2008 and 2018, using the Household Socio-Economic Survey of Mongolia. Its findings illustrate that gender bias in households' expenditure on higher education does exist, and it favors girls over boys at the household and individual levels in 2008 and 2018. The findings show that households allocate a greater share of education expenditure to females aged 16–18 and 19–24 than to their male counterparts. Statistical analysis suggests that households' residence and the occupation of household heads are two important factors affecting this gender bias. Thus, if a household resides in the countryside and its head is employed in the agricultural sector, female offspring are more likely to receive higher education than male offspring. Traditional gender roles and the Mongolian way of life, which centers around attending to livestock and requiring a male labor force and the wage gap, are contextual factors that help explain this gender bias.

Keywords Gender bias · Household's expenditure on education · Hurdle model · Engel's curve · Mongolia

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11.1 Introduction

Intra-household gender bias exists in different forms regarding the household decision-making process, asset ownership, allocation of food, health, education expenditure, etc. One such bias that is particularly applicable to Mongolia is the gender bias in higher education. According to the OECD's Centre for Educational Research and Innovation, trends in gender inequality in higher education is defined as "examining the changes in the composition of the student population in higher education, the relative share of degrees awarded to women each year, the levels of education attained by men and women and lastly, the differences between the subjects studied by men and women" (Lancrin 2008). Female participation in all levels of education was discriminated against to some degree in almost all countries in the past centuries. Therefore, until the 1990s men's participation in higher education was more common than females in the OECD countries (Lancrin 2008).

However, the trend has changed over the years, and it has become a "reversal of the gender gap in higher education" in recent decades (Riphahn and Schwientek 2015). For instance, in 2005, there were more female students than men in higher education in the 16 OECD countries than in the 1990s (Lancrin 2008). Moreover, the increasing number of students entering higher education has been one of the important factors contributing to the country's development (Woolhouse and Cramphorn 1999). Although education plays an important role in any country's economic and sustainable development, the gender imbalance of all types of educational levels is becoming a phenomenon in many countries. This also applies to Mongolia, in terms of the higher composition of female students in higher education.

The evidence for the inequality in higher education enrolment rates within the country shows that males are less favored than females to receive higher education. The "Gender Profile Mongolia Report," which is prepared by the Swiss Development Corporation, concluded that the government should impose quotas for male students in higher education (SDC 2014). "The Gender Profile Report" also indicated that reverse gender gap exists in higher education in Mongolia and noted that "the gender imbalance in favor of girls persists at the tertiary level" (SDC 2014). In light of these findings, however, the Government of Mongolia has not undertaken any measures to address the gender misbalance in higher education.

Moreover, even though there are more highly educated women in the country, it does not promise to convert their higher level of education into the highest social position or higher level of income. In addition, Japan International Cooperation Agency considered the wage gap and unemployment rates between the two genders and concluded that girls are expected to have a higher education than boys in order to be employed in better workplaces. However, the educational advantage for girls does not hold the promise of stable work or a better salary(Guillén Soto 2011).

According to the "Institute of Labor Economics Report" about the gender gap in careers in Mongolia, women have better access to education. The young men in the countryside tend to look after the animals while living at home, whereas girls have an advantage to pursue higher education (Pastore 2008). It might be one of the rational explanations for the widening gender gap. Stereotypes of employment opportunity for both genders, family decisions for withdrawing boys from school and low quality of vocational education quality might be the contributing factors to this gender imbalance. However, there are not approved statistical results or findings for these assumptions and plausible explanations at the household-level.

Pastore (2008) studies the returns to education of young people in Mongolia using the School to Work Transition Survey in Mongolia which is carried out in 2016. He found that there is a sizeable gender pay gap in which the median wage of women is about 25% lower than men with the same characteristics. However, in general, women have much higher levels of education than men; therefore, on the whole, they should have higher income. Moreover, estimation results demonstrate that females' average return to education is much higher than for males with secondary level education (11% vs. 20.6) and almost the same at the university level (Pastore 2010). These findings suggest that females have a higher rate of return to education than men.

There were many programs aimed at decreasing the inequality in gross enrolment rates in higher education in Mongolia. However, up to now, very little has been done to examine the gender differences in higher education in Mongolia. Considering the research gaps, understanding and finding the household influences on higher education, attendance is very important to develop further policy recommendations to the Government of Mongolia. Trends in the higher education reverse gender gap are expressed in terms of raw numbers of the gender gap in related articles about Mongolia. In order to find more plausible explanations and differences in enrolment rates for this reverse gender gap, it is important to choose household-level data and do more quantitative and alternative econometric analyses.

Gender inequalities are not only reflected in the number of highly educated men and women. In the long term, they hinder efforts to develop the country in many aspects, such as inclusive economic growth and equal opportunities for both genders and equity. Furthermore, it will lead to inequalities in the labor market and in society, such as single-parent homes (headed by women), more single women and less qualified men for jobs. Moreover, it will affect life expectancy and mortality. In other words, men who have less education than women might find themselves socially excluded. Therefore, decision makers and governmental actors should consider the promotion of equal higher education for both genders.

The purpose of the present study is to examine gender differences in higher education expenditures within Mongolian household's decision-making about investing in higher education. Identifying gender differences in the allocation of households for investment in higher education in Mongolia is important to understand what policy measures should be taken to reduce gender inequality in the country. This study identifies two main research questions. Are there gender differences in the allocation of higher education expenditures within Mongolian households? What factors explain households' educational expenditure and gender difference?

11.2 Background on Mongolia's Educational Policy

The importance of education in the overall development of a nation is now recognized on the global stage (Forum 2016). Furthermore, the quality of education determines labor productivity and economic growth (Hanushek and Woessmann 2008). Therefore, since the education index is considered a part of the "Human Development Index" in most countries, public education is strongly emphasized. Public education is compulsory up to the basic educational level in many countries, and governments have committed themselves to guaranteeing opportunities for all students who want to pursue their education. Thus, to understand the Mongolian context, it is important to discuss the education system in Mongolia. This will allow for showcasing how the education system works in the country, how it shows its neutrality in terms of being universal, and how it does not favor the enrolment of any particular gender, eliminating any notions that gender bias is a structural issue that stems from the education system.

Looking back at the history of education, since gaining its independence in 1921, Mongolia has provided free and universal access to primary, secondary and higher education to its citizens (Banzragch and Bayanjargal 2018). Meantime, while developing higher education, Mongolia adopted the Soviet style education system and "shared a number of cultural characteristics with Central Asia countries" (Weidman and Chapman 2004). The language of instruction was mainly Mongolian and partially Russian during the socialist period of the history of Mongolia (Worden and Savada 1991). The first university was established in 1942, and since then, the country has developed its own unique education system with a mixture of the Russian style education system.

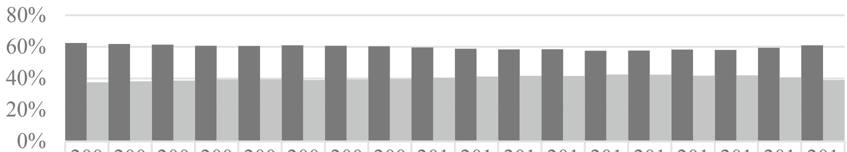
The transition to a market economic system during the early 1990s brought dramatic changes to the economic and social sphere of the country overall. After the transition, the higher educational framework, including funding, tuition fees, academic curriculum and ownership of universities, has been reshaped again by the Government of Mongolia (IMF 2003). Prior to the transition, "The government owned, financed and operated all higher education institutions in Mongolia" (Weidman and Bat-Erdene 2002). Since the adoption of the new Constitution in 1992, the private sector provision of higher education in Mongolia increased rapidly and tuition fees for public and private universities increased year by year. As a result, currently, there are currently 71 private and 21 public and 3 international universities (NSO 2020a). The introduction of tuition and fees brought considerable financial burden to families that have many children and thus may lead to gender preference decisions. Especially poor households are faced with decisions regarding whom to enroll to tertiary education, boys or girls.

A new Law of Education was introduced after the peaceful democratic revolution in 1990 and dramatic political shifts in 1991, and in light of constitutional reforms, and passed with several amendments in 1995 (Banzragch and Bayanjargal 2018). In Mongolia, kindergarten, elementary, secondary, high school and vocational education are fully funded by the government and free of charge. Moreover, the Mongolian education system was a 10-year system (4 + 4 + 2) up to 2004, and shifted to an 11-year system (5 + 4 + 2), then to a 12-year system (5 + 4 + 3) in 2015. This was in compliance with international standards (ADB 2017). At the same time, the official general education age shifted from 7 to 17 years old to 6 to 18 years old. On the other hand, Mongolian people have the right to free high school education for 12 years. Note that compulsory education is up to secondary education, which is nine years, and almost all primary, secondary and high schools in Mongolia are co-ed, and they enroll both boys and girls together.

After high school graduation, students have two choices to continue their education. One is enrolling in technical-vocational schools, and the other is enrolling in colleges and universities within the country or abroad. The academic length of time for vocational school is two years, while colleges and universities take from four to seven years, depending on majors. Vocational schools are also funded by the government and students received monthly stipends. However, higher education in the country is financed by students' households, and partially by the government. The tuition fee was introduced in 1993, and higher education financing started to be covered by the tuition payment (Bat-Erdene et al. 2010).

Statistics of gross secondary enrolment rates starting from 2005 to 2018 show that both genders are almost equally enrolled in basic education (NSO 2020b). It indicates that parents can send their children without any gender preferences up to secondary education. Figure 11.1 shows official statistics of enrolment in higher education institutions by gender between 2002 and 2019 period. In 2002, the numbers of female students were at 62% of the total number of students. Up to now, in 2019, the share of female students is 61% (NSO 2020c). In other words, in 2002, there were 1.66 (female-to-male ratio) females for every male graduating from the higher educational institutions in Mongolia. After 2002, to the present, relatively small changes have occurred in higher education enrolment by gender, and the female-to-male ratio decreased by 0.1. As a result, in 2019, there were 1.56 females for every male graduating from the higher educational institutions in Mongolia.

The enrolment among the two genders is different for each academic year, showing more women obtaining higher education than men. From the available statistical data starting from 2002 and continuing until the present in an almost unbroken trend, male



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
female	62%	62%	61%	61%	61%	61%	61%	60%	60%	59%	58%	58%	58%	58%	58%	58%	59%	61%
male	38%	38%	39%	39%	39%	39%	39%	40%	40%	41%	42%	42%	42%	42%	42%	42%	41%	39%

Fig. 11.1 Share of students in tertiary educational institutions, by gender, 2002–2019 year. *Source* 1212.mn (Mongolian Statistical Information Service)

students' enrolment rates have hardly increased. It also shows there is a big gender discrepancy in terms of educational attainments and differences between the levels of education among males and females. Although the fact is not widely known, the ratio of female-to-male students in higher education is not balanced in Mongolia. Therefore, it is worth drawing attention to educational policies to aim at closing the gap between the level of education between female and male students.

11.3 "Engel and Hurdle Curves" in the Mongolian Education Sector

An Engel Curve describes a household's expenditure on a particular good as a function of the household's total expenditure and other household characteristics, assuming that prices are fixed. This model was taken from (Deaton 1997). This study uses the Working-Leser model for the linear budget share specification, to test for gender biases within households. The Working-Leser specification is as follows:

$$s_i = \alpha + \beta \log(x_i/n_i) + \gamma \log(n_i) + \left[\sum_{j=1}^{j-1} \theta_j \left(\frac{n_{ij}}{n_i}\right)\right] + \eta^{`} z_j + u_i \quad (11.1)$$

where: s_i is the budget share of the education expenditure of ith household (education expenditure/total expenditure), $\log(x_i/n_i)$ is the log of per capita monthly household expenditures, x_i is the total monthly household expenditures; n_i is the household size, $\frac{n_{ij}}{n_i}$. The household age-gender composition variables (n_i is the number of household members in age-sex category j, for instance: females aged 16–25 as a proportion of all household members), z_j a vector of other household head's characteristics including household head's education in years, gender and age, a dummy variable for location and household's occupation, and u_i is the error term.

The household age-gender composition variables $\frac{\boldsymbol{n_{ij}}}{\boldsymbol{n_i}}$ can be used to test for gender biases within the household, where $\boldsymbol{n_{ij}}$ is the number of members in household i in the jth age-gender category. There are 14 age-gender compositions that are used in previous studies (such as Subramanian and Deaton 1991; Wongmonta and Glewwe 2017; Datta and Kingdon 2019), which are 0–4 years, 5–9 years, 10–14 years, 15–19 years, 20–24 years, 25–60 years, and 61 years and more for both males and females. This study uses 10 age-gender groups: males and females aged 0–5 years, 6–15 years, 16–18 years, 19–25 years, and 25 years and above for both males and females. Since the $\frac{\boldsymbol{n_{ij}}}{\boldsymbol{n_i}}$ add up to one, 25 years and above is omitted from the estimation. The categories of most interest are males and females aged 16–18 (high school age) and 19–25 (higher education age), as this paper is concentrated on students who study at a higher level of education. Thus, the age group under focus mostly belongs to the 16–25 bracket. The age-gender category is based on children who are going to join university and studying at the university. And after that age, this paper assumes that many people complete their education and start a professional life or start a family life. The marriage and gender roles in the family might have an impact on a household's education expenditure pattern.

The θ_j coefficients measure the impact of household age-gender composition on the share of the household's budget allocated to education expenditure. One would expect that the θ_j coefficients for age groups 16–18 and 19–25 will be positive, and that gender biases are likely to exist (Datta and Kingdon 2019). In a separate model, the gender difference is tested using an F test to see whether (2): $(\theta_{j,m} = \theta_{j,f})$.

In this study, $\theta_{j,m}$ stands for male age groups 16–18 and 19–25. $\theta_{j,f}$ for female age groups 16–18 and 19–25. Testing, for example, whether males aged 16–18 are treated differently from females aged 16–18, the paper simply seeks whether the coefficient on m16_18, that is, the proportion of males aged 16–18 years in the household. It is significantly different from the coefficient on m16 to 18, that is, the proportion of females aged 16–18 years in the household.

For further analysis, this study adopts the methodology utilized by Datta and Kingdon (2019) and employs the Hurdle model to explain households' educational expenditure patterns. Datta and Kingdon (2019) apply a Hurdle model to Indian data on education expenditures and compares the results of those obtained with an OLS estimation. They used the Tobit model as a standard solution for the above-mentioned problem. However, a Tobit suffers from the problem of heteroskedasticity and it also assumes that a single mechanism determines the decision whether to spend anything at all ($s = 0$ vs. $s > 0$), and the decision of how much to spend, given positive spending ($s \mid s > 0$). Alternative to the Tobit model is the Hurdle model, which is widely used as a two-part model. The first part of the Hurdle model is to estimate the probability of positive educational expenditures. The second part of the model uses OLS regression of educational expenditure for households with positive levels of expenditures, mentioned as conditional OLS (Wooldridge 2010).

In particular, the marginal effects $\partial P(s > 0|x)/\partial x_j$ and $\partial E(s|x, s > 0)/\partial x_j$ are constrained to have the same sign.

An alternative to censored Tobit that allows the initial decision of $s = 0$ versus $s > 0$ to be separate from the decision of how much s is, given that $s > 0$, is the "Hurdle model" (Wooldridge 2010). These models allow the effect of a variable to differently affect the decision $s = 0$ versus $s > 0$, and the conditional decision of how much to spend ($s|s > 0$). *A simple Hurdle model can be written down as (from* Datta and Kingdon 2019*):*

$$P(s = 0|x) = 1 - \Phi(x\gamma) \tag{11.2}$$

$$\log(s)|(x, s > 0) \sim \text{Normal}(x\beta, \sigma^2) \tag{11.3}$$

where s is the budget share of education, x a vector of household characteristics, β and γ are parameters to be estimated, and σ is the deviation of s. Equation (11.3) estimates the probability that s is a zero or positive. Equation (11.4) presents—a conditional—positive education expenditure and follows a lognormal distribution.

Note that Eq. (11.2) is simply a probit regression, while Eq. (11.3) is the conditional OLS.

The conditional expectation of $E(s|x, s > 0)$ and the unconditional expectation of $E(s|x)$ are easy to obtain using properties of the lognormal distribution (from Datta and Kingdon 2019). This is shown below:

$$E(s|x, s > 0) = \exp\left(x\beta + \frac{\sigma^2}{2}\right) \tag{11.4}$$

$$E(s|x) = \Phi(x\gamma)\left(x\beta + \frac{\sigma^2}{2}\right) \tag{11.5}$$

Therefore, the marginal effect of x on s can be obtained by transforming the marginal effect of x on $\log(s)$ using the exponent. Thus, the marginal effect of x on s in the OLS regression can be obtained by transforming the marginal effect of x on $\log(s)$ using the exponent. Thus, the marginal effect of x on s in the OLS regression of $\log(s)$ conditional on $s > 0$ is obtained by taking the derivative of the conditional expectation of s with respect to x (from Kingdon 2005). This is shown below:

$$\frac{\partial E(s|x, s > 0)}{\partial x} = \beta.\exp\left(x\beta + \sigma^2/2\right) \tag{11.6}$$

Using the product rule and taking the derivative of the unconditional expectation Eq. (11.4), the combined marginal effects can be obtained as follows (from Kingdon 2005):

$$\frac{\partial E(s|x)}{\partial x} = \Phi(x\gamma)\left(x\beta + \frac{\sigma^2}{2}\right) = \left\{(x\gamma) + \Phi(x\gamma)\left(x\beta + \frac{\sigma^2}{2}\right)\right\}.\exp(x\beta + \sigma^2/2) \tag{11.7}$$

where $\Phi(.)$ is the standard normal density function, and $\Phi(.)$ is the cumulative normal distribution function.

Equation (11.7) refers to the combined marginal effect of an independent variable. Estimates of γ, βandσ^2 are obtained from the Hurdle model.

The main question of this study is the presence of gender differences in households. Thus, the presence of the gender difference will be tested using the difference in marginal effects and combined marginal effects of selected age-gender categories. These calculations will provide the answer for gender bias in a more nuanced manner. The standard errors of the coefficients and the combined marginal effect standard error are estimated by bootstrapping in STATA (from Kingdon 2005).

In many other studies, researchers used regional dummy and ethnicity. However, in Mongolia, regional cluster and ethnicity do not have much significance, as the country is quite homogeneous ethnically, with the majority of the population comprised of the same social and ethnic groups. The Mongolian language is spoken by more than

95% of the population, and the second largest ethnic group is Kazakh, consisting 4% of the total population. In this regression estimation, I used herder for occupation and a rural dummy for the location since 31.4% of the population lives in rural areas (NSO 2021). Moreover, 26% of households from total households account for herder households (NSO 2021). Thus being a herder and this occupation plays a significant role in this country. Moreover, people who live in the countryside tend to spend less on their male children's education (Diffendal and Weidman 2011). As a result, dropping out of high school is more common in male students.

In addition to estimating the Engel Curve and Hurdle model using household-level data, this paper will use individual level data to test for gender bias. The dependent variable of the individual model is "total higher education expenditure" in absolute terms rather than the budget share of the household's expenditure on higher education. The difference between the individual level model and the household-level model is that the gender dummy variable "female" is used instead of age-gender categories. However, the remaining variables of the individual level model are identical with household-level variables. The methodology presented above allows one to examine the effects of child gender on higher education expenditure, controlling for other relevant characteristics. Since the pattern of the allocation of educational resources within a household would depend on the child's level of education, the equation for each education expenditure category is estimated separately for the three age groups of interest.

The data used in this analysis is extracted from the Household Socio-Economic Survey (HSES) conducted in 2008 and 2018. The data was obtained from the Mongolian National Statistics Office (NSO) from the publicly available platform 1212.mn. The NSO conducts the survey every year, and data collection covers a 12-month period to capture seasonal variations. The HSES 2008 and 2018 is a nationally representative survey that intends to evaluate and monitor households' income and expenditure and measure poverty and consumer price index analysis. The survey has the following components: basic socio-economic information about household members, education, health, migration, employment, payment of jobs and other income, savings and loans, housing and energy, durable goods, non-food expenditures and food consumption (30 days' daily food diary for urban households and 7 days' food diary for rural households and eating out).

For the 2008 HSES, data was collected from 11,172 households, which consists of 44,510 individual level data. The analysis of the 2008 HSES was limited to households that have at least one child aged 16–24, which decreases the data size to 4,518. For the 2018 HSES, data was collected from 16,454 households, which consists of 59,820 individual level data. The sample size was reduced from the 16,454-household data size, the sample size was reduced to 5,183 households that have at least one child aged 16–24. Education expenditure was available at the individual level for the past 12 months. It consists of the following subparts: tuition fees, accommodation, books and other stationary supplies, transportation, and other expenses such as private tutoring.

Since this paper is aimed at estimating the higher educational expenditure, data is limited to households with male and female children aged 16 to 24. The age group

16 to 24 years old was selected based on the Mongolian education system year and official age of education. Moreover, Pastore, professor of Economics at Seconda Università di Napoli, classified the age groups as teenagers (aged 15–19 years), young adults (aged 20–24 years), and the oldest segment of young people (aged 25–29 years). The breakdown of the age group 20–24 belonged to mostly students studying at higher educational institutions. Based on this information, this study refers to an age group of 16–18 old pupils. I this age group, it is critical for parents to decide whether to invest extra resources in their children's education, in order for them to continue their studies. In this regard, it is at this age that parents have to decide whether to arrange private tutoring for general entrance exams or motivate their children to keep growing by sending them to private schools. Therefore, the age group of 19–24 by gender is considered to be the most essential part of this paper. Each age group will be explained separately after the estimated results to give more of an understanding of the gender bias issue.

Before estimating the factors impacting household higher educational expenditure in Mongolia, it is useful to present some descriptive statistics. Thus, Table 11.2 presents the variable names and their definition and also the mean, the standard deviation of variables used in the analysis data from the 2008 and 2018 HSES.

The dependent variable in the Engel Curve analysis is the share of educational expenditure in total household expenditure. The key variables of interest are the age and gender category of 16–18 years and 19–24 years above for both males and females. The share of male and female children aged between 16 and 18 years old and 19 to 24 years old are comparable from Table 11.2. In the 2008 HSES data, male and females aged 16–18 are shown to have the same mean equal to 8.1% and quite similar mean for the 19–24 age groups. Furthermore, in the 2018 HSES data, 6.4% for males and 5.8% for female 16–18, whereas 10% for males and 9.3% for female 19–24 age group.

The proportion of females aged 19–24 years old in the household was used to investigate whether budget shares for education increase with the addition of a female aged 19–24 years to a household. Education expenditure as a share of total expenditure for all households with at least one child aged 16–24 is reasonable at approximately 9% in 2008 and was lowered to 6.4% in 2018. Because higher education is not free, and we expect that the expenditure on higher education will increase. Moreover, the Table 11.1 shows that almost half of the households live in rural areas for the two years of study. It means that people who live in rural areas significantly affect the nationwide interpretation of the current estimation result. In addition, urban households' decision also matters most. As mentioned above, the rural areas' households tend to invest more in their daughters' education than their sons (Mongolian Education Alliance 2005). This is due to the labor force deficiency in the agriculture sector for the men. In addition, child labor could explain the education gender gap in higher education since in rural areas, the dropout rate is high for male students compared to females.

Male and female responsibilities within the household can be a reflection of social norms that determine—often for the rest of their lives—the future of many women and men. It should be noted that most rural families tend to participate in livestock or

Table 11.1 Description of variables and summary statistics at the household-level

Variable	Definition of variables	2008		2018	
		Mean	SD	Mean	SD
Dependent					
Educshare	Budget share of education = Household education expenditure/total household expenditure*100	9.0	10.2	6.484	9.446
Independent					
lnpcexp	Log of household expenditure per capita	12.11	0.615	15.11	0.717
lnhhsize	Natural logarithm of household size	1.52	0.35	1.478	0.349
Age-gender category					
m16 18	Share of male children 16–18	0.081	0.123	0.064	0.115
m19 24	Share of male children 19–24	0.109	0.146	0.109	0.147
m25	Share of male children 25 and above	0.198	0.121	0.208	0.129
f16 18	Share of female children 16–18	0.081	0.121	0.058	0.109
f19 24	Share of female children 19–24	0.106	0.142	0.093	0.133
f25	Share of female children 25 and above	0.251	0.112	0.259	0.115
Household Head's characteristics					
hheadage	Household head's age in years	49.138	8.952	49.148	8.636
sqhheadage	Square of household head's age in years	2494.06	978.66	2490.10	941.74
headgender	Gender of the household head, dummy (male = 1)	0.772	0.42	0.771	0.42
marital	Household head's marital status, dummy	0.739	0.42	0.753	0.431
sec higher	Household head's level of education, dummy (if secondary and high education = 1, 0 otherwise)	0.612	0.487	0.669	0.471
livestock	A dummy variable = 1 where household's head being in engage in livestock			0.563	1.024

(continued)

Table 11.1 (continued)

Variable	Definition of variables	2008		2018	
		Mean	SD	Mean	SD
Rural	Location, dummy (1 if rural, 0 if urban)	0.413	0.492	0.481	0.5

Table 11.2 Descriptive statistics for education expenditure per child aged 16–24, by gender, (Mongolian tugrug) 2008 and 2018

Education expenditure category	2018			2008		
	Male	Female	Total	Male	Female	Total
Tuition and school fees	217,327	222,650	220,283	1,136,513	1,249,069	1,196,257
Accommodation	30,188	37,615	34,314	208,856	225,915	217,911
Books and stationary	46,487	49,358	48,081	105,919	116,598	111,588
Uniforms	9521	9502	9510	32,250	24,830	28,311
Expense on transportation	43,442	47,342	45,608	86,491	84,790	85,588
Other education expenditures	104,090	108,713	106,658	72,963	66,078	69,309
Total education expenditure	451,055	*475,181*	*464,457*	*1,642,992*	*1,767,280*	*1,708,963*

Source Compiled by the author from the 2008 and 2018 HSES data
Notes These figures include children aged 16–24 within the household, respectively

animal husbandry. For this reason, the number of men in the household matters for raising and maintaining the livestock numbers and are typically most affected when it comes to rural areas. On the other hand, it is likely that rural areas' households, which have a higher poverty level, may need to use their sons to earn money for their families, while young female members can attend to school due to their lack of capability to work as herders (Diffendal and Weidman 2011).

Table 11.2 presents descriptive statistics on detailed education expenditure categories, calculated from the 2008 and 2018 HSES at the individual level. Since the data is at the individual level, the present paper divided expenditure categories by gender. The survey results show that the total education expenditure per child aged 16–24 is about 464,457 MNT in 2008 and 1,708,963 MNT in 2018. The mean education expenditure per child aged 16–24 shows tuition fee, dormitory, books, and equipment, which is higher for female students than for male students. Table 11.1 suggests that male students have less total education expenditure by 24,126 tugrug/year (one percent) than females in 2008. Moreover, in 2018, this figure shows that male students have less total education expenditure of 1,642,992 tugrug/year comparing to female students 1,767,280 tugrug/year. In terms of tuition fee, in 2008, it was 220,283 tugrug total in 2008 and increased by 5.5 times in 2018. In the meantime from 2008 to 2018, the tuition fee of tertiary education had increased around five times in the report prepared by NSO of Mongolia (NSO 2019).Hence, the tuition fee results were consistent with the NSO report about tuition fee information from 2000 to 2018.

However, the budget share of the education expenditure decreased by 2.5% from 2008 to 2018. Therefore, tuition fees account for around 48% of the total education expenditure, and female students have higher total education expenditure than male students in 2008. However, it soared by 70% of the total education expenditure as of 2018.

School uniforms had the least share at 2% of total education expenditure. It shows most students do not wear special uniforms during the academic year, except for some majors (nurses, doctors). Unfortunately, on the questionnaire, the clothing expenditure question does not distinguish between adults and children clothes. Hence, this paper could not include clothing inside the individual level expenditure. In addition, other education expenditures show less amount comparing to the other expenses. It might be the reason students at that age do not need additional schooling or private tutoring since they are enrolling at paid universities. Furthermore, there is no need to enroll in extra activities, whereas high school students mostly prepare for the General Entrance Examination, to gain enrolment in universities and often prefer to get extra schooling, which is paid in general.

11.4 The Household-Level

More than 80% of the households with children aged 16–24 in the HSES 2008 and 2018 had positive total education expenditure; for this reason, ordinary least squares (OLS) were applied for the household-level of higher education expenditure. Table 11.3 represents the Engel Curve of higher educational expenditure for households with at least one child aged 16–24 (those with either positive or non-educational expenditure). From the estimation results, the log of total household monthly expenditure per capita is not significant and negative in 2008, whereas it was both positive and significant in 2018. In 2018, per capita monthly expenditure indicates that when per capita expenditure increases, the education budget share also increases because the higher educational expenditures are usually costly when households have children to pay for their tuition fee.

In other words, the coefficients of the higher education elasticity are positive, which states that it is treated as a luxury good. The log of number of household members is significant and positive in both years, which indicates that larger households are certain to have extra educational expenditures compared to smaller households. It suggests that the larger households will have more resources or money as the demand for higher education increases. This matches that theoretical explanation, which argues that larger households are better off due to per capita resources (Press 2010). However, note that household heads with higher education levels are more likely to have smaller families and extra educational expenditure.

Table 11.3 OLS estimation results of Engel's Curve estimation, educational budget share, 2008 and 2018

Variables	2008		2018	
	Coeff × 100	Robust SE × 100	Coeff × 100	Robust SE × 100
Log of total household monthly expenditure per capita	−0.265	0.192	8.342[b]	1.997
Log of household members	2.079[b]	0.588	1.583[b]	0.548
f16_18	15.23[b]	1.702	12.84[b]	1.721
f19_24	20.32[b]	1.563	14.78[b]	1.571
f25_	1.400	2.034	−0.662	1.571
m16_18	10.73[b]	1.589	7.04[b]	1.715
m19_24	13.47[b]	1.469	9.14[b]	1.472
m25_	−3.946[a]	1.769	−3.80[a]	1.568
sec_highe	2.385[b]	0.353	0.83[a]	0.307
Maritalstatus	1.973[b]	0.671	−0.377	1.155
Headgender	0.649	0.807	0.809	0.441
Household head's age in years	0.151	0.149	−0.1241	0.115
Square of household head's age in years	−0.00155	0.00140	0.000893	0.00104
Livestock	0.464	0.446	−0.578[a]	0.347
Rural	0.115	0.397	−0.968[a]	0.304
Constant	−3.754	4.651	−5.293	4.249
Observations	4,084		5,183	

Robust standard errors in parentheses (Significant at 10%, [a]Significant at 5% or better, [b]Highly Significant at 1% or better percent)

The most crucial result for this paper was to observe the age-gender categorical variables and compare these coefficients with females and males of the same age group. As expected, the coefficients for the female aged 16–18, and 19–24 is statistically significant and positive in both years. The same goes for the males' coefficients aged between 16 and 18 and 19–24. Another interesting finding is that the coefficient of females aged 25 and above turned out to be not statistically significant and negative signs, which means after reaching 25, females are less likely to spend on higher education. This can also explain that after the age 25, females are more likely to get married and do not continue pursuing a higher level of education. On the other hand, males aged 25 and above have negative significant higher education expenditure and are less likely to spend on education compared to the other age groups.

Having an education level higher than the secondary level for the head of the household is also positively significant for both years. This indicates that household heads with a higher level of education tend to invest more in their children's education expenditure and suggest a higher preference for children's education among educated heads of households. This result is consistent with past studies that show that the head of the household's years of education is a significant determinant of de mand for children's education (Datta and Kingdon 2019; Kenayathulla 2016; Wongmonta and Glewwe 2017).

Moreover, the gender, age, and age squared of the household head have no effect and non-significant on the budget share of household higher education in both years. These are consistent with the results of the studies consulted (Datta and Kingdon 2019; Himaz 2010; Kenayathulla 2016; Wongmonta and Glewwe 2017).

The occupation of herder was not statistically significant and positive in 2008. However, the occupation of a herder was negatively significant in 2018. It indicates that if a person is a herder and household head, there will be a decrease in the budget share of education rather than an increase. Therefore, the location dummy, which is rural areas, is negatively significant, and it goes in line with the occupation of the herder. This suggests that rural households, which are mostly involved in animal husbandry, are more likely to spend less on a household's higher educational expenditure.

Coming to the point of whether there is a gender bias in the household higher educational expenditure, the coefficients on the proportion of males and females demonstrates that: (1) households are more likely to allocate higher educational expenditure for females than males, (2) the gender discrepancy exists in age groups 16–18 and 19–24.

According to the estimation results in Table 11.4. Table 11.5 gives an outline of the bias in gender coefficients for a budget share of higher educational expenditure. From Table 11.4, the differences in gender coefficients for ages 16–18 and 19–24 are

Table 11.4 The difference in coefficients of gender variables for a budget share of education, by higher education-age groups

Age group	2008			2018		
	Female coeff	Male coeff	Female-male diff	Female coeff	Male coeff	Female-male diff
16–18	15.23[b] (1.702)	10.73[b] (1.589)	4.5[b]	12.84[b] (1.721)	7.03[b] (1.715)	5.81[b]
19–24	20.32[b] (1.563)	13.47[b] (1.469)	6.85[b]	14.78[b] (1.571)	9.14[b] (1.472)	5.64[b]

Robust standard errors presented in parentheses (Significant at 10%, **Significant at 5% or better, [b]Highly Significant at 1% or better percent)

Table 11.5 F tests

Age groups	2008	2018
16–18	9.17 (0.0025)	16.06 (0.0001)
19–24	19.37 (0.000)	18.07 (0.000)

Notes The F-tests refer to a testing for the equality of coefficients, for instance, f16_18 and m16_18 statistically highly significant and positive in 2008 and 2018, respectively. Moreover, it means if a child had been a female rather than male in the age group 16–18 within the same household, families would have spent 4.5% more on her higher education expenditure in 2008 and 5.8% more in 2018, respectively.

In addition, if a child had been a female rather than male in the age group 19–24 within the same household, families would have allocated 6.85% more on her higher education expenditure in 2008 and 5.64% more in 2018, respectively. It should be pointed out that the scales of the differences in the age group 16–18 became larger in 2008 than in 2018. It seems, on the contrary, the magnitude in the age group 19–24 coefficient decreased by 1.21 in 2018. These results show that there is a significant gender bias in the allocation of household higher education expenditure in Mongolia in both years. These findings are consistent with previous findings that reveal that gender bias favoring females in intra-household education expenditure allocation for Thailand and Sri Lanka (Himaz 2010; Wongmonta and Glewwe 2017).

Another important approach to detect gender bias in household higher educational expenditure is the method using the F test. The F test compares the difference of the coefficients in males and females of the same group. If there is no gender bias, then coefficients of male and female age groups would be equal to each other. Table 11.6 shows F tests the equality of the coefficients, which computes F-statistics and p-value presented in brackets.

The F tests are shown in Table 11.5 suggests that the female age group 16–18 coefficient is not equal to the male age group coefficient 16–18 in both years. Hence, the statistical significance reveals a gender bias favoring females aged 16–18 and 19–24 in 2008 and 2018. These estimation results from Tables 11.4 and 11.5 provide evidence for gender bias favoring females aged 16–24 over males aged 16–24, especially in the allocation of higher educational expenditure within the households. These estimates of F tests are consistent with those of Himaz (2010) for Sri Lanka; her estimates ranged from 4.23 to 12.15 in school-age groups (Himaz 2010).

In summary, the Engel Curve Method is able to pick up the gender bias within the household's higher educational expenditure in 2008 and 2018. Moreover, over the ten-year period from 2008 to 2018, the gender bias in household higher education expenditure has not disappeared; it still exists. Before jumping to conclusions, it is important to note that the Engel Curve cannot explain the gender bias itself alone. As the Engel Curve is mainly interested in education expenditure once children are enrolled in a higher education institute or university. Hence, it is better to explore the other approaches to offer more plausible explanations.

Another way to detect gender bias at the household-level is by using the Hurdle model by dividing a household's education expenditure into two parts. Many researchers have used this approach, such as Kingdon, who applied this model first in 2005 for estimating gender differences in household's education expenditure (Kingdon 2005). The main technique of this model is to have two parts: (1) a binary probit of whether the budget share of a household's higher education expenditure is positive or zero; (2) linear regression of the natural log of higher education budget share and incurred conditional on positive higher education expenditure. In

Table 11.6 Hurdle model for 2008 and 2018 at household-level

	2008		2018	
Variables	Probit (anyexpend)	Conditional OLS (logedushare)	Probit (anyexpend)	Conditional OLS (logedushare)
	ME	Coefficient	ME	Coefficient
lnpcmonthly_hh_exp	0.0813^{c} (0.00798)	−0.265^{c} (0.0269)	1.145^{c} (0.111)	−1.771^{c} (0.397)
Lnhhsize	0.167^{c} (0.0198)	−0.173^{b} (0.0818)	0.179^{c} (0.0224)	−0.214^{b} (0.0951)
f16_18	0.205^{c} (0.0604)	0.942^{c} (0.202)	0.152^{b} (0.0725)	1.707^{c} (0.262)
f19_24	−0.309^{c} (0.0482)	2.917^{c} (0.179)	−0.655^{c} (0.0610)	3.375^{c} (0.239)
f25_	−0.489^{c} (0.0631)	0.799^{c} (0.273)	−0.755^{c} (0.0659)	1.171^{c} (0.300)
m16_18	0.0342^{c} (0.0561)	0.697^{c} (0.203)	−0.0249^{b} (0.0686)	0.674^{c} (0.261)
m19_24	−0.405^{c} (0.0456)	2.157^{c} (0.176)	−0.635^{c} (0.0578)	2.348^{c} (0.233)
m25_	−0.657^{c} (0.0577)	0.452^{a} (0.261)	−0.901^{c} (0.0620)	0.428 (0.284)
sec_higher	0.0439^{c} (0.0122)	0.0254^{c} (0.0437)	0.0277^{b} (0.0136)	0.0369^{b} (0.0520)
Headmarried	0.0482^{a} (0.0260)	0.0604 (0.0967)	0.0741 (0.0462)	0.0268 (0.174)
Gender	0.0471 (0.0306)	0.0920 (0.110)	0.0727^{c} (0.0214)	0.127 (0.0809)
Hheadage	−0.00378 (0.00472)	0.00825 (0.0195)	−0.0294^{c} (0.00554)	−0.0201 (0.0210)
Sqheadage	1.89e-05 (4.22e-05)	−8.83e-05 (0.000183)	0.000226^{c} (4.90e-05)	0.000160 (0.000192)
Herder	−0.0265^{a} (0.0151)	−0.175^{c} (0.0542)	−0.0534^{c} (0.0128)	−0.0732 (0.0502)
Rural	−0.0231^{a} (0.0132)	0.0161 (0.0470)	−0.0446^{c} (0.0166)	−0.0420 (0.0606)
Constant		3.705^{c} (0.625)		−1.259 (0.780)
Observations	4,084	3,388	5,183	3,933
R-squared		0.133		0.084

Robust standard errors in parentheses (^{a}Significant at 10%, ^{b}Significant at 5% or better, ^{c}Highly Significant at 1% or better percent) addition, this model is fitted for households with at least one child aged 16–24 years. Table 11.6 represents the first and the second part of the Hurdle model.

From Table 11.6, the probit model estimates "anyexpend," and explains the first decision about enrolment and whether any positive education expenditure was incurred or not. Therefore, conditional OLS estimates "logedushare," about how much to spend on education and shows the natural logarithm of budget share of education. The Table 11.6 columns show that the log of per capita monthly household expenditure (lnpcmonthly_hh_exp) have a significant positive impact on budget share of education in the probit of *anyexpend* in 2008 and 2018. However, in the conditional OLS model, it is negative and significant for both years.

This shows that the tertiary education tuition fee is not free and that higher education enrolment might depend on a household's economic status, as better off households allocate a bigger share to education. The effect of the number of household members on the higher education budget share is significant and positive in the probit estimates in both years. It suggests that the larger households have more children to send to higher educational institutes, which is in line with the theoretical consideration about per capita resources. These are consistent with estimates from the Engel Curve Model presented in Table 11.3 and previous studies (Aslam and Kingdon 2008; Kingdon 2005; Malik et al. 2018).

In the probit and the conditional OLS model, the household head's education dummy variable "sec_higher," whether the education level is above secondary level or not, is positive and statistically significant in 2008 and 2018. It demonstrates that the household head's level of education significantly increases the budget share of household's higher education expenditure in the both models. For instance, in the conditional model the household's level of education increases the budget share of the household's higher education expenditure by 2.5 in 2008 and by 3.6 in 2018, respectively. It reveals the higher demand for the education of children among more educated parents. These findings are consistent with the Engel Curve estimation results and also with past studies (Aslam and Kingdon 2008; Datta and Kingdon 2019; Himaz 2010; Kenayathulla 2016).

For the household head's occupation, the "herder" variable is chosen to explain the household's main activity, whether they are involved in animal husbandry or not. In other words, it stands for herders who live in rural areas. In both models, the effect of being a herder is negative and significant for both years. Also, it suggests that being a herder decreases the budget share of higher education expenditure and tends to lead to less spending on higher education in 2008 and 2018. This finding is consistent with the result from the Engel Curve Model in the previous section at the household-level. Therefore, the finding from Ghana in 2018 suggests that households whose heads work in the agricultural sector have a lower budget share of education as compared to other sectors. Moreover, it was significant, too, as it indicates that households whose heads have agriculture-related jobs tend to spend less on education than others (Malik et al. 2018). This is also applicable to Mongolia, where most people are engaged in the agricultural sector.

Turning to the point of gender bias in the household higher education expenditure, the coefficients of the age-gender category variables are presented in Table 11.8 with

Table 11.7 The difference in marginal effects (DME) × 100 of gender variables by age group (household-level data), 2008 and 2018

	2008			2018		
	Probit (a)	Conditional OLS (b)	Combined (c) = f(a, b)	Probit (a)	Conditional OLS (b)	Combined (c) = f(a, b)
Females 16–18 and males 16–18	17.08[c]	3.23[c]	4.64[c]	17.7[a]	11.64[c]	8.58[c]
Females 19–24 and males 19–24	9.6[c]	9.98[c]	8.33[c]	2[c]	11.57[c]	6.59[c]

Notes In Col.3 Combined means Probit + Conditional OLS ([a]Significant at 10%, [b]Significant at 5% or better, [c]Highly Significant at 1% or better percent)

their significance level. The variable "f16_18" is the proportion of females aged 16–18 compared with the variable "m16_18," the proportion of males aged 16–18. All these demographic variables, which show the gender bias, are statistically significant in 2008 and 2018. The impact of these variables' marginal effect help to detect the gender bias within the household education expenditure. This paper computes the difference in marginal effects from Table 11.6 and presents separately in Table 11.7 for further interpretation. The DME of the combined marginal effects, or the Hurdle model results, are reported in Table 11.7.

Since the main focus of this paper is gender bias, the analysis in this section focuses on the difference of the age-gender categorical variables f16_18 and m16t_18 (share of female and male children ages 16–18), and f19_24 and m19_24 (share of female and male children ages 19–24). Table 11.7 presents the difference in marginal effects (DME) of these variables for the ages 16–18 and ages 19–24 for 2008 and 2018.

The method used to calculate the DME is based on the approach by (Datta and Kingdon 2019). Table 11.7 presents the Probit Model in the marginal effects form in both years. First, in order to calculate the DME of the Probit Model, the marginal effect of m16_18 (0.0342) was subtracted from f16_18 (0.205), and then the result was multiplied by 100 to obtain the 17.08 (0.1708 × 100). A positive DME demonstrates a favor of female bias, whereas a negative DME demonstrates a favor of male bias in the budget share of higher education. The associated p-value is presented of the t-test of the DME.

The DME of conditional OLS required a different approach than the Probit Model. The dependent variable of the model is presented in the logarithm form as the log of educational shares. First, retransformation of the log of educational shares was needed before calculating differences between the marginal effects of the two variables (for instance, f16_18 to m16_18). So, the DME of the conditional OLS can be compared with the difference in gender coefficient of the Engel model and also with the Probit Model. For 2008, the coefficient on the variable f16_18 in the conditional OLS equation of log of educational shares in column 2 is 0.942 and the coefficient

Table 11.8 Regressions of the log of monthly wages on years of education and other variable 2018

Variables	OLS		OLS 2		IV		OLS		OLS 2		IV	
	GaSfE Robust SE		Casfi Robust SE		M	Robust fir	CfiSff Robust SE		GasS Robust SE			Robust SE
Years of education	0.082[c]	(0.002)	0–079[c]	(0.0024)	0.092[c]	(0–004}	0065[c]	(0.003)	0–059[c]	(0.003)	0.087[c]	(0.004)
Years of work experience	0 024[c]	(0.00201)	0.025[c]	(0.00201)	0.025[c]	(0–002)	0 035[c]	(0–002)	0–033[c]	(0.002)	0039[c]	(0.002)
Square of years of work experience	−0 0005[c]	(0.0005)	−0.0005—	(0 0004)	−0.0005[c]	(0 000 s 5)	−0,0008[c]	(0.005)	-O-OOOS[c]	(0.001)	−0 0009[c]	(0.001)
Rural areas	−0.00?	(0.012)	−0 005	(0.012)	−0.00788	(0.012)	−0.070[c]	(0017)	−0.054[c]	(0.017)	−0056[c]	(0.017)
West	−0 075[c]	(0.0183)	−0078[c]	(0018)	−0.0795[c]	(0018)	−0.208[c]	(0.024)	−0199[c]	(0.024)	−0215[c]	(0 025)
East	−0 041[b]	(0.0188)	−0.044[b]	(0 018)	−0.0389[b]	(0 019)	−0.130[c]	(0.027)	−0 091[c]	(0.027)	−0120[c]	(0 027)
Central	0.002[c]	(0.0158)	0.058[c]	(0.015)	0.0625[c]	(0.016)	0.114[c]	(0.022)	0.116[c]	(0.022)	0.117[c]	(0.022)
Llaanbaatar	0.159[c]	(0.0170)	0.156[c]	(0.017)	0.156[c]	(0.017)	0.154[c]	(0.021)	0.153[c]	(0.021)	0.145[c]	(0.021)
Professional choice												
Industry			−0014	(0030)					000,903	(0.019)		
Livestock			0.403[c]	(0.0977)					−0.487[c]	(0.040)		
Constant	11 82[c]	(0.0 + 03)	11 85[c]	(0 040)	11.68[c]	(0 0621)	12.30[c]	(0.045)	12.37[c]	(0.047)	11.99[c]	(0 061)
Observations	5,879		5,879		5,879		6,045		6,045		6,045	

Robust standard errors in parentheses
[a]Significant at the 0.1 level
[b]Significant at the 0.05 level
[c]Significant at the 0.01 level

on the m16_18 is 0.697. Applying the method of retransformation, the log transformation is estimated using the property of the log normal distribution expectation of $E(w|x, w > 0) = \exp\left(\boldsymbol{x}\beta + \sigma^2/2\right)$ and the marginal effect of x on the conditional education expenditure, $\frac{\partial E(w|\boldsymbol{x}, w>0)}{\partial \boldsymbol{x}} = \beta.\exp\left(\frac{\boldsymbol{x}\beta+\sigma^2}{2}\right)$ (Datta and Kingdon 2019).

Moreover, the calculation command on the STATA is taken from Cameron and Trivedi estimation example (Cameron 2009). The exp(.) for this sample is 0.131472. Second, the transformed marginal effect for the f16_18 is calculated f16_18*exp(.) = 0.9424901*0.131472 = 0.123911. For the males, m16_18* exp(.) = 0.6970488*0.131472 = 0.091642. Hence, the difference of the marginal effect between f16_18 (share of female children aged 16–18) and m16_18 (share of male children aged 16–18) is 0.0322. In Table 11.10, the DME is multiplied by 100, and the DME, in this case, is 3.23. These computing procedures were repeated for the age group 19 to 24 and for both years.

The DME of the combined marginal effects from the probit and conditional OLS model is calculated differently from the above-mentioned DMEs. The estimation is calculated in the way shown in Eq. (11.7) and used STATA command for the combined marginal effect. For the coefficient on the variable f16_18 combined marginal effect is 11.5336 and for the male m16_18 is 6.892937. The DME of the combined marginal effect of the age group 16–18 is 4.641 in 2008. The same procedures were repeated for the age group 19–24 and also for both years.

From the DME results reported in Table 11.7, a comparison of 2008 and 2018 results for the 16 to 18 age group shows that in 2008 the DME of the Probit Model was 17.08. There was statistically significant pro-female bias in positive education expenditure and enrolling a child in higher education. Furthermore, in 2018, the DME of the Probit Model coefficient was 17.7, which is similar to the result of 2008. Overall, it indicates that having an additional female child aged 16–18 increased the probability of the household having "positive education expenditure," significantly more than having an additional male child aged 16–18.

In addition, the conditional OLS is significantly positive in both years for the age group 16–18. It suggests that the households spend 3.23% less for males aged 16–18 than for females of similar age, once the decision on "how much" to spend has been made in 2008. By 2018, the coefficient of the DME was 11.64, which increased by 8.41 after ten years in the age group 16–18. Thus, the DME of the combined probit and the conditional OLS or "the Hurdle model" for the age group 16–18 also detects gender bias in 2008. Moreover, the DME of the combined model was positive and highly significant in 2018 in the age group 16–18 too. It leads to the conclusion that both the Engel Curve approach and Hurdle model detect the existence of gender bias in both years.

Moving to the 19–24 age group in 2008, the coefficient of the DME in the Probit Model is positive and highly significant. However, in 2018 the DME of age group 19–24 shows different signs than 2008. It suggests that a pro-male bias exists in 2018 for the age group 19–24 in the Probit Model. Nevertheless, it is important to draw a conclusion after the combined marginal effects of the probit and the conditional OLS model. Furthermore, the DME in the conditional OLS model shows significantly positive signs in both years. This result has increased by 1.59% over a ten-year period. It illustrates the decision on how much was spent per household's on education. Similar to the DME of the age group 16–18, the gender bias favoring a female child was also detected in both reported years. Additionally, it indicates that after enrolling the male and female children alike, households may spend or allocate more expenditure on the female children's education than on male children's.

The DME of the combined marginal effects or the Hurdle model results reported in Table 11.7, column 3 and 6 for the year 2008 and 2018, respectively. In the age group 19–24 in 2008, unsurprisingly, this paper detects a pattern of gender difference and reports significantly positive results. It also has been reduced over ten years' period by 1.74. This finding is consistent with the result of Engel Curve Method's difference in the coefficients of age group 19–24, which is also reduced by 1.21 over time. Therefore, the Hurdle model is expected to detect the gender bias better than Engel Curve in many resources (Aslam and Kingdon 2008; Datta and Kingdon 2019; Himaz 2010).

In summary, the estimation results of using the household-level data suggest that the gender bias in households' higher education expenditure in the age groups 16–18 and 19–24 have remained over the ten years from 2008 to 2018. Therefore, in the age group 16–18 in both years, the gender difference is high in the enrolment decision or in the Probit Model. It indicates that the most important decisions have been made about whether to enroll children or not at this particular age. Besides that, the DME for the age group 16–18 is positive and highly significant in the Probit Model in both years. It indicates that the probability of having positive budget shares for education increases 17% more with the addition of a female child aged 16–18 than with the addition of a male child aged 16–18 in 2008 and 2018, respectively.

11.5 Gender Bias and Individuality

Marginal effects of the individual and household-level estimation results cannot be compared because age-gender categorical variables in the household-level data do not exist in the individual level data. Moreover, the dependent variable of the individual level is estimated in absolute terms in conditional and unconditional OLS methods rather than the budget share of the education from the total household expenditure. For this reason, this paper cannot compare the estimated results of the household-level data (Table 11.6) with individual level estimated results (Table 11.9). However, since the main interest of this paper is to investigate the gender difference of the households education expenditure, the individual level data analysis included the gender dummy variable "female" to detect gender bias. Thus, the individual level data estimation results are presented with the statistical significance on the Hurdle model and Engel Curve.

On the individual level analysis, the age groups are divided into 16–18 and 19–24 groups to get more rigorous results and to capture gender bias at different age groups. Thus, the estimation results of the year 2008 and 2018 are presented in separate tables

Table 11.9 Hurdle model and Engel Curve for 2008 at the individual level

	Children aged 16–18			Children aged 19–24		
	Probit	Conditional	Unconditional	Probit	Conditional	Unconditional
Variables	anyexp	logedu1	Highedu1	anyexp	logedu2	highedu2
	margin	coeff	coeff	margins	coeff	coeff
Female	0.0268*** (0.00791)	0.0637 (0.0420)	38,777 (28,144)	0.0307*** (0.0119)	0.159*** (0.0389)	80,606*** (21,969)
lnpcmonthly_hh_exp	0.0405*** (0.00629)	0.766*** (0.0293)	446,529*** (19,686)	0.108*** (0.00977)	0.860*** (0.0301)	504,579*** (16,763)
Lnhhsize	0.134*** (0.0137)	1.071*** (0.0747)	525,596*** (48,728)	0.377*** (0.0207)	0.297*** (0.0702)	490,777*** (36,665)
sec_higher	0.0313*** (0.00966)	0.247*** (0.0485)	116,793*** (32,376)	0.00652 (0.0138)	0.336*** (0.0453)	131,275*** (25,513)
Maritalstatus	−0.0136 (0.0147)	−0.0426 (0.105)	−21,375 (67,808)	−0.0119 (0.0251)	0.189** (0.0958)	70,403 (51,042)
Gender	0.00464 (0.0178)	−0.00258 (0.107)	29,777 (68,977)	0.0441 (0.0287)	−0.0640 (0.0983)	13,495 (52,031)
Hheadage	−0.000746 (0.00354)	0.135*** (0.0226)	58,255*** (13,930)	−0.032*** (0.00709)	0.0526** (0.0231)	8,449 (12,522)
Sqheadage	−1.70e-05 (3.28e-05)	−0.0128*** (0.000219)	−536.8*** (133.0)	0.0217*** (6.31e-05)	−0.000415* (0.000213)	−111.1 (113.5)
Rural	−0.0217** (0.0102)	−0.00315 (0.0519)	−13,688 (34,973)	−0.0283* (0.0156)	0.0368 (0.0502)	43,616 (28,481)
Herder	−0.031*** (0.012)	0.172*** (0.0591)	24,598 (39,069)	−0.0173 (0.0173)	0.135** (0.0575)	10,837 (31,941)
Constant		−1.466** (0.689)	−6.95106*** (436,921)		0.755 (0.736)	−6.19206*** (402,647)

(continued)

Table 11.9 (continued)

	Children aged 16–18			Children aged 19–24		
	Probit	Conditional	Unconditional	Probit	Conditional	Unconditional
Variables	anyexp	logedu1	Highedu1	anyexp	logedu2	highedu2
	margin	coeff	coeff	margins	coeff	coeff
Observations	3,104	2,858	3,104	4,085	3,274	4,085

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

Table 11.10 Hurdle model and Engel Curve for 2018 at the individual level

	Children aged 16–18			Children aged 19–24		
	Probit	Conditional	Unconditional	Probit	Conditional	Unconditional
Variables	anyexp	Logedu	highedu1	anyexp	logedu	highedu2
	Margin	Coeff	Coeff	Margins	Coeff	Coeff
Female	0.00301*** (0.00213)	0.250*** (0.0605)	202,671 (71,037)	0.00233*** (0.00250)	0.00368*** (0.0523)	−51,298 (94,984)
lnpcmonthly_hh_exp	0.0505** (0.0225)	10.46*** (0.545)	9.933*** (638,826)	0.0126 (0.0171)	5.402*** (0.503)	1.002e + 07*** (912,246)
lnhhsize	0.00242 (0.00318)	0.258** (0.106)	183,533 (124,131)	9.29e-05 (0.00212)	−0.0597 (0.0876)	89,129 (159,242)
sec_higher	−0.00276 (0.00192)	0.0248 (0.0725)	12,473 (85,171)	−0.000195 (0.00148)	0.121* (0.0671)	162,536 (121,910)
headmarried	−0.00421* (0.00220)	0.0261 (0.128)	46,098 (150,062)	−0.000703 (0.00231)	0.189 (0.131)	16,384 (238,175)
Gender	0.00449 (0.00587)	0.0170 (0.126)	40,706 (146,947)	0.00223 (0.00795)	−0.0362 (0.131)	70,609 (238,480)
hheadage	−0.000595 (0.00141)	0.0198 (0.0261)	15,646 (30,686)	−0.00226 (0.00173)	−0.0183 (0.0300)	−2,209 (54,462)
sqheadage	6.97e-06 (1.46e-05)	−0.000128 (0.000242)	−127.6 (284.8)	2.21e-05 (1.72e-05)	0.000200 (0.000278)	10.88 (504.6)
Rural	0.000978 (0.00213)	−0.0406 (0.0722)	−93,458 (84,860)	−0.000249 (0.00140)	0.188*** (0.0594)	241,655** (107,883)
livestock	0.000520 (0.00135)	−0.0628 (0.0392)	−54,024 (46,149)	−4.31e-05 (0.000799)	0.0287 (0.0343)	44,462 (62,404)
Constant		−1.657 (1.015)	−1.234*** (1.192e + 06)		7.788*** (1.073)	−1.04e + *** (1.948e + 06)

(continued)

Table 11.10 (continued)

	Children aged 16–18			Children aged 19–24		
	Probit	Conditional	Unconditional	Probit	Conditional	Unconditional
Variables	anyexp	Logedu	highedu1	anyexp	logedu	highedu2
	Margin	Coeff	Coeff	Margins	Coeff	Coeff
Observations	2804	2,071	2804	1407	1,403	1407

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

for space reasons (see Tables 11.9 and 11.10). Moreover, descriptive statistics for each year at the individual level are also presented in Tables 11.13 and 11.14.

The individual level analysis results suggest some important perceptions about the gender bias in household education expenditure. In 2008, the probit estimation or the enrolment decision (anyexp) in the age group 16–18 and 19–24 was statistically significant and positive. It suggests that gender bias in the enrolment decision at the individual level still exists, which favors female children. Moreover, it goes in line with household-level findings which showed pro-female bias. In other words, it means that having an additional female child aged 16–18 and 19–24 increased the probability of the household having "positive education expenditure" significantly more than having an additional male child aged 16–18 and 19–24.

Comparing the 2008 results with the 2018 findings at the individual level also shows a similar gender bias trend, which is pro-female. It is also positive and highly statistically significant. However, the marginal effect of the "female" dummy variable has decreased by 0.02379 in the age group 16–18 and by 0.02837 in the age group 19–24, respectively, from 2008 to 2018. In the conditional OLS model the "female" dummy variable is insignificant in the age group 16–18 in 2008. However, it is highly significant in other age groups of 2008 and 2018. It shows that once the decision is made on "how much to spend," the pro-female bias exists in the age group 19–24 in 2008, and 16–18 and 19–24 in 2018.

In the unconditional OLS method or Engel Curve approach, the "female" dummy variable is insignificant in the age group 16–18 in 2008 and age groups 16–18, 19–24 in 2018. From these findings, it can be stated that the Engel Curve approach fails to detect gender bias at the individual level in some ways. The failure of the Engel Curve approach was also presented in the household and individual level in India (Datta and Kingdon 2019).

The present paper has shown strong empirical evidence of gender bias in household's higher education expenditure in favor of females in Mongolia. Other empirical studies have found gender bias in higher education at a national level, reflecting raw numbers (Nozaki et al. 2009). This section tries to explain the factors responsible for gender bias in higher education in Mongolia.

There is no single answer that can explain the above-mentioned gender bias. In traditional Mongolian society, the dowry or bride payment has little importance among the Mongolian people. Therefore, the national study on gender-based violence in Mongolia survey (2018) conducted by the UNFPA in Mongolia included the questions about the dowry and concluded that there is not much evidence that marriage involves a dowry (Nations and Fund 2018). However, in other countries such as Thailand and Sri Lanka, which have a female preference in education, there is an evidence that dowry plays an important role in this gender bias (Wongmonta and Glewwe 2017). Because for the better-educated girls, the payment will be higher compared to the less-educated girls.

Historically, Mongolian households were patriarchal, so that a bride moved to her husband's parents' home and lived with them. The youngest son and his wife are expected to take care of his parents (Rogers 2020). In addition, there was no obligation for married women in Mongolia to support their parents and live with them. This also applies to current Mongolian society. In this case, there is no evidence that girls were favored in terms of inheritance. However, because the male workforce is more needed in the livestock sector, parents prefer to send their daughters to higher education institutes rather than boys (Diffendal and Weidman 2011).

Another important aspect of this factor could be the different returns to education for men and women in the labor market in Mongolia. Because there is a wage gap between men and women, in order to get paid equally with men, women are required to have more education and more competence (Pastore 2010).

The 2018 HSES used the Mincerian wage equations for men and women separately for estimations to address this possibility. The analysis is limited to men and women who work full time because the Mincerian wage equation captures the male–female wage gaps (Heckman et al. 2003). There are 12,206 individuals who work full time and received a salary in the HSES 2018, 5,879 (48%) women.

The descriptive statistics of the main variables for men and women used in estimating the Mincerian wage equation are presented in Tables 11.11 and 11.12, respectively. Note that women have more years of schooling or education than men; however, the monthly wage is less than men. This indicates that women need to be more educated than men to get paid equally.

To examine the returns to education for men and women, the Mincer's earning regression is used (Heckman et al. 2003). This is shown below:

$$\log(y_i) = \alpha + \rho_1 s_i + \beta_1 \exp_i + \beta_2 \exp_i^2 + n' Z_i + u_i \tag{11.8}$$

where y_i is the monthly wage earnings, α measures the returns to education, s_i is years of education (schooling), $\exp_i$ is years of work experience, $\exp_i^2$ is the square of work experience, and Z_i is an additional control variable (rural, region, occupation).

Table 11.11 Descriptive Statistics of returns to education for male, 2018

Variable	Obs	Mean	Std. Dev	Min	Max
lnmonthlysalary	6260	13.248	0.598	9.903	15.895
education	21,013	8.168	4.864	0	22
exp	21,013	15.977	16.237	−6	84
expsq	21,013	518.897	763.678	0	7056
rural	29,283	0.458	0.498	0	1
West	29,283	0.215	0.411	0	1
East	29,283	0.106	0.308	0	1
Central	29,283	0.231	0.421	0	1
Ulaanbaatar	29,283	0.223	0.416	0	1
Industry	29,283	0.053	0.225	0	1
livestock	29,283	0.132	0.338	0	1

Table 11.12 Descriptive Statistics of returns to education for female, 2018

Variable	Obs	Mean	Std. Dev	Min	Max
lnmonthlysalary	5946	13.093	0.479	9.903	16.604
education	22,750	8.978	4.933	0	22
exp	22,750	16.944	16.796	−6	98
expsq	22,750	569.18	851.707	0	9604
rural	30,537	0.439	0.496	0	1
west	30,537	0.206	0.405	0	1
east	30,537	0.11	0.312	0	1
central	30,537	0.228	0.42	0	1
Ulaanbaatar	30,537	0.233	0.423	0	1
industry	30,537	0.019	0.138	0	1
livestock	30,537	0.091	0.287	0	1

Table 11.13 Descriptive statistics at the individual level, 2008

Variable	Obs	Mean	Std. Dev	Min	Max
highedu1	2084	998,865.35	1,722,080.7	0	30,800,000
highedu2	1407	2,760,735.5	1,841,906.3	0	30,460,000
female	59,820	0.51	0.5	0	1
lnpcmonthly hh exp	24,094	1.253	0.06	1.04	1.634
lnhhsize	24,094	1.594	0.332	0.693	2.773
sec higher	24,094	0.662	0.473	0	1
maritalstatus	24,094	0.799	0.401	0	1
headgender	24,094	0.808	0.394	0	1
hheadage	24,094	48.7	8.511	29	93
sqhheadage	24,094	2444.107	925.791	841	8649
rural	24,094	0.48	0.5	0	1
herder	24,094	0.601	1.069	0	6

Two separate OLS regressions are estimated: (1) a logarithm of monthly salary as dependent variable and education, work experience, region and rural dummy variables and (2) adds additional control variables such as certain professions' dummy variables (indicating whether a person works at industry or livestock sector) to the first OLS, separately, for each gender.

The estimation results are presented in Table 11.9. Without adding the control variables to the OLS estimation, the return to an additional year of education is 8.2% for women and 6.5% for men and is statistically significant. For comparison, the difference in the return to an additional year of education for men is lower by 1.7 percentage points. One more year of schooling raises the wage rate by about 10%. After the additional control variables, the returns to an additional year of education

Table 11.14 Descriptive Statistics at the individual level, 2018

Variable	Obs	Mean	Std. Dev	Min	Max
highedu1	2084	998,865.35	1,722,080.7	0	30,800,000
highedu2	1407	2,760,735.5	1,841,906.3	0	30,460,000
female	59,820	0.51	0.5	0	1
lnpcmonthly hh exp	24,094	1.253	0.06	1.04	1.634
lnhhsize	24,094	1.594	0.332	0.693	2.773
sec higher	24,094	0.662	0.473	0	1
maritalstatus	24,094	0.799	0.401	0	1
headgender	24,094	0.808	0.394	0	1
hheadage	24,094	48.7	8.511	29	93
sqhheadage	24,094	2444.107	925.791	841	8649
rural	24,094	0.48	0.5	0	1
herder	24,094	0.601	1.069	0	6

decrease from 8.2 to 7.9% for women and from 6.5 to 5.9% for men. These findings are consistent with the study on returns to education in Mongolia, showing that women have higher rates of return than men (Pastore 2010).

Since the professional choice dummy variables are exogenous and correlated with the error terms, it is recommended to use the instrument variable (IV) methodology to deal with the endogeneity problem of education. The IV methodology can be used to get more precise estimates of the returns to education. In this regard, following Gong (2018), the father's and mother's education are chosen as instruments (Gong 2018). The IV estimates for the returns to education is higher than the OLS estimates results and for women is higher than men. This finding is consistent with Gong (2018).

These results suggest that Mongolian males have more opportunities to earn a higher salary with a lower level of education compared to women. Therefore, Mongolian females use higher education as an instrument to decrease the wage gap. Because of the wage gap, parents are likely to spend more on their daughters' education.

11.6 Conclusion

This study illustrates the gender differences in households' expenditure on higher education in Mongolia. It addressed two specific questions related to the household allocation of educational expenditure. (1) Are there gender differences in the allocation of higher education expenditures within Mongolian households? (2) What factors explain household educational expenditure and gender difference? To answer these questions, this study used the Household Socio-Economic Survey (2008 and 2018) for regression analysis.

This study has detected and showcased the gender bias at the household and individual levels for both 2008 and 2018 using the Engel Curve approach and the Hurdle model method.

First, in the Engel Curve approach at the household-level, the study has shown that the gender bias does exist in both years. The main finding has been that if a child was a female rather than male in the age group 16–18 within the same household, families would have spent 4.5% more on her higher education expenditure in 2008 and 5.8% more in 2018, respectively.

Moreover, in the Hurdle model, the results reported two distinct processes by which gender bias occurs (the probit or enrolment decision and the conditional OLS or the conditional educational expenditure decision) in both years. The combined marginal effects of these two regressions in both years have shown that the gender bias exists in the age group 16–18 and 19–24, at the household and individual levels.

The difference in coefficient at the household-level by the Engel method revealed that the gender gap has not changed over the years. Positive difference in marginal effects at the household-level by the Hurdle model showed a favor of female bias in 2008 and 2018. Moreover, the gender bias in households' higher education expenditure in the age groups 16–18 and 19–24 have remained over the ten years from 2008 to 2018 in the Hurdle model.

The most plausible explanation for the gender bias in the allocation of higher education expenditure at the household-level might be related to the household head's profession and residence. The fact that household heads worked in livestock/agricultural sector and resided in rural areas had a negative and significant result on the education of male children. Since the herder households need more labor power that could be provided only by a man, they tend to allocate more household resources to their daughters' education than to sons' education. Supporting the male students from rural areas with financial support and allocating greater resources in their education budget is likely to improve the educational outcomes and gross enrolment rate.

At the general level, per capita monthly expenditure was highly significant in all findings and in both urban and rural areas. It suggests that the number of members in the household and income is the most consistent predictor of education expenditure. It is fair to conclude that any policy that aims to increase the income of households is likely to positively impact a household's education expenditure on higher education.

Apart from the household analysis, the individual level analysis also assessed the research question, and the findings were consistent with the Hurdle model estimates at the household-level in 2018 and 2018. However, the Engel Curve approach failed to detect the gender bias at the individual level in some ways. Because the "female" dummy variable is insignificant in the age group 16–18 in 2008, and age groups 16–18 and 19–24 in 2018. The "female" variable here is the variable of the interest which takes the value of one for female and zero for the male child. However, the Hurdle model estimation results showed the gender bias in enrolment decision at the age groups 16–18 and 19–24, and in "how much to spend" on a child for both years.

Therefore, this study concludes that being female is more favored than male when it comes to intra-household higher education expenditure. It could be linked to parents' tendency to invest less in the education of a male child. Since the reverse gender gap trend has not changed the over the ten-year period (2008–2018), Mongolian parents are likely to continue their propensity to give better education to their daughters than to their sons.

One of the contributing factors to this gender bias in higher education could be the female-male wage gap. More specifically, the fact that women are expected to obtain higher education in order to stake their claim for equal pay. Put differently, whereas men can get away with lower-level education at the workplace, women in Mongolia must have higher education in order to be compensated at the level of their less-educated male counterparts. However, it needs further investigation with more in-depth analysis.

Another implication of increased education of women is that it may positively impact health and education of their own children and life expectancy and is likely to decrease child mortality. There are many research projects done in this field. Furthermore, considering gender bias in the households' expenditure on higher education, the policies aimed at maintaining equality in education should aim to change the household's attitude toward the importance of male education. This is perhaps the most important implication of this research in terms of developing education policies and eradicating inequality in education.

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