Access to Formal Credit and Gender Income Gap: The Case of Farmers in Cambodia

SAM, Vichet

National Bank of Cambodia

21 November 2019

Access to Formal Credit and Gender Income Gap: The Case of Farmers in Cambodia

Vichet Sam[§]

Abstract

This article analyzes the factors that drive the gender income difference among farmers in Cambodia with a focus on the access to formal credit, using the FinScope survey data. First, an Ordinary Least Square regression (OLS) is used to investigate the main determinants of farmers' income, while an instrumental variable approach (IV) is estimated to check the causal effect of the access to formal credit on earnings. Next, the Blinder-Oaxaca technique is employed to decompose the gender earnings gap.

Results from OLS regression show that individual education and health, farm size and other inputs, irrigation system and weather conditions, access to market and formal credit are strongly associated with farmers' earnings, while the positive impact of access to formal credit is also confirmed by the IV regression at 5% significant level. These results suggest that improving infrastructure and formal credit access in the rural areas play a critical role in increasing farmers' income. Then, based on the Blinder-Oaxaca decomposition technique, most of gender earnings difference is due to the endowment effect in favor of male farmers such as education, farm size and volume of work hours. Access to formal credit also contributes to the gender earnings gap, yet not in terms of endowment but coefficient effect, as a higher return to credit access for male farmers is observed. This could be due to the levels of education and financial literacy that are higher for men, allowing them to use the formal credit better. Closing the gap in education and financial literacy would therefore reduce their earnings gap. Discrimination against female farmers, not in terms of credit access, but in loan amount should be worth to consider as well, as the median of loan amounts of male farmers is higher than those of female. If such discrimination exists, it could also limit the women's capacity to manage and invest in their farms effectively, and thus, the return to credit access must be lower for female farmers.

Keywords: Gender income gap, access to formal credit, agriculture, Blinder-Oaxaca decomposition.

JEL codes: J16, J31, J43, J71.

[§] National Bank of Cambodia (NBC), Economic Research and International Cooperation (ERIC) department.
Email: samvichet77@gmail.com
The opinions expressed in this article are those of the author. They do not necessarily reflect the views of the NBC or the ERIC department.

I- Introduction

According to UN Womenwatch Organization (2019), women play a key role in supporting their households and communities in achieving food and nutrition security, generating income, and improving livelihoods as well as overall well-being. Nevertheless, it has been found that there exists a substantial gender wage gap across the world (Ortiz-Ospina and Roser, 2018). By definition, the gender wage gap is the average difference between the remuneration for men and women who are working (ILO, 2018), and in general, women are paid less than men. Thus, the question of interest that has received attention in the literature is why these gaps exist. The wage differences have been shown to exist due to differences in individual characteristics such as age, education, marital status or job characteristics such as fulltime or part-time job, occupation and industry (Hertz et al., 2009). After controlling for those characteristics, if the gap still exists, it is generally attributed to the labor market discrimination against women (Rozelle et al., 2002).

The literature on the economics of discrimination may refer back to Becker's seminal study in 1957 who analyzes the economic effects of discrimination in the market due to race, religion, social class and gender. Since then, the study of gender wage differentials has become a routine job for labor economists as more available Microdata allow to compare wages of equally productive males and females (Weichselbaumer, & Winter-Ebmer, 2005). Nevertheless, although the literature on gender wage differentials is abundant, mostly focuses on developed countries, while gender gaps are larger in developing countries (Jayachandran, 2015). In addition, despite some research works on this topic exist in developing nations, the determinants of gender wage gap should merit more attention because the gap is found to substantially differ between countries due to different social contexts. For example, in the garment industry, the male-female gap earnings ranges from 10% in Indonesia to 54.7% in Pakistan (Huynh, 2016). Furthermore, limited research works devoted attention to the gender earnings gap in the agricultural sector even though in developing countries, this sector employs most of the workforce and wage differences between males and females are commonly seen in this sector (World Bank, 2009; FAOb, 2011; ILO, 2015). For instance, the FAO estimates that closing the agricultural productivity gap between women and men globally could increase agricultural output in lower-income countries by 2.5% to 4%, reducing undernourishment by 12% to 17% or 100 million to 150 million individuals (FAOa, 2011a).

In Cambodia's economy, agricultural sector also plays an important role as in 2017, around 40% of the population work in farms and this sector accounts for 22% of the GDP (World Bank, 2019). In addition, agriculture is one of the largest sectors of women's employment in Cambodia, but women own less land and receive less agricultural extension training and credit than men (Layton and MacPhail, 2013). Other

challenges for women in Cambodia include the domestic work and care burden, their limited access to resources, inadequate education and training programs (Layton and MacPhail, 2013). However, despite these facts, none of existing studies pay attention to the gender earning gap among farmers in Cambodia. Thus, the objective of this paper is to contribute to the existing literature by investigating the determinants of gender wage differential in the agricultural sector in Cambodia.

Not only in Cambodia, but also in other developing countries, only few papers analyze the gender gap in wage or productivity in the agriculture sector. For instance, using Tobit regression applied on a household survey conducted in rural Zimbabwe in 2001, Horrell et al. (2007) find that female-headed households are poorer than male-headed households because they are lack of assets needed for agricultural production. This constrains their ability to diversify the types of crops grown and to take advantage of local labour market options. The difference in resource endowment which leads to the difference in productivity between male and female headed households are also found in Nigeria by Oladeebo and Fajuyigbe (2007), in Benin by Kinkingninhoun-Medagbe et al. (2010). Similarly, in Uganda, using Oaxaca-Blinder decomposition technique applied on National Panel Survey for 2009/10 and 2010/11, the productivity gap between women and men are estimated to be 17.5% (Ali et al., 2015). This gap is mainly explained by the greater child care responsibilities and difficulty accessing input and output markets of women (Ali et al., 2015). A question that could be raised here is why men may have greater access to agricultural inputs or assets than women.

According to Dong et al. (2012), agricultural production can be conditioned by the fact that inputs are transformed into outputs with considerable time lags, which may cause the farmers to balance its budget during the season when there are high expenditures for input purchases and few revenues. Without adequate access to loans, farmers who face negative shocks can lose some of the assets they have (Diagne and Zeller, 2001). Thus, a limited access to credit could be a constraint to agricultural production. Previous studies from Latin America, South Asia and Sub-Saharan Africa find that women in the rural areas have less access to credit than men even though their socioeconomic conditions are the same (Fletschner, 2009). FAO (2011b) also mentions that credit markets may treat women and men differently, causing women to have less access to purchased inputs.

In Cambodia, however, there is only a small gender gap to financial access based on the FinScope data conducted in 2015 (UNCDF, 2017). Nevertheless, even if men and women have equal access to financial services, the actual usage patterns in terms of the loans and savings amounts mobilized are found to be much lower for most women. For instance, from the customer data of four large Cambodian financial

service providers (AMK, AMRET, Sataphana and VisionFund) in 2015, women on average had around 1,200 USD lower average loan amount (UNCDF, 2017). In addition, not only general education, but the level of financial literacy among women in Cambodia also seems to be lower than men (Allen, 2017). Thus, in Cambodia, rather than the gap in access to credit, the gap in return to credit use might exist and contribute to the gender earning gap. However, to the best of our knowledge, only Palacios-López and López (2015) who theoretically examine the effect of credit constraint on gender labour productivity gap among farmers in developing countries. Therefore, our research question is: "Does the access to formal credit contribute to the gender income differentials among farmers in Cambodia?"

To answer to this question, we will use the FinScope survey data conducted between November 2015 and January 2016. First, we will employ the OLS regression to identify the determinants of income among farmers and we will test the difference in coefficients to see whether there is a difference in variable coefficients between male and female farmers. To check the causal effect of access to formal credit on farmers' income, a two-stage least square regression was also used. Second, we will employ the Blinder-Oaxaca decomposition technique, which allows us decomposing the gap into a part that is due to differences in the mean values of the independent variable within the groups such as education and access to credit, and another part that is due to the differences in the effects of the independent variable, for example, with the same level of access to credit, men may use the credit better than women or vice versa.

Thus, this paper contributes to the literature on two main points. First, we examine if there exists a gender gap in formal credit access among male and female farmers in Cambodia and if it contributes to the gender earning differential. More importantly, we investigate if with the same level of credit access, there is a difference in the return to this access between men and women and why. Second, given the importance of agriculture and women in Cambodia's development, the identification of the factors that influence farmers' income on the one hand and the factors that limit the female famers' earnings on the other hand should help policy-makers in designing policies that target those farmers' challenges in order to promote the farmers' earnings as well as gender equality.

The paper is structured as follows: Section 2 describes the database, section 3 presents descriptive statistics, section 4 describes the method and results, and section 5 concludes.

II- Data and variables

The FinScope Survey in Cambodia was conducted by the National Institutes of Statistics (NIS) and the FinMark Trust that is an independent non-profit trust whose purpose is to promote the financial inclusion among the poor. The objective of the Finscope survey is to measure the level of access to financial services by all adults, aged 18 years and older. This survey was conducted in Cambodia by face-to-face interviews with 3,150 individuals, nationally representative of the adult population, from November 2015 to January 2016. The surveys records details about respondents' personal characteristics, their household characteristics and the levels of access to financial services and products. Among those adults, 1,693 are involved with farming activities, but only 847 adults declare that their main income source comes from the agriculture. As this paper focuses on the gender earning gap in the agricultural sector, we select only individuals whose the main source of income come from farming activities, leaving us with 847 observations, in which 526 are female and 321 are male.

Based on the data, men clearly have a higher total monthly income with an average of 543,159 riels or 136 USD against women that have an average income of 428,015 riels or 107 USD. Thus, on average, female farmers earn 21.3% lower. Why does this gap exist?

There are several theories that explain why people could earn differently. Some theories emphasize personal characteristics as the principal wage determinants. For example, the famous Mincer earning function (1974) explains wage as a function of years of schooling and experience. Actually, farmers with more education may possess better knowledge to shape the way in which inputs are used, which influences the agricultural productivity, and to adapt their practices to a particular situation (Rapsomanikis, 2014), and in Cambodia, in general, women get less education than men. In the data, we have information regarding the individual schooling years, but no information related to job market experiences. However, we could proxy the job experience with the individual age as older farmers should have spent a longer time in farming activities than young adults. Next, a concern when we analyze the determinants of income is the volume of work hour that farmers spend on their farms. It is reasonable that besides farming job, women must also take care of domestic works, and thus, they would spend less time on farm than men, and therefore, they should earn less. Unfortunately, in the data, we cannot know how many hours each farmer works on the farm, but there is a variable which indicates if individual is one of the main household income earners or not. We assume that the main income earner should work more hours than individual who is not the main income earner. We acknowledge that this variable is not a good proxy for the on-farm hour volume, but at least, it should capture the fact that women might be more

responsible for domestic work, while men are assigned to be the main household income earner, and consequently, a part of the gender wage gap might be related to this issue. Then, given that good health and being married are found to provide a wage premium (Gilleskie and Hoffman, 2014; Chun and Lee, 2001), we also add health and marital status as additional control variables for personal characteristics.

Besides individual characteristics or human capital that may affect the labour productivity and thus earning, land, capital and market access should also influence the farm output, which could provide more income for farmers (Ahmad and Heng, 2012). In the survey data, we have information concerning the farm size that we classify into below or beyond 1 ha given that almost half of farmers had plots of land measuring less than 1 ha, considered as small farms, according to the Census of Agriculture in Cambodia 2013 (NIS and MAFF, 2015). Besides land, the irrigation system, the region where the farmers are located and farming challenges in terms of drought and other natural disasters should have impacts as well on the output and their earnings. Indeed, irrigation is one of the most productive assets, leading to significant increases in land productivity, as micro evidence from Asia suggests that irrigation results in higher yields and income (Rapsomanikis, 2014). Similarly, the Tonle Sap Lake is a good area for agricultural production, thanks to the ease of access to water and natural fertilizer (Un et al., 2015). In contrast, farmers who report that drought and other natural disasters are a main challenge for them, could find themselves in a worse condition regarding their farming activities. Next, some assets like tractor and the use of inputs such as fertilizer may also increase the output for farming activities that we should control for. Then, the access to market might be also important because a long distance to market could encourage farmers to sell their products at farm to the middlemen at low prices in order to avoid the transportation costs (Hassan, 2015). Furthermore, it is known that some farmers farm not only for selling but also for own consumption, especially for female farmers (Orr et al., 2014). If it is the case, they should earn less than those who sell all their products. Hence, distance to market and whether they produce to sell only or for consumption as well would be added as control variables. Finally, our main independent variable is the access to formal credit, which is defined as having or using credit/loan products from institutions that are regulated or supervised by the National Bank of Cambodia or any other formal regulator/agency (FinScope, 2015).

III- Descriptive statistics

Table 1 below presents descriptive statistics of all variables used in this analysis. We also separate the sample into male and female to see their different characteristics that may make their income different and if those differences are statistically significant or not by using the T-Test.

Table 1: Descriptive statistics

	Total			Male			Female			Difference between male and female
Variables	Mean	Std. dev.	Average income	Mean	Std. dev.	Average income	Mean	Std. dev.	Average income	
Dependent variable										
Income (log)	4.25	0.91		4.40	0.86		4.16	0.91		0.23***
Individual characteristics:										
Years of schooling	3.87	3.31	4.30	4.60	3.35	4.42	3.42	3.21	4.20	1.17***
Age	43.95	13.78	4.21	44.80	14.34	4.41	43.44	13.42	4.09	1.35
Main household income earner	0.46	0.49	4.66	0.56	0.49	4.66	0.40	0.49	4.67	0.16***
Good health	0.27	0.44	4.41	0.32	0.46	4.57	0.23	0.42	4.26	0.08***
Married	0.82	0.38	4.32	0.90	0.29	4.42	0.76	0.42	4.24	0.13***
Land and weather condition:										
More than 1 ha of farm size	0.43	0.49	4.46	0.49	0.50	4.57	0.39	0.48	4.37	0.09***
Irrigation as source of water	0.04	0.19	4.86	0.02	0.15	5.33	0.04	0.20	4.70	-0.02
Tonle Sap region	0.40	0.49	4.35	0.36	0.48	4.64	0.42	0.49	4.19	-0.06*
Challenge with drought and other natural disasters	0.61	0.48	4.21	0.59	0.49	4.41	0.61	0.48	4.08	-0.02
Agricultural asset and input										
Having tractor	0.21	0.41	4.44	0.24	0.43	4.65	0.19	0.39	4.28	0.05*
Having used fertilizer	0.75	0.43	4.29	0.72	0.44	4.44	0.76	0.42	4.20	-0.04
Market access and other										
More than 30 minutes to access the market	0.47	0.49	4.13	0.50	0.50	4.25	0.45	0.49	4.06	0.05
Production for sale only	0.11	0.31	4.48	0.12	0.32	4.47	0.09	0.29	4.48	0.02
Access to formal credit	0.33	0.47	4.42	0.33	0.47	4.59	0.33	0.47	4.31	0.00
Observations		847			321			526		847

Note: For continuous variables (years of schooling and age), observed mean wages are evaluated for the two last quartiles of each variable.

**** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1*

Based on these descriptive statistics, we clearly see that men possess several personal characteristics in favor of their productivity, and the differences are highly significant at 1% level. For example, their average year of schooling is 4.6 years higher than 3.4 years of women. In addition, 56% of male adults are also the main income earners in the household against 40% of female. Men are also reported to be more likely in good health (32% against 23%). Regarding the farm size, 49% of male farmers possess a farming land higher than 1 ha against only 39% of female. Nevertheless, women seem to be in a better location as 42% live in the Tonle Sap area (against 36% of men) and only 45% of them who must take more than 30 minutes to market (50% for men), yet those characteristics that favor women are not statistically significant. An econometric analysis is needed to find out the factors that determine the gender earnings difference.

IV- Method and results

Before we investigate the determinants of gender income gap among farmers in Cambodia, first, we start with a simple OLS regression on the full sample size to see the wage determinants, then, we run the regression separately for the male and female samples to see if those determinants are different between male and female farmers.

Next, we will use the Blinder-Oaxaca decomposition technique that divides the wage differential between two groups into a part that is "explained" by group differences in their characteristics, and a residual part called the "unexplained" part that may include the effects of group differences in unobserved predictors (Jann, 2008):

We have two groups, male farmers (M) and female farmers (F) with the outcome variable of our interest, log income (Y). The income difference (D) between male and female can be written as:

$$D = E(Y_M) - E(Y_F) \quad (1)$$

where $E(Y)$ denotes the expected value of the income variable, which is accounted by group differences in the predictors. Based on the linear model:

$$Y_Z = X_Z'\beta_Z + \mu_Z, \qquad \text{with } E(\mu_Z) = 0 \text{ and } Z \in (M, F)$$

where X is a vector containing the predictors (e.g., education, age, health, etc.) and a constant, β contains the slope parameters, and μ is the error term. Thus, the equation (1) can be written as follows:

$$D = E(X_M)'\,\beta_M - E(X_F)'\,\beta_F \quad (2)$$

To identify the contribution of group differences in predictors to the overall outcome difference, while assume that there is a nondiscriminatory coefficient vector β^*, the equation (2) is written as:

$$D = \{\,E(X_M) - E(X_F)\}'\beta^* + \{E(X_M)'(\,\beta_M - \beta^*) + E(X_F)'(\beta^* - \,\beta_F)\} \quad (3)$$

We have thus a twofold decomposition:

$$D = Q + U$$

where the first component:

$$Q = \{\,E(X_M) - E(X_F)\}'\beta^*$$

is the part of the income differential that is explained by group differences in the predictors, called "the endowment or quantity effect", and the second component:

$$U = \{E(X_M)'(\beta_M - \beta^*) + E(X_F)'(\beta^* - \beta_F)\}$$

is the unexplained component that can capture the effects of differences in variable coefficients that are due to unobserved characteristics.

Tables 2 and 3 below present the regression results

Table 2: OLS regression results

Variables	Full sample	Male sample	Female sample	Difference in coefficients between men and women
Individual characteristics				
Years of schooling	0.037*** (0.008)	0.039*** (0.012)	0.030** (0.012)	
Age	0.039*** (0.012)	0.019 (0.019)	0.058*** (0.016)	
Square of age	-0.0004*** (0.0001)	-0.0002 (0.0002)	-0.001*** (0.0002)	*
Main household income earner	0.694*** (0.053)	0.582*** (0.090)	0.778*** (.069)	*
Good health	0.163** (0.063)	0.218** (0.093)	0.113 (0.086)	
Married	0.140* (0.072)	0.153 (0.145)	0.090 (0.087)	
Land and weather condition				
More than 1 ha of farm size	0.216*** (0.058)	0.171* (0.095)	0.221*** (0.073)	
Irrigation as source of water	0.582*** (0.166)	0.891*** (0.199)	0.535** (0.210)	
Tonle Sap region	0.102* (0.054)	0.153* (0.092)	0.077 (0.069)	
Challenging with natural disasters	-0.164*** (0.055)	-0.016 (0.088)	-0.279*** (0.074)	**
Agricultural asset and input				
Having tractor	0.067 (0.071)	0.173 (0.116)	-0.010 (0.090)	
Having used fertilizer	0.128** (0.061)	0.074 (.095)	0.137* (0.082)	

Market access and other				
More than 30 minutes to access market	-0.108** (0.054)	-0.211** (0.087)	-0.043 (0.071)	
Production for sale only	0.129 (0.106)	0.188 (0.168)	0.104 (0.136)	
Access to formal credit	0.144** (0.057)	0.292*** (0.094)	0.034 (0.071)	**
Constant	2.597*** (0.283)	2.936*** (0.399)	2.412*** (0.377)	
Observations	847	321	526	
Adjusted R^2	0.274	0.253	0.283	

*Note: Robust standard errors are in brackets; *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1*

Based on the Table 2, several variables may have impacts on the farmers' earnings. First, education has a positive impact as suggested by the human capital theory (Becker, 1964) given that a one-year increase in schooling would increase individual income by 3.8%.[1] Older farmers also tend to earn more as a one-year increase in age increases the income by 4%. This could be due to the experience of older farmers, leading to a more work efficient (Guo et al., 2015), but the physical strength is also required in the agricultural production, and thus, as we could observe with the squared term of age that the impact of age becomes negative after the age of 47, with a one-year increase in age would reduce the income by 0.04%. Given that the average age of farmers in our sample is 44 years old, it seems that the agriculture sector in Cambodia has been facing a shortage of labor because young people tend to move out the rural areas to work for garment or construction sectors for higher wage.[2] Next, there is no doubt that adults who are one of the main household income earners do earn much larger than those who are not. Given that the proportion of men who are the main income earners is higher, this suggests that women must also take care about their children and other domestic works, while men focus more on income earnings, and consequently, the latter must earn more. Health also plays a main role in wage equation, as adults who report that they are in good health earn on average 17.7% more than people who are not. In the data, only 27% of adults are healthy, this suggests that improving the health education, the health access and its quality would help farmers to earn more.

Then, farm size and weather conditions strongly influence the farmers' income. Farmers who have a farm size over 1 ha earn 24.1% higher than those who possess farms smaller than 1 ha. More importantly,

[1] $e^{0.037}-1$

[2] The minimum wage for garment workers, without including other benefits, will be 190 USD from January 2020.

farmers who depend on the irrigation as the source of water for their farms, earn 78.9% higher than those who depend on other sources, but unfortunately, only 4% rely on this watering system, while around 80% still depend on the rain[3]. Thus, continuing developing the infrastructure in the rural areas is extremely important to help the farmers. Next, people who must spend more than 30 minutes to reach the nearest market, earn 10.2% lower than those who spend 30 minutes or less. This suggests that being far from the market could affect their livelihood as this could raise the transportation costs and thus their commodity prices, making their products less competitive (Rapsomanikis, 2014) or they may prefer to sell to the middlemen at low prices in order to avoid the transportation costs (Hassan, 2015). This, again, requires an improvement of physical infrastructure in the rural areas such as the road. Lastly, access to formal credit and earnings are highly correlated, with farmers who have access to this financial service earn 15.5% higher than those who do not. This correlation is statistically significant at 5% level, even though we already controlled several variables.[4] However, one shortcoming of OLS regression is that the association between access to formal credit and earnings may impose a reverse causality in the sense that farmers with higher earnings are more likely to get access to formal credit. To check this issue, a two-stage least square regression was employed, and we find that access to formal credit does have a positive impact on farmers' earnings. A detail result of this regression is reported in the Appendix 2.

Next, when we separate the sample into two sub-samples, male and female, some differences in pattern of income determinants are observed. First, age is statistically significant for women, but not for men. The possible explanation for this might be that rural women in Cambodia marry and have children at a very young age (UNFPA, 2015), which makes them having less time for income-generating. In contrast, even good health has positive impacts for both men and women, but it is statically significant for men only. The same for the negative impacts of distance to market. However, the difference in those variable coefficients are not statistically significant.

Nevertheless, it is worth noting for two variables "the challenge with drought and other natural disasters" and "the access to formal credit". The negative impact of challenges with natural disasters is strong and statistically significant for women only, while the positive influence of access to formal credit is only for men, and the difference in coefficients of these two variables, for male and female samples, are also significant at 5% level. The results suggest that men may cope better with natural disasters than women,

[3] The rest depends on river and other reservoirs such as lake as a source of water supply.

[4] Testing for prediction power, homoscedasticity, specification error, multicollinearity and normal distribution of residuals are available in the Appendix 1.

thanks to their physical strengths and resources, while more access to education and information may allow men to manage climate-related risks to agriculture and livestock better than women (PRB, 2012). Similarly, men may use the credit better than women thanks to their higher education and/or financial literacy (Goldsmith and Goldsmith, 2006; Mottola, 2013). For instance, among those who have access to formal credit, only 11% of men report that they have never went to school against 21% of women. Regarding the financial literacy, no information is provided in the data, but according to the International Network on Financial Education (INFE), financial literacy is defined as: "A combination of awareness, knowledge, skill, attitude and behavior necessary to make sound financial decisions and ultimately achieve individual financial well-being". We, therefore, use the variables "awareness about insurance" as proxy for financial awareness, the variable "dealing with finance is not stressful" as proxy for financial knowledge and skill, and then, the variable "keeping track of income and expenditure on a monthly basis" as proxy for financial attitude and behavior. Overall, the average score for male farmers who have access to formal credit is slightly higher than their female counterparts (1 against 0.98)[5]. It might be also possible that women are not discriminated in terms of financial access, but in terms of amount. For instance, the median of loan amount that farmers borrowed for the last time was 4 million riels (1,000 USD) for male against 3 million riels (750 USD) for female.[6] Another possible reason is that male farmers might use the credit to purchase agricultural inputs, which increases the farming productivity, while women might use the credit for other purposes such as the fulfillment of their daily household needs (Akter et al., 2017). Nevertheless, it seems not to be the case as according to the data, among farmers who have access to formal credit, 58% of male and 60% of female declare that they borrow money for farming activities such as buying livestock, farming equipment and for farming expenses such as seeds or fertilizer.

We have seen the factors that drive farmers' wages, and if there is a difference between men and women regarding those income determinants. The next table, using Blinder-Oaxaca decomposition technique, will present what factors and to what extent that they contribute to explain the gender-income gap among farmers in Cambodia.

[5] We attribute one score for an individual who says he/she is aware of insurance and one more score if he/she says "dealing with finance is not stressful" and one more point if he/she keeps track of their income/expenditure.
[6] Unfortunately, there are several missing values, making impossible for us to consider it more deeply.

Table 3: Blinder-Oaxaca decomposition results

VARIABLES	Differential	Explained	Unexplained
Individual characteristics			
Years of schooling		0.042***	0.032
		(0.013)	(0.071)
Age		0.055	-1.722
		(0.044)	(1.125)
Square of age		-0.063	1.049*
		(0.044)	(0.607)
Main household income earner		0.110***	-0.095*
		(0.026)	(0.056)
Good health		0.013*	0.030
		(0.007)	(0.036)
Married		0.017*	0.052
		(0.010)	(0.145)
Land and weather condition			
More than 1 ha of farm size		0.021**	-0.024
		(0.009)	(0.054)
Irrigation as source of water		-0.012	0.010
		(0.008)	(0.009)
Tonle Sap region		-0.006	0.030
		(0.005)	(0.044)
Challenging with natural disasters		0.003	0.159**
		(0.006)	(0.068)
Agricultural asset and input			
Having tractor		0.004	0.041
		(0.004)	(0.033)
Having used fertilizer		-0.006	-0.046
		(0.005)	(0.092)
Market access and other			
More than 30 minutes to access the market		-0.006	-0.081
		(0.005)	(0.054)
Production for sale only		0.003	0.010
		(0.004)	(0.024)
Access to formal credit		-0.000	0.087**
		(0.005)	(0.039)
Total		0.175***	0.055
		(0.039)	(0.058)
Prediction_1	4.399***		
	(0.048)		
Prediction_2	4.168***		
	(0.040)		
Difference	0.231***		
	(0.063)		
Constant			0.523
			(0.539)
Observations	847	847	847
Robust standard errors in parentheses;	*** p<0.01, ** p<0.05, * p<0.1		

Based on the Blinder-Oaxaca decomposition results, we find out that on average, male farmers earn 25.9%[7] higher than female farmers in which 19.2 percentage points are explained by the difference in resource endowments between male and female farmers, which is statistically significant at 1% level. For example, if women have the same amount of schooling as men, the gap could be reduced by 4.3 percentage point. Other 6.7 percentage points (25.9-19.2) are due to the unexplained component, meaning that the return to the same level of resource endowments is higher for men than women. Even though this component is not statistically significant, when we break down the contribution by variables, we observe that there are two variables that are significant at 5% level: "Challenge with drought and other natural disasters" and "Access to formal credit". For instance, the return to formal credit access is higher for male farmers and contributes to explain 9.1 percentage points of the gender earning gap. As previously mentioned, this could be due to gender gap in education and financial literacy. For instance, it was found that 16% of women in Cambodia are financially literate, lower than the overall average of 18% (Hasler and Lusardi, 2017). To verify these assumptions, we rerun the OLS regression for different groups of individuals who have high/low years of schooling and high/low levels of financial literacy, and results show that those who possess a better number of years of schooling and a high level of financial literacy tend to get a higher return to their formal credit access. The details of those results are available in the Appendix 3.

This result implies that to reduce the gender earning gap among farmers in Cambodia, closing the gap in education and financial literacy is very important. Besides this, it might be worth to explore more if there exists a discrimination against female farmers in terms of loan amount whether the loan size that is typically smaller for women is due to their smaller needs or the limit by financial institutions.

[7] $e^{0.231}-1$

V- Conclusion

Using the FinScope data and Blinder-Oaxaca decomposition technique, this research work aims at examining what factors that drive the gender income gap among farmers in Cambodia, especially if the access to formal credit also contributes to explain this gap.

Before answering to this question, an OLS regression was employed to identify the determinants of wages and results find that several variables such as the number of schooling years, age, volume of work hours, health, marital status, farm's size, water source, region, natural disaster, fertilizer usage, distance to market and access to formal credit, all are associated with farmers' earnings. To check the problem of reverse causality between income and access to formal credit, a two-stage least square regression, using the combination of farmers' trust in MFI and distance to MFI as the instrumental variable was employed, and results indicate that access to formal credit does influence the farmers' income, which is statistically significant at 5% level. These findings suggest that to increase the farmers' earnings, increasing their level of education and improving the rural infrastructure such as the access to irrigation system, farming inputs, market and formal credit are critical.

Next, with results from Blinder-Oaxaca decomposition, male farmers are found to earn on average 26% higher than female and most of this gap (19%) are explained by the quantity effect such as years of schooling, farm size and working hours (proxied by whether individual is one of the main household income earner or not). Regarding the access to formal credit, even though there is no gender gap in the access, there is an unexplained gap in return to credit access in favor of male farmers. A possible explanation for this different return could be due to the level of education and financial literacy that are higher for men, allowing them to use credit better than female farmers. This result implies that closing the gap in education and financial literacy between men and women is an important factor to reduce the gender earning gap among farmers in Cambodia.

This paper faces, however, several challenges. First, we have no data on the volume of work hours and financial literacy, which requires us to proxy with other available variables. Second, we select adults who declared that their main source of income is from the agriculture, thus, it is possible that besides farming, some adults may have other activities that have impacts on their earnings as well. However, when we add the information whether those farmers rely on another job as a secondary source of income, it does not change our findings.[8] Third, regarding farming, there are also different activities such as crops, livestock

[8] Results are available upon request.

and fishery, in which we may also separate into different crops and different livestock. However, again, adding these variables (commercial crops such as rice, rubber, etc.) into our regression does not modify our findings.[9] Fourth, given that farming activities may require the supports from other family members, the unit of analysis should focus on the household head, but owing to a small sample size of adults with the status as household head (394 observations), even though we find similar impacts of independent variables, the coefficient of our main variable of interest (access to formal credit) is not statistically significant anymore. Analysis with a focus on household head could be also problematic as normally, female household heads tend to be more widowed than male household heads. Fifth, closing gender gap in education and financial literacy would be not enough to close the gender earnings gap if there exists a discrimination against female farmers in terms of loan amount, limiting thus their capacity to manage and invest in their farms as effectively as their male counterparts. Further exploration on this issue would be appreciated.

[9] It could be due to the lack of variation in our data as most farmers (69%) declare that their main income crop is rice. This also shows that the lack of crop diversification among farmers could be also a problem in Cambodia. We also control for livestock, but no interesting results were obtained either. Results are available upon request.

Appendix 1

Figure 1: Observed and predicted income

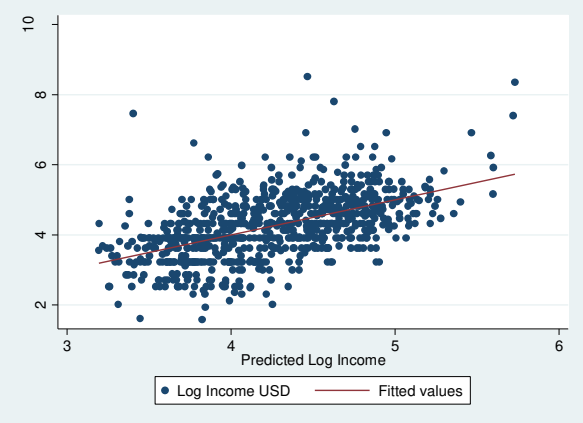

Figure 2: Residuals plot

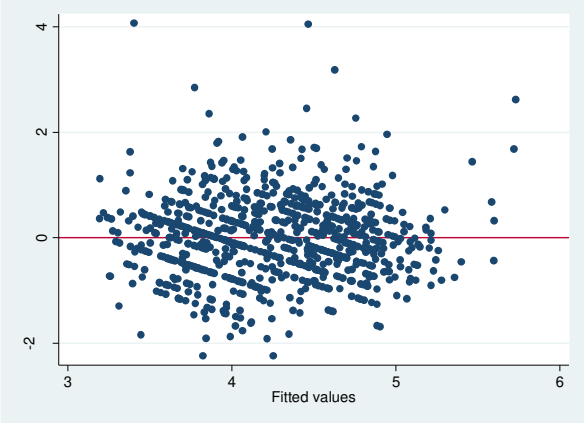

Figure 3: Distributions of residuals

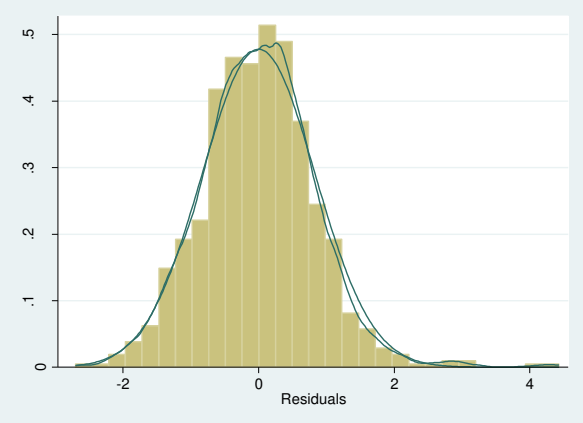

Table 4: Multicollinearity test

Variable	VIF
Age	43.95
Square of age	43.33
Years of schooling	1.29
More than 1 ha of farm size	1.18
Having tractor	1.14
Tonle Sap region	1.14
Married	1.1
Good health	1.09
Production for sale only	1.09
More than 30 minutes to market	1.06
Challenging with natural disasters	1.06
Formal credit	1.05
Having used fertilizer	1.05
Main household income earner	1.05
Irrigation as source of water	1.02
Mean VIF	6.77

Table 5: Testing for specification error

Log_income	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
_hat	0.2838912	0.8331224	0.34	0.733	-1.351344	1.919126
_hatsq	0.0835706	0.0970195	0.86	0.389	-0.1068572	0.2739984
_cons	1.514358	1.773373	0.85	0.393	-1.966381	4.995098

Appendix 2

Table 5: Two-stage least square (2sls) regression results

VARIABLES	Full sample	Male	Female
Access to formal credit	0.975**	0.897*	0.960
	(0.476)	(0.535)	(0.722)
Years of schooling	0.040***	0.045***	0.030**
	(0.010)	(0.015)	(0.014)
Age	0.018	0.007	0.035
	(0.019)	(0.021)	(0.026)
Square of age	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Main household income earner	0.661***	0.626***	0.689***
	(0.065)	(0.099)	(0.108)
Good health	0.184***	0.222**	0.150
	(0.070)	(0.095)	(0.101)
Married	0.062	0.020	0.029
	(0.093)	(0.189)	(0.108)
More than 1 ha of farm size	0.184***	0.126	0.205**
	(0.068)	(0.113)	(0.082)
Irrigation as source of water	0.515***	0.846***	0.453**
	(0.170)	(0.140)	(0.217)
Tonle Sap region	0.143**	0.141	0.144
	(0.065)	(0.096)	(0.094)
Challenging with natural disasters	-0.170***	-0.044	-0.255***
	(0.062)	(0.097)	(0.085)
Having tractor	0.111	0.189	0. 052
	(0.086)	(0.125)	(0.116)
Having used fertilizer	0.129*	0.077	0.143
	(0.068)	(0.098)	(0.094)
More than 30 minutes to access the market	-0.088	-0.213**	-0.017
	(0.061)	0.091	(0.082)
Production for sale only	0.011	0.133	-0.054
	(0.129)	(0.175)	(0.184)
Constant	2.801***	3.062***	2.584***
	(0.329)	(0.395)	(0.454)
Observations	847	321	526
Adjusted R2	0.092	0.147	0.064

Robust standard errors in parentheses

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

Based on the 2SLS regression, access to formal credit has a positive impact on farmers' income and it is statistically significant at 5% level. Given that our endogenous variable is a binary choice, we follow the three-step procedure, proposed by Adams et al. (2009), by using the probit regression for the "first stage" and OLS for the "second stage". The combination of variables "trust in microfinance institutions (MFI)" and "time to MFI for less than 30 minutes" was employed as an instrumental variable. Indeed, a previous

research finds that “trust in and time to financial institutions” are the main determinants of formal financial access in Cambodia (Sam, 2019).

We also check the quality of instrument using the Cragg-Donald Wald test, and the F-statistics equals 14.6, higher than the conventional threshold of 10 as proposed by Stock et al. (2002), and significant at 1% level, rejecting the H_0 that the instrument used is weak.

Table 6: Test of quality instrument

First-stage regression summary statistics					
Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	Robust F(1,831)	Prob > F
Access to formal credit	0.066	0.049	0.017	14.582	0.000

Appendix 3

Table 7: OLS regression by years of schooling and level of financial literacy

Dependent variable: Log Earnings	Model 1	Model 2	Model 3	Model 4
Years of schooling	0.060***	0.004	0.039***	0.035***
	(0.013)	(0.030)	(0.010)	(0.010)
Age	0.032**	0.053***	0.045***	0.031**
	(-0.016)	(0.018)	(0.015)	(0.014)
Square of age	-0.001*	-0.001***	-0.001***	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)
Main household income earner	0.701***	0.656***	0.659***	0.702***
	(0.067)	(0.073)	(0.066)	(0.063)
Good health	0.086	0.242***	0.134*	0.211***
	(0.078)	(0.085)	(0.076)	(0.073)
Married	0.163	0.156	0.067	0.151*
	(0.100)	(0.100)	(0.089)	(0.087)
More than 1 ha of farm size	0.151**	0.319***	0.224***	0.203***
	(0.073)	(0.082)	(0.070)	(0.067)
Irrigation as source of water	0.799***	0.300	0.774***	0.500***
	(0.232)	(0.186)	(0.217)	(0.174)
Tonle Sap region	0.140*	0.112	0.146**	0.119*
	(0.072)	(0.073)	(0.071)	(0.061)
Challenging with natural disasters	-0.212***	-0.137*	-0.278***	-0.047
	(0.071)	(0.077)	(0.070)	(0.065)
Having tractor	0.046	0.020	0.094	0.057
	(0.091)	(0.094)	(0.091)	(0.084)
Having used fertilizer	-0.062	0.292***	-0.049	0.191***
	(0.082)	(0.078)	(0.084)	(0.064)
More than 30 minutes to access the market	-0.156**	-0.031	-0.164**	-0.083
	(0.067)	(0.076)	(0.066)	(0.063)
Production for sale only	0.177	0.119	0.072	0.209*
	(0.127)	(0.147)	(0.125)	(0.126)
Access to formal credit	0.215***	0.049	0.160**	0.144**
	(0.074)	(0.078)	(0.071)	(0.067)
Constant	2.743***	2.171***	2.822***	2.621***
	(0.343)	(0.407)	(0.353)	(0.325)
Observations	513	458	567	640
Adjusted. R2	0.318	0.274	0.271	0.295
Robust standard errors in parentheses				*** p<0.01, ** p<0.05, * p<0.1

Model 1: Years of schooling >= 3; Model 2: Years of schooling <=3 (3 is the median of years of schooling).
Model 3: Financial literary >=1; Model 4: Financial literacy <=1 (1 is the median score of financial literacy).

References

- Adams, R., Almeida, H., & Ferreira, D. (2009). Understanding the relationship between founder–CEOs and firm performance. Journal of empirical Finance, 16(1), 136-150.
- Ahmad, K., & Heng, A. C. T. (2012). Determinants of agriculture productivity growth in Pakistan. International Research Journal of Finance and Economics, 95, 163-173.
- Akter, S., Rutsaert, P., Luis, J., Htwe, N. M., San, S. S., Raharjo, B., & Pustika, A. (2017). Women's empowerment and gender equity in agriculture: A different perspective from Southeast Asia. Food Policy, 69, 270-279.
- Allen, P. (2017, April 27). Why financial literacy is more important (and less boring) than it seems. Retrieved 28 October 2019, from: https://www.sheinvestments.com/news/2017/4/27/why-financial-literacy-is-more-important-and-less-boring-than-it-seems
- Ali, D., Bowen, D., Deininger, K., & Duponchel, M. (2015). Investigating the gender gap in agricultural productivity: Evidence from Uganda. The World Bank.
- Becker, G. S., & Capital, H. (1964). A theoretical and empirical analysis with special reference to education.
- Chan, S. (2017, June 15). Report says farming workforce halved. Retrieved 21 October 2019, from: https://www.khmertimeskh.com/8857/report-says-farming-workforce-halved/
- Chun, H., & Lee, I. (2001). Why do married men earn more: Productivity or marriage selection? Economic Inquiry, 39(2), 307-319.
- Diagne, A., & Zeller, M. (2001). Access to credit and welfare in Malawi. Research report, 116.
- Dong, F., Lu, J., & Featherstone, A. M. (2012). Effects of credit constraints on household productivity in rural China. Agricultural Finance Review, 72(3), 402-415.
- Elder, Sara, and Sriani Kring. (2016). Young and female-a double strike? Gender analysis of school-to-work transition surveys in 32 developing countries.
- Hasler, A., & Lusardi, A. (2017). The gender gap in financial literacy: A global perspective. Global Financial Literacy Excellence Center, The George Washington University School of Business.
- Huynh, P. (2016). Assessing the gender pay gap in Asia's garment sector. Bangkok, Thailand: International Labour Organization.
- FAO. (2010). Gender dimensions of agricultural and rural employment: Differentiated pathways out of poverty Status, trends and gaps. Rome, Italy: Food and Agriculture Organisation.

- FAOa. (2011). The State of Food and Agriculture. Rome, Italy: Food and Agriculture Organisation.
- FAOb. (2011). Women in agriculture: Closing the gender gap for development. Rome, Italy: Food and Agriculture Organisation.
- FinScope (2015). Consumer Survey Highlights, Cambodia 2015. Retrieved 11 November 2019, from: http://www.finmark.org.za/wp-content/uploads/2016/07/finscope-cambodia-pocket-guide.pdf
- Fletschner, D. (2009). Rural women's access to credit: market imperfections and intrahousehold dynamics. World Development, 37(3), 618-631.
- Gilleskie, D., & Hoffman, D. (2014). Health capital and human capital as explanations for health-related wage disparities. Journal of Human Capital, 8(3), 235-279.
- Goldsmith, R. E., & Goldsmith, E. B. (2006). The effects of investment education on gender differences in financial knowledge. Journal of Personal Finance, 5(2), 55-69.
- Guo, G., Wen, Q., & Zhu, J. (2015). The impact of aging agricultural labor population on farmland output: from the perspective of farmer preferences. Mathematical Problems in Engineering, 2015.
- Hassan, T. A. (2015). Economic analysis of factors affecting the farmer income under traditional farming system in South Darfur state–Sudan. Journal of Agricultural Science and Engineering, 1(3), 114-119.
- Horrell, S., & Krishnan, P. (2007). Poverty and productivity in female-headed households in Zimbabwe. The journal of development studies, 43(8), 1351-1380.
- ILO. (2018). Global wage report 2018/19: What lies behind gender pay gaps? Geneva, Switzerland: International Labour Office.
- Jann, B. (2008). The Blinder–Oaxaca decomposition for linear regression models. The Stata Journal, 8(4), 453-479.
- Jayachandran, S. (2015). The roots of gender inequality in developing countries. economics, 7(1), 63-88.
- Kinkingninhoun-Mêdagbé, F. M., Diagne, A., Simtowe, F., Agboh-Noameshie, A. R., & Adégbola, P. Y. (2010). Gender discrimination and its impact on income, productivity, and technical efficiency: evidence from Benin. Agriculture and human values, 27(1), 57-69.
- Layton, R., & MacPhail, F. (2013). Gender equality in the labor market in Cambodia. Manila, Philippines: Asian Development Bank.
- Mincer, J. (1974). Schooling, Experience, and Earnings. Human Behavior & Social Institutions No. 2.
- Mottola, G. R. (2013). In our best interest: Women, financial literacy, and credit card behavior. Numeracy, 6(2), 4.

- NIS and MAFF. (2015). Census of Agriculture in Cambodia 2013. Phnom Penh: National Institute of Statistics in collaboration with the Ministry of Agriculture, Forestry and Fisheries.
- Oladeebo, J. O., & Fajuyigbe, A. (2007). Technical efficiency of men and women upland rice farmers in Osun State, Nigeria. Journal of human ecology, 22(2), 93-100.
- Orr, A., Tsusaka, T. W., Homann-KeeTui, S., & Msere, H. W. (2014). What do we mean by 'Women's Crops'? A Mixed Methods Approach (No. 23). ICRISAT SocioEconomics Discussion Paper Series.
- Ortiz-Ospina, E. and Roser, M. (2018, March). Economic Inequality by Gender. Retrieved 28 October, 2019, from: https://ourworldindata.org/economic-inequality-by-gender
- Palacios-López, A., & López, R. (2015). The gender gap in agricultural productivity: the role of market imperfections. The Journal of Development Studies, 51(9), 1175-1192.
- PRB (2012, December 26). Women More Vulnerable Than Men to Climate Change. Retrieved 25 October 2019, from: https://www.prb.org/women-vulnerable-climate-change/
- Rapsomanikis, G. (2014). The economic lives of smallholder farmers; an analysis based on household surveys. Rome: Food and Agriculture Organization.
- Robertson, R. (2011). Apparel wages before and after Better Factories Cambodia, Better Work Discussion Paper Series No. 3 (Geneva, ILO).
- Rozelle, S., Dong, X. Y., Zhang, L., & Mason, A. (2002). Gender wage gaps in post-reform rural China. Pacific Economic Review, 7(1), 157-179.
- Sam, V. (2019). Formal Financial Inclusion in Cambodia: What are the Key Barriers and Determinants? MPRC working paper.
- Stock, J. H., Wright, J. H., & Yogo, M. (2002). A survey of weak instruments and weak identification in generalized method of moments. Journal of Business & Economic Statistics, 20(4), 518-529.
- Un, B., Pech, S., & Baran, E. (2015). Aquatic agricultural systems in Cambodia: national situation analysis.
- UNCDF. (2017, September 4). The Gender Gap in Financial Inclusion: What Can We Learn From Microfinance and Banking Data? Retrieved 22 October 2019, from: https://www.uncdf.org/article/2705/
- UNFPA. (2015, October). Teenage pregnancy in Cambodia. Retrieved 25 October 2019, from: https://cambodia.unfpa.org/sites/default/files/pub-pdf/TeenagePregnancyCasesCompiled%28approved4Nov2015%29.pdf
- UN Womenwatch Organization. (2019, March 8). The global role of women – caretakers, conscience, farmers, educators and entrepreneurs. Retrieved 24 October 2019 from:

https://globalvolunteers.org/global-role-of-women/

- Weichselbaumer, D., & Winter-Ebmer, R. (2005). A meta-analysis of the international gender wage gap. Journal of Economic Surveys, 19(3), 479-511.
- World Bank. (2009). Gender in Agriculture Sourcebook. Washington-DC, United States: World Bank.
- World Bank (2019). Cambodia Economic Update.