

INTERNATIONAL TRADE AND UNEXPLAINED GENDER WAGE GAPS: EVIDENCE FOR AGRICULTURAL SECTOR IN BOLIVIA

COMERCIO INTERNACIONAL Y BRECHAS SALARIALES NO EXPLICADAS POR GÉNERO: EVIDENCIA PARA EL SECTOR AGRÍCOLA EN BOLIVIA

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ABSTRACT

The present investigation has the objective of showing evidence that there would be a reduction on wage differences between men and women in agriculture if they participate in international trade. The methodology that will be used is based on Molina [1], who used Becker [2] as a knowledge base for his study. This methodology consists on showing that wage difference occurs because of a taste for discrimination. This means that companies are willing to pay a higher salary to men just because they want to. But because international trade brings new competence to the markets, local companies need to be more competitive to survive. Therefore they wouldn't be able to pay higher wages to men; this would reduce the wage difference by gender. Agriculture shows a different behavior from other sectors due to the strong agricultural subsidies governments give, De la Dehesa [3]. Using the Oaxaca-Blinder decomposition an estimate wage can be found for both men and women in tradable and non-tradable sectors of agriculture. At the same time two components will be found, one of them shows the difference produced by factors that affect the productivity of an individual. The second component shows the difference that cannot be explained, this is where discrimination is shown. Once these results are found they will be compared to find out if they are different in tradable and non-tradable sectors. The results that have been found show consistency with Molina's study for the year 2002. Agriculture shows a behavioral difference from other economic sectors and different from Becker's idea. As there is no unexplained wage difference by gender between tradable and non-tradable sectors. The results show that the difference is that these two sectors are the same. Thus international trade doesn't result in a reduction of inequality in agriculture.

Keywords: Wage Gap, Agriculture, International Trade.

RESUMEN

El presente trabajo tiene como objetivo evidenciar que en el sector agrícola la apertura comercial significaría una reducción de las diferencias salariales entre hombres y mujeres. La metodología a utilizarse está basada en la propuesta metodológica por Molina [1], quien uso los lineamientos teóricos de Becker [2] como criterio base. Dicho procedimiento consiste en demostrar que la discriminación salarial se debe a la existencia de un gusto por discriminar a las mujeres. Esto significaría que las empresas pagarían un salario mayor a los hombres por simple "gusto". Pero ante la apertura comercial y la entrada de nuevas empresas al mercado, las empresas antiguas se ven obligadas a volverse más competitivas para seguir funcionando. Por lo tanto ya no estarían en condiciones de darse el "gusto" de pagar un salario más alto a los hombres, lo cual terminaría reduciendo la brecha salarial no explicada entre hombres y mujeres. Pero el mercado agrícola normalmente presenta comportamientos distintos a aquellos de otros sectores ya que existen fuertes subsidios agrícolas en países con mayores ingresos, De la Dehesa [3]. Usando la descomposición de Oaxaca-Blinder se propone encontrar un salario esperado para hombres y mujeres en los sectores transables y no transables del sector agrícola. Al mismo tiempo se obtendrían dos componentes, uno que mide la diferencia explicada por variables que afectan a la productividad y otro componente sin explicación, donde se encontraría la discriminación. Una vez se encuentren estos datos se los comparará y se verá si son distintos entre el sector transable y no transable. Los resultados son los mismos que encontró Molina para el año 2002, el mercado agrario todavía muestra un comportamiento distinto al de los demás sectores y contrario a lo planteado por Becker; ya que el mercado agrícola presenta características de un mercado imperfecto. No existe diferencia salarial no explicada por género entre el sector transable y no transable. Por lo tanto la apertura comercial no implicaría una reducción en la desigualdad del sector agrícola.

Palabras clave: Desigualdad Salarial, Agricultura, Comercio Internacional.

1. INTRODUCTION

1.1 Problem presentation

Trade openness has been a highly analyzed topic through the course of economic history. Due to the fact that trade openness may be crucial for developing countries as shown by Spence *et al.* [4]. Many papers and journals conclude that trade openness may generate a reduction in inequities thanks to various motives and factors, such as an increase in

production through an increase in exportation, which generates an expansion in these sectors and a higher growth in the country. But at the same time there is evidence that proves the exact opposite. Thus the relation between trade openness and inequity must be studied.

First it is necessary to understand that there is a difference between inequities inside a country and among countries. For instance an inequity reduction among countries does not translate to an inequity reduction inside a country. The investigation in this area is vast, for example Adam Smith himself already studied this subject and wondered what the causes of such differences in wage gap are. Recent studies made by Becker [2] give an economic approach to such matter and also highlight the importance of studying inequities.

For Becker trade openness generates higher rivalry for the local companies, because now they will not only have to compete with the locals but also with foreign companies. Assuming that discrimination is used for some kind of taste to discriminate or nepotism, this would mean that the company owner can give himself the pleasure of discriminating by paying a higher wage to a specific target group simply for this satisfaction. But the apparition of international companies causes an inability for the company owner to discriminate because the new goal is to maximize the company revenue decreasing the costs and thus reducing the extraordinary wage that the target group had in comparison to the rest.

Using this idea as the base it is expected that trade openness will cause a reduction in the wage gap between women and men. Such wage gap is one of the most studied subjects as shown in different papers and journals like Ransom *et al.* [5], Molina [1], Black *et al.* [6] or Ransom *et al.* [7] among many others. Such studies prove the existence of a wage gap between women and men in imperfect markets, for example a monopsony. But according to Becker's theory a higher number of companies reduces the market power for the companies, thus all the companies get closer to perfect competition and as a result also reduce the gender wage gap.

This paper is based on Becker's theory; to demonstrate that trade openness effectively translates to higher rivalry and consequently lower inequity. As already mentioned this would mean that people that work on tradable sectors in the economy should have a similar wage between women and men. In comparison non tradable sectors should have an opposite effect.

The present study focuses on a specific economic sector: agriculture. This sector is treated by a lot of people as an imperfect market, as mentioned by De la Dehesa [3] the strong subsidies made by developed countries generate market distortions in such a market. As shown by Molina [1] Becker's proposal works for all different sectors in Bolivia except for one, the agricultural sector. This sector presents a strange behavior that matches the behavior of an imperfect market. Because the study Molina did used data from 2002 it is necessary to actualize the data to 2013. This way the results from these two years can be compared to see if there has been a change from 2002 throughout 2013. The other sectors have already been studied again by Molina [8] and there is evidence that these sectors show a behavior that follows the theory proposed by Becker.

Bolivia experienced a strong reduction in its poverty since 2000 to 2013, for 2000 66.38% of the population was below the poverty line but in 2013 that percentage this number reduced to 39.06%. At the same time there has been a reduction in inequities, for instance the Gini index in 2000 was 0.63 and in 2013 it reduced to 0.45, meaning there has been a reduction in wage inequities since the beginning of this century.

There have also been several changes in Bolivian politics, in the economy and the social environment during the last century. This was caused mainly by different political and social problems that existed in Bolivia during 2003 to 2005. This last year (2005) a new kind of government is elected and it started a new economic process in the country. But this political change also comes with an economic boom thanks to the high prices in minerals and fossil fuels.

Analyzing the producers and their impact on the GDP (Gross Domestic Product) there is relevant data. Using information from the Bolivian National Statistics Institute (INE) it is known that:

- 29.78% of the population works in the agricultural sector.¹
- The agricultural sector contributes 13.6% to the country's GDP.

Observing this data a gap can be found. This gap shows that this sector is not only competitive at an international level as mentioned before, but also it is not competitive at a local level because the proportion of the population that works in this sector is considerably lower than what it contributes to the GDP. Based on an investigation made by Molina, the existence of this gap may translate to inequity because to counteract for the gap other sectors in the economy must have a higher contribution to GDP and a lower work force, meaning a difference in productivity and thus wage.

¹ It is worth mentioning that for the INE the agricultural sector also includes livestock, forestry, hunting and fishing.

Hence the hypotheses for this paper raises. Globalization, measured by the differentiation of tradability in the agricultural sector does not reduce the unexplained gender wage gap in Bolivia for 2013.

2. THEORETICAL FRAMEWORK

2.1 Globalization and its effects

2.1.1 Wage gap

First it is necessary to understand the decision an individual has to make involving whether to accept a job or not and the decision a company has to make whether to hire a person or not. According to Becker [9] this decision depends on how the agent wants to spend its time, which is a limited resource. The agent is a producer and a consumer at the same time and thus must reach equilibrium in the usage of its time for working or leisure. If the person works then a reward is obtained which can be used to obtain different goods and services. But as mentioned by Pencavel [10] the decision is not as simple as maximizing the agent's utility function between consumption and leisure. It is something that goes beyond that. This decision is taken in the real world with a familiar and social context that has influence on a person's decision. And even if someone believes he or she has all the variables to predict the decision of a person whether to work or not there will always be more factors that influence these decisions, for example the way a person was raised.

At the same time an individual seeks a job, a company looks for workers. A company looks for workers because they represent an essential input for the production. Following Varian [11], in the classic theory a company has two production factors in its function, labor force and capital. Ergo a question is raised, which factors influence the company's decision on whether to hire a person or not? For Borjas [12] productivity is the factor that influences this decision, and also directly affects the decision of what salary a person must receive. The conclusion is that the salary is equal to marginal productivity; this means that a more productive person should receive a higher wage.

Productivity can be measured in many ways; this would allow companies to know how much a single person can produce. Mincer [13] concludes that companies normally use education and work experience as productivity proxies. In simple words a higher level of education would mean a higher salary and at the same time a higher number of experience years would mean the same effect. A more recent study in this area done by Carneiro *et al.* [14] shows that there is a problem in order to obtain a higher education level and thus a higher wage. This problem initiates in childhood as parents are the ones in charge of investing in education so a higher education is not a decision one makes for himself but rather a decision that is made by the parents and their socioeconomic reality.

But wage is not determined by the hiring company but it is determined in a negotiation process between the company and the agent looking for a job. As mentioned by Manzini *et al.* [15], this negotiation process can be done in different ways; the more accepted one is Nash's negotiation game between two agents. But then a question rises, what if one of the two agents has a higher negotiation power? This higher negotiation power gives signs that the market structure in this case may be imperfect.

Consequently this market power the company or the worker has translates to a higher or lower wage respectively. An example would be a company that wants to hire workers for a position that does not have a long list of requirements, thus the number of applications will be high. This generates a market distortion and in this particular case the company has the power, therefore having an advantage in the wage negotiation. In an opposite case there may be an individual that has a specific set of characteristics and a group of companies are interested in hiring this individual. Because she/he is the only one with this specific set of characteristics this individual may request a higher wage.

But this higher power market can be used in other ways. According to Becker [2], who did one of the first investigations that took wage discrimination in a more academic manner; there is a taste for discrimination. This taste for discrimination may cause someone to pay a higher wage to men than women; this among all the different types of discrimination may exist. Among these types of discrimination there may be race, nationality, gender and many other kinds of discrimination as mentioned and studied by Kofi *et al.* [16]. But the focus of the present paper is to study wage differences between women and men.

Some of the first investigations in the wage gap start with a past present inequities analysis. Such is the case of Newell *et al.* [17] where the men and women wage gap is studied in different countries of Eastern Europe and URSS before and after communism. And it is concluded that there is no substantial change between the communist period and the next one, but the main difference in the wage gap between women and men is composed of a "non-explained" component. Discrimination may be inside this non-explained component.

As mentioned before the wage gap may be generated because of an imperfect market. There is evidence about the relation between imperfect markets and inequities for example Ransom *et al.* [7] or Ransom *et al.* [5]; some sectors that presented monopsonic structures where studied and analyzed to prove if higher company power translates to a higher

wage gap between women and men. And the results are exactly as mentioned, but Ransom doesn't attribute this gap directly to discrimination but to unexplained factors and discrimination may be a component of these factors. Another paper, Hellerstein *et al.* [18], shows that markets where there is high company power may present characteristics of wage discrimination. An interesting fact is that more profitable companies normally hire more women.

2.1.2 Globalization

First it is necessary to understand what globalization is. There are many definitions or texts about globalization, but the one that fits the most this paper is taken from Al-Rhodan *et al.* [19, pp. 5]:

“Globalization is a process that encompasses the causes, course, and consequences of transnational and transcultural integration of human and non-human activities”

With this small definition it is understood that globalization is a process in which humanity stops being a group of almost “autarchic” states where there is no trade between countries. Because of high transportation costs and because communication in the past was different from what it is today countries that were separated by oceans would have serious problems communicating and transporting goods.

For Frankel [20] there are two reasons for the generation of the globalization process: i) A reduction in transportation and communication costs; ii) A reduction in tariff and inversion barriers. This process takes place at the start of the XX century, as a result of transportation technological enhancement and the creation of airplanes which reduces considerably the cost and duration of transportation. At the same time communication begins an extreme development since the 80s. These two events promote the globalization process.

Thus a question rises, is globalization good for a country's economy or is it bad and generates different problems? Stiglitz [21] shows that there is evidence that globalization brings negative effects; for example he compares globalization to a trap where underdeveloped countries fall in hope of escaping poverty. He considers it a trap because as soon as countries open up their frontiers they are bombarded with foreign products that completely destroy their local industry. Then why do underdeveloped countries do not benefit as much as developed countries from the effects of globalization? Aisbett [22] concludes that this happens because there is no reciprocity in the decision making process among countries. This happens because countries with a strong commercial sector are normally the countries that take decisions and terms of trading.

A clear example of market imperfections is the case of the USA and the European Union with their strong subsidies to agriculture. As mentioned by Molina [1] these countries do this because it helps their farmers maintain a certain level of competitiveness as agriculture is not as profitable as other sectors in the economy. This generates a distortion in the international market as the agricultural products that these countries export carry the subsidy to other countries. And not only the sell price of these products is distorted but also local products have to compete against foreign products that normally have a lower price than the local products.

A problem with most investigations that study the relationship between poverty and globalization is that they are static as mentioned by Bhagwati *et al.* [23]. By being static there is only one alternative to trade openness hereby a dynamic analysis looks to trade openness as an opportunity to grow, so in the future this opportunity may translate to poverty reduction in the country.

Even though there is evidence that proves that globalization has a negative effect on the economy there are studies that prove exactly the opposite. For example McMillan *et al.* [24] contrast what happened in Asia, Africa and Latin America. The conclusion, Asia's success is a process of transformation from low to high productivity. The cause of this transformation is the investment in sectors in which this country has an advantage and the enhancing of production methods. All this did not happen in Latin America, showing that in some ways countries that have an advantage with the commercial exploitation of natural resources do not usually follow this structural change to receive the benefits of globalization.

But not only can there be benefits such as a higher country growth as mentioned by Frankel [20] evidence about globalization effects may depend and vary from country to country and even regions inside a country thus there is never enough evidence to give a definitive conclusion. For example there are some changes caused by globalization in a country besides GDP. For instance sometimes as a result of the openness some countries tend to experience higher inequities and a higher level of contamination. But as time passes on these tend to lower to such a degree that it finally has a better impact on the life quality the people of this country. This may also apply to other aspects such as democracy, human rights, and security.

2.1.3 Globalization and inequities

As mentioned by Molina [1] there are two kinds of inequities: inequities inside a country and inequities among countries. The present paper studies the first kind, specifically inequities in salary between two groups of people, women and men.

De la Dehesa [3] mentions that one of the first models to measure the results of globalization was the Solow-Ramsey growth model. In this model they assume free access to technology and capital decreasing returns on scale. This generates a convergence point that all countries should reach eventually.

One of the most relevant aspects of globalization is mentioned by Barro *et al.* [25]; imitating is easier than innovating. Because innovating requires higher costs, better human capital quality and more time thus it is easier for underdeveloped countries to imitate and consequently have a technological leap obtaining technology that was invented in other countries. Romer [26] supports this idea as it is shown that some countries that normally copy to eventually begin producing knowledge and it also shows that knowledge has increasing returns ergo generating a higher accumulation of knowledge.

Even with all that has been already mentioned there is not enough evidence to conclude whether or not trade openness has positive effects on inequities. But economic growth may also translate to a reduction on inequities as shown by Kuznets [27]. At the beginning economic growth may cause an increase on inequities but eventually a point will be reached where economic growth begins to decrease inequities. This phenomenon is better known as Kuznets' curve; but even if Kuznets' curve is usually accepted this point is not always reached as it is never known at which points inequities stop increasing and start decreasing as a result of economic growth. Bonesmo [28] also proves the existence of this point where economic growth begins to reduce inequities but before that point the benefits of economic growth may be absorbed by the rich thus increasing inequities. Sweden is an example of this kind of growth that increases inequities but in other countries such as Hungary the poor absorb the benefits of decreasing inequities and showing an example of a country that reached the point of inequities reduction.

2.2 Agricultural market

The agriculture market presented characteristics that make it different from other sectors in the economy. Molina [1] shows that this market presents an opposite behavior in comparison to the other economic sectors in a trade openness analysis. De la Dehesa [3] explains one of the possible reasons for the imperfections of this market; he says that member countries of the Organization for Economic Co-Operation and Development (OECD) generate distortions caused by the subsidies they give to their agricultural sector.

Lloyd *et al.* [29] mention that this distortion may carry on from a post-World War Two period and at the start the effects of the distortion were underestimated. In the same investigation it is shown that the distortion effect during the 70s and 80s was bigger than most studies had shown but in the last decade the effect may have been smaller than most studies had shown.

McCorrison [30] mentions the significance of studying the characteristics of the agricultural market. Because this market may present characteristics of an oligopolistic market and therefore it is very important to study for different subjects, as food security. Saxowsky [31] mentions that imperfect competition may not only happen among countries but inside one; for example different regions of the same countries may cause inequities between these two regions.

There are also studies made in underdeveloped countries for example Verpoorten [32]; who studies Senegal. The conclusion is that there is enough evidence to show that the agricultural market may not be perfect. He found this as normally the size of the property and quantity of livestock are crucial to a farmer as they allow a higher production and normally only big farmers receive credit or loans to keep on growing. But small farmers don't have a lot of chances for growing as they have a lower probability to obtain a loan for their production.

In a closer study made by Anderson *et al.* [33], they found that since the 60s in Latin-America there has been a process of agricultural reforms. Those reforms may have certain consequences nowadays, for example a reduction of inequities among farmers and lately reducing inequities among farmers and the rest of the population. It is worth mentioning that there are still inequities but they are not as big as they were in the past. Another consequence not often mentioned is an increase in productivity.

2.3 Gender wage gap and trade openness

The present paper is based on the theory presented by Becker [2] and the methodology developed by Molina [1]. Becker shows that the rivalry created by foreign companies as a result of trade openness should reduce and eventually eliminate the extraordinary profit and thus the wage gap between women and men. But trade openness would increase the number

of companies therefore reducing the market power local companies have explaining the reduction of the extraordinary profit. And as the gap, if paid with extraordinary profits the reduction of those would mean no more money to give the company owner the pleasure to pay men a higher wage than women.

Black *et al.* [34] and Hellerstein *et al.* [18] show evidence that regulated markets have a wage gap between women and men. But as soon as the markets open to international trade this wage gap tends to get smaller. Then a questions rises, in which way do the reductions of inequities takes place? Normally it happens in two ways: the first one consists in women working in job positions that were normally dominated by men as observed in the study men by “United Nations Development Fund for Women” [35]. The second one is that women begin working in better job positions; positions that in the past were not accessible for women. An example is the study done by Black *et al.* [6], in the study it is shown that because of trade openness there is an increase of women working in the manufacturing industry with higher salaries.

One of the first studies made to analyze the relation between gender wage gap and trade openness is made by Joeke *et al.* [36]. Thus this topic begins to be more studied and many other papers and journals are being made studying this relationship but for the present paper the only sector of interest is agriculture. An example of investigations studying this area is made by Mehra *et al.* [37]. There it is found that even though there is a reduction in the wage gap between women and men the conditions do not always get better for women. For example many times women are sub employed or work in agricultural sector that require a lower level of productivity hence receiving a lower wage.

In the area of underdeveloped countries there many papers as is the case of Fontana [38]. He concludes that even among under developed countries the results of the relationship between gender wage and trade openness differ from country to country. A factor that influenced this relationship is the laws of land property and how well established they are. Studying different cases in Africa it is observed that if land property rights are well established trade openness normally reduces inequities but if they are not well established the reduction is limited. Another study is made by Von Braun *et al.* (1994) [39] who finds evidence for Kenya and has similar results to Fontana [38]; he found that more women work but they work in less tradable sectors and the same they are less inclined to work under a contract.

Finally there are also studies made in different countries in Latin America. For example Newman [40] studies the wage gap for the agricultural sector in Ecuador, the study shows that trade openness has an effect in the number of hours a woman works but leisure hours reduce as they are replaced by working hours in the home. But the conclusion is that the effect of a reduction in leisure hours may correspond to cultural factors that influence the number of working hours in home chores.

2.5 Evidence in Bolivia

There are some investigations that study inequities in Bolivia. Yañez [41] made an analysis based on labor economics and includes certain variables to this analysis as Bolivia presents some unique characteristics such as a very strong informal market. This affects the obtained results for example is it more likely for a woman to participate in the labor market than a man. This was made in a logit model which studied the probability of getting a job based on different characteristics that may have influence. Something worth mentioning is the fact that even if a woman is more likely to get a job the expected wage she would receive for job would lower than a man’s wage.

Contreras *et al.* [42] studied the relationship between the accessibility to social webs and women income generation. This new variable is studied along other classic variables such as education and experience. And effectively the access to social webs has an effect as it increases the access to jobs for women, but in the case of men it doesn’t have the same effect.

Finally the most important investigation for the present paper is made by Molina [1]. In this investigation he studied exactly the effect of globalization on the wage gap between women and men. Molina develops an economic model to prove this and this will be studied in the methodology of the present paper. Molina concludes that there is not enough evidence to prove the existence of a wage gap between women and men in sectors with international trade, but in the case of non-tradable sectors there is an unexplained wage gap between women and men. These results were similar for all the sectors in the economy except one: agriculture. In this sector the results were the exact opposite proving that agriculture may prove to be a market with imperfections.

2.6 Bolivian characteristics

The topic of this investigation can be better explained with some statistical information from Bolivia and from the survey. First some characteristic of the survey are presented:

TABLE 1 - BOLIVIA: PEOPLE THAT WORK ON THE AGRICULTURAL SECTOR ON TRADABLE AND NON-TRADABLE AREAS ON 2013

Variables	Tradable	Non-Tradable	Total
Men	484	1,787	2,271
Women	348	1,315	1,663
Total	832	3,102	3,934

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

TABLE 2 - BOLIVIA: PERCENTAGE OF PEOPLE THAT WORK ON THE AGRICULTURAL SECTOR ON 2013

Variables	Tradable	Non Tradable	Total
Men	12.30%	45.42%	57.73%
Women	8.85%	33.43%	42.27%
Total	21.15%	78.85%	100.00%

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

TABLE 3 - BOLIVIA: PERCENTAGE OF PEOPLE THAT WORK ON THE AGRICULTURAL SECTOR ON 2002

Variable	Tradable	Non Tradable	Total
Men	28,54%	31,43%	59,97%
Women	15,50%	24,53%	40,03%
Total	44,04%	55,96%	100,00%

Source: Molina [1].

As we can observe in Table 1, 2 and 3, using the study made by Molina [1] as a comparison point it can be observed that there has been a reduction on the amount of people that work on this sector. On 2002 there were 4,884 people that worked on this sector but on 2013 there are only 3.934. This is corroborated by the information the Bolivian National Institute of Statistics released as on 2002 a 42.26% of the population worked on agriculture but this number reduced as on 2009 only a 31.77% of populations worked on this sector.

It can also be observed at on 21.15% of the population export or import their products and thus are part of the tradable list which means that 78.85% of the population is not part of international trade. At the same time it can be observed that there is no major difference in the percentage of farmers that are women or men as 57.73% of the total farmers are men and 42.27% are women. Hence it can be observed that there is no big difference between the number of women and men that work on tradable and non-tradable sectors.

Finally, it can be observed that there is a reduction on the population that works on tradable agricultural sectors. On 2002 a 44.04% percent of the farmers worked on tradable sectors but on 2013 this reduced to 21.15%.

TABLE 4 - BOLIVIA: MONTHLY INCOME OF THE POPULATION THAT WORKS ON THE AGRICULTURAL SECTOR

Variable	Monthly Income for Farmers	
	Mean	Standard deviation
Men	2250.84	5068.21
Women	1034.18	1700.78
Total	1967.12	4542.22

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

Analyzing Table 4 it can be observed that the wage of a man is considerably higher than that of a woman. An average man receives a monthly income of 2250.84 Bs but a woman only receives a monthly income of 1034 Bs. At the same time it can be observed that the standard deviation of men's income is much higher than that of women. Thus, meaning that men have a higher volatility in their wages than women. It is also important to study the different variables proposed by Mincer (1974) that will be part of the model.

TABLE 5 - BOLIVIA: YEARS OF EDUCATION AND EXPERIENCE OF PEOPLE THAT WORK THE AGRICULTURAL SECTORS BY GENDER ON 2013

Variable	Years of Education		Experience	
	Mean	Standard Deviation	Mean	Standard Deviation
Men	6.31	4.45	28.04	22.13
Women	4.60	4.34	29.08	23.28
Total	5.59	4.49	28.48	22.63

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

In Table 5 it can be observed that men study an average of 6 years, translating to enough years to finish the basic education. But women only study an average of 4 years. But viewing the information on experience it can be observed that men have a smaller quantity of years than women, which could be explained by the lower years of education women observe.

TABLE 6 - BOLIVIA: PEOPLE THAT ARE INDIGENOUS AND WORK THE AGRICULTURAL SECTOR BY GENDER

Variable	Indigenous	Non Indigenous	Total
Men	1,244	1,019	2,263
Women	689	970	1,659
Total	1,933	1,989	3,922

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

TABLE 7 - BOLIVIA: PERCENTAGE OF PEOPLE THAT ARE INDIGENOUS AND WORK THE AGRICULTURAL SECTOR BY GENDER

Variable	Indigenous	Non Indigenous	Total
Men	31.72%	25.98%	57.70%
Women	17.57%	24.73%	42.30%
Total	49.29%	50.71%	100.00%

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

Viewing Tables 6 and 7 it can be observed that are slightly more men working on the agricultural sector than women, as there are 57.70% men working on this area and only 42.30% women. The division of indigenous and non-indigenous shows that there almost the same number of people belonging to these groups.

Analyzing Tables 8 and 9 it can be observed that agriculture is practiced more on rural areas than in urban areas. As 89.58% of agriculture workers live in rural areas and only 10.24% live in urban areas. But since the area is agriculture it makes a lot of sense.

In Tables 10 and 11 it can be observed the fact that a men or women receive a wage is important as a wage means that the studied person works for a company and is part of a formal agricultural production. No wage would translate to people only selling their products and not receiving a wage per se; people that only dedicate themselves to agriculture for auto consumption and people that are part of an informal agricultural production. The data shows that most farmers do not receive a wage, 92.63% and only a smaller part receive a wage, 7.37%.

TABLE 8 – BOLIVIA: PEOPLE THAT LIVE IN URBAN AND RURAL AREAS THAT WORK ON AGRICULTURAL SECTORS BY GENDER

Variable	Urban	Rural	Total
Men	291	1,980	2,271
Women	119	1,544	1,663
Total	410	3,524	3,934

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

TABLE 9 - BOLIVIA: PERCENTAGE OF PEOPLE THAT LIVE IN URBAN AND RURAL AREAS WORKING ON AGRICULTURAL SECTORS BY GENDER

Variable	Urban	Rural	Total
Men	7.40%	50.33%	57.73%
Women	3.02%	39.25%	42.27%
Total	10.42%	89.58%	100.00%

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

TABLE 10 - BOLIVIA: PEOPLE THAT RECEIVE A WAGE AND WORK ON THE AGRICULTURAL SECTOR BY GENDER

Variable	Receives a wage	Does not receive a wage	Total
Men	238	2,033	2,271
Women	52	1,611	1,663
Total	290	3,644	3,934

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

TABLE 11 - BOLIVIA: PERCENTAGE OF PEOPLE THAT RECEIVE A WAGE AND WORK ON THE AGRICULTURAL SECTOR BY GENDER

Variable	Receives a wage	Does not receive a wage	Total
Men	6.05%	51.68%	57.73%
Women	1.32%	40.95%	42.27%
Total	7.37%	92.63%	100.00%

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

3. METHODOLOGY

The methodology used for the present paper was developed by Molina in different investigations and it was based on the theory proposed by Becker [2]. This methodology was used in Molina [1] and further updates for the same paper for example Molina [43]. The idea has been already mentioned in this paper, trade openness brings more companies to the local market thus reducing the market power local companies had before. The extraordinary wage paid to men was possible thanks to extraordinary profits that local companies received but as their profits are normalized the company owners cannot pay this extraordinary wage therefore reducing the wage gap between women and men. Under the assumption that women and men have the same productivity level:

$$w_m = w^* + d \quad (1)$$

where w_m = Men's wage, w^* = Equilibrium wage, d = Discrimination coefficient.

If it assumed that there is wage discrimination towards women (women earn a lower wage than men):

$$w_w < w^* + d \quad (2)$$

where w_w : Women's wage.

As observed on equations (1) and (2) there is a wage gap between women and men. Women earning a lower wage than men because of the existence of a discrimination coefficient and the higher this coefficient the higher gap there is. And at the same time having this coefficient translates to a higher cost for the company.

Then if a company discriminates and incurs in a higher cost it will be losing competitiveness. In perfect competition this will be translated to the closure of the company as now it not only competes with local companies but foreign companies. But if this kind of company behavior is observed then it would be possible for the market to present imperfections that allow this kind of behavior. Now connecting the idea that a higher number of companies reduces market power and helps the market reach perfect competition and the idea that trade openness allows the arrival of international companies to the country then it would be expected to have a reduction of the wage gap as a result of trade openness. Therefore:

$$d = f(g, a) \quad (3)$$

where g = Tastes for discrimination, a = Other variables that affect discrimination.

And at the same time:

$$g = h(p) \quad (4)$$

where p = Market power .

Equation (4) shows that there is a positive relation between p and g . Because it is known that if market power increases then there is space for a greater taste for discrimination but if a company's market power reduces then to stay in business its discrimination coefficient will not be high.

At the same time it is known that market power depends on the number of companies there are. The higher the number of companies lesser market power each of them will have. Thus:

$$p = n(e_n, e_f) \quad (5)$$

where e_n = Number of local companies , e_f = Number of foreign companies.

And number of foreign companies depends on the trade openness degree. The higher this is the more foreign companies there will be. Therefore:

$$e_f = q(ci) \quad (6)$$

where ci = Trade openness degree.

Thus replacing the equations it can be found that:

$$d = t(ci) \quad (7)$$

Equation (7) explains the negative relationship there is between the "taste for discrimination" and the trade openness degree. In other words if a country has opened its frontiers to international trade there should be a reduction of the wage gap between women and men.

Thus it can be expected that the wage gap between women and men that work on tradable sectors is smaller than the same gap in non-tradable sectors. It is important to know that it is assumed that men earn a higher wage than women ergo the difference in the men wage and women wage will be positive. And finally it is important to understand that part of the wage gap may be explained by factors that influence productivity; for example an average man may have a higher level of education that an average woman therefore explaining the gap. And at the same time there is a component that includes all factors that may affect productivity but there is also a component that measures a part of the gap that cannot be explained. Discrimination may be a part of this unexplained component. So:

$$w_m^t - w_w^t \geq a \quad (8)$$

$$w_m^{nt} - w_w^{nt} \geq b \quad (9)$$

where:

- w_m^t = The wage of a man that works on tradable sectors
- w_w^t = The wage of a woman that works on tradable sectors
- w_m^{nt} = The wage of a man that works on non – tradable sectors
- w_w^{nt} = The wage of a woman that works on non – tradable sectors

It would be expected that:

$$b \gg a \quad (10)$$

replacing:

$$w_m^{nt} - w_w^{nt} \gg w_m^t - w_w^t \quad (11)$$

This way the equation may be formulated as a hypothesis equation following the methodology proposed by Lind et al (2004) [44] thus:

- Null hypothesis 1: The unexplained wage gap between women and men is equal to 0. This would mean there is no sign of wage discrimination with trade openness.

$$w_m^t - w_w^t = 0 \quad (12)$$

- Alternative hypothesis 1: The unexplained gender wage gap is different from 0. This would mean that there may wage discrimination with trade openness.

$$w_m^t - w_w^t \neq 0 \quad (13)$$

- Null hypothesis 2: The unexplained wage gap between women and men in the non-tradable agricultural sectors is equal to 0. This would mean there is no sign of gender wage discrimination without trade openness.

$$w_m^{nt} - w_w^{nt} = 0 \quad (14)$$

- Alternative hypothesis 2: The unexplained gender wage gap is different from 0 in non-tradable agricultural sectors. This would mean there may be wage discrimination without trade openness.

$$w_m^{nt} - w_w^{nt} \neq 0 \quad (15)$$

To prove what the model proposes null hypothesis 1 should be accepted and null hypothesis 2 should be denied. This would mean that trade openness in the agricultural sector reduces the wage gap between women and men. And those non-tradable sectors do actually have a gender wage gap. Combining both hypotheses it would be understood that trade openness reduces the gender wage gap in comparison to agricultural sectors that do not have international trade.

But there is a problem with hypothesis 1 as the real purpose of the model is to show that trade openness reduces the wage gap but not that it completely eliminates it as shown by equation (12). Therefore another hypothesis is proposed:

- Null hypothesis 3: There are no significant differences in the unexplained gender wage gap between tradable and non-tradable sectors.

$$w_m^{nt} - w_w^{nt} = w_m^t - w_w^t \quad (16)$$

- Alternative hypothesis 3: There may be significant differences in the unexplained gender wage gap between tradable and non-tradable sectors. And the gap in non-tradable sectors being higher than the same gap in tradable sectors.

$$w_m^{nt} - w_w^{nt} > w_m^t - w_w^t \quad (17)$$

To prove Becker's proposal null hypothesis 3 should be rejected and alternative hypothesis 3 should be accepted. This way it would be proven that trade openness effectively reduces the wage gap between women and men.

Additionally a fourth hypothesis will be made, one that evaluates the wage gap between tradable sectors based on their tradability degree. There will be three tradability degrees and the both highest and lowest degrees will be compared for the study.

- Null hypothesis 4: There are no significant differences in the unexplained wage gap in agricultural sectors with a high level of tradability and those with a low level of tradability.

$$w_m^{ltd} - w_w^{ltd} = w_m^{htd} - w_w^{htd} \quad (18)$$

- Alternative hypothesis 4: The unexplained gender wage gap in sectors with a low tradability degree is higher than the same gap in sectors with a high tradability degree.

$$w_m^{ltd} - w_w^{ltd} > w_m^{htd} - w_w^{htd} \quad (19)$$

where:

- w_m^{ltd} = The wage of a man that works in a sector with a low tradability degree
- w_w^{ltd} = The wage of a woman that works in a sector with a low tradability degree
- w_m^{htd} = The wage of a man that works in a sector with a high tradability degree
- w_w^{htd} = The wage of a woman that work in a sector with a high tradability degree

By refusing null hypotheses 4 it would mean that a higher degree of tradability represents a reduction in the unexplained gender wage gap. It would be very interesting if null hypothesis 3 is not rejected but null hypotheses 4 is rejected. As it would mean that there is no significant difference in the gap between tradable and non-tradable sectors but there is a significant difference inside tradable sectors as sectors with a high tradability degree have a smaller gap than sectors with a low tradability degree.

The methodology to find the unexplained wage gaps will be based on the Oaxaca Blinder decomposition. Such methodology is found in different works such as Oaxaca *et al.* [45], Oaxaca [46], Oaxaca *et al.* [47], Blinder [48]. Such methodology is vastly used in this study area and at the same time the same methodology was used for the Bolivian case by Molina [1]. The reason for the vast usage of this decomposition is because it divides the differences in wage between groups in three parts. The first part in a explained differences, as it can be explained by different factors that influence productivity such as education, experience, etc. The second difference is an unexplained difference as it cannot be explained by factors that influence productivity. Finally the third difference is a combination of the two previous.

As explained by Molina [1] and Vincéns [49] there are two components in the analysis. The first component is one that can be observed of explained, inside this components there are variables such as education, experience and other variables that may explain the wage gap between women and men. And the second component is one that cannot be explained and so it includes variables that cannot be observed, discrimination may be part of this component.

Adapting the methodology:

$$R = E(\ln w_m) - E(\ln w_w) \quad (20)$$

where:

- R = Difference of the logarithm of the expected wages
- $E(\ln w_m)$ = Expected logarithm of a man's wage
- $E(\ln w_w)$ = Expected logarithm of a woman's wage

And a proposed linear regression model:

$$\ln w_i = X_i' \beta_i + \varepsilon_i \quad , \quad i = m, w \quad (21)$$

and:

$$E(\varepsilon_i) = 0 \quad (22)$$

where:

- X_i' = A matrix with control variables
- β_i = A vector of the regression parameters
- ε_i = The regression error
- $E(\varepsilon_i)$ = Expected error

Replacing equations (22), (21) and (20):

$$R = E(\ln w_m) - E(\ln w_w) \quad (23)$$

$$R = E(X_m')\beta_m - E(X_w')\beta_w \quad (24)$$

Following the methodology proposed by Winsborough *et al.* [60] the procedure for the expansion and obtaining the Oaxaca-Blinder decomposition.

Suppose we have two functions on the real plane:

$$Y = f_1(x_1) \quad (25)$$

$$Y = f_2(x_2) \quad (26)$$

Let D_1 and D_2 denote the domains of f_1 and f_2 respectively, and R_1 and R_2 the codomains. For any Y_1 , an element of R_1 , and Y_2 an element of R_2 there exists an \mathbf{a} which is an element of D_1 and a \mathbf{b} , an element of D_2 , such that $Y_1 = f_1(\mathbf{a})$ and $Y_2 = f_2(\mathbf{b})$. The difference $Y_1 - Y_2$ can be written as $f_1(\mathbf{a}) - f_2(\mathbf{b})$.

Let:

$$\delta_1 = f_1(\mathbf{a}) - f_2(\mathbf{b}) \quad (27)$$

$$\delta_2 = f_1(\mathbf{b}) - f_2(\mathbf{b}) = \Delta f(\mathbf{b}) \quad (28)$$

$$\delta_3 = \Delta f(\mathbf{a}) - \Delta f(\mathbf{b}) \quad (29)$$

Clearly,

$$\sum_{i=1}^3 \delta_i = [f_1(\mathbf{a}) - f_2(\mathbf{b})] + [f_1(\mathbf{b}) - f_2(\mathbf{b})] + [f_1(\mathbf{a}) - f_2(\mathbf{a}) - f_1(\mathbf{b}) + f_2(\mathbf{b})] = f_1(\mathbf{a}) - f_2(\mathbf{b}) = Y_1 - Y_2 \quad (30)$$

We see then that the difference between two values, Y_1 and Y_2 , can be expressed in terms of three additive components: a change in the argument of the function, a change in the function, and an interaction term, the result of a simultaneous change in both argument and function.

As proposed by Jann [50], who uses other studies such as Jones et al (1984) [51] and Daymont *et al.* [52].

It is observed that equation (23) can be expanded becoming:

$$R = [E(X_m) - E(X_w)]' \beta_w + E(X_w)' (\beta_m - \beta_w) - [E(X_m) - E(X_w)]' (\beta_m - \beta_w) \quad (31)$$

As observed in equation (31) there are three main elements in the equation, three components thus it can be rewritten like this:

$$R = D + C + I \quad (32)$$

where:

$$D = [E(X_m) - E(X_w)]' \beta_w \quad (33)$$

Equation (32) shows 3 elements, D shows the existing difference between the two control variables (dotation effect). Let it be known that dotation means different characteristics that influence productivity therefore having an impact on wage, for example age, education, experience are part of the dotation of an individual.

$$C = E(X_w)' (\beta_m - \beta_w) \quad (34)$$

In equation (34), C shows the existing difference between the two coefficients (coefficient effect).

$$I = [E(X_m) - E(X_w)]' (\beta_m - \beta_w) \quad (35)$$

Equation (35) shows a combined effect of both the difference between the two control variables and the difference between the two coefficients (interaction effect).

As observed in equation (30) it is divided in such way that it shows the different coefficients that explain the wage gap between women and men. This can be observed in equation (31) that uses the coefficient for women. And equation (33) uses women's dotation. Equation (31) may be reformulated to be made from the perspective of men and in that case it would be like this:

$$R = [E(X_m) - E(X_w)]' \beta_m + E(X_m)' (\beta_m - \beta_w) - [E(X_m) - E(X_w)]' (\beta_m - \beta_w) \quad (36)$$

As observed in equation (31) and equation (36) they are basically the same equation but the only change is the perspective it is made from. In the first case, equation (31), it is analyzed from the perspective of and with the coefficients of men and in the second case, equation (31), from the perspective of women.

To perform the Oaxaca – Blinder decomposition first it is necessary to estimate an income model. But most income models suffer from a selection bias and this is caused because the model only studies observations that receive an

income but there are people that would potentially receive an income that are not part of the model. Ergo the Heckman in two steps method will be used to solve this bias; it was developed by Heckman [53].

Because of this another model must be estimated, one that estimates participation in the labor market:

$$y_w^* = X_w' \beta_w + \varepsilon_w \quad (37)$$

where y_w^* = Dicotomic variable of a woman's labor market participation .

And if this means that it could take two possible values:

$$y_w^* = \begin{cases} 1 & \text{If the woman participates in the labor market} \\ 0 & \text{If the woman does not participate in the labor market} \end{cases}$$

This means that the value lies between 0 and 1, where a value closer to 1 means that that woman has a higher probability of having a job.

In chapter 2 it was mentioned that there were different factors that influence the amount of salary a persona receives. Because there are many aspects and factors that may influence the estimated income equation will be based on investigations made by Molina [1], Mincer [13], Blinder [54], Oaxaca [46], Borjas [12] and Yañez [41] among others. These are the variables:

- Years of education
- Experience
- Squared experience

These are the most important variables in equation and as an addition there some other control variables that are unique to Bolivia. These variables are based on other studies made by Molina [1], Andersen *et al.* [55], Andersen *et al.* [56], Yañez [41] and Psacharopoulos [57].

- Indigenous
- Rural

As part of the Heckman in two steps model there are other control variables that will be used based on studies made by Molina [1], Molina *et al.* [58], Mroz [59] and Yañez [41].

- Age
- Squared age
- Experience
- Number of children under 6 years old
- Single
- Interaction between number of children under 6 years old and single

Additionally to make the tradability degree analysis an additional variable was created. This variable was created using the amount of the addition of exportations and importations thus a sector has a higher result in this relationship will be part of the sectors with a high degree of tradability. The three degree groups were created as three groups with a similar variance.

4. RESULTS

As mentioned previously the first step is to create an income model, this regression should include different variables that have an effect on the income level of an individual. Therefore the first result is the regression of the logarithm of salary, Table 12.

Analyzing the different variables and their coefficients it is observed that number of education years has a positive sign and an extra year of education would mean an increase in the income of 4.5%. Experience also has a positive coefficient and an extra year of working experience would mean an increase of 1.08% on the income. Squared Experience has a negative coefficient that goes according to theory cause of diminishing returns. The additional variables such as indigenous, women or rural have a negative coefficient that also goes accordingly to other studies such as Yañez [41]. This would mean that women, indigenous people or people that live in rural areas would receive a lower salary.

TABLE 12 - BOLIVIA: REGRESSION OF THE INCOME LOGARITHM FOR PEOPLE THAT WORK ON THE AGRICULTURAL SECTOR

Explanatory Variable	Coefficient
Education Years	0.0450 ***
	0.0073
Experience	0.0108 ***
	0.0044
Squared Experience	-0.0003 ***
	0.0044
Indigenous	-0.8148 ***
	0.0540
Woman	-0.4136 ***
	0.0651
Rural	-0.4804 ***
	0.0677
Constant	2.1149 ***
	0.1336
Sample size	2,207
Squared R	0.2807
F Test	163.3
P value of the F Test	0.0000
Variables with *** are significant at a 1%. The ones with ** are significant at a 5%. The ones with * are significant at a 10% and finally the one without a symbol are not significant.	

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

After finding the equations that explains people's salary it is necessary to solve the selection bias for women in the labor market, Table 13.

TABLE 13 - BOLIVIA: PARTICIPATION MODEL OF WOMEN THAT WORK ON THE AGRICULTURAL SECTOR

Explanatory Variable	Coefficient	Marginal Effect
Education	0.0263 ***	0.0082
	0.0111	
Age	0.1279 ***	0.0398
	0.0112	
Squared Age	-0.0010 ***	-0.0003
	0.0001	
Single	0.1055 ***	0.3533
	0.0979	

Explanatory Variable	Coefficient	Marginal Effect
Children under 6 years old	0.1845 ***	0.0574
	0.0657	
Single and children under 6 years old	-0.4412 ***	-0.1374
	0.1279	
Constant	-4.5244 ***	
	0.3046	
Sample size	1,527	
Squared Wald Chi	291.41	
P Value of the Squared Wald Chi Test	0.0000	
Squared R	0.2066	
Expected Probability	0.2406	

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

Analyzing the results it can be observed that education has a positive sign meaning that if a woman has a higher education it is more likely that she will get a job. Age also has a positive sign, age if related to experience as it is assumed that years not spent in early childhood nor education were years spent in experience. Squared age has a negative sign representing the diminishing returns of this variable. If the woman is single she is more likely to be working and the more children under 6 years old she has the more likely that she is working. But the interaction variable between the two previous variables has a negative sign; meaning that if a woman is single the more children she has the less likely that she is going to be working.

Then it is necessary to observe the Mincer equations for both women and men separated from each other to see if the variables have a different kind of behavior between women and men, Table 14.

TABLE 14 - BOLIVIA: REGRESSION OF THE INCOME LOGARITHM FOR PEOPLE THAT WORK ON AGRICULTURAL SECTORS BY GENDER

Explanatory Variable	Coefficient Women	Coefficient Men
Education Years	0.0188***	0.0365***
	0.0179	0.0080
Experience	0.0248***	0.0113***
	0.0106	0.0048
Squared Experience	-0.0003***	-0.0004***
	0.0001	0.0001
Indigenous	-0.9428***	-0.7640***
	0.1191	0.0597
Rural	-0.4676***	-0.4707***
	0.1903	0.0696
Constant	0.9493***	2.2283***
	0.3648	0.1391
Sample size	518	1,689

Squared R	0.2249	0.269
F Test	39.8	135.68
P value of the F Test	0.0000	0.0000

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

Following the methodology proposed by Molina [1] null hypothesis one will be estimated. As observed in equations (12) and (13):

The results of these two regressions are very similar between each other and also similar to the original regression. The first variable is education years and it is shown in both cases that more education years mean a higher salary but a man receives an extra 3.65% increase for an extra year and a woman only receives an extra 1.88% increase. But women receive a higher increase for experience years, a woman receives an extra 2.48% for extra experience year and a man only receives 1.13% for each additional year. Other variables such as rural and Squared Experience show a similar effect on both women and men and it also follows the same behavior as the original model. Finally the constant is also of interest as it shows that men have a higher reserve salary than women. The constant for men is 2.2283 and for woman it is 0.9493.

After estimating the different models it is possible to make the Oaxaca-Blinder decomposition for farmers that work on tradable and non-tradable sectors, Table 15.

TABLE 15 - BOLIVIA: OAXACA-BLINDER DECOMPOSITION FOR BOTH TRADABLE AND NON-TRADABLE SECTORS IN AGRICULTURE

Model Prediction	Tradable	Non Tradable
Predicted Value for Men	2.1759 ***	1.3527 ***
	0.0518	0.0368
Predicted Value for Women	0.8748 ***	0.8577 ***
	0.1214	0.0772
Difference	1.3011 ***	0.4950 ***
	0.1320	0.0855
Selection Bias Adjusted Difference	3.1071 ***	1.8042 ***
	0.7702	0.5912
Dotation Effect	0.2867 ***	-0.0621
	0.1791	0.1389
Coefficient Effect	2.7262 ***	1.5366 ***
	0.7727	0.5926
Interaction Effect	0.0942 *	0.3298 ***
	0.1845	0.1456
Sample size	564	1642

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

Analyzing the results of the decomposition it can be observed that the predicted income on tradable sectors is higher than that of non-tradable sectors for men, 2.1759 and 1.3527 respectively. Both predicted incomes are higher than those of women, thus showing that there is a gender wage gap in agriculture between tradable and non-tradable sectors. In non-tradable sectors men have an expected income of 1.3527 and women have an expected income of 0.8577. This goes according to equation 3.15 which shows that there is a wage gap between women and men on non-tradable sectors. This would prove the theory proposed by Becker but the gender wage gap on tradable sectors is even bigger than its counterpart. The expected income of men is 2.1759 and of women it is 0.8748 on tradable sectors on agriculture. Hence

the wage gap on tradable sectors is 1.3011 and the same gap on non-tradable sectors is 0.4950 which would show that trade openness doesn't reduce inequities. This would prove the hypothesis and would follow that same line as the study made by Molina [1].

Something worth mentioning are the results obtained by Molina [1, pp. 161-162] the wage gaps have reduced from 2002 to 2013. The wage gap for 2002 on tradable sectors was 1.7026 but on 2013 the gap reduced to 1.3011. On non-tradable sectors the wage gap for 2002 was 0.9194 but on the gap reduced to 0.4950. At the same time the expected incomes for men increased; for example on 2002 men had an expected income of 1.0894 and women of 0.17. But on 2013 men had an expected income of 1.3527 and women of 0.8577.

As the different coefficients have been found it is possible to finally make the hypothesis tests. Using the coefficient effect in the Oaxaca-Blinder decomposition as this effect measures the gap that cannot be explained.

Null hypothesis 1:

$$C^{Tradable} = 0 \tag{38}$$

Alternative hypothesis 1:

$$C^{Tradable} \neq 0 \tag{39}$$

Using the given critic values:

$$\text{Critic value at 1\%} = -2,575; 2,575$$

$$\text{Critic value at 5\%} = -1,960; 1,960$$

$$\text{Critic value at 10\%} = -1,645; 1,645$$

Then the statistics is to be found using the following formula:

$$z = \frac{\overline{C^{Tradable}} - 0}{\sqrt{\frac{s_{C^{Tradable}}^2}{n_{Tradable}}}} \tag{40}$$

where:

$$\overline{C^{Tradable}} = \text{Unexplained wage expected gap on tradable sectors}$$

$$s_{C^{Tradable}}^2 = \text{Unexplained wage gap variance on tradable sectors}$$

$$n_{Tradable} = \text{Sample size of the tradable sector}$$

And it is known that:

$$\frac{s_{C^{Tradable}}^2}{n_{Tradable}} = \text{Squared standard error of the unexplained wage gap on tradable sectors}$$

Replacing the values on the equation:

$$z = \frac{2,7262 - 0}{\sqrt{0,7727^2}}$$

$$z = 3,5281 \tag{41}$$

Since the value found is higher than the critic values at the different levels null hypothesis is rejected at a 5% level of confidence. Showing that effectively there is an explained wage gap on tradable agricultural sectors.

Then hypothesis 2 is formulated:

Null hypothesis 2:

$$C^{Non-Tradable} = 0 \tag{42}$$

Alternative hypothesis 2:

$$C^{Non-Tradable} \neq 0 \tag{43}$$

Using the same formula:

$$z = \frac{\overline{C^{Non-Tradable}} - 0}{\sqrt{\frac{s^2_{C^{Non-Tradable}}}{n_{Non-Tradable}}}} \quad (44)$$

Replacing the values found on the decomposition:

$$z = \frac{1,5366 - 0}{\sqrt{0,5926^2}}$$

$$z = 2,5929 \quad (45)$$

The null hypothesis is rejected at a 5% level of confidence showing that there is effectively an unexplained gender wage gap on agricultural sectors with no tradability.

As shown by equations (12) and (13) it is found that:

Null hypothesis 3:

$$C^{Tradable} = C^{Non-Tradable} \quad (46)$$

Alternative hypothesis 3:

$$C^{Tradable} > C^{Non-Tradable} \quad (47)$$

Using the following critic values:

$$\begin{aligned} \text{Critic Value at 1\%} &= 2,330 \\ \text{Critic Value at 5\%} &= 1,645 \\ \text{Critic Value at 10\%} &= 1,280 \end{aligned}$$

Using the following statistics test value for the hypothesis:

$$z = \frac{\overline{C^{Tradable}} - \overline{C^{Non-Tradable}}}{\sqrt{\frac{s^2_{C^{Tradable}}}{n_{Tradable}} + \frac{s^2_{C^{Non-Tradable}}}{n_{Non-Tradable}}}} \quad (48)$$

Replacing the values found on the decomposition on equation (47):

$$z = \frac{2,7262 - 1,5366}{\sqrt{\frac{336,7448}{564} + \frac{576,6289}{1642}}}$$

$$z = 1,2216 \quad (49)$$

The result presented in equation (48) is under the critic value at 10%. Thus the null hypothesis cannot be refused, thus the unexplained wage gap between tradable and non-tradable sectors is the same.

This way it is proved that there is an unexplained gender wage gap in both tradable and non-tradable sectors. And that such gap in both sectors is similar between each other. This has proven that trade openness on the agricultural sector does not reduce the unexplained wage. But in comparison to the study made by Molina [1] trade openness does not increase the gap as it happened for 2002 and for 2013 tradable and non-tradable sectors have a similar gap.

But there is a final analysis that needs to be made, analyze gender wage gap differences among tradability degrees, Table 16.

At first sight it can be observed that the predicted value for men on low tradability sectors is 2.2259 and women have an expected value of 0.7474. The gap at such level is 1.4785 and with a selection bias correction the gap is 3.7848. At the same time it can be observed that the gap is mostly explained by the coefficient effect thus showing that the gender wage gap cannot be explained by factors that influence productivity.

Before analyzing the wage gap on high tradability sectors it is necessary to understand that in all cases for the decomposition there was an adjustment due to the selection bias as in all the cases the adjustment coefficient was significant except in one case. In high tradability sectors it was not necessary to adjust the decomposition because of the selection bias and ergo a new model was created without the adjustment. Table 17 shows the results.

TABLE 16 - BOLIVIA: OAXACA-BLINDER DECOMPOSITION FOR TRADABLE SECTORS IN AGRICULTURE BY DEGREE

Model Prediction	Low Degree	High Degree
Predicted Value for Men	2.2259 ***	2.0946 ***
	0.0711	0.0729
Predicted Value for Women	0.7474 ***	1.9837 ***
	0.1284	0.2808
Difference	1.4785 ***	0.1108
	0.1468	0.2901
Selection Bias Adjusted Difference	3.7848 **	1.8078
	0.7775	2.7496
Dotation Effect	0.3011	-0.2476
	0.2033	0.9875
Coefficient Effect	3.2168 **	1.7147
	0.7828	2.7506
Interaction Effect	0.2669	0.3407
	0.2161	0.9903
Sample Size	247	169

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

TABLE 17 - BOLIVIA: OAXACA-BLINDER DECOMPOSITION FOR AGRICULTURAL SECTORS WITH A HIGH TRADABILITY DEGREE WITHOUT SELECTION BIAS ADJUSTMENT

Model Prediction	Coefficients
Predicted Value for Men	2.0946 ***
	0.0729
Predicted Value for Women	1.9837 ***
	0.2743
Difference	0.1108
	0.2838
Dotation Effect	0.1796
	0.4288
Coefficient Effect	0.0177
	0.2902
Interaction Effect	-0.0864
	0.4324
Sample Size	169

Source: Prepared by the authors based on information by the Bolivian National Institute of Statistics.

Without the adjustment to selection bias the expected salary for men is 2.0946 and women's salary is 1.9837 for high tradable sectors. The gap between the two expected salaries is 0.1108 and such difference is the smallest gap found in this paper. At the same time most of the gap is explained mostly by dotation effect, this means that the gap is explained mostly by factors that influence the productivity between women and men.

At simple sight it can be observed that sectors that have a higher tradability degree tend to have a lower unexplained wage gap. Not only is it smaller but also the gap is mostly explained by factors that can be observed and that have an impact on productivity in comparison to the other estimated models.

Analyzing equations (16) and (17):

Null hypothesis 4:

$$C^{Low Degree} = C^{High Degree} \quad (50)$$

Alternative hypothesis 4:

$$C^{Low Degree} > C^{High Degree} \quad (51)$$

Using the critic values mentioned before and the next formula to find the critic value:

$$z = \frac{\overline{C^{Low Degree}} - \overline{C^{High Degree}}}{\sqrt{\frac{s^2_{C^{Low Degree}}}{n_{Low Degree}} + \frac{s^2_{C^{High Degree}}}{n_{High Degree}}}} \quad (52)$$

Replacing the values found in the formula:

$$z = \frac{3,2168 - 0,0177}{\sqrt{\frac{151,3556}{247} + \frac{14,2325}{169}}} \\ z = 3,8319 \quad (53)$$

With the result found in (53) null hypotheses 4 is rejected. This means that the gender wage gap on agricultural sectors with a high tradability degree is smaller than the same gap on sectors with a low tradability degree.

5. CONCLUSIONS

In the present document the methodology proposed by Molina [1] was used and at the same it was based on the theoretical guidelines proposed by Becker [2]. Such methodology consists on proving if trade openness reduces the wage gap between women and men. This happens because men receive a higher wage because the company owner has a taste for discrimination and market power thus receiving an extraordinary profit. But because of trade openness more companies enter the local market reducing the market power each company has and normalizing the extraordinary profit companies had. As a result company owners cannot give themselves this taste for discrimination and must pay men a wage that represents their productivity. And many investigations showed that agriculture has characteristics of an imperfect market so allowing the creation of wage gaps between women and men.

The conclusion is that the unexplained gender wage gap found on agricultural sectors with international trade and those that have none is the same. Thus it is shown that trade openness has no effect on the reduction of wage gap on agriculture. At the same time comparing the results to those found by Molina [1] for 2002; there is a major difference. In 2002 sectors with international trade had a bigger gap than those with none; but in 2013 the gap between these two sectors was the same. This shows evidence that the agricultural market may be an imperfect market as it does not follow a similar behavior from other sectors in the economy. Also the gap since 2002 has reduced and became smaller therefore showing that possibly the gap may be reducing since the start of this century.

Making the same analysis but with tradability degrees it is found that the higher tradability degree a sector has the smaller the gap will be. As it is found that the gender wage gap sectors with a high tradability degree is different from the same gap on sectors with a low tradability degree.

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