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TTULO: GENDER DIFFERENCES IN FIRM'S LEADERSHIP AND RISK PREFERENCES

TESIS PARA OPTAR EL GRADO ACADÉMICO DE DOCTOR EN ECONOMÍA

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Abstract

This thesis is composed of two studies related to gender issues in economics. The first one explores whether companies experience benefits when the firm's CEO and owner are both women. It employs data from the 2009-2014 World Bank Enterprise Surveys (WBES) to measure firms' performance through growth in sales and productivity. Potential endogeneity was corrected by using the UN Gender Development Index and the average fertility rate as they comply with the exclusion restrictions. The paper uses the Control Function method with a Probit first stage estimation and an OLS main equation. The findings suggest that a female owner strengthens the female CEO's business skills and leads to better firm performance than when the CEO is a woman and the owner is a man. The second study analyzes if there are gender differences in the socioeconomic characteristics that impact the risk aversion of a person. Gender differences in risk aversion may explain the gaps between men and women in the professional or labor field. If this situation is to be modified, it is important to understand how actors behave when facing risky situations and which variables could influence this change. In this sense, the paper draws from laboratory experiments associated with risky and uncertain decisions, representative of six cities in Latin America, through two empirical strategies: regression analysis with interactions and Blinder-Oaxaca decomposition. We conclude that women are more risk averse than men, and that the main variables associated with this behavior are education, age, and whether or not the person is part of the labor market.

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Contents

List of tables and graphics

Introduction

The present thesis offers two studies analyzing gender differences in the economic business and in agent preferences. The first of these two explores the relationship between firm performance and the leaders' gender. In recent years, business women have made considerable contributions to global economic development. Despite the fact that in many countries women are finally recognized for their financial abilities, creativity, and capacities for problem solving and teamwork, they still face considerable obstacles when attempting to reach the highest ranks of business leadership (OIT, 2015). Women are generally understood to carry more family responsibilities than men and are often perceived as lacking the business experience required for the positions they hold. What is more, the literature often shows that women tend to run smaller, less profitable, low-growth, or informal firms (Kepler and Shane (2007) and Morris et al. (2006)).

In their recent work, Flabbi et al. (2014) argue that economic interaction among individuals of the same gender will result in a more accurate perception of the individuals' signaling of abilities. That is to say, a female boss will show greater capability in assessing the productivity of a female employee than she would be of assessing a male employee's productivity. Thus, according to this theory, the presence of gender matching in a given firm will translate into an improvement in overall performance.

Relatedly, this study seeks to empirically substantiate whether matching a female CEO with a female owner will improve the performance of the firm, namely, whether the dynamics of gender matching will reinforce the business performance of a female CEO compared to when the owner is a man. This paper utilizes the World Bank Enterprise Survey (WBES), which allows for the analysis of firm data, both at the sector and national level. The paper makes contributions by: adding insights into gender dimensions of the production function of a company; incorporating a potential multiplier effect on firm performance that arises from gender matching between owner and CEO; and providing causal empirical evidence that relies on less volatile performance measurements than typical financial indicators of related work (Dobbs & Koller, 2005).

The second study analyses the possible differences between men and women on their attitude towards risk, and the variables explaining them. Analyzing the differences between men and women with respect to risk aversion may be relevant when it comes to making decisions that affect business success or professional growth. On one side, gender differences may be associated with the labor environment, which has long been characterized by a lower presence of women in positions of responsibility. Also, differences may be linked to the way in which parents tend to raise children differently and contemporary societies tend to socialize people in distinct ways,

depending on their gender. These broad processes may explain why women have been unable to gain experience in risky decision making, even when they have attained equal educational and professional standing as their male counterparts. In any case, it is important to understand the reasons for these gender differences in behavior when facing risks and which variables to address if a change is to be achieved.

There is a vast literature that discusses the diverse preferences that characterize men and women with respect to their level of risk aversion, such as Olsen and Cox (2001); and Byrnes et al. (1999). This literature evaluates whether or not behavior is differentiated by the specific characteristics of the person, such as age (Bommier & Rochet, 2006), sex (Byrnes, Miller, & Schafer, 1999) or their level of education (Brunello, 2002), although the direction of these relationships is not always conclusive. Nevertheless, a topic that has not been sufficiently explored, especially in Latin America, is whether or not the relationship between socioeconomic characteristics of people and their risk aversion is conditioned by the sex of the person.

The objective of this second paper is to analyze if there is a gender difference in the socioeconomic characteristics that are related to the risk aversion of a person, as well as the magnitude of the impact these factors have on their risk aversion. We investigate if it is possible to differentiate the behavior equation that characterizes this relationship by distinguishing between men and women. We also analyze if these links are modified depending on the degree of ambiguity of the decision or the possibility of facing losses. Our main hypothesis is that men and women show differences in terms of the variables that explain their risk aversion, as well as differences in the effect these variables have on their risk aversion. Also, such distinctions are modified according to the level of ambiguity and loss that they face in risky situations.

This study makes three contributions: First, it uses the general theory of the life cycle and human capital to explain risk aversion according to socioeconomic variables such as age, education, and sex. Second, it applies two empirical strategies - regression analysis and Blinder-Oaxaca decomposition; this latter technique has not been previously used in a study with similar objectives. Finally, this paper utilizes a database that includes laboratory experiments on risky decisions (Cárdenas, Chong, & Ñopo, 2013), representing six cities in Latin America, whose random sampling has been stratified according to the variables of interest for our study (age, sex, and education).

This thesis is structured in main two chapters. The first one presents the paper analyzing firm leadership and firm performance. The second one offers the study related to gender gaps in risk preferences, and their explanatory variables. Lastly, it is included a section with the main conclusions and recommendations of both studies.

Chapter I: Female Leadership and Firm Performance

Abstract

This study explores whether companies experience benefits when the firm's CEO and owner are both women. It employs data from the 2009-2014 World Bank Enterprise Surveys (WBES) to measure firms' performance through growth in sales and productivity. Potential endogeneity was corrected by using the UN Gender Development Index and the average fertility rate as they comply with the exclusion restrictions. The paper uses the Control Function method with a Probit first stage estimation and an OLS main equation. The findings suggest that a female owner strengthens the female CEO's business skills and leads to better firm performance than when the CEO is a woman and the owner is a man.

1.1 Introduction

In recent years, businesswomen have made considerable contributions to global economic development. Despite the fact that in many countries women are finally recognized for their financial abilities, creativity, and capacities for problem solving and teamwork, they still face considerable obstacles when attempting to reach the highest ranks of business leadership (OIT, 2015). Women are generally understood to carry more family responsibilities than men and are often perceived as lacking the business experience required for the positions they hold. What is more, the literature often shows that women tend to run smaller, less profitable, low-growth, or informal firms; see Kepler and Shane (2007), Morris et al. (2006), and Cliff (1998).

In their recent work, Flabbi et al. (2014) argue that economic interaction among individuals of the same gender will result in a more accurate perception of the individuals' signaling of abilities. That is to say, a female boss will show greater capability in assessing the productivity of a female employee than she would be of assessing a male employee's productivity. Thus, according to this theory, the presence of gender matching in a given firm will translate into an improvement in overall performance.

Relatedly, this study seeks to empirically substantiate whether matching a female CEO with a female owner will improve the performance of the firm, namely, whether the dynamics of gender matching will reinforce the business performance of a female CEO compared to when the owner is a man. In order to do this, this paper utilizes the World Bank Enterprise Survey (WBES), which allows for the analysis of firm data, both at the sector and national level. The paper makes contributions by: 1) adding insights into gender dimensions of the production function of a

company; 2) incorporating a potential multiplier effect on firm performance that arises from gender matching between owner and CEO; and 3) providing causal empirical evidence that relies on less volatile performance measurements than typical financial indicators of related work (Dobbs & Koller, 2005).

The chapter is organized as follows: section 1.2 presents a review of empirical literature and provides a basic framework that supports the research hypothesis; section 1.3 describes the data and variables included in the analysis; section 1.4 proposes and explains the methodology and empirical procedure; section 1.5 shows the general results; section 1.6 discusses main findings; lastly, section 1.7 offers concluding remarks.

1.2 Theoretical Background

1.2.1 How the gender of firms' leaders impacts firm performance

Various studies have linked the presence of women in positions of leadership with firm performance indicators. Some of these works suggest that this relationship is negative or not statistically significant, while others argue just the opposite. Offering an example of a negative relationship, Ahern and Dittmar (2012) examine the link between a firm's value and the characteristics of its executive board. The study analyzes the effects of exogenous variation created by new legislation passed in Norway in 2006, which mandated that at least 40% of a company's executive board members must be comprised of women. Their work surveyed 248 firms listed on the Norwegian stock exchange in 2001-2009 and found a negative relation between the changes imposed on boards by the law and firms' values as measured by Tobin's *q*. Their work concluded that in these cases, firms' values had fallen due to the deterioration in the quality of their executive boards and due to the fact that, although highly educated, the new female directors were less experienced than their male counterparts. Relatedly, Bardasi et al. (2011) argue that the performance differences by gender of ownership may also be attributable to real restrictions, such as lack of access to credit or limited business networks. Their study also suggests that additional constraining factors may exist, such as women's motivational biases to reach a more balanced domestic and professional life. These researchers use the World Bank Enterprise Survey from 2005 to 2007, as well as various measurements of firm performance, such as sales revenues, employment growth, and value added per worker, to conclude that women face significant gender barriers as entrepreneurs, which are both real and motivational, and that overall, these obstacles negatively affect firm performance. Similarly, Dezső and Ross (2008), using Standard and Poor's ExecuComp database for 1992-2006, which includes data for the top 1,500 U.S. firms, demonstrate

that the relationship between female participation in managerial positions (excluding CEO) and firm performance (measured by Tobin's q), is positive and strongly statistically significant. However, the same study also finds that the presence of a female CEO is not systematically related to firm's performance and even appears to yield a negative correlation. Dezső and Ross (2008) conclude by suggesting that there may be something particular about the position of CEO and the "female management style" that, in combination, do not produce positive results for firm performance.

Contradictory to the above findings, Post and Byron (2015) have conducted a meta-analysis of 140 studies and examined whether a country's legal and socio-cultural environment may explain the conflicting results found in the relationship between a firm's performance and female presence on executive boards. Their results suggest that firms with greater female board representation tend to have higher financial yields. In the case of market performance indicators, the relationship with female board representation tends to be strongly positive for firms in countries with greater gender parity. In addition, Navarro and Gallo (2014) use the World Bank Enterprise Survey to analyze how the presence of a female general manager affects the performance of 130,000 companies from developing countries. They use six performance indicators related to sales, employment, and productivity. They employ a two-stage ordinary least squares estimation in order to address potential endogeneity that includes two instruments: 1) female ownership of the firm; and 2) the UN Gender Equality Index. They find a positive and statistically significant link between the presence of a female CEO and growth in sales per employee, and in productivity. Finally, Campbell and Mínguez-Vera (2008) examine the linkage between the presence of women at executive boards and firm performance. Their study utilizes panel data to analyze the relationship between the value of the firm, measured by Tobin's q, and four indicators of female board participation: a dummy variable that measures the existence of one or more female directors, the percentage of female directors, and the Blau (1977) and Shannon (1948) indices of gender diversity. Their sample is comprised of 68 non-financial firms listed on the Madrid continuous market, from January 1995 to December 2000. Overall, their results consistently show that gender diversity has a positive effect on the value of a firm.

As seen above, various studies arrive at conflicting conclusions or suggest there may be no empirical link between gender and firm performance whatsoever. A shortcoming of current literature is that many studies tend to use databases comprised of partial surveys of firms in specific countries, which rarely allows for cross-national comparison in different regions of the world. In contrast, an advantage of the research presented in this paper is that it draws upon a cross-national database. Additional constraints of extant literature is that many studies mainly focus on the impact

of gender diversity of top manager positions on performance of the firm, but very few studies have analyzed the effects generated by female participation on the general labor force. The exception is Flabbi et al. (2014), which focuses on the complementary role of women in different positions at a firm, but does not explore potential synergies that may result from gender-related issues expressed during interactions between management and the ownership, which is what my study seeks to address.

1.2.2 The complementary role of women in different positions of a firm

In order to incorporate the gender impact in the firm production function, this paper uses an approached based on Phelps (1972) and proposed by Flabbi et al. (2014), in which women CEOs impact the distribution of the salary difference between male (m) and female (f) workers. This provides a theoretical link to performance of firms. Following Flabbi et al. (2014), this paper assumes that both types of employees are endowed with an ability q, which is normally distributed with mean μ and variance σ^2. The ability observed by the manager ($s=q+\varepsilon$) has a random component ε (which measures the quality of the information) with mean 0 and variance $\sigma^2_{\varepsilon g}$, where g is the employee's gender ($g=\{m, f\}$). The employees are assigned to tasks that are either simple (e) or complex (c); an assignment error implies a larger cost in the case of complex work. Firms maximize their output subject to the salaries they pay. In the context outlined above, this paper makes no distinction in the gender of the manager. In particular, it is assumed that, in equilibrium, each worker is paid for his or her marginal productivity and this depends on his or her expected ability, given the signal received from them, $E(q|s)$:

$$E(q \mid s) = (1-\alpha_g)\mu + \alpha_g s, \qquad (1)$$

where the weights are given by their relative variances, $\alpha_g = \frac{\sigma^2}{(\sigma^2_{\varepsilon g}+\sigma^2)}$. When the signal comes close to the truth ($\sigma^2_{\varepsilon g} = 0$), only the signal matters; when it does not provide relevant information ($\sigma^2_{\varepsilon g} \to \infty$), only the mean of the ability of the population is observed.

According to Phelps (1972), a person's ability can have a general source of variability, as well as more specific sources of variability that depend upon on social factors, such as gender or race. Phelps (1972) associates the groups that tend to suffer discrimination with the largest variability, which reduces the relevance of the signal he proposes for identifying the ability expected from employees. The individual that receives the signal, while lacking complete information, will fill in this information gap based on their previous experiences with or prejudices towards the people being evaluated. In this way, it is to be expected that women will show higher

variance in their ability signal and therefore, it will be riskier for those who hire them to assign them to more complex jobs. Similarly, Flabbi et al. (2014) differentiate the bosses' gender, *G*, which is equal to *F* or *M* depending on whether the owner is female or male. It is assumed that the individual has greater ability for assessing the productivity of an employee of the same sex.[1] It is possible to derive that the variance of a female worker's ability signal is lower when it is assessed by a female boss $(\sigma^2_{\varepsilon fF})$ than when it is assessed by a male boss $(\sigma^2_{\varepsilon fM})$. This may result in a decrease of statistical discrimination faced by female workers, allowing for greater compatibility between the productivity of women and the requirements of the jobs for which they apply, and may result in a direct and positive effect on the performance of the company.

Based on the work by Phelps (1972) and Flabbi et al. (2014), this paper explores the relationship between the owner of a firm and the CEO, by taking into explicit account their corresponding genders, as opposed to the more frequently studied relationship between the gender of the CEO and the employees of a firm. Following the above studies, the research presented here assumes that the owner has better abilities for evaluating the productivity of a CEO of the same sex, given that the former extracts information from a more precise distribution. This means that the variance of the signal of a woman's ability is lower when assessed by a female owner $(\sigma^2_{\varepsilon fF} < \sigma^2_{\varepsilon FM})$; symmetrically, the variance for the case of a male decreases when it is perceived by another man $(\sigma^2_{\varepsilon mF} > \sigma^2_{\varepsilon mM})$. As mentioned above, the signal of a woman's ability has a higher average variance, i.e. $\sigma^2_{\varepsilon f} > \sigma^2_{\varepsilon m}$, if the gender of the individual that perceives it is not considered. Instead, if all the firms had male owners, the difference between variances would be greater, given that they would better perceive the signal of a male candidate and his dispersion would decrease even further. On the other hand, if female ownership is assumed, the disparity between variances would decrease, as the variance of the signal of a woman's ability would be smaller, given that another woman perceives it. This would lead to a reversal or reduction of statistical discrimination against women, which could have a direct effect on the performance and productivity of the firm, as a female owner would choose the best and most productive candidate, regardless of gender, to manage the firm. Additionally, once a CEO assumes their position, and given that a female owner has better skills to communicate and perceive signals, she could also strengthen the female CEO's ability to run the firm. Accordingly, a firm's performance can be expected to improve when the owner and CEO are both women, in contrast to when the owner is a man.

[1] According to the authors, this assumption is derived from the belief that the communication styles of each gender are different and the interaction between men and women, when conducted separately, brings about a better understanding of people's capacities and attitudes, and also helps facilitate conflict resolution.

With the previous literature review in mind, this paper tests the impact of CEO and firm owner gender on firm performance. It is hypothesizes that a company will have better performance when both its owner and CEO are women, compared to when the CEO is a woman but the owner is a man, due to the ability of the female owner to better perceive the management skills of the female CEO.

1.3 Data and Variables

The data come from the World Bank Enterprise Survey (WBES), which gathers economic information from a representative sample of companies, from many countries around the world, where owners or general managers are asked about the characteristics of their firm and its performance. Respondent companies are selected through random sampling stratified by size, sector, and location, based on a national registry of firms to generate representative samples across the economy.[2] The surveys used in this study were conducted between 2009 and 2014. The database contains information on 75,980 manufacturing and service companies in 127 countries. I use a pool data of a cross-section of firms between these years.[3]

The two variables that measure the performance of the company, the growth rates of sales and productivity, are based in the WBES standardized indicator that make them comparable at a global level[4] (World Bank, 2014). The formula that is used is as follows and corresponds to an annualized rate, with limits that vary between -66% and 66%[5]:

$$\left[\left\{\frac{Sales_t - Sales_{t-3}}{\left(\frac{Sales_t + Sale\ _{t-3}}{2}\right)}\right\} \times \frac{1}{3}\right] \times 100 \qquad (2)$$

The most important behavioral aspects of the firms in the sample are as follows (see Table 1): A typical company has operated for 18 years. On average, 89% of the companies are domestically-owned while 8% are foreign-owned. The firms have a workforce of around 129 full-time employees, of which 32 are women. More women are found in production areas than in administrative or management fields. The data also report that in 31% of the firms, at least one of the owners is a woman, while only 14% have a female general manager. In terms of performance,

[2] The mode of data collection is face-to-face interviews. The survey sample frame is derived from the universe of eligible firms obtained from the country's statistics office, either from a government master list, business associations, or marketing databases. In a few cases, the sample is created via block enumeration (World Bank, 2014).
[3] We worked with the latest information available on each company for the years mentioned, given that it was not possible to work with a panel of firms.
[4] This is an indicator of normalized growth proposed by Davis & Haltiwanger (1992) that allows the inclusion of new firms which tend to have a value for t-3 equal to 0, and contributes to reducing the large rates that could be associated with small firms, which begin with very small values for sales.
[5] It is worth noting that this formula reveals that only firms having positive sales for more than 3 years could enter in the estimation sample.

sales growth is 3.12% yearly on average, while growth in sales per employee stands at 0.42% per year. Several statistically significant findings should be mentioned about the correlation between variables of interest.[6] For example, there is a positive relationship between the company's size and the CEO's years of experience (11%). It is also possible to verify that larger firms tend not to hire female CEOs (-8%). Companies that dedicate a larger proportion of their production to direct exports seem to hire a greater share of women within their total workforce (13%), particularly in production areas (22%). A larger number of female workers is associated with better company performance (3%), larger size (18%), and fewer years in business (-7%). Finally, there is a positive correlation between the measurements of performance and the presence of women in executive management (5%).

Table 1: Variable Description

Variable	Description of the variable	Mean
Industry	Industrial sectors, built with the ISIC code. From 1 to 20 according to the industrial sector	
Firm size	0 Micro (< 5 employees) 1 Small (> 5 and <20 employees) 2 Medium (>20 and <100 employees) 3 Large (>100 employees)	
Years operating in the market	Year of database recollection minus year in which the company began operations	18.23
Years of informal activity	Year in which the company began operations minus Year in which it was formally registered	0.72
Ownership of the firm	Percentage of the company that belongs to private, foreign, public or other owners	
Private property	Persons, companies, or national private organizations	89.35
Foreign property	Persons, companies, or private foreign organizations	7.68
Public property	Government/State	0.66
Owned by others	Others	2.32
Part of a large firm	The company is part of a larger firm 1 Yes 0 No	0.1780
Has a credit line	The company has a line of credit or a loan from a financial institution 1 Yes 0 No	0.3454

[6] The correlation matrix between these variables is available upon request.

Variable	Description of the variable	Mean
Sales growth	Percentage annual growth in total sales over the past 3 years	3.12
Growth of labor productivity	Percentage annual growth in total sales per employee over the last 3 years	0.42
Female owner	Some of the owners of the company are women 1 Yes 0 No	0.3051
Female CEO	The company's general manager is a woman 1 Yes 0 No	0.1395
Experience of the CEO	Years of experience the general manager of the company has in the sector	17
Value of capital replacement	Cost of replacing all machinery and all land and buildings. Log value in millions of USD	3.30
Security services	The establishment paid for security services three years ago 1 Yes 0 No	0.6268
Permanent employee	Total number of permanent and full time employees at the end of last fiscal year.	128.54
Total number of women	Total number of female employees in the labor force at the end of last fiscal year.	31.77
Female employees in productive areas	Total number of women in productive areas at the end of the last fiscal year	31.61

1.4 Empirical procedure

From an empirical perspective, the variable for the performance of the firm should be an outcome variable from the production function that is a performance indicator and not a traditional measure of output quantities. Following Dobbs and Koller (2005) and Santos and Brito (2012), there are different ways to measure this outcome variable. Typical measures are 1) financial indicators, in the form of firm profitability or value contribution to the economy; 2) indicators related to the capacity of a firm to grow and generate value, such as sales productivity, operating efficiency, unit costs, and indicators associated with market performance; and 3) performance in the capital markets, such as forecasts related to share prices.[7] Likewise, there is no empirical consensus regarding the factors that explain the performance of a firm due to the heterogeneity of

[7] In this case, the study uses short-term indicators linked to the second option, the firm's capacity to grow.

firms across the world (Cooper et al. 1994). Nevertheless, it is possible to make some generalizations and propose four groups of determinants (Hansen and Wernerfelt, 1989):

a) The industry's characteristics (growth rate, level of concentration, and capital intensity).
b) Position of the firm vis-à-vis its competitors, generally measured through each company's market share, experience, and level of formalization.
c) The quantity and quality of the company's financial, human, and physical resources.
d) Other less tangible factors, such as the organizational structure and climate of the firm.

The empirical specification for the firm's performance was chosen using the following linearized Cobb-Douglas production function,[8] including some of the factors discussed above as regressors and taking into account the relationship between the gender of the general manager and the owner.[9]

$$\ln Y_i = \ln\alpha + \beta \ln K_i + \pi \ln LD_i + \gamma \ln LP_i + \left(\delta + \varphi GM_i + \theta DM_i \times GM_i\right)\ln LG_i + \omega \ln C_i + \varepsilon_i \qquad (3)$$

where Y_i is the performance of firm i; K_i is its capital stock; L_i is its availability of human resources, differentiated between the owners (LD_i), those who hold management positions (LG_i) and those who are employees (LP_i); C_i represents other factors that can affect the firm's performance (including geographical and sectoral fixed effects); and ε_i is a random component. The management productivity factor is distinguished by the gender of the general manager (GM_i) and that of the owner (DM_i). As such, GM_i and DM_i are dummies that take the value of 1 when the individual is a woman.

Based on the specification described in (3), I select an empirical specification according to the data available, which are estimated with OLS in a cross-section structure, including all regions and industrial sectors:

$$Y_i = \alpha + \varphi GM_i + \pi DM_i + \theta\left(GM_i \times DM_i\right) + \omega X_i + \tau Loc_i + \vartheta Sec_i + \varepsilon_i \qquad (4)$$

where Y_i is the dependent variable for each of the two different measurements of firms' performance: annual growth in sales and annual growth in labor productivity. GM_i is a dummy

[8] The study follows Fernandez-Baca (2011), who argues that the grade 1 homogenous production functions have specific characteristics that allow us to adequately model a company's productive processes (the average and marginal productivities of factors, and their marginal rates of substitution, depend on the proportion in which they are combined). Other researchers who have discussed the subject of firms' performance, such as Bardasi, Sabarwal, & Terrell (2011), also use this type of production function because of its versatility. Finally, even if the Constant Elasticity of Substitution (CES) production function is a general version with similar properties to the Cobb-Douglas formula, its estimation process is more complex, since it is not easily linearized.

[9] For simplicity, it can be assumed that the function proposed has constant returns to scale. Other assumptions behind this production function may not be aligned with a firm's performance model such as the proposed one. Among them is the fact that elasticities associated with production factors remain unchanged over time or that the differences in the quality of factors, like the labor force, cannot be captured. However, as mentioned before, for the purposes of this paper it is used as a basic approach of the process for the firm's behavior and its results, as other authors have proposed. Finally, it can be stated that the functional form used to specify the model will not be key for demonstrating the proposed hypothesis.

that takes the value of 1 when the manager is a woman. DM_i is a dummy that takes the value of 1 when one of the owners of the company is a woman.

Following the model, the marginal impact on sales or productivity growth rate, Y_i, for having a female CEO, instead of being male, if the owner is male, would be φ. If, on the other hand, the owner were also women, that marginal impact would be $\varphi+\theta$. Following the proposed hypothesis, the sign of the parameter of the multiplicative variable (θ) is expected to be positive, meaning that regardless of the connection between the presence of a female CEO and the firm's performance, the presence of a female owner will improve the result obtained. Control variables are also included in X_i, like capital stock (K_i), human resources (L_i), and other controls (considered in C_i in equation (3)). Finally, the study includes fixed effects for the firms' geographic location (Loc_i) and industrial sector (Sec_i). In all regressions we allow for clustering at the industry level to account for robust estimators.

It is important to consider the possibility that the explanatory variables of interest (i.e., the presence of a woman at a higher managerial level within a firm) may not have the exogeneity condition necessary to ensure a consistent estimation of the parameters. Possible sources of endogeneity would be the bidirectional relation with the dependent variable, which could eventually introduce a bias in either direction (Smith et al. 2006). In this regard, it is likely that the least productive companies may be tempted to hire more women to reduce costs (negative bias). It is also possible that firms that have attained favorable outcomes will decide to take more risks and appoint women to higher positions within the firm (positive bias). Another issue at play are possible unobservable elements, such as cases when the firm decided to adopt a non-conservative business approach involving higher risks.

Due to the lack of relevant and exogenous instruments, from the three gender variables included in the analysis (GM_i, DM_i and $GM_i \times DM_i$,), only GM_i was instrumentalized. This was considered fundamental to correct for the endogeneity created by the fact that the manager is a woman, given that this outcome is the result of the firm's decision. Moreover, it is the firm that decides who to hire as general manager, and the gender of the candidate is part of the selection process. Additionally, it is to be expected that the performance of a female owner will have a significant impact on the CEO's performance.[10] I use two instruments: the UN Gender

[10] It is important to take into account that the DM_i variable can be subject to a host of possible endogeneity problems since, in large firms, there is a high number of owners, meaning there is an increased chance that there are more female owners. Therefore, it is important to take into account the distortions that can be generated if the DM_i variable is not instrumentalized. If we consider that the women who have the necessary skills to carry out these positions are those who become owners of a company, we can expect that they can also obtain better results for the firm. This would make it more difficult to isolate the final effect of their presence on

Development Index (GDI, 2016), following Navarro and Gallo (2014), and the average fertility rate of the country in which the firm is located (see Cruces and Galiani (2007), Ponczek and Souza (2012) and Angrist and Evans (1998)). GDI measures the gaps between men and women in each country on the three basic dimensions contemplated by the Human Development Index (HDI): life expectancy, education, and standard of living (gross income). We expect to find that in those countries where the human development of both sexes is more homogenous, and where opportunities for both genders are very similar, women can compete with men under more equal conditions to obtain higher positions within firms. Otherwise, using the average fertility rate I attempt to capture its possible influence on the participation of women in the labor market, especially for more educated women in positions of authority (Angrist & Evans, 1998). The proposed instrumentalization procedure considers country instruments to characterize the behavior of the enterprises in the country. In line with Fisman and Svensson (2007), the probability of hiring women as managers depends on constitutive aspects of the firm, which are associated, in this case, with the gender equity level (GDI) and the level of fertility in the country where the firm operates. These two variables are not correlated with unobservables that may affect a firm's growth, given that this depends on the aggregate characteristics of the country and should have no direct influence on the firm's performance. However, it can be expected that in countries with a specific degree of gender equity or level of fertility, there is a greater predisposition to have CEO of any gender, and not only a male CEO. As such, it is possible to instrumentalize the probability that the manager would be a woman by using both instruments, given that they comply with the two conditions for a good instrument, i.e., relevance and exogeneity.[11]

1.5 Results

The results of the first estimation stage (the CF), using the GDI and Fertility as instruments are presented in Table 2 (column 1). These variables explain the presence of a woman as company CEO, with a significance level of 1% and 10%, respectively.[12]

Table 2 also shows the results for the two proposed measurements of performance, the OLS estimations (column 2 and 4), and the CF procedure (column 3 and 5). The fact that the coefficient

the company, if this effect is solely associated with the fact that they are women: this could be overestimated due to the fact that we are observing a sub-group of women who actually become owners.

[11] The instrumentalization procedure is carried out by using the Control Function (CF) methodology proposed by Wooldridge (2015) and considers the cases where the main equation is linear (OLS), while the first stage of estimation is non-linear (Probit). The fixed effects of the geographic location and industrial sector of the company, as well as cluster at the industry level, are also considered in this first stage.

[12] According to Wooldridge (2002), this is sufficient proof of the relevance of the proposed instrument.

of the variable from the first stage (generalized errors) is statistically significant (at 1%) in columns 3 and 5 implies that the endogeneity problem is appropriately captured.

When analyzing the effect of the variables of interest on the firm's performance, in the case of sales growth (column 3), the study supports the hypothesis that when the owner is women, the business performance of a female CEO improves: if the owner were male, having a woman CEO (instead of a man) would produce a decrease in the company's performance of 15 percentage points (parameter φ); this decrease would be 3 percentage points lower if the owner were a woman (because the parameter θ would be added to the parameter φ). The fact that both are women improves annual sales growth by 3 percentage points (with a significance of 1%) respect to the situation in which the owner is a man and the CEO is a woman. The analyses also suggest that a female CEO performs worse for a given firm than her male CEO counterparts; when the owner is female the situation improves, yet fails to reverse the observed negative effect on the firm's performance. The results are very similar in the case of the second measurement of performance (column 5), where the combination of a female CEO and female owner, suggests an improvement in the firm's performance of 2 percentage points (at a 5% level of statistical significance) compared to when the owner is a man.

Additional findings of interest become evident when focusing on the CF results (see column 3 and 5 in Table 2). In the case of sales growth, there is a positive relationship between the firm's performance and variables such as being part of a large firm, the company's capital stock, and the CEO's years of experience. It is also evident that the firm's growth rate declines the more years that it operates, but stabilizes after 77 years.[13] The fact that a firm has a credit line and hires security services contribute with additional growth around 1.5 percentage points, at a 1% level of significance. Regarding the firm's productivity, the results are very similar, but also highlight the participation of foreign capital in the firm, which, when increased, improves the firm's performance. Lastly, it is important to note that the proportion of women working at the firm is a highly significant explanatory variable (between 1% and 5% confidence level) and has a positive sign in both performance measurements, which indicates that a firm's performance increases are commensurate with a higher percentage of female employees. Therefore, a one-percentage point increase in this share increases sales growth by 0.04 percentage points and the firm's productivity growth by 0.06 percentage points.

[13] Where the slope of the squared explanatory variable "years' operating in the market" becomes 0.

1.6 Main Findings

This study supports the hypothesis that when the owner is female, the business skills of the female CEO are strengthened, improving the firm's performance compared to when the owner is male. It also confirms that on average a female CEO performs worse than her male counterparts, and that when the owner is female, the situation improves, but cannot reverse the negative effect on a firm's performance. This paper also concludes that a higher proportion of female workers increases a firm's performance, regardless of the function the female employees carry out at the firm.

CF results confirm that the marginal effect of variables of interest (GM_i, DM_i and its interaction term) increase in absolute terms versus OLS estimation (for both measurement of a firm's performance). Signs remain unchanged, confirming the complementary effect of the presence of female owner and female CEO on the performance of the firm.

The differences in results with and without instrumentalization are due to the fact that this procedure reduces the (positive) bias caused by the endogeneity of the explanatory variable of interest (e.g. a female CEO). It is likely that women who assume management positions will be the most qualified among the pool of capable applicants. Accordingly, observed female CEOs are ostensibly those that have successfully managed their firms. For this reason, their performance would be overestimated if the endogenous explanatory variable of interest is not instrumentalized. This also allows the model with instrumentalization to show the effect of the presence of the female owner on the performance of the female CEO, since it partly compensates for the lower performance that the company shows when the CEO is a woman and not a man.

Table 2: Sales Growth Model & Labor Productivity Growth Model

	Female CEO	Sales Growth		Labor Productivity Growth	
VARIABLES	Probit (1)	OLS (2)	CF (3)	OLS (4)	CF (5)
Female CEO		-1.333**	-14.978***	-0.894	-11.159***
		(0.615)	(2.732)	(0.544)	(2.625)
Female Owner	1.225***	2.582***	5.074***	2.351***	4.223***
	(0.051)	(0.428)	(0.770)	(0.326)	(0.654)
Female owner*Female CEO		-0.683	3.016***	-0.667	2.125**
		(0.805)	(0.660)	(0.557)	(0.763)
Firm size	-0.134***	1.084***	0.769***	-0.163	-0.401**
	(0.016)	(0.172)	(0.194)	(0.161)	(0.154)
Years' operating in the market	0.004***	-0.182***	-0.176***	-0.039*	-0.035*
	(0.001)	(0.035)	(0.034)	(0.019)	(0.018)
(Years' operating in the market)^2	-0.000***	0.001***	0.0012***	0.001**	0.0005**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years' operating informally	-0.000	0.019	0.017	-0.017	-0.018
	(0.002)	(0.023)	(0.022)	(0.024)	(0.023)
Foreign property	-0.000	0.009	0.009	0.023***	0.023***
	(0.000)	(0.006)	(0.006)	(0.006)	(0.006)
Part of a large firm	0.093***	0.759***	0.918***	0.399*	0.519**
	(0.030)	(0.226)	(0.232)	(0.204)	(0.214)
Has a credit line	-0.024	1.569***	1.484***	0.715***	0.651***
	(0.016)	(0.291)	(0.284)	(0.174)	(0.168)
Experience of the CEO	-0.015***	0.056***	0.029***	0.095***	0.075***
	(0.001)	(0.009)	(0.009)	(0.011)	(0.012)
Value of capital replacement	0.008**	0.093	0.106*	0.020	0.030
	(0.003)	(0.056)	(0.057)	(0.067)	(0.067)
Security services	-0.127***	1.607***	1.362***	1.550***	1.367***
	(0.022)	(0.250)	(0.261)	(0.229)	(0.248)
Proportion of women in the company	0.012***	0.014	0.042**	0.036***	0.057***
	(0.001)	(0.013)	(0.017)	(0.011)	(0.014)
GDI	0.479*				
	(0.266)				
Fertility	0.124***				
	(0.007)				
Generalized error			6.321***		4.751***
			(1.320)		(1.244)
Constant	-2.631***	-4.428***	-3.407***	-8.635***	-7.869***
	(0.271)	(0.910)	(0.797)	(0.626)	(0.548)
Observations	53,035	38,935	38,935	38,244	38,244
Goodness of fit (R2)		0.052	0.053	0.052	0.053
Pseudo R2	0.2570				

Robust errors in parenthesis
*** p<0.01, ** p<0.05, *p<0.1

Nevertheless, the negative result attributable to a female CEO, obtained after instrumentalizing, may be due in part to the inability to control the specific characteristics of those who hold the positions in question, as well as their education or specific experience in similar positions. This generates a bias against women who, on average, perform at a lower level than men in these fields. This has nothing to do with their gender condition, but instead reflects the fact that they must compete for higher positions within firms with human capital that is less qualified than that of their male peers. The marginal effect of female owners on female CEO performance, compared to that of a male owner (parameter θ), may have a similar problem due to the factors mentioned above (lower education and business experience). Nevertheless, if this were the case, the estimated θ would be expected to have a downward bias, as it is impossible to control the equation for the aforementioned characteristics that, according to international evidence, should be assumed to be less favorable than for their male counterparts.

1.7 Conclusions

This research has sought to establish whether a firm reaps benefits from having women in top management positions, particularly when the owner of the firm and CEO are both women. Recent literature posits that this may be true, as female workers may help mutually strengthen their business skills, which can result in improved firm performance.

To accomplish this, the research presented here drew upon the 2009-2014 World Bank Enterprise Survey, which covers 75,980 manufacturing and service companies, and applied an OLS approach on the pool data of a cross-section of firms between these years. In order to account for endogeneity of the explanatory variables for gender, the CF approach was applied by using the UN GDI and the average fertility rate at the country level as instruments, as these variables comply with the exclusion restrictions.

The results support the hypothesis that a female owner strengthens the business skills of a female CEO, improving the firm's performance compared to when the owner is a man. This shows that a female owner has greater capacity to perceive and strengthen the skills of the women who manage the firm. It was also verified that, on average, female CEOs perform at a lower level than their male counterparts, and that the presence of a female owner improves the situation, but is not capable of reversing the negative results of the firm's performance.

In this sense, it is necessary to make efforts to ensure that equal opportunities are provided for recruiting personnel of both genders to fill positions at different levels within a firm. This would leverage the productivity and commitment of the female workforce to achieve

objectives and improve a firm's performance. However, to ensure that equal opportunities exist, both women and men must start on equal ground when competing for a position; thus, it is imperative to close the remaining gender gaps in the labor market.

In the near future, researchers should consider creating a panel structure from the WBES, that although may be difficult to carry out at the company level, could be used in reference to industrial sectors. In this regard, it would allow the testing of differential patterns in the relationship between the gender of those who run a firm and its performance, according to the sector in which the firm operates. Similarly, an analysis by geographic region could be carried out to analyze the strength of the relationship in connection with specific cultural characteristics. However, this differentiation might involve some representativeness problems, since not all countries have conducted surveys on the same number of companies. Finally, alternative instruments for gender variables of interest, whether included in the database or not, could also be tested to establish a more precise marginal contribution of the explanatory variables.

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Chapter II: Gender Differences in Risk Aversion: Evidence from Six Latin American Cities

Abstract

Gender differences in risk aversion may explain the gaps between men and women in the professional or labor field, specifically when success depends on uncertain decisions. The context in which people develop seems to generate such differences, such as the workplace, home and school, which tend to show different patterns of behavior for people of different sex. If this situation is to be modified, it is important to understand how actors behave when facing risky situations and which variables could influence this change. In this sense, this paper analyzes if there are gender differences in the socioeconomic characteristics that impact the risk aversion of a person. This paper draws from laboratory experiments associated with risky and uncertain decisions, representative of six cities in Latin America, through two empirical strategies: regression analysis with interactions and Blinder-Oaxaca decomposition. We conclude that women are more risk averse than men, and that the main variables associated with this behavior are education, age, and whether or not the person is part of the labor market.

2.1 Introduction

Analyzing the differences between men and women with respect to risk aversion may be relevant when it comes to making decisions that affect business success or professional growth. On one side, gender differences may be associated with the labor environment, which has long been characterized by a lower presence of women in positions of responsibility. Also, differences may be linked to the way in which parents tend to raise children differently and contemporary societies tend to socialize people in distinct ways, depending on their gender. These broad processes may explain why women have been unable to gain experience in risky decision making, even when they have attained equal educational and professional standing as their male counterparts. In any case, it is important to understand the reasons for these gender differences in behavior when facing risks and which variables to address if a change is to be achieved.

There is a vast literature that discusses the diverse preferences that characterize men and women with respect to their level of risk aversion, such as Olsen and Cox (2001); Byrnes et al. (1999); and Croson and Gneezy (2009). This literature evaluates whether or not behavior is differentiated by the specific characteristics of the person, such as age (Bommier & Rochet, 2006), sex (Byrnes, Miller, & Schafer, 1999) or their level of education (Brunello, 2002), although the

direction of these relationships is not always conclusive. Nevertheless, a topic that has not been sufficiently explored, especially in Latin America, is whether or not the relationship between socioeconomic characteristics of people and their risk aversion is conditioned by the sex of the person.

The objective of this paper is to analyze if there is a gender difference in the socioeconomic characteristics that are related to the risk aversion of a person, as well as the magnitude of the impact these factors have on their risk aversion. That is to say, we investigate if it is possible to differentiate the behavior equation that characterizes this relationship by distinguishing between men and women. We also analyze if these links are modified depending on the degree of ambiguity of the decision or the possibility of facing losses. Our main hypothesis is that men and women show differences in terms of the variables that explain their risk aversion, as well as differences in the effect these variables have on their risk aversion. Also, such distinctions are modified according to the level of ambiguity and loss that they face in risky situations.

This study makes three contributions: First, it uses the general theory of the life cycle and human capital to explain risk aversion according to socioeconomic variables such as age, education, and sex. Second, it applies two empirical strategies - regression analysis and Blinder-Oaxaca decomposition; this latter technique has not been previously used in a study with similar objectives. Finally, this paper utilizes a database that includes laboratory experiments on risky decisions (Cárdenas, Chong, & Ñopo, 2013), representing six cities in Latin America, whose random sampling has been stratified according to the variables of interest for our study (age, sex, and education).

The work is divided into five sections (including this introduction). The section 2.2 presents a review of theoretical and empirical literature on the subject of risk aversion and its main determinants. The section 2.3 details the methods of analysis, which includes a description of the database, as well as the estimation procedure. The section 2.4 analyzes the main results obtained through the two empirical strategies employed. The last section offers overall conclusions.

2.2 Literature Review

2.2.1 Models of risk aversion and characteristics of the individual

2.2.1.1 Lifecycle

Bommier and Rochet (2006) developed a life cycle risk aversion model under a context of preferences that are not additively separable.[14] When preferences are additively separable, the risk tolerance index for an individual of age *n* can be approximated as the weighted sum of instantaneous risk tolerance indices of each period. From this sum, the aggregate substitutability coefficients along the life horizon of the individual should be subtracted; this factor will be more important the more years the person lives. Then, if the consumption in the different periods of time are substitutes, the risk tolerance index is reduced with respect to the case where such substitutability does not occur. This correction term is greater, in absolute value, for younger individuals, who still have many years of life remaining. Thus, a positive relationship between the person's age and risk tolerance would be verified.

Regarding gender difference in the above formulation, Bommier (2013) showed that the possibility that women are more averse to risk than men can only be a result of the heterogeneity in the instantaneous preferences of each period (the discount rates). Bommier also found that these rates are higher for men, confirming that men are more impatient than women.[15] For this reason, women are more flexible towards the substitution of consumption between periods, while men place more value on current consumption. This implies that the substitution correction would be less for men than for women, given that, regardless of age, the substitutability coefficients are of lesser magnitude for men. This supports the claim of men's greater risk tolerance. Likewise, the reduction of the effect of life cycle on risk tolerance is less for men, because the substitutability coefficients are always lower for men; as a result, it is expected that the effect of each year of age over the tolerance to risk will be greater for women.

These findings lead us to two results in the empirical section of the study: a negative relationship between age and risk aversion, and a negative coefficient, which increases the previous effect when we include a variable that reflects the interaction between age and being a woman.

[14] That is, the level of satisfaction that a good itself provides depends on the period in which the good is consumed. Many aspects of human behavior can be explained by observing these types of preferences, such as plans for retirement (Bergstrom, 2010).

[15] See, for example, Dittrich and Leipold (2014) and McLeish and Oxoby (2007) who demonstrate that gender affects the way individuals value future consumption. These authors find that women are more patient when making long term choices, while for men the present has more influence on their choices.

2.2.1.2 Human capital

Friend and Blume (1975) explain the choice between risky and non-risky assets in the investment portfolio of an individual, incorporating non-marketable assets such as human capital. The authors relate the proportion of risky assets selected by an individual with variables that capture the returns of capital, the percentage of taxation that affects this person, the fraction of total wealth dedicated to human capital, the ratio of covariance between the returns of risky assets and that of human capital, and the degree of relative risk aversion of Arrow-Pratt. Fama and Schwert (1977), Liberman (1980), and Davis and Willen (2000) estimated that returns on financial assets and human capital have a minimal correlation,[16] which makes it possible to establish a positive relationship between the proportion of wealth allocated to human capital and the relative risk aversion.[17] However, the dynamics between these two variables is complex, due to possible problems of bidirectional causality and endogeneity.

As such, the empirical literature on the relationship between these two variables has not been conclusive. While a group of authors such as Donkers et al. (2001), and Hartog et al. (2002) confirm that the correlation between human capital and the relative risk aversion is negative, others such as Kapteyn and Teppa (2011), Kristjanpoller and Olson (2015a), and Sepúlveda and Bonilla (2014), show that it is positive. Following Jung (2015), it can be affirmed that the higher one's educational level and the greater one's knowledge about the consequences of the decisions they make, their capacity to manage a risk increases, and their risk aversion is reduced (risk management effect). It could also be argued that, if a person possesses the level of knowledge necessary to foresee the risks associated with an action, they may be more cautious when choosing the options that are presented to them and, therefore, more risk averse (risk knowledge effect). In this way, both signs of the relationship are viable and empirically verifiable.

Regarding the causality of the relationship between risk and education, Outreville (2015) distinguishes between studies that consider one or another direction: that the level of education conditions one's tendency to make risky choices, or whether a more or less risky person chooses or declines to continue studying. However, Outreville failed to attain sufficient statistical robustness to confirm that one of two directions was valid. Alternately, Jung (2015) performs a causality analysis using England's educational reform of the early 1970's to instrumentalize

[16] According to the authors, this makes sense if we consider that the discounted present value of future labor income (return of human capital) tends to decrease with age, simply because a worker has fewer years of work left ahead of them; however, the performance of risky assets does not have to be reduced in the same way

[17] In the models that will be estimated later, the variable proposed by Friend & Blume (1975), the proportion of wealth destined to human capital, will not be incorporated because the database this paper used does not allow access to the information necessary to build it. In its place, we will work with the years of education of the person, under the assumption that there is a direct relationship between the level of capital invested in education and the level of educational attainment reached from that investment.

education and finds that education has a positive causal effect on the propensity to be risk averse. Similarly, Chong and Martinez (2015) found a positive causality in that same direction, for a representative sample of Lima, when examining the exogenous shock of the economic boom on the construction of new schools as an identification strategy.

Regarding gender differences linked to the relationship between education and risk aversion, there are few empirical works. Two salient examples are Johnson and Powel (1994), and Black et al. (2015). Johnson and Powel's research explores whether gender differences vary according to one's level of education by comparing employees of sports betting companies in the United Kingdom who do not have formal education in administration. This study observes employees' actual decisions and concludes that women are more risk averse than men only in the case of the group with the lowest educational level, while among more educated employees there is no significant difference. The study by Black, Devereux and Lundborg seeks to determine the effect of education on stock market share for more than one million Swedes, distinguishing by the sex of the individual. It also includes a change in school legislation in the 1950s and 1960s as an exogenous variation of education. This study shows a significant and positive effect between higher education and maintaining a higher proportion of risky assets only in the case of men.

Taking into consideration the previous literature review, it will be necessary to verify the type of relationship between these two variables in the model to be estimated below and the likely gender differences.

2.2.1.3 Familiar structure

Drewianka (2008) presents an induced risk aversion model that considers the proposal of Chaulk et al. (2003) which argues that changes in family structure induce variations in risk aversion of household members. In the base model he proposes, the individual maintains resources from a non-labor income, a salary, and the fraction of time destined for leisure. For individuals without resource constraints, the propensity for taking financial risks is only determined by their own psychological risk aversion. However, when an individual faces less flexibility in the use of resources, the propensity to take financial risks is altered. So, in an extension of the model, household members interact with each other: leisure time of one member is a determining factor in the utility function of another. So we can conclude that a person becomes more risk averse when one of the other family members has resource constraints, since the home has less flexibility to adjust to shocks overall.

The author uses this theoretical framework to emphasize that an individual can increase or decrease their propensity towards taking risks when their family structure changes. For example,

the model predicts that an individual increases their risk aversion when they marry someone with time restrictions, while their aversion decreases otherwise. Therefore, it is expected that there will not only be modifications in risk aversion when changing civil status, but also depending on whom you marry.

Finally, Chaulk et al. (2003) predict that being married reduces gender differences in risk aversion. The authors suggest that men are more likely to change their attitudes towards risk and become more conservative when they get married. Also, when women cohabitate, they tend to increase their risk tolerance in order to reach a consensus with their partner. Drewianka (2008) complements the above research, proposing that this reduction in gender differences in risk aversion is caused by lessened flexibility in the use of household resources, as supporting a partner can constrain resources and, therefore, generate an increase in risk aversion, especially in the case of men.

In the empirical model presented further on, we will verify the effect of civil status on risk (if married persons show greater risk aversion or not), as well as their possible gender differences.

2.2.2 Gender differences in risk aversion

A first group of authors state that there is a significant relationship between gender and risk aversion. Among these, Byrnes et al. (1999) conducted a meta-analysis of 150 studies comparing risk preferences between men and women. According to the authors, in more than 60% of cases, the gender difference is statistically significant, and shows that women are more risk averse than men. It was verified that this difference is conditioned by the context. For example, women take much less risks than men in physical activities, especially those involving spatial skills.

Eckel and Grossman (2008b) distinguished those studies involving bets or hypothetical games, from those that were also simulated, but that take place in a specific context, such as investing money in a certain asset or purchasing an insurance policy. They also analyzed non-experimental studies conducted with secondary information. Their main conclusion was that both, the experiments with abstract bets and the studies carried out with secondary information, showed a greater risk aversion for women. The contextualized experiments were demonstrated to be less conclusive.

In a comparative analysis, Cárdenas et al. (2012) explored gender differences in preferences for competition and risk in children aged 9 to 12 in Colombia and Sweden, two countries with different global gender equality indexes according to their macro indicators. They ran an experiment that involved six decisions in which children could choose between an option with greater risk – an equal probability coin toss where the player wins either 0 or 10 points – and

a less risky option, where the amount that a player could win/lose increased incrementally from 2 to 7.5 points. It was found that in both countries the children were riskier than girls, with a minor difference in Sweden. In Colombia, boys took between 40% higher risks than girls; in Sweden, boys took only 15% higher risks than girls.

A second group of studies showed that gender has no conclusive relationship with risk aversion. Alison et al. (2009) designed an experiment where students from mixed and single-sex schools had the possibility of choosing between options with and without risk. The results showed that girls from women's colleges were as likely to choose betting games as boys from single-sex or mixed-sex schools and were more likely to choose betting games than girls from mixed schools. This suggests that the gender differences observed in previous studies may reflect social learning rather than an intrinsic trait associated with the sex of a person.

Galarza (2009) approximated the risk preferences of cotton producers in southern Peru, using the results of an experiment that involved multiple price lottery games (MPL).[18] In addition, he compared models of risk aversion using the theory of expected utility and the cumulative prospect theory. He estimated a regression of risk preferences which included variables such as sex, age, education, and geographic location. He found that women's behavior was slightly more risk averse, although not significantly.

The work of Kristjanpoller and Olson (2015a) sought to show that in Chile, women are more risk averse than men regarding their retirement investment decisions. The authors present a Probit estimation to determine which demographic factors affected the choice of the least risky retirement fund. They concluded that gender differences in the choice of risky funds were not significant.

A third set of studies addressed the distinction of the specific characteristics that affect individual risk aversion according to the sex of the person. Yao and Hanna (2005), relate marital status to risk aversion, distinguishing between men and women. They utilized the Federal Reserve of the United States' Survey of Consumer Finance between the 1980s and 1990s, including questions related to risk tolerance. Their results showed that married men tended to be less risky than single men (62% of the time), but always more risk-tolerant than women. Among women, single women took more risks than married women (1.2 times more).

Using a standardized risk tolerance score (RTS), which ranges from 1 to 100, Faff et al. (2011) evaluated the effect of interactions of sex, marital status, income level, and number of

[18] In MPL, respondents make a series of consecutive choices between two risky options, where the expected value of one result increases at a higher rate than the other. The point at which an individual changes their choice from one outcome to the other is used as a measure of their risk aversion.

dependents. Their results determined that marriage has a less negative impact on risk tolerance for women than for men, with an RTS reduction of 3.63 points for men, and only 1 point for women. Also, the number of dependents was positively related to risk tolerance for women, but negatively for men, although the impacts were relatively small.

Kristjanpoller and Olson (2015b) examined the influence of financial knowledge and other demographic factors on preferences for retirement funds in Chile, taking into account interaction effects of sex and marital status. Two Probit models were estimated, differentiated by the inclusion of a variable of financial knowledge, where the dependent variable distinguished between the options with risk and the low risk "default" fund. They found that married men tended to invest in riskier assets than married women. These results did not change when the tests were controlled for financial knowledge.

2.2.3 Risk aversion with ambiguity and losses

Unlike the theory of expected value, which defines the approach to risk solely by the curvature of the utility function, prospect theory incorporates two psychological aspects (Tversky & Kahneman, 1992): 1) the aversion to loss, i.e. the idea that losses are felt more than profits (reflection effect)[19]; and 2) non-linear probabilities, or the fact that people make subjective evaluations that distort the probabilities and explain why the same subjects may be risk-averse in certain cases and a risk-lover in others. However, Holt and Laury (2002) show that prospect theory is not always true. While compliance is verified with lotteries with hypothetical payments, by introducing actual payments, asymmetry is greatly reduced, mainly when such payments increase.

Borghans et al. (2009) use laboratory games to analyze if there are gender differences in ambiguous risky choices, as well as if psychological and cognitive factors can explain such differences. Their results indicate that women do not require additional compensation when a slight ambiguity is introduced, unlike men who demand it. However, as the level of ambiguity increases, risk aversion increases at the same rate for both genders. The authors also conclude that the psychological traits of people are more linked to aversion to ambiguity than to simple risk.

Schubert et al. (2000) designed an experiment that applied to a sample of students from two Swiss universities, with the aim of analyzing gender differences in insurance and investment decisions. For this study, three cases were considered: 1) pure risk (with known probabilities); 2) weak ambiguity (with two different probability distributions); and 3) strong ambiguity (with

[19] It has been found that starting from a base point (usually a person's average wealth), the person tends to be risk averse for profits and risk-loving for losses (Kahneman & Tversky, 1979). For example, they prefer to gain a small but assured amount, whereas when they face the possibility of losing, they prefer to take more risk, seeking the zero loss option.

unknown probability distributions). Three random effects models were estimated for each type of risk, where the dependent variable was the certainty equivalent of each participant,[20] and the explanatory variables of interest were gender and income of the individual. The results showed that, for both investment and insurance experiments, there were no significant gender differences in the certainty equivalents with pure risk. In the context of investment, women showed a greater risk aversion facing weak and strong ambiguity. In the context of insurance, no differences in gender were found in the case of weak ambiguity, although a subtle but significant difference was found in the face of strong ambiguity.

Rau (2014) analyzed the gender differences in the disposition effect[21] in making investments by running an experiment with losses, using a sample of students from the University of Dusseldorf, Germany. Each participant received an amount of money that they used to make investment decisions during 13 periods; over this time the participants had to choose between six risky options. In period 14, the portfolios were liquidated and the students received the investment profits. Using an analysis of correlations and tests of equality of medians, it was shown that women were more risk averse to losses than men, and that women suffered less capital losses, and had a greater disposition effect than men.

This study uses hypothetical games with certainty, ambiguity, and losses, with real monetary payouts, albeit in relatively small amounts. Therefore, and in accordance with the literature reviewed, there should be a positive rate of reflexivity, although low. Likewise, it is possible to expect that the degree of risk aversion of women will increase when they face situations of ambiguity and loss with respect to the case of risk with known probabilities.

2.3 Methodology

2.3.1 The database

This paper utilizes a database created by Cárdenas et al. (2013) from six Latin American cities: Bogotá, Buenos Aires, Lima, San José, Montevideo, and Caracas. The database recruited 3,109 people from diverse economic, social, and demographic profiles, and used stratified random sampling at the city level, based on education, average family income, sex, and age.[22] It also

[20] The certainty equivalent is the amount of money that a person could win with certainty that guarantees that the individual is indifferent between this amount and the expected return of the asset with risk.
[21] The disposition effect is the tendency to keep assets with disproportionate monetary loss in the same portfolio, while assets with accrued profit are simultaneously liquidated (Fromlet, 2001).
[22] This procedure allowed us to obtain empirical distributions of individuals within these combinations of characteristics that reproduce those characteristics of the population of each city, favoring the external validity of the database.

incorporated socio-economic information, as well as the results of laboratory games previously tested in other contexts.[23]

These authors conducted a series of sessions, which all adhered to the same protocol, with 20 participants each, on average, who had been recruited randomly on the street of the above cities. Each session lasted between two and three hours. As one of the main objectives was to observe the effect of social heterogeneity on the decisions of individuals, information regarding the socioeconomic composition of the group participants was made as clearly as possible. However, participants were not allowed to communicate with each other during the sessions, nor were two people who previously knew each other allowed to participate in the same session. As the session progressed, participants were given information about their peers, depending on the objective of each activity.[24] The participants involved in the exercises played knowing that their decisions would allow them to make profits at the end of the session; the idea was to motivate participants to make deliberate calculations before taking action. They received the earnings from only one of the activities, which was chosen by raffle drawing at the end of the games in the presence of all the participants. After the games were conducted, the participants completed a survey administered by the coordinators of each session.

This study relies on an activity based on a Risk Game[25] that was applied for the first time in India by Binswanger (1980) and in Zimbabwe by Barr (2003). In this activity, each player made individual decisions about three games that measured attitudes about risk, uncertainty, and loss. In the first stage, participants were offered a set of six possible lottery options and could choose only one. Each option consisted of an envelope with 10 chips, 5 of high value and 5 of low value. Each of the six envelopes increased in expected total revenue and in value between the highest and the lowest potential revenue. In the second stage, the game was the same but the individuals ignored the exact probabilities of the results (i.e. they did not know how many chips of what value were in each envelope), although they were informed that they had at least 30% probability of obtaining the low payment and the same probability of obtaining the high payment. In the last stage, the six possible options with 50/50 probabilities were maintained, but negative results involving losses were included.

[23] These experiments were based on those designed by Berg et al. (1995), Binswanger (1980), Holt & Laury (2002), Barr (2003), Marwell and Ames (1979), Isaac and Walker (1988); and adaptations of those by Carpenter et al. (2005), Harrison and List (2004), Cárdenas (2003), and Cárdenas and Carpenter (2008).

[24] All these procedures allowed us to reduce the presence of biases that could affect the identification of causality relationships or correlation between the variables to be studied, contributing to the internal validity of the database.

[25] The other activities that were developed are used as controls for the models of risk aversion estimated below, given that they measure confidence, voluntary contribution to common goods, and willingness to share the risk with other participants. For more details, see Cárdenas et al. (2013).

Based on this source of information, this study uses a subjective risk measure,[26] which is basically the hypothetical choice of a lottery game (the person chooses one among several alternatives). This allows us to not exclude anyone from the database, because subjective measure is applied to everyone, in order to avoid selection bias.

Table 1 of Annex 1 offers a description of the variables used in this study. The average player was in their mid to late 30s, 56% of participants were female, and had nearly 12 years of education and socioeconomic level between medium and low (this characterizes 75% of sample participants). It was found that 71% of the individuals in the sample had a high degree of risk aversion (choose the least risky option), 74% when there is ambiguity in the game, and 57% in case of risk with losses.

When analyzing the correlation matrix (Table A 1 .2 of Annex 1) the positive relationship between the gender variable and the three types of risk aversion can be confirmed. Also, there is an observable positive relationship between the three types of risk aversion listed above, with the level of education, years that one tenant is living in the city, owning the house they occupy (homeowner), and that the observed person identifies as racially white (race). Older players seemed to be less risk averse (negative correlation); additionally, a positive and significant association between the three types of risk aversion is confirmed.

2.3.2 Estimation procedure

2.3.2.1 Models with interactions

To test the hypotheses proposed, we work with a model of binomial limited dependent variable in a cross section context. The reduced form of the empirical specification is observed in 1:

$$R_i^* = \beta_0 + \beta_1' X_i + \beta_2 Sex_i + \beta_3' Sex_i \times X_i + \beta_4 Fix_i + \varepsilon_i \qquad 1.$$

where:

R_i^* is a latent variable that measures the degree of risk aversion of the person i (with certainty, ambiguity, or losses). Although it is not observable, what is in fact observed is the

[26] The proposed experiments involve monetary-based decisions. However, as argued by Binswanger (1980) and Barr (2003), who designed and used the same type of database experiment, what the games try to measure are people's attitudes in situations that involve risk in general. Therefore, these and other studies, such as Chong and Martinez (2015), and Cárdenas et al. (2013), consider these experiments generalized measures of people's attitudes towards risk.

dichotomous variable R_i, with two values[27] obtained from the results of each game,[28] where 1 implies a high risk aversion.[29]

X_i are the characteristics of the individual *i*, such as age, race, marital status, education level, socioeconomic level, years living in the city, and the ownership of the house they inhabit.

Sex_i, is the sex of the person *i*, and takes the value of 1 when the person is a woman. This is the explanatory variable of interest for what is included in the model in two ways: 1) directly as a dummy; and 2) interacting with other characteristics of the individual (which are part of the X_i), such as the person's education level, their age, and their marital status. That is, we are interested in the individual effect of sex and the final impact it has on the relationship between individual characteristics and risk aversion. For example, if one of the variables to be analyzed is education ($X_i = Ed_i$), equation 2 tells us its effect on the likelihood of high risk aversion ($R_i = 1$), when the number of years of education of the person increases (see Wooldridge (2010)). The first bracket on the right side of 2 is the same for any individual, whether male or female. Therefore, changes in the impact effect are only due to the second bracket: if the person is female (*Sex i* = 1), this would be $\beta_1 + \beta_3$, while if they were a man, it would only be β_1. In which case the final effect is greater depends on the sign and magnitude of each parameter.

$$\frac{\partial R_i}{\partial X_i} = [f(\beta' X_i)][\beta_1 + \beta_3' Sex_i] \qquad 2.$$

The three interactions associated with the analytical framework are tested, i.e. sex with age, with education and with marital status (with partner). Given the previous literature review, we should expect that β_1 would be negative for age, and positive for the other two variables, education and marital status. On the other hand, β_3 would be negative for age and still indeterminate, at this

[27] The most traditional way to measure a person's risk aversion has been through the calculation of some variant of the certainty equivalent, which compares uncertain options with the payment or price chosen to reveal preferences about them. These types of indicators can have complex estimation procedures that generate measurement errors, as explained by Eckel and Grossman (2008a). These authors use a simpler alternative: the choice between a set of lotteries, which linearly augment the expected payments and dispersion (similar to what is applied by Binswanger (1980)). Eckel and Grossman recognize that the certainty equivalent produce more refined estimates of the parameters of the utility function, but at the cost of increasing measurement errors. Instead, the procedure they use are the simplest possible games that, while keeping enough heterogeneity in the elections, minimize measurement errors. For this reason, we adopted this procedure in this study

[28] Cárdenas et al. (2013), using the database of this study, propose an ordered categorical variable, in which the degree of risk aversion is measured as high, medium, or low. However, the estimates made using an Ordered Logit model, which considered these three categories, showed that there was no difference between the second and third (the second cutoff point was not statistically significant). Therefore, we use the binomial model that, despite being a non-linear model, is easy to estimate and its results are easy to interpret.

[29] That is, if the person chooses the envelopes 1, 2, and 3 in each game, they are highly risk averse (category 1), if they choose the envelopes 4, 5, and 6, they are low risk averse (category 0). This is the most conservative distribution of results between high and low risk aversion. Other alternatives were also tested, under the same dichotomous context (distributing the selections between 0 and 1), but with very similar results in terms of adjustments, signs and significance of the explanatory variables of interest.

stage of the analysis, for the other two variables. Finally, it should also be expected in situations of ambiguity and loss that the gender gap in risk aversion widens.

As presented earlier, the education variable generates the most doubts regarding its final relationship with risk aversion.[30] Therefore, we will test alternative specifications. First, we will test it as a quadratic, allowing us to identify possible changes in the slope of the relationship. Then, given the doubts in the direction of the causal relationship, we will attempt to instrumentalize it. Because we work with six different cities, it is difficult to find an appropriate instrument external to the database, which is why we propose an internal one: the average years of education of the rest of people of the same sex, who live in the city of residence of each individual.[31] This variable meets the two requirements of a good instrument. First, it is relevant because it is expected that the average years of education observed in each city are positively related to those of the person who lives in that city, as they live in similar socioeconomic conditions as the rest of the citizens. Second, it is exogenous, because there is no reason to expect that the average education of the city in which the individual lives directly influences their risk aversion; as such, the instrument would interact on the variable of interest only through the original explanatory variable, i.e. the years of education of the person. This variable is instrumentalized using the Control Function (CF) methodology, from Wooldridge (2015), considering the case in which the main equation is not linear (Probit), while the first stage is lineal (MCO). This procedure accounts for the endogeneity of the variable and allows the incorporation of interactions of the same variable with other exogenous variables of the model.

All specifications incorporate dummies associated with the sessions in which these individuals participated, and the cities in which the experiments were conducted (Fix_i). It is understood that the two main sources of unobservable heterogeneity come from both these factors. In the first case, sessions could be handled in very different ways, and although there was a protocol for their development and training for those who conducted it, it was impossible to reproduce a session in an identical way, more than once. In terms of cities, it is expected that city of origin conditions participants' attitudes and behaviors, especially because cultural similarities

[30] Another explanatory variable that could generate doubts about endogeneity is a person's marital status. Some works, such as Spivey (2010) and De Paola and Gioia (2017), have found that risk tolerance and people's level of impatience, can account for their decision to marry, which holds that the most risk averse persons get married early in life because they consider marriage to be a less uncertain situation than remaining single. However, in the absence of appropriate instruments, we decided to include this variable in its original form. No major distortions are expected in the results since this variable is not significant in most of the estimates presented.

[31] A similar strategy has been used by other authors to address the endogeneity of an explanatory variable. For more, see Hanlon et al. (2003), and Cheng et al. (2014).

or the context in which participants operate. In all regressions we allow for clustering at session level to account for robust estimators.

2.3.2.2 Decomposition of Blinder-Oaxaca

This paper uses the Blinder (1973) and Oaxaca (1973) decomposition in order to comprehensively analyze gender differences in risk aversion. This parametric technique is commonly used when seeking to estimate the differences in the contribution of diverse variables, on a dependent variable, distinguishing between two separate groups of the study sample. In our case, the idea is to approximate how different the relationships are between the socioeconomic characteristics of a person and their level of risk aversion, when comparing men and women. As a supplement to the empirical strategy outlined in the previous section, the technique described below allows for a comprehensive view of differentiation, by estimating one equation of distinct behavior for each sex, and to compare their estimated parameters to determine if they yield similar results.

To perform this decomposition, we use a two-fold strategy (see Jann (2008)) that allows us to identify a differentiated effect between the observable characteristics or endowments of the individuals, and the differentiated effect linked to the estimated coefficients. Formally, the following equation is the one that relates the indicators of the three types of risk in the previous section with the proposed explanatory variables:

$$\overline{R}'_g = \hat{\beta}'_{jg}\overline{X}_{jg} \qquad 3.$$

Where $\overline{R}'_g$ is the average selection of the individual of sex *g*, taken from the six possible options of each lottery;[32] $\overline{X}_{jg}$ is the average value of the explanatory variable *j* for individuals of sex *g*; $\hat{\beta}'_{jg}$ is the estimated coefficient for the explanatory variable *j* in the equation of individuals of sex *g*. Subtracting the results for $\overline{R}'_g$ from men (*h*) and women (*m*) we have:

$$\overline{R}'_h - \overline{R}'_m = \hat{\beta}'_{jh}\overline{X}_{jh} - \hat{\beta}'_{jm}\overline{X}_{jm} \qquad 4.$$

Adding and subtracting the term $\hat{\beta}'_{jm}\overline{X}_{jh}$ to the right:

[32] The lottery that involves less risk is given the highest value among the six, in order to express risk aversion.

$$\bar{R}'_h - \bar{R}'_m = \hat{\beta}'_{jh}\bar{X}_{jh} - \hat{\beta}'_{jm}\bar{X}_{jm} + \hat{\beta}'_{jm}\bar{X}_{jh} - \hat{\beta}'_{jm}\bar{X}_{jh} \quad 5.$$

and, finally, rearranging, we reach:

$$\bar{R}'_h - \bar{R}'_m = \hat{\beta}'_{jm}(\bar{X}_{jh} - \bar{X}_{jm}) + (\hat{\beta}_{jh} - \hat{\beta}_{jm})'\bar{X}_{jh} \quad 6.$$

The first component to the right of 6, $(\hat{\beta}'_{jm}(\bar{X}_{jh} - \bar{X}_{jm}))$, represents the observable characteristics X_j that explain the difference in risk aversion between men and women (their difference in endowments for explanatory variables, for example, what level of education they have attained, how much money they spend, their age, etc.) The second component, $((\hat{\beta}_{jh} - \hat{\beta}_{jm})'\bar{X}_{jh})$, shows how the effect of the explanatory variable changes by being a man or a woman (it is the differential of the estimated β). This decomposition will allow us to establish how the different behavioral models explain the attitude towards the risk of men and women, in terms of the variables that are significant within them, as well as the marginal contribution of these variables to explain the behavior of the person towards risk.[33]

2.4 Results

The Probit estimation results are shown in Table 1. In the first three columns, the models for risk aversion with certainty, ambiguity, and losses are shown, without including interactions. These models support the hypotheses outlined in the analytical framework: that women are more likely to be highly risk averse, as are people with more years of education, as well as those without partners (significant variable at 10 % only for the model with losses). On the other hand, higher age is associated with a lower risk aversion. The impact effects (EI) on the probability of having high risk aversion (equation 2 without the interaction effect), are observed in Table 2.A, and show that being a woman increases the probability of being risk averse between 6 and 12 percentage points (pp), while each additional year of education increases the probability around 1 pp, and having a partner increases this probability by 4 pp in the loss model. Likewise, an additional year of life reduces probability of risk aversion by 0.3 pp. Also, when moving from a situation with certainty towards ambiguity and loss (columns 2 and 3 of Table 2.A), the impact effects of the sex variable are larger in absolute value. This allows us to verify that the gender gap widens under such situations, as suggested in the above analytical framework. Other significant variables are the

[33] In all cases, the procedure compares the resulting β in each model, as well as the joint contributions by groups of factors, through statistical equality tests. The details of the tests can be found in Yun (2005), page 300.

number of years that a person has lived in the same city, their identification as racially white, and their ownership of the house they live (only in the loss model), all of which makes them more risk averse; likewise, belonging to a high socioeconomic group reduces risk aversion in the model with certainty.

The columns (4), (5), and (6) of Table 1 present the models with the three proposed interactions[34]: Sex*Age, Sex*Education, and Sex*Marital Status. In the risk model with certainty the first two are significant, while the variables individually (age, education, and marital status) are not. This leads us to conclude that age and education are statistically significant variables to explain the risk aversion of a woman, and with the signs proposed from the analytical framework: negative with age and positive with education. For risk with ambiguity model, only the Sex*Education interaction is significant, with a positive sign and significance of 5%, while for risk with loss model, the only significant interaction is Sex*Age (in both cases the individual variables age and education cease being significant), with the same conclusions for the model with certainty; the sex variable continues to be significant at 1% only in the loss model. If we analyze the impact effects of these models (Table 2. B), the effect of the sex variable implies an increase of 34 pp in the probability of being highly risk averse (in the loss model). Differentiating the effects of other variables of interest according to the sex of the person, they are only significant for women, with signs and dimensions similar to the average effects of the model without interactions. That is to say, the effects of these variables of interest in the model for an average individual could be attributed to the risk-facing behavior of the women in the sample.

To clarify doubts that arise about the relationship between education and risk aversion, some variants of the models are proposed in Annex 2. First of all, we include the variable education years in level and in quadratic form, in order to verify if the positive relationship previously found is linear or not.[35] As can be seen, in the three models (columns 1, 2, and 3 of Table A2.1), the level and square of the years of education are significant, with the first sign positive and the second sign negative. That is to say, the higher the level of education the greater the person's risk aversion, but this increase becomes smaller and smaller, to the point that this relationship becomes negative.

[34] Although in all the estimated equations the probability of accepting the null hypothesis of the likelihood ratio test (LR Test) is 0 (indicating the model has a good fit), it can be verified that in the specifications with interactions, the distance of the value of the log likelihood function between the complete model and that with only the constant is greater, allowing us to conclude that this specification has a better fit than that without interactions.

[35] Other possible nonlinearities could be conceived of, for example, the relationship between risk aversion and age. However, when the squared age is included in the models in Table 1, it is never significant, while the rest of the results, including those for the variable Age, remain the same.

Table 1: Probit Results

	(1)	(2)	(3)	(4)	(5)	(6)
	(1=high, 0=low)					
	Risk certainty	Risk ambiguity	Risk losses	Risk certainty	Risk ambiguity	Risk losses
Sex (woman)	0.1748***	0.2254***	0.3075***	-0.0926	-0.0108	0.8706***
	(0.050)	(0.054)	(0.051)	(0.229)	(0.273)	(0.256)
Age	-0.0086***	-0.0094***	-0.0097***	-0.0027	-0.0055	-0.0022
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Race (white)	0.0702	0.0279	0.1821***	0.0721	0.0275	0.1793***
	(0.053)	(0.066)	(0.064)	(0.053)	(0.065)	(0.064)
Marital status (with partner)	-0.0151	0.0280	0.0978*	-0.0338	-0.0355	0.1113
	(0.062)	(0.054)	(0.055)	(0.099)	(0.094)	(0.092)
Education	0.0355***	0.0364***	0.0230**	0.0009	0.0139	0.0191
	(0.011)	(0.010)	(0.011)	(0.014)	(0.014)	(0.014)
Sex*Age				-0.0102**	-0.0061	-0.0144***
				(0.004)	(0.005)	(0.004)
Sex*Marital Status				-0.0333	0.0714	-0.0877
				(0.119)	(0.122)	(0.107)
Sex*Education				0.0568***	0.0370**	0.0011
				(0.015)	(0.017)	(0.015)
Middle socioeconomic status	-0.0831	-0.1031	-0.0166	-0.0790	-0.1012	-0.0135
	(0.066)	(0.070)	(0.069)	(0.068)	(0.070)	(0.068)
High socioeconomic status	-0.2625***	-0.0895	-0.0212	-0.2555***	-0.0829	-0.0092
	(0.091)	(0.087)	(0.087)	(0.093)	(0.088)	(0.087)
Years living in the city	0.0015*	0.0007	0.0016**	0.0015*	0.0006	0.0017**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Homeowner	0.0229	0.0427	0.1118*	0.0307	0.0455	0.1200**
	(0.059)	(0.058)	(0.060)	(0.060)	(0.058)	(0.061)
Employed	-0.0631	-0.0713	-0.0255	-0.0833	-0.0765	-0.0372
	(0.056)	(0.056)	(0.059)	(0.056)	(0.057)	(0.058)
Participation in trust game	-0.1965*	-0.1639	-0.0951	-0.1835*	-0.1565	-0.0871
	(0.106)	(0.104)	(0.092)	(0.106)	(0.104)	(0.093)
Participated in voluntary contribution game	0.1011	0.0550	0.0547	0.1054	0.0583	0.0605
	(0.072)	(0.067)	(0.056)	(0.073)	(0.067)	(0.057)
Participated in shared risk game	0.0779	0.1146*	0.0242	0.0774	0.1138*	0.0174
	(0.061)	(0.060)	(0.052)	(0.062)	(0.060)	(0.052)
Constant	0.9249***	0.3696**	0.2423*	1.0174***	0.4645**	-0.0959
	(0.143)	(0.147)	(0.142)	(0.187)	(0.183)	(0.190)
Observations	3,000	2,959	3,035	3,000	2,959	3,035
Pseudo R-squared	0.0903	0.0825	0.0883	0.0977	0.0853	0.0932
Log likelihood	-1637	-1579	-1887	-1624	-1574	-1877
Log likelihood (Constant)	-1799	-1721	-2070	-1799	-1721	-2070
LR Test (Chi2)	325.05	283.78	365.53	351.45	293.42	385.99
Prob > Chi2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Robust standard errors in parenthesis

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

Table 2: Effects Impact on Risk Aversion (in percentage points)

A. Model without interaction			
Variables	Risk with certainty (1)	Risk with ambiguity (2)	Risk with loss (3)
Sex	0.0575***	0.0713***	0.1201***
	(0.016)	(0.017)	(0.020)
Age	-0.0028***	-0.0030***	-0.0038***
	(0.001)	(0.001)	(0.001)
Marital status	-0.0050	0.0089	0.0382*
	(0.020)	(0.017)	(0.021)
Years of education	0.0117***	0.0115***	0.0090**
	(0.004)	(0.003)	(0.004)
Observations	3,000	2,959	3,035

B. **Model with interactions**						
Variables	Risk with certainty (1)		Risk with ambiguity (2)		Risk with loss (3)	
Sex	-0.0303		-0.0034		0.3396***	
	(0.075)		(0.086)		(0.100)	
	Man	Woman	Man	Woman	Man	Woman
Age	-0.0009	-0.0040***	-0.0019	-0.0034***	-0.0009	-0.0063***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Marital status	-0.0116	-0.0209	-0.012	0.0106	0.0442	0.0090
	(0.034)	(0.024)	(0.032)	(0.021)	(0.037)	(0.025)
Years of education	0.0003	0.0179***	0.0047	0.0150***	0.0076	0.0077*
	(0.005)	(0.004)	(0.004)	(0.003)	(0.006)	(0.005)
Observations	3,000		2,959		3,035	

Standard error in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

The rest of the results are very similar to those in Table 1. Additionally, when we incorporate the three multiplicative variables proposed (columns 4, 5, and 6), the signs and the significance of the estimations are also similar: negative sign for Sex*Age and positive for Sex*Education (the interaction with marital status is not significant). However, in this case, education and its square are still significant, showing a strong relationship between this variable and risk aversion of a person, whatever their sex, although it is intensified for women, as evidenced by the fact that the Sex*Education interaction is significant and positive (except in the case of the loss model).[36]

[36] We also tried to include an interaction between sex and the variable years of education squared. Most of the results remained the same except that the two interactions with the education variable and its square were not significant, while the variable in level and squared continued to be individually significant. This again reinforces the importance of the variable education to explain risk aversion. Whatever the sex of the person, it was found in this new specification that the impact effects of the education variable were only statistically significant for women.

Figure A2.1 of Annex 2 shows that there is statistical evidence that the relationship between risk and years of education is reversed[37] once a person reaches 16 years of education for the model with certainty, 17 years for ambiguity, and 13 years for loss (models with interactions, columns 4, 5, and 6). That is to say, for persons who have attained secondary education and the first years of higher education,[38] it is possible that more education can reduce their risk aversion.[39] These findings coincide with those obtained by Tanaka et al. (2010) and Jung (2014), who find a positive relationship between level of education and risk aversion, but mainly for people with low educational levels. As Jung maintains, this could mean that the *risk management effect* of the education prevails over the *risk knowledge effect*, only when one reaches high levels of education. On the right side of same graph, the results differentiated by sex are observed. We see in panel a) that, faced with a simple risk situation, there is statistical evidence that the relationship reverts first for men; that is, the risk management effect prevails in them 6 years prior than for women.[40] There is a similar occurrence with ambiguity, in which years of education to reach a reversal point increase in all cases. Facing losses, the year of reversal is very similar for both men and women, around 14 years, although whatever their level of education, women are shown to be more risk averse than men.

Finally, the results are shown when the variable Education is instrumentalized (Table A2.2). Column 1 presents the estimate of the first stage, where the instrument used has a positive and significant coefficient at 5%.[41] Then, columns 2, 3, and 4 show the results of the second stage for models without interactions, including the error of the first stage as a regressor. As it is only significant in the risk model with certainty, we will concentrate our attention on this. As shown, most of the variables have the expected sign according to the previous results, specifically, women are more likely to be more risk averse, similar to those people with higher levels of education. On the other hand, age and marital status lose significance. It is also observed that those persons of

[37] This is the point of change of the slope of the relationship, where the derivative is equal to zero. That is to say:

$$\frac{\partial R_i}{\partial Ed_i} = [f(\beta' X_i)][\beta_{Ed} + 2\beta'_{Ed^2} Ed_i + \beta'_{Sex*Ed} Sex_i] = 0$$

Since $f(\beta' X_i)$ cannot be 0, what is equal to this value is the second bracket; from that expression you get the years of education from which the relation between education and risk aversion becomes negative.

[38] It is worth mentioning that in the six cities of the sample, very similar educational structures are verified: 3 years of initial education, 10 of basic education (primary and secondary), and 5 of higher education. As such, a person could have completed higher education after approximately 18 years of study.

[39] It should be noted that 18% of the sample analyzed has accumulated 16 or more years of education, 20% of men and 16% of women. These percentages, being relatively low, reduce the accuracy of calculations at the (two) ends of the distribution.

[40] Given the education level needed for the relationship reversal between risk aversion and education to occur, for the subsample of women (18 years in the model with certainty and 19 years in the ambiguity model) it can be concluded that for women, the reversion is only reached at educational levels that few women reach. In fact, it is possible that the reversion statistically never occurs for women, so that in their case the relationship between risk aversion and education will always be positive.

[41] This result is sufficient proof that it is an appropriate instrument. See Wooldridge (2010), chapter 5, pages 83-86, as well as Wooldridge (2015), for the case of Control Function methodology.

higher socioeconomic status, those who are homeowners, and those who are employed, reduce their risk aversion. Referencing Table A2.3, we conclude that the effect of education is intensified when the variable is instrumentalized: for each year of education, the probability of being more risk averse increases by 16 pp, while the EI of sex remains the same as in the previous specifications (around 5 pp).

In columns 5, 6, and 7 the models with the interactions are shown. In all three cases, the error of the first stage is significant, adequately correcting for endogeneity of the variable Education. We see that these results are very similar to those of the specifications without instrumentalizing: the interactions are significant and have the expected signs that were proposed in the theoretical framework. At the same time, the sex variable loses significance, except in the loss model, as previously confirmed. Education remains statistically positive, confirming that persons with more years of education are more likely to be risk averse, regardless of their sex. The significance and signs of the two interactions, Sex*Education and Sex*Age, confirm that the effects are intensified in the case of women, for whom higher age reduces the probability of being more risk averse, while more education increases this probability. Once again, the EI shows that when education is instrumentalized, its impact on the probability of being averse to risk increases,[42] and it is significant, only for women, in models with ambiguity and loss.

We now turn to the results of the Blinder-Oaxaca decomposition in the models of the three risk variables utilized. They are presented in Table 3 (simple risk), and in Table A3 (risk with ambiguity and with losses) of Annex 3. In Table 3, the difference (0.1594) in the level of risk between men and women is significant at 5% and shows that women are more risk averse (they have a higher $\overline{R'}_i$ value according to the equation 3 and 4). The decomposition of the factors that explain this result show that differences in initial endowments or tangible characteristics tend to equal the degree of risk aversion between men and women (they have a positive sign), while the valuation or differential impact of these aspects (the estimated β), would be those that enlarge the gender difference.

The most important variables among endowments are age and education, both of which reduce the risk aversion gap between men and women. In the first case, because the women in the sample are older on average than men, and since the β of this variable is negative, it is women's

[42] This increase in EI may be due to the fact that instrumentalization eliminates the double causality between education and risk aversion. If we assume that higher education increases risk aversion (Jung, 2015) and we can also verify, that someone who is more risk averse tends to seek lower levels of education (see, for example, Outreville (2015) and Breen et al. (2014)), then, if not controlled by this second causality direction, the estimated regression with risk aversion as a dependent could underestimate the effect of education, since it would be biased (downwards) by the second (negative) causality relationship. Likewise, this would explain the negative sign of the error of the first stage in the main equations (or second stages).

risk aversion which is reduced compared to that of the men. Education also decreases that gap because the associated β is positive (more education, greater risk aversion), and on average women have fewer years of education.

In terms of differential coefficients, again the individual factors that are significant are age and education. The first factor, age, reduces the abovementioned gap, because the effect of negative age for men and women is greater (in absolute value) in the case of women.[43] Additionally, this result coincides with the findings in the previous section, when we used regressions with interactions.[44] Education is the variable that seems to explain much of the gender gap, since the sign of β is different in the equations for men and women. When a person is more educated, in the case of women they are more risk averse, while for men they are less risk averse. That is to say, for women, the risk knowledge effect prevails, while for men, the risk management effect prevails. This could reflect differences in the education that people of different sex receive in the cities analyzed, which has influenced their characteristics and preferences: it is possible that the educational institutions based in those cities foster and instill more conservative characteristics in their female students.[45]

For the other two models, the aggregate results are similar in many respects. The difference is significant, showing that women are more risk averse, and this gap increases with respect to risk with certainty, until reaching 0.2780 in the case of risk with losses, in the same way that was verified with the regression analysis presented above (where the IE of sex becomes more pronounced for the ambiguity and loss models respect to the simple risk model). Also, the endowments factor reduces the gap, while the coefficient factor increases it.

In regard to endowments and the cases with ambiguity and loss, age and education are significant factors, with the same explanations proposed for simple risk. Additionally, in the loss model, marital status also contributes to increasing the gap between men and women, given that it has a positive sign in both models, and that a greater proportion of women in the sample have partners than men. Regarding the differential of coefficients, a new significant factor appears: a person's occupation. Being employed increases the gap in both models because the sign of β is

[43] See section 2.3.1.1, about the Risk Aversion Model in the Life Cycle, where it was stated that the effect of an increase in age on risk tolerance should be greater among women.

[44] Note that in Table 1 (columns 4 and 6), the Sex*Age interaction is significant and negative, indicating that for women, risk aversion decreases with age, while for men the effect is null.

[45] Irwin and Millstein (1991), suggest that the gender gap in risk aversion can be explained by social factors that influence men and women differently, such as maturity, self-esteem, the influence of peers and family members, values and beliefs, among others. Wigfield and Eccles (1993) argue that the gap is partly explained by the fact that men and women manifest different expectations and values, especially in the face of changing environments they experience when they are attending formal education. Finally, according to Byrnes (1998), an apparent source of gender gap in risk aversion may be the double standards employed in the upbringing that men and women receive outside and inside the home, according to which, more rules and restrictions are imposed on women.

different in men and women, as women who work outside the home are more risk averse, while men who do are less risk averse.[46] This situation could be explained by women's lack of experience in the labor market,[47] which leads them to behave more cautiously than their male peers, even when women have the same educational and professional qualification as men.[48]

Finally, in the case of risk with losses, another element that contributes to increase the gender gap in risk aversion due to the differential of coefficients, are the unobservable variables that the constant represents. This demonstrates that there are several factors that cannot be captured by the estimation, because they cannot be identified, which makes it appear that women are more risk averse than men. As such, we can consider various factors discussed by Bajtelsmit and Bernasek (1996), and Grable and Lytton (1998), such as the possible discrimination against women or the approach to the gender of a given culture (or city), which may condition people's risk preferences.

[46] This same result can be confirmed using the first empirical strategy. If in the models of Table 1 we add the interaction Sex*Occupation, for the loss model, its sign will be positive, while that of the Occupation variable will be negative. When making the corresponding calculations, it is confirmed that for men, their being occupied has a negative relationship with the risk aversion, while in the case of women, the sum of the coefficients of Occupation and Sex*Occupation is positive, indicating that women who are employed in the labor market are more risk averse.

[47] As stated by the World Economic Forum (2016), improvements in women's education levels have not always translated into economic gains for women because, although there is increasing equity in professional employment between men and women, the latter still hold only one third of the positions of responsibility. Likewise, in many countries, women have limited access to financial services, either due to restrictive regulations or because they do not meet the minimum assets or collateral requirements to qualify for such services, which may limit their business and professional development.

[48] Townsed (1996) reports, analyzing a 1995 survey of the NGO Catalyst, that more than half of the female executives interviewed considered male stereotypes as a key factor preventing their promotion at work. For these interviewees, male stereotypical conduct impeded women's improved work experiences (in years and quality of the activities they performed), which perpetuated women's greater risk aversion.

Table 3: Blinder-Oaxaca decomposition for risk aversion with certainty

Full model				
Man	4.1229***			
	(0.052)			
Woman	4.2822***			
	(0.045)			
Difference	-0.1594**			
	(0.062)			
Explained	0.0470**			
	(0.022)			
Not explained	-0.2063***			
	(0.067)			
Endowments	Coefficient	X_i man	X_i woman	β woman
	(1)	(2)	(3)	(4)
Age	0.0396***	35.221	38.920	-0.011
	(0.012)			
Race (white)	-0.0050	0.538	0.572	0.149
	(0.004)			
Marital status (with partner)	-0.0008	0.429	0.500	0.010
	(0.006)			
Education	0.0224**	12.081	11.570	0.044
	(0.010)			
Middle socioeconomic status	0.0005	0.342	0.353	-0.043
	(0.001)			
High socioeconomic status	-0.0051	0.272	0.244	-0.176
	(0.004)			
Years living in the city	0.0038	64.926	62.711	0.002
	(0.003)			
Homeowner	-0.0006	0.687	0.653	-0.017
	(0.003)			
Employed	-0.0059	0.682	0.499	-0.032
	(0.013)			
Participation in trust game	-0.0007	0.449	0.445	-0.150
	(0.002)			
Participated in voluntary contribution game	0.0008	0.235	0.247	-0.063
	(0.001)			
Participated in shared risk game	-0.0021	0.452	0.498	0.046
	(0.004)			
Coefficients	Coefficient	β man	β woman	X_i man
	(1)	(2)	(3)	(4)
Age	0.3073*	-0.002	-0.012	35.221
	(0.165)			
Race (white)	-0.0327	0.088	0.149	0.538
	(0.065)			
Marital status (with partner)	-0.0315	-0.063	0.010	0.429
	(0.060)			
Education	-0.7950***	-0.022	0.044	12.081
	(0.204)			
Middle socioeconomic status	0.0393	0.073	-0.043	0.342
	(0.049)			
High socioeconomic status	0.0319	-0.059	-0.176	0.272
	(0.041)			
Years living in the city	-0.1084	0.0001	0.0017	64.925

	(0.091)			
Homeowner	0.1162	0.152	-0.017	0.687
	(0.079)			
Employed	-0.0541	-0.112	-0.032	0.682
	(0.077)			
Participation in trust game	-0.0408	-0.241	-0.150	0.449
	(0.106)			
Participated in voluntary contribution game	0.0464	0.135	-0.063	0.235
	(0.030)			
Participated in shared risk game	0.0112	0.071	0.046	0.452
Age	(0.054)			
	0.3041	4.441	4.137	1
	(0.268)			
Observations	3,034			

Robust standard error in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

2.5 Conclusions

Understanding how actors make decisions when faced with risky situations is critical for identifying which variables to address in order to change behavior, specifically those related to professional and business decisions. Based on various models of risk aversion that incorporate life cycle, the accumulation of human capital, and differences in preferences, and analyzing data from six cities in Latin America, this paper has examined how gender influences the way in which socioeconomic characteristics of people affect their degree of risk aversion. To accomplish this, we drew upon Risk Games laboratory experiments from Cárdenas et al. (2013).

Two empirical strategies were used: regression analysis with binomial nonlinear models, in which interactions were incorporated, and the Blinder-Oaxaca decomposition, to identify if there were different behavioral equations for risk aversion for people of different sexes.

The results obtained from our analysis allow us to conclude that women have a higher degree of risk aversion. The first empirical strategy also showed that there are certain differences between men and women, as it was found that age and education mainly impacted the degree of risk aversion of women, with aversion increasing with education and reducing with age. The incorporation of non-linearity in the education variable, and its instrumentalization to control for possible endogeneity, showed that the impact of education is important, regardless of the sex of the person; the significance and direction of signs of the interactions confirmed that the effects intensified in the case of women.

The Blinder-Oaxaca technique showed that it is the differential impacts of the characteristics of the individual that account for the gender gap in risk aversion. Three key factors are education, the occupation of the person, and unobservable aspects. Regarding education, it was

found that, unlike men, more educated women were more risk averse, showing that for women, the risk knowledge effect was prevalent. This could be the result of an education system that has assigned them a more conservative role in society. Meanwhile, women working outside the home were found to be more risk averse than men working in the same condition. This is possibly due to women's lack of labor experience, which has led them to behave more cautiously, even when they have attained the same level of education and professional status as their male counterparts. Finally, there were several factors, which could not be captured by the estimation, which have caused women to appear more risk averse, such as discrimination or gender norms that shape and constrain the cultural realities of the cities analyzed.

Much of the data presented here suggest that the main differences between men and women when facing risk issues, and certainly in preferences in general, is influenced by the context in which they develop from birth, which strongly conditions the roles they play in society. This notion is supported by the results presented previously in this paper, which observed the relevance of the variables linked to the education of a person and their presence in the labor market. So, if there is interest in modifying behaviors towards risk aversion in the professional and labor fields, especially women's approaches towards risks, in order to achieve better business related success, various broad structural changes must be enacted. To begin, there needs to be changes in the educational philosophies and practices in schools so that young people of both sexes receive adequate training and preparation, so they can both pursue equal labor opportunities. Also, another focal point should be addressing the observed logic in the labor market, which often does not place equal value on the work done by women, as compared to men. In response, salary scales and job promotions should be based on worker productivity, educational level, and work experience, irrespective of the gender of the employee. Finally, the cultural norms and stereotypes that are reproduced and reinforced within the household, where women almost always carry out the majority of household chores as well as a disproportionate amount of domestic care work, restricts and impedes women's ability to advance their professional careers at the same pace as their male counterparts. In light of this reality, domestic duties should be distributed more equitably among all household members, while households should be able to rely on state-provided social services to support family and personal care.

Still, there are areas of analysis that would be fruitful to explore in future research. One of the most important topics would be analyzing the differences in the results according to the city where the study was conducted and the historical, cultural, and political legacies that characterize them. This study could explore not only which people, from what city of origin, are on average more risk averse, but also if there are different gender gaps linked to their city's cultural and

political behavior. Also, researchers could seek to identify whether the dimensions of the impacts of different explanatory variables change, and the differences between men and women that capture the interactions included in the models according to the city that is analyzed. Alternately, other specifications could be considered, like other non-linearities, new interactions that seek to test changes in the impacts of additional explanatory variables, such as the occupation of the person, the type of occupational activity performed and their associated risks, or their standard of living. Additionally, alternative procedures of Blinder-Oaxaca Decomposition (e.g. three fold) could be pursued, or the estimation of other methods of decomposition, such as that developed by Ñopo (2007).

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2.7 Appendices

APPENDIX 1: DESCRIPTION OF VARIABLES

Table A1.1: Descriptive statistics of the variables

Variable	Description	Mean	Stan. Dev.
R. certainty	Degree of risk aversion (1=high 0=low)	0.71	0.45
R. ambiguity	Degree of risk aversion to ambiguity (1=high 0=low)	0.74	0.44
R. loss	Degree of risk aversion to losses (1=high 0=low)	0.57	0.49
Sex	Sex of participant (1=woman 0=man)	0.56	0.50
Age	Age of participant (in years)	37.27	14.57
Race	Race (1=white 0=indigenous/*mestizo*/black/afro)	0.56	0.50
Marital Status	Marital status (1=married/cohabitating 0=single/widowed/separated)	0.47	0.50
Education	Years of education	11.78	3.68
Employment	Currently employed (1=Yes 0=No)	0.70	0.46
Low socioeconomic status	Low socioeconomic status (1=Yes 0=No)	0.40	0.49
Middle socioeconomic status	Middle socioeconomic status (1=Yes 0=No)	0.35	0.48
High socioeconomic status	High socioeconomic status (1=Yes 0=No)	0.26	0.44
Years living in the city	Years living in the city X	29.42	15.88
Homeowner	Owner of your home (1=Yes 0=No)	0.66	0.47
Participation in trust game	Delivery from player 1 to player 2, in trust game (in %)	0.45	0.28
Participated in shared risk game	Participated in shared risk game (1=Yes 0=No)	0.48	0.50
Participated in voluntary contribution game	Participated in voluntary contribution game (1=Yes 0=No)	0.24	0.43

Source: Candelo, N. et al. (2007)
Prepared by author

Table A1.2: Correlation Matrix

	Participation in trust game	Participated in voluntary contribution game	R. Simple	R. ambiguity	R. loss	Participated in shared risk game	Sex	Age	Race	Marital Status	Education	Employment	Low socioeconomic status	Middle socioeconomic status	High socioeconomic status	Years living in the city
Participation in trust game	**1**															
Participated in voluntary contribution game	0.1016*	1														
R. Simple	-0.0266	0.0016	1													
R. ambiguity	-0.0339	-0.0026	0.4951*	1												
R. loss	-0.0213	-0.0069	0.3198*	0.3312*	1											
Participated in shared risk game	0.0866*	0.2825*	0.0069	0.0188	-0.0038	1										
Sex	-0.0056	0.0173	0.0469*	0.0664*	0.0838*	0.0477*	1									
Age	0.02	0.1160*	-0.0873*	-0.0858*	-0.0953*	0.1321*	0.1276*	1								
Race	0.0007	-0.0176	0.0314	0.007	0.0435*	0.0473*	0.031	0.1270*	1							
Marital Status	0.0334	0.0286	-0.0223	-0.0156	0.0052	0.0467*	0.0666*	0.3033*	0.0055	1						
Education	0.0793*	0.002	0.0805*	0.0695*	0.0816*	0.0105	0.0641*	0.1437*	0.0546*	-0.0602*	1					
Employment	0.0314	-0.0137	-0.0013	-0.0241	-0.0282	0.0007	0.1702*	-0.0056	0.0477*	0.0122	0.1271*	1				
Low socioeconomic status	-0.0653*	-0.0082	0.0143	0.019	0.0018	-0.0098	0.0189	-0.0324	0.1414*	0.0466*	-0.3879*	-0.0089	1			
Middle socioeconomic status	0.0414*	-0.0099	0.0037	-0.0227	0.0022	0.0058	0.009	0.0161	0.0265	-0.0109	0.0870*	-0.003	-0.5918*	1		
High socioeconomic status	0.028	0.0199	-0.02	0.0035	-0.0044	0.0046	-0.031	0.0188	0.1295*	-0.0404*	0.3396*	0.0133	-0.4739*	-0.4294*	1	
Years living in the city	0.005	0.0077	0.0417*	0.0152	0.0467*	-0.0089	-0.0288	0.0389*	0.0706*	-0.0254	0.1285*	0.0724*	0.032	-0.0807*	0.0523*	1
Homeowner	0.0338	0.0152	0.0159	0.0053	0.0453*	0.0206	-0.0347	0.0599*	0.0801*	-0.0235	0.1461*	-0.0473*	-0.0756*	-0.0299	0.1175*	0.1898*

Source: Candelo, N. et al. (2007)
Prepared by author.

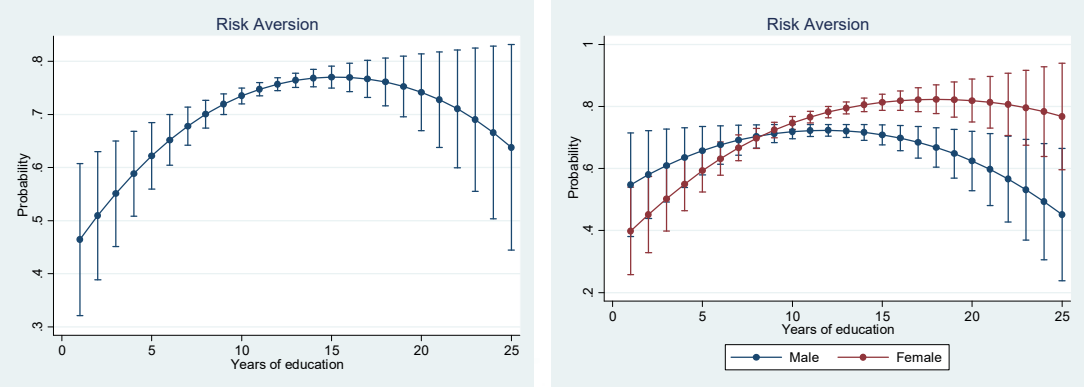
APPENDIX 2: ESTIMATIONS WITH ALTERNATIVE EDUCATION SPECIFICATION

Table A2.1: Quadratic specification

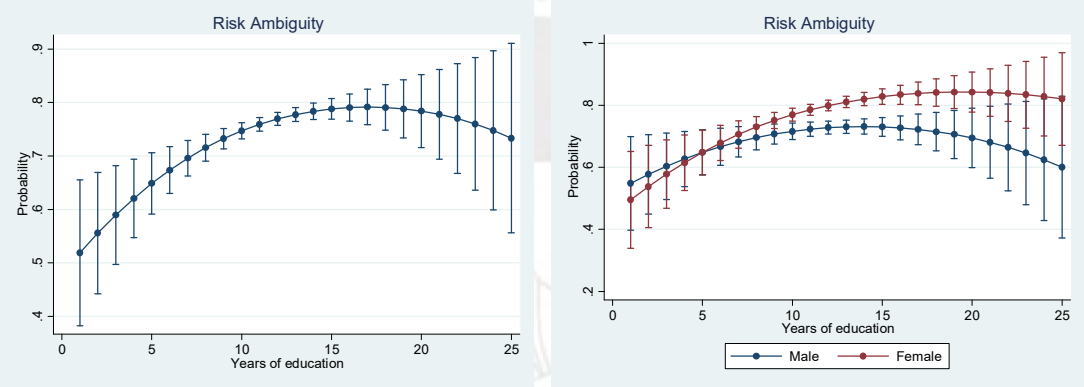
	(1)	(2)	(3)	(4)	(5)	(6)
	(1=high, 0=low)					
	Risk certainty	Risk ambiguity	Risk losses	Risk certainty	Risk ambiguity	Risk losses
Sex (woman)	0.1764***	0.2268***	0.3097***	-0.0173	0.0414	0.9645***
	(0.050)	(0.054)	(0.051)	(0.225)	(0.270)	(0.259)
Age	-0.0073***	-0.0084***	-0.0081***	-0.0016	-0.0046	-0.0006
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Race (white)	0.0606	0.0211	0.1731***	0.0633	0.0209	0.1701***
	(0.054)	(0.066)	(0.065)	(0.054)	(0.066)	(0.064)
Marital status (with partner)	-0.0268	0.0199	0.0878	-0.0364	-0.0391	0.1103
	(0.062)	(0.054)	(0.055)	(0.099)	(0.094)	(0.092)
Education	0.1398***	0.1120***	0.1429***	0.0960***	0.0828**	0.1474***
	(0.034)	(0.034)	(0.038)	(0.037)	(0.035)	(0.038)
Education squared	-0.0046***	-0.0034**	-0.0052***	-0.0041***	-0.0030**	-0.0054***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Sex*Age				-0.0104**	-0.0063	-0.0146***
				(0.004)	(0.005)	(0.004)
Sex*Marital status				-0.0444	0.0661	-0.1037
				(0.120)	(0.123)	(0.108)
Sex*Education				0.0512***	0.0332**	-0.0053
				(0.015)	(0.016)	(0.015)
Middle socioeconomic status	-0.0891	-0.1075	-0.0255	-0.0838	-0.1050	-0.0228
	(0.066)	(0.070)	(0.069)	(0.068)	(0.071)	(0.068)
High socioeconomic status	-0.2488***	-0.0798	-0.0081	-0.2433***	-0.0746	0.0041
	(0.092)	(0.087)	(0.087)	(0.094)	(0.087)	(0.087)
Years living in the city	0.0015*	0.0006	0.0016**	0.0015*	0.0006	0.0016**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Homeowner	0.0194	0.0398	0.1081*	0.0282	0.0434	0.1168*
	(0.059)	(0.058)	(0.060)	(0.060)	(0.058)	(0.061)
Employment	-0.0501	-0.0624	-0.0123	-0.0717	-0.0682	-0.0236
	(0.056)	(0.056)	(0.059)	(0.056)	(0.056)	(0.059)
Participation in trust game	-0.1991*	-0.1668	-0.0978	-0.1863*	-0.1595	-0.0906
	(0.106)	(0.104)	(0.092)	(0.107)	(0.104)	(0.093)
Participated in voluntary contribution game	0.0965	0.0516	0.0518	0.1008	0.0549	0.0580
	(0.072)	(0.066)	(0.056)	(0.073)	(0.067)	(0.057)
Participated in shared risk game	0.0859	0.1199**	0.0315	0.0842	0.1186**	0.0246
	(0.061)	(0.060)	(0.051)	(0.062)	(0.060)	(0.052)
Constant	0.4279**	-0.0067	-0.3550	0.5324**	0.1052	-0.7613***
	(0.214)	(0.225)	(0.240)	(0.254)	(0.245)	(0.270)
Observations	3,000	2,959	3,035	3,000	2,959	3,035
Pseudo R-squared	0.0934	0.0841	0.0919	0.100	0.0865	0.0970
Log likelihood	-1631	-1576	-1880	-1619	-1572	-1869
Log likelihood (Constant)	-1799	-1721	-2070	-1799	-1721	-2070
LR Test (Chi2)	351.45	293.42	385.99	359.87	298.10	401.90
Prob > Chi2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Graphic A2.1: Quadratic relationship between education and risk aversion

Panel a)



Panel b)



Panel c)

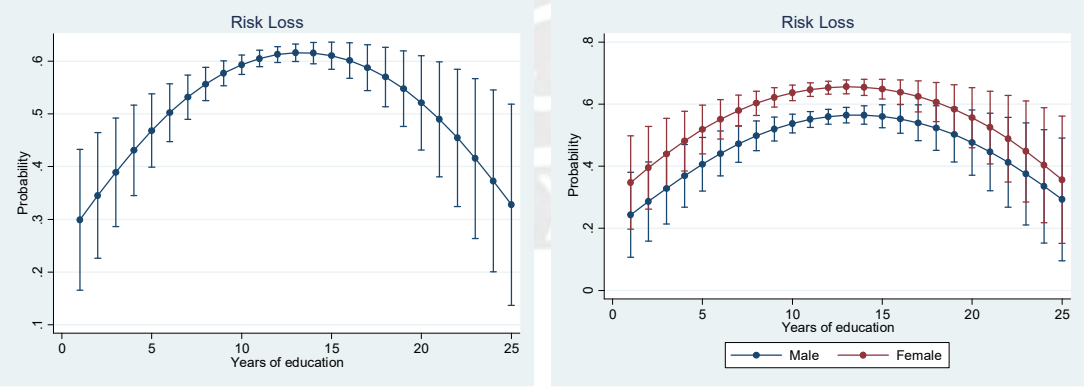


Table A2.2: Instrumentalization of Education

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		(1=high, 0=low)					
	First Stage (Years of education)	Risk certainty	Risk ambiguity	Risk losses	Risk certainty	Risk ambiguity	Risk losses
Sex (women)	0.1411	0.1602***	0.2160***	0.3017***	-0.0818	-0.0051	0.8791***
	(0.128)	(0.049)	(0.054)	(0.051)	(0.228)	(0.274)	(0.254)
Age	-0.0285***	0.0041	-0.0027	-0.0040	0.0139**	0.0030	0.0070
	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Race (white)	0.0275	0.0542	0.0193	0.1751***	0.0518	0.0168	0.1685***
	(0.115)	(0.054)	(0.066)	(0.065)	(0.054)	(0.065)	(0.065)
Marital status (with partner)	0.0499	-0.0369	0.0162	0.0877	-0.0702	-0.0538	0.0906
	(0.124)	(0.062)	(0.054)	(0.056)	(0.098)	(0.093)	(0.091)
Education		0.4832**	0.2728	0.2234	0.5597***	0.3018*	0.3238*
		(0.188)	(0.175)	(0.190)	(0.179)	(0.171)	(0.183)
Sex*Age					-0.0116***	-0.0068	-0.0151***
					(0.004)	(0.005)	(0.004)
Sex*Marital status					-0.0237	0.0752	-0.0821
					(0.119)	(0.122)	(0.107)
Sex*Education					0.0581***	0.0373**	0.0019
					(0.015)	(0.017)	(0.015)
Middle socioeconomic status	1.8137***	-0.8972***	-0.5327*	-0.3812	-1.0973***	-0.6251**	-0.5685*
	(0.151)	(0.346)	(0.318)	(0.355)	(0.327)	(0.316)	(0.344)
High socioeconomic status	2.9189***	-1.5758***	-0.7836	-0.6095	-1.8973***	-0.9292*	-0.9045*
	(0.250)	(0.553)	(0.513)	(0.563)	(0.524)	(0.508)	(0.544)
Years living in the city	0.0042**	-0.0004	-0.0003	0.0008	-0.0009	-0.0006	0.0004
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Homeowner	0.4786***	-0.1944*	-0.0722	0.0143	-0.2405**	-0.0943	-0.0282
	(0.112)	(0.104)	(0.101)	(0.105)	(0.104)	(0.101)	(0.104)
Employment	0.7734***	-0.4165***	-0.2591*	-0.1839	-0.5256***	-0.3054**	-0.2785*
	(0.117)	(0.158)	(0.149)	(0.157)	(0.151)	(0.151)	(0.151)
Participation in trust game	0.3754*	-0.3670***	-0.2534**	-0.1708	-0.3961***	-0.2654**	-0.2019*
	(0.196)	(0.121)	(0.113)	(0.113)	(0.119)	(0.113)	(0.112)
Participated in voluntary contribution game	-0.0816	0.1402**	0.0752	0.0723	0.1545**	0.0830	0.0875
	(0.148)	(0.071)	(0.068)	(0.060)	(0.072)	(0.069)	(0.060)
Participated in shared risk game	-0.0031	0.0771	0.1143*	0.0229	0.0759	0.1131*	0.0151
	(0.145)	(0.061)	(0.060)	(0.052)	(0.062)	(0.061)	(0.052)
Instrument	0.3442**						
	(0.155)						
Error		-0.4488**	-0.2370	-0.2010	-0.5613***	-0.2891*	-0.3060*
		(0.190)	(0.176)	(0.192)	(0.180)	(0.175)	(0.184)
Constant	4.0013**	-2.6548*	-1.5251	-1.3669	-3.4699**	-1.8540	-2.5589*
	(1.824)	(1.513)	(1.419)	(1.536)	(1.445)	(1.395)	(1.496)
Observations	3036	3,000	2,959	3,035	3,000	2,959	3,035
Pseudo R-squared	0.480	0.0918	0.0829	0.0886	0.0999	0.0859	0.0939
Log likelihood	-7267	-1634	-1578	-1886	-1619	-1573	-1875
Log likelihood (Constant)	-8258	-1799	-1721	-2070	-1799	-1721	-2070
LR Test (Chi2)	1983.65	330.43	285.23	366.73	359.65	295.54	388.69
Prob > Chi2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Table A2.3: The education models instrumentalized

A. Models without interactions						
VARIABLES	Risk with certainty (1)		Risk with ambiguity (2)		Risk with loss (3)	
Sex	0.0526***		0.0683***		0.1178***	
	(0.016)		(0.017)		(0.020)	
Age	0.0013		-0.0009		-0.0016	
	(0.002)		(0.002)		(0.002)	
Marital status	-0.0121		0.0051		0.0342	
	(0.020)		(0.017)		(0.022)	
Years of education	0.1587**		0.0862		0.0872	
	(0.062)		(0.055)		(0.074)	
Observations	3,000		2,959		3,035	
B. Models with interactions						
Sex	-0.0268		-0.0016		0.3430***	
	(0.075)		(0.086)		(0.099)	
	Man	Women	Man	Women	Man	Women
Age	0.0048**	0.0007	0.0010	-0.0011	0.0028	-0.0031
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Marital	-0.0242	-0.0293	-0.0182	0.0063	0.0360	0.0032
	(0.034)	(0. .024)	(0.031)	(0.021)	(0.036)	(0.026)
Years of education	0.1928***	0.1930***	0.1023	0.1000**	0.1287	0.1237*
	(0.0618)	(0.056)	(0.058)	(0.052)	(0.073)	(0.069)
Observations	3,000		2,959		3,035	

Standard errors in parenthesis

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

APPENDIX 3: BLINDER-OAXACA DECOMPOSITION

Table A3: Risk with ambiguity and losses

Full model	Risk with ambiguity				Risk with loss			
Man	4.2226***				3.6228***			
	(0.054)				(0.058)			
Woman	4.4492***				3.9008***			
	(0.041)				(0.051)			
Difference	-0.2266***				-0.2780***			
	(0.060)				(0.065)			
Explained	0.0504**				0.0989***			
	(0.021)				(0.026)			
Not explained	-0.2769***				-0.3769***			
	(0.063)				(0.067)			
Endowments	Coefficient (1)	X_i man (2)	X_i woman (3)	β woman (4)	Coefficient (1)	X_i man (2)	X_i woman (3)	β woman (4)
Age	0.0340***	35.223	38.920	-0.009	0.0755***	35.223	38.920	-0.020
	(0.012)				(0.017)			
Race (white)	-0.0046	0.538	0.572	0.137	-0.0062	0.538	0.572	0.183
	(0.004)				(0.005)			
Marital status (with partner)	-0.0017	0.429	0.500	0.024	-0.0120*	0.429	0.500	0.168
	(0.005)				(0.007)			
Education	0.0220**	12.083	11.570	0.043	0.0148*	12.083	11.570	0.029
	(0.009)				(0.009)			
Middle socioeconomic status	0.0016	0.342	0.353	-0.140	0.0006	0.341	0.353	-0.053
	(0.003)				(0.002)			
High socioeconomic status	-0.0049	0.272	0.244	-0.172	-0.0040	0.272	0.244	-0.141
	(0.004)				(0.004)			
Years living in the city	0.0011	64.949	62.711	0.0004	0.0074	64.949	62.711	0.003
	(0.002)				(0.006)			
Homeowner	-0.0019	0.686	0.653	-0.057	0.0019	0.686	0.653	0.058
	(0.003)				(0.004)			
Employment	0.0064	0.682	0.499	0.035	0.0177	0.449	0.445	-0.196
	(0.014)				(0.015)			
Participation in trust game	-0.0013	0.449	0.445	-0.306	-0.0008	0.449	0.445	-0.197
	(0.003)				(0.002)			
Participated in voluntary contribution game	0.0012	0.234	0.247	-0.097	0.0003	0.234	0.247	-0.025
	(0.002)				(0.001)			
Participated in shared risk game	-0.0014	0.453	0.498	0.032	0.0036	0.453	0.498	-0.080
	(0.003)				(0.004)			

Coefficients	Coefficient (1)	β man (2)	β woman (3)	X_i man (4)	Coefficient (1)	β man (2)	β woman (3)	X_i man (4)
Age	0.1258	-0.006	-0.009	35.223	0.5602***	-0.005	-0.020	35.223
	(0.163)				(0.198)			
Race (white)	-0.0470	0.048	0.136	0.538	-0.0069	0.170	0.183	0.538
	(0.062)				(0.073)			
Marital status (with partner)	-0.0139	-0.008	0.024	0.429	0.0131	0.199	0.168	0.429
	(0.054)				(0.061)			
Education	-0.5258**	-0.001	0.043	12.083	0.0419	0.032	0.029	12.083
	(0.212)				(0.257)			
Middle socioeconomic status	0.0413	-0.020	-0.140	0.342	0.0343	0.047	-0.053	0.342
	(0.043)				(0.051)			
High socioeconomic status	0.0396	-0.026	-0.172	0.272	-0.0200	-0.214	-0.141	0.272
	(0.035)				(0.048)			
Years living in the city	0.0454	0.001	0.0004	64.949	-0.1298	0.001	0.003	64.949
	(0.094)				(0.110)			
Homeowner	0.1138	0.108	-0.057	0.686	0.1313	0.250	0.058	0.686
	(0.075)				(0.094)			
Employment	-0.1571**	-0.195	0.035	0.682	-0.2579***	-0.281	0.097	0.682
	(0.077)				(0.095)			
Participation in trust game	0.0349	-0.228	-0.306	0.449	0.0696	-0.042	-0.197	0.449
	(0.087)				(0.104)			
Participated in voluntary contribution game	0.0281	0.023	-0.097	0.235	0.0299	0.102	-0.025	0.234
	(0.033)				(0.035)			
Participated in shared risk game	0.1054**	0.264	0.032	0.453	0.0367	0.001	-0.080	0.453
	(0.050)				(0.072)			
Constant	-0.0675	4.380	4.448	1	-0.8793***	3.185	4.064	1
	(0.296)				(0.332)			
Observations	3,035				3,035			

Robust standard errors in parenthesis

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

Conclusions and Recommendations

This section presents the main conclusions and recommendations drawn from the two previous chapters. The first study has sought to establish whether a firm reaps benefits from having women in top management positions, particularly when the owner of the firm and CEO are both women. Recent literature posits that this may be true, as female workers may help mutually strengthen their business skills, which can result in improved firm performance.

To accomplish this, the research presented here drew upon the 2009-2014 World Bank Enterprise Survey, which covers 75,980 manufacturing and service companies, and applied an OLS approach on the pool data of a cross-section of firms between these years. In order to account for endogeneity of the explanatory variables for gender, the CF approach was applied by using the UN GDI and the average fertility rate at the country level as instruments, as these variables comply with the exclusion restrictions.

The results support the hypothesis that a female owner strengthens the business skills of a female CEO, improving the firm's performance compared to when the owner is a man. This shows that a female owner has greater capacity to perceive and strengthen the skills of the women who manage the firm. It was also verified that, on average, female CEOs perform at a lower level than their male counterparts, and that the presence of a female owner improves the situation, but is not capable of reversing the negative results of the firm's performance.

In this sense, it is necessary to make efforts to ensure that equal opportunities are provided for recruiting personnel of both genders to fill positions at different levels within a firm. This would leverage the productivity and commitment of the female workforce to achieve objectives and improve a firm's performance. However, to ensure that equal opportunities exist, both women and men must start on equal ground when competing for a position; thus, it is imperative to close the remaining gender gaps in the labor market.

In the near future, researchers should consider creating a panel structure from the WBES, that although may be difficult to carry out at the company level, could be used in reference to industrial sectors. In this regard, it would allow the testing of differential patterns in the relationship between the gender of those who run a firm and its performance, according to the sector in which the firm operates. Similarly, an analysis by geographic region could be carried out to analyze the strength of the relationship in connection with specific cultural characteristics. However, this differentiation might involve some representativeness

problems, since not all countries have conducted surveys on the same number of companies. Finally, alternative instruments for gender variables of interest, whether included in the database or not, could also be tested to establish a more precise marginal contribution of the explanatory variables.

About the second study, included in the chapter two, understanding how actors make decisions when faced with risky situations is critical for identifying which variables to address in order to change behavior, specifically those related to professional and business decisions. Based on various models of risk aversion that incorporate life cycle, the accumulation of human capital, and differences in preferences, and analyzing data from six cities in Latin America, this study has examined how gender influences the way in which socioeconomic characteristics of people affect their degree of risk aversion. To accomplish this, we drew upon Risk Games laboratory experiments from Cárdenas et al. (2013).

Two empirical strategies were used: regression analysis with binomial nonlinear models, in which interactions were incorporated, and the Blinder-Oaxaca decomposition, to identify if there were different behavioral equations for risk aversion for people of different sexes.

The results obtained from our analysis allow us to conclude that women have a higher degree of risk aversion. The first empirical strategy also showed that there are certain differences between men and women, as it was found that age and education mainly impacted the degree of risk aversion of women, with aversion increasing with education and reducing with age. The incorporation of non-linearity in the education variable, and its instrumentalization to control for possible endogeneity, showed that the impact of education is important, regardless of the sex of the person; the significance and direction of signs of the interactions confirmed that the effects intensified in the case of women.

The Blinder-Oaxaca technique showed that it is the differential impacts of the characteristics of the individual that account for the gender gap in risk aversion. Three key factors are education, the occupation of the person, and unobservable aspects. Regarding education, it was found that, unlike men, more educated women were more risk averse, showing that for women, the risk knowledge effect was prevalent. This could be the result of an education system that has assigned them a more conservative role in society. Meanwhile, women working outside the home were found to be more risk averse than men working in the same condition. This is possibly due to women's lack of labor experience, which has led them to behave more cautiously, even when they have attained the same level of education and professional status as their male counterparts. Finally, there were several

factors, which could not be captured by the estimation, which have caused women to appear more risk averse, such as discrimination or gender norms that shape and constrain the cultural realities of the cities analyzed.

Much of the data presented here suggest that the main differences between men and women when facing risk issues, and certainly in preferences in general, is influenced by the context in which they develop from birth, which strongly conditions the roles they play in society. This notion is supported by the results presented previously in this paper, which observed the relevance of the variables linked to the education of a person and their presence in the labor market. So, if there is interest in modifying behaviors towards risk aversion in the professional and labor fields, especially women's approaches towards risks, in order to achieve better business-related success, various broad structural changes must be enacted. To begin, there needs to be changes in the educational philosophies and practices in schools so that young people of both sexes receive adequate training and preparation, so they can both pursue equal labor opportunities. Also, another focal point should be addressing the observed logic in the labor market, which often does not place equal value on the work done by women, as compared to men. In response, salary scales and job promotions should be based on worker productivity, educational level, and work experience, irrespective of the gender of the employee. Finally, the cultural norms and stereotypes that are reproduced and reinforced within the household, where women almost always carry out the majority of household chores as well as a disproportionate amount of domestic care work, restricts and impedes women's ability to advance their professional careers at the same pace as their male counterparts. In light of this reality, domestic duties should be distributed more equitably among all household members, while households should be able to rely on state-provided social services to support family and personal care.

Still, there are areas of analysis that would be fruitful to explore in future research. One of the most important topics would be analyzing the differences in the results according to the city where the study was conducted and the historical, cultural, and political legacies that characterize them. This study could explore not only which people, from what city of origin, are on average more risk averse, but also if there are different gender gaps linked to their city's cultural and political behavior. Also, researchers could seek to identify whether the dimensions of the impacts of different explanatory variables change, and the differences between men and women that capture the interactions included in the models according to the city that is analyzed. Alternately, other specifications could be considered, like other non-linearities, new interactions that seek to test changes in the impacts of additional

explanatory variables, such as the occupation of the person, the type of occupational activity performed and their associated risks, or their standard of living. Additionally, alternative procedures of Blinder-Oaxaca Decomposition (e.g. three-fold) could be pursued, or the estimation of other methods of decomposition, such as that developed by Ñopo (2007).

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