IDB WORKING PAPER SERIES Nº IDB-WP-848

Gender Gaps in Entrepreneurship and their Macroeconomic Effects in Latin America

Prepared for the Institutions for Development Sector by:

David Cuberes
Marc Teignier

Inter-American Development Bank
Institutions for Development Sector

November 2017

Gender Gaps in Entrepreneurship and their Macroeconomic Effects in Latin America

Prepared for the Institutions for Development Sector by:

David Cuberes*
Marc Teignier**

* Clark University
** Universitat de Barcelona

November 2017

Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

Cuberes, David.
Gender gaps in entrepreneurship and their macroeconomic effects in Latin America / David Cuberes and Marc Teignier.
p. cm. — (IDB Working Paper Series ; 848)
Includes bibliographic references.
1. Businesswomen-Latin America. 2. Businesswomen-Caribbean Area. 3. Women-owned business enterprises-Latin America. 4. Women-owned business enterprises-Caribbean Area. 5. Women in economic development-Latin America. 6. Women in economic development-Caribbean Area. I. Teignier, Marc. II. Inter-American Development Bank. Competitiveness, Technology and Innovation Division. III. Title. IV. Series.
IDB-WP-848

http://www.iadb.org

Gender Gaps in Entrepreneurship and their Macroeconomic Effects in Latin America*

David Cuberes
Clark University

Marc Teignier
Universitat de Barcelona

November 23, 2017

Abstract

This paper studies the aggregate effects of the existing differences between male and female-run firms in Latin America and the Caribbean (LAC). Using data from the World Bank Enterprise Survey and the International Labor Organization (ILO), we show that only about one-fourth of the total firms are run by women and that female-run firms are about three times smaller than male-run firms in LAC. We then extend the theoretical framework in Cuberes and Teignier (2016) to account for these facts and quantify their aggregate effects on productivity and income per capita. In our model, men and women are identical in all aspects except for the fact that some women face barriers to becoming entrepreneurs, which may be a function of their talent. The calibration of our model implies that the barriers that some women face to becoming firm managers depend positively on their managerial talent, which results in female-run firms being smaller than those managed by men in equilibrium. In our baseline simulation, we obtain an output per capita loss due to these gender gaps of 9.4%, all of which is due to misallocation of resources and the resulting fall in aggregate productivity. This loss is 1.3 times larger than the one obtained in a framework where barriers to entrepreneurship were assumed to be independent of talent.

JEL classification numbers: E2, J21, J24, O40.

Keywords: firm-size distribution, entrepreneurship talent, gender inequality, aggregate productivity, span of control technology.

*We wish to thank Matteo Grazzi, Jocelyn Olivari, Janet Stotsky, Phil Keefer, and one anonymous referee. We also thank the participants in the Inter-American Development Bank (IDB) workshop "RESEARCH ON SCIENCE, TECHNOLOGY AND INNOVATION GENDER GAPS AND THEIR ECONOMIC COSTS IN LATIN AMERICA AND THE CARIBBEAN" for their comments and support. This paper is part of the research project "Science, Technology and Innovation Gender Gaps and their Economic Costs in Latin America and the Caribbean," led by the Competitiveness, Technology, and Innovation Division of the IDB and financed by the IDB Gender and Diversity Fund. The information and opinions presented here are entirely those of the authors and do not necessarily reflect the views of the IDB, its Board of Executive Directors, or the countries they represent.

1 Introduction

Gender inequality is present in many socioeconomic indicators around the world in both developed and developing countries. These gaps can be observed in education, earnings, occupation, access to productive inputs, political representation, or bargaining power inside the household, among others.[1] One important aspect of gender inequality in the labor market that has been largely overlooked in the literature is the low presence of women in entrepreneurial activities. In this paper we study this issue for LAC using data from the World Bank Enterprise Survey. In LAC, on average, female-run firms represent only about 25% of the total number of firms and the average firm managed by a woman is about 3 times smaller than firms managed by a man.

We develop a general equilibrium model, based on Cuberes and Teignier (2016), to quantify the aggregate effects of these gender gaps in entrepreneurship. In our theoretical framework, agents are endowed with a random entrepreneurship skill. Based on this skill, they decide to become employers, self-employed, or workers. An employer in this model produces a homogeneous good using a span-of-control technology that combines his or her entrepreneurship skills with capital and workers. In our model, men and women are identical in terms of their managerial skills in the sense that both groups draw their managerial talent from identical distribution functions. However, women are subject to exogenous barriers in their occupational choices, which results in a a fraction of them being excluded from employership. This generates a loss in income per worker because less able managers run firms of sub-optimal size and productivity. Our framework takes these restrictions as given, that is, we focus on explaining their effects instead of their origins. It may be possible, for instance, that some women choose not to participate in the market and, although this hurts the economy's productivity, it enhances their welfare.

To properly determine the magnitude of this aggregate loss, in our framework, it is extremely important to know which type of women are excluded from employership. If the less talented women were the only ones who did not participate, for instance, the aggregate effects would be quantitatively small because they would be running small firms. If it was the most talented ones, on the other hand, the aggregate effects would be larger because they would run the main firms. We address this question comparing the size distribution of male and female managed firms. Since the data indicates that females run smaller firms than males, this implies, through the lens of our model, that the probability that a woman is excluded from employership increases with her talent. In other words, our framework suggests that there is a negative selection of women into entrepreneurship, meaning that the most talented women are the ones that do not participate into this occupation. Admittedly,

[1]See the World Development Report 2012 (World Bank, 2012) for a comprehensive review of these and other gender gaps discussed in the literature.

there could be other important reasons to explain the difference in firms size. For example, it is possible that women face more constraints in accessing capital than men. We do not claim that these types of barriers, which are likely to affect both entry to entrepreneurship and firm size conditional on being an entrepreneur, are less important than the barrier based on skills that we exploit here. We focus on this specific barrier of entry because our data allows us only to identify barriers of entry and not barriers to size and because the model has a very clear testable implication regarding the relationship between the barrier, female's skill, and firm size.

We find that the effects of these employership gender gaps on aggregate and productivity are large. In our baseline simulation, we estimate an 8.9% fall in aggregate output in the short run, when we keep the stock of capital fixed, and 9.4% in the long run, when this stock is also negatively affected. These losses are 1.3 times larger than the ones we would obtain using a model where the exclusion probability was independent of talent. The intuition behind the output loss is as follows: When a woman with very good management skills cannot become an employer, a less skilled man takes her position and becomes the manager of a firm and, as a consequence, the average firm size and output per worker in the economy fall. If more talented women face a higher exclusion probability, the average talent of employers falls even more, which results in a larger loss. We check the sensitivity of the results to some of our assumptions, and we find that the short-run losses are between 5.6% and 11.8%, while the long-run ones are between 6.3% and 12.5%.

To our knowledge, there are very few articles that quantify the macroeconomic effects of gender gaps in the labor market.[2] The ILO provides some estimates of the output costs associated with labor gender gaps in the Middle East and Northern Africa but without proposing any specific theoretical model (ILO, 2014). One shortcoming of that exercise is that it does not allow one to shed light on the mechanisms through which gender gaps in the labor market may affect aggregate efficiency. Cavalcanti and Tavares (2016) construct a growth model based on Galor and Weil (1996) in which there is exogenous wage discrimination against women. Calibrating their model using U.S. data, they find very large effects associated with these wage gaps: a 50% increase in the gender wage gap in their model leads to a decrease in income per capita of a quarter of the original output. Their results also suggest that a large fraction of the actual difference in output per capita between the U.S. and other countries is indeed generated by the presence of gender inequality in wages. Hsieh et al. (2013) use a Roy model to estimate the effect of the changing occupational allocation of white women, black men, and black women between 1960 and 2008 on U.S. economic growth and find that the improved allocation of talent accounts for 17% to 20% of growth

[2]See Cuberes and Teignier (2014) for a critical literature review of the two-directional link between gender inequality and economic growth.

over this period. Finally, in the model summarized in Section 3.1 of this paper, Cuberes and Teignier (2016) calculate the macroeconomic effects of gender inequality in the labor market using data from the ILO for a large sample of countries, including several countries from the LAC region, among them, Chile, Colombia, and Peru. An important difference is that in the present paper we use firm-level data rather than labor aggregates to carry out our analysis. These data allows us to make implications in terms of firm size and selection that were not possible to derive in Cuberes and Teignier (2016). In terms of analyzing firm size by gender in Latin America, Arellano and Peralta (2015) report significant differences in firms size and productivity in Chile but they do not use any theoretical model in their analysis.

The rest of the paper is organized as follows. Section 2 presents the empirical facts, while Section 3 sketches the general equilibrium occupational choice model based on Cuberes and Teignier (2016). The numerical results of the paper are presented and discussed in Sections 4 and 5. Finally, Section 6 concludes.

2 Empirical facts

We start the analysis documenting the existing differences in employership between men and women in the LAC region. First, using data for the latest available year on all the countries in this region from the ILO (KILM, 8th edition) on employers by gender, we find that women are clearly underrepresented in employership.[3] As we can see in Table 1, the share of female employers in the population is less than one-third the male share, which is significantly lower than the fraction of women who are self-employed or workers.

Table 1: Female-to-male ratios by occupation (Data source: ILO KILM, 8th edition)

	Employers	**Self-Employed**	**Workers**
LAC	0.31	0.60	0.76

We then compute the size distribution of firms with male and female top managers in LAC using from the World Bank Enterprise Survey for 2010.[4] The World Bank Enterprise Survey is a firm-level survey of a representative sample of an economy's private sector conducted for a large set of countries.[5] For the LAC region, it contains information for 13,855

[3] http://kilm.ilo.org

[4] http://www.enterprise surveys.org/

[5] The Enterprise Survey is answered, in most cases, by business owners and top managers. Typically 1200-1800 interviews are conducted in larger economies, 360 interviews are conducted in medium-sized economies and for smaller economies 150 interviews take place. The manufacturing and services sectors are the primary business sectors of interest. This corresponds to firms classified with ISIC codes 15-37, 45, 50-52, 55, 60-64, and

firms, with sizes between 1 and 21,955 employees, and from 26 different countries.[6] In order to count the number of firms with female managers we use the question b7a: *"Is the top manager a female?"*. Another possibility would be to use the question b4a: *"What percentage of the firm is owned by females?"*. The first problem with this second proxy is that, in many cases, this percentage is greater than zero but less than 100, which implies that both men and women own the firm. While it may be interesting to study the performance of firms jointly owned by both men and women, our model is not well-suited to do so. Second, for large firms that sell their shares in the stock market, it is unclear what is the role of small owners in making relevant decisions for the firm. For these two reasons, we prefer to use the first question in the main results of the paper.

As we can see in Table 2, female-run firms are significantly smaller in terms of employees. The median size of firms with a female manager, for example, is 16 workers, while it is 30 workers for firms with a male manager. It is important to point out here that we do not make any attempt to control for other determinants of firm size by gender. Arguably, these differences may change if we control for sector, manager age and education, and many other covariates. However, lack of accurate data prevents us from carrying out this analysis here.[7]

Table 2: Percentiles of the firm-size distribution by gender (Data source: WB Enterprise Survey)

	Min	**10 pct**	**25 pct**	**50 pct**	**75 pct**	**90 pct**	**Max**
Females	1	5	8	16	45	119	2137
Males	1	6	12	30	100	279	11718

Figure 1 shows graphically that the firm-size distribution of female-run firms (i.e. firms with a female manager) is shifted to the left relative to the distribution of firms managed by men or, in other words, the distribution of female-run firms has a thicker density at low numbers of employees.[8]

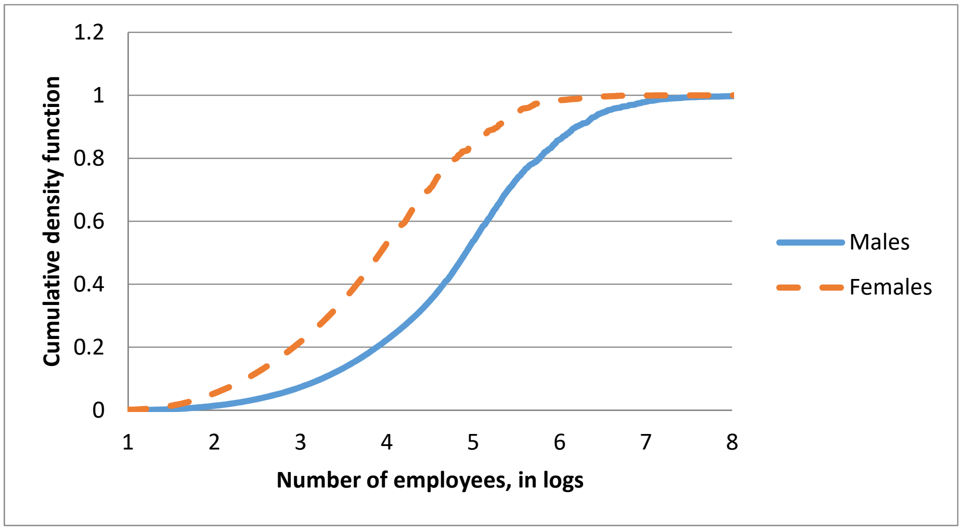
72. Formal (registered) companies with 5 or more employees are targeted for interview. Firms with 100% government/state ownership are not eligible to participate in an Enterprise Survey. In each country, businesses in the cities/regions of major economic activity are interviewed. The sampling methodology for Enterprise Surveys is stratified random sampling, that is, all population units are grouped within homogeneous groups and simple random samples are selected within each group.

[6]The countries are Argentina (1054 firms), The Bahamas (150 firms), Barbados (150 firms), Bolivia (362 firms), Brazil (1802 firms), Chile (1033 firms), Colombia (942 firms), Costa Rica (538 firms), Dominican Republic (360 firms), Ecuador (360 firms), El Salvador (360 firms), Grenada (153 firms), Guatemala (590 firms), Guyana (165 firms), Honduras (360 firms), Jamaica (376 firms), Mexico (1480 firms), Nicaragua (336 firms), Panama (365 firms), Paraguay (361 firms), Peru (1000 firms), St. Kitts and Nevis (150 firms), St. Vincent and the Grenadines (154 firms), Trinidad and Tobago (370 firms), Uruguay (607 firms), and Venezuela (320 firms).

[7]See IDB (2016) for a survey of papers that carry out this micro analysis in different countries in LAC.

[8]We plot the natural logarithm of the number of employees to help visualize the plots. Without taking logs, the large number of small firms in the data make it hard to appreciate the shape of the entire distribution.

Figure 1: Firm-size distribution by gender (Data source: WB Enterprise Survey)



3 Theoretical framework

3.1 Setup description

In this section, we briefly describe the general equilibrium framework presented in Cuberes and Teignier (2016), which is based on the span-of-control model of Lucas (1978). It consists of an occupational choice model where agents are endowed with a random entrepreneurship skill, based on which they decide to work as either employers, self-employed, or workers.[9] We also consider a fourth employment category, namely the *out-of-necessity* entrepreneurs, who choose this occupation because they have no other occupational choices apart from running their own business. This is important in developing countries since, as shown in Poschke (2013), the Global Entrepreneurship Monitor survey reveals that out-of-necessity entrepreneurs represent almost 50% of all entrepreneurs in non-OECD countries.[10] An employer in this model can produce goods using a span-of-control technology that combines his or her entrepreneurship skills, with capital, and workers:

$$y(x) = x\left(k^{\alpha}n^{1-\alpha}\right)^{\eta}, \tag{1}$$

where y denotes the amount of output, x the employer's managerial talent, k the units of capital rented, and n the units of labor. The parameter η takes a value between 0 and 1,

[9]By entrepreneurship talent we refer to the set of abilities that make a person a good manager. Our framework is compatible with a situation where agents have other abilities, which may make some workers better than others. What is needed for our occupational map fin Figure 2 to hold is that these other abilities do not correlate too strongly with the entrepreneurship talent.

[10]Strictly speaking, out-of-necessity self-employment is not a different employment category; agents who end up in this category are still self-employed, but they choose this occupation because they could not work in better alternatives.

which implies that firms with different productivity levels coexist in equilibrium and that more talented agents manage larger firms. On the other hand, a self-employed agent can produce goods using a similar technology, adjusted by the productivity parameter τ, but without hiring any workers:

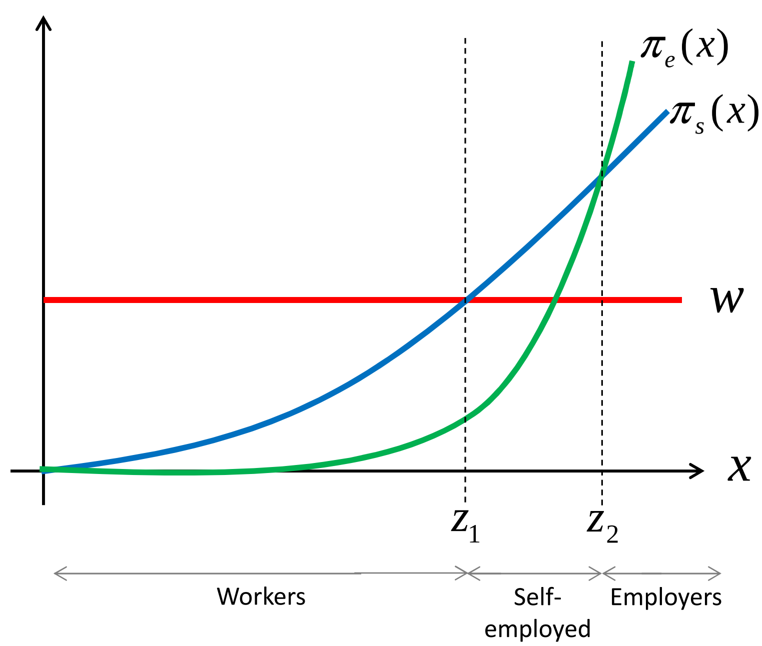
$$\widetilde{y}(x) = \tau x k^{\alpha\eta}.$$

The parameter τ is a self-employed productivity parameter, which can be interpreted as one minus the fraction of time a self-employed agent spends on management tasks.

Figure 2 displays the payoff of the three occupations at each talent level. It shows that in this model agents with the highest entrepreneurship skill (those with a talent equal or larger than z_2) optimally choose to become employers, whereas those with the least skill (with a talent lower than z_1) become workers , leaving the self-employed occupation to agents with intermediate skill levels. Specifically, denoting the employer's profits by $\pi_e(x)$, the self-employed profits by $\pi_s(x)$, the equilibrium wage rate w, and the capital rental rate by r, the payoff functions are

$$\begin{aligned}
\pi_e(x) &\equiv \max_{w,\, r} \{y(x) - rk - wn\}, \\
\pi_s(x) &\equiv \max_{r} \{\widetilde{y}(x) - rk\}.
\end{aligned}$$

Figure 2: The occupational map



In this economy, aggregate production per capita is the sum of output by employers and self-employed:

$$y \equiv \frac{Y}{N} = \left[\int_{z_2}^{\infty} y(x) d\Gamma(x) + \int_{z_1}^{z_2} \tilde{y}(x) d\Gamma(x) + \frac{(1-\theta^f)}{2} \int_{1}^{z_1} \tilde{y}(x) d\Gamma(x) + \frac{(1-\theta^m)}{2} \int_{1}^{z_1} \tilde{y}(x) d\Gamma(x) \right],$$

where θ^m and θ^f are fraction of men and women who cannot get job offers as workers and choose self employment even if their managerial talent is below z_1. $\Gamma(\cdot)$ denotes the cumulative density function of managerial talent, which is assumed to be Pareto with a lower bound equal to 1:

$$\Gamma(x) = 1 - x^{-\rho},\ x \geq 0, \tag{2}$$

where $\rho > 0$.

As Appendix B shows, the optimal number of employees for a profit-maximizing firm is $n(x) = \left[x\eta(1-\alpha) \left(\frac{\alpha}{1-\alpha}\right)^{\alpha\eta} \frac{w^{\alpha\eta-1}}{r^{\alpha\eta}} \right]^{1/(1-\eta)}$. Using this result together with the talent distribution defined in equation (2) we obtain the following cumulative density function of firms' size $S(n)$ in equilibrium:

$$S(n) = 1 - n^{-\rho(1-\eta)} \left(\eta \left(\frac{\alpha}{r}\right)^{\alpha\eta} \left(\frac{1-\alpha}{w}\right)^{1-\alpha\eta} \right)^{\rho},$$

where n is the number of workers, our measure of firm's size. We can then calculate the statistic Ψ:

$$\Psi \equiv \frac{\partial \ln(1 - S(n))}{\partial \ln(n)} = -\rho(1-\eta), \tag{3}$$

which corresponds to the log-log slope of the function $1 - S(n)$.

3.2 Introducing gender gaps into the framework

As explained above, the model assumes that men and women are identical in terms of their managerial skills, in the sense that they draw their talent from the same distribution function. However, in our framework, women are subject to an exogenous friction in their occupational choice, namely a fraction of women who would like to be employers are excluded from this occupation. This distorts the efficient talent allocation and reduces the average talent of employers. Specifically, females face a probability $1 - \widetilde{\mu}(x)$ of being excluded from employership, which depends on their ability in the following way:

$$\widetilde{\mu}(x) = \mu x^{\gamma}, \tag{4}$$

where μ is a positive constant while γ can be positive or negative. When $\gamma < 0$, the slope of this exclusion function is negative, i.e. $\widetilde{\mu}'(x) = \gamma\mu x^{\gamma-1} < 0$, which implies that more talented women are more likely to be excluded from employership. As explained above, this modeling assumption is made to match the empirical fact documented in Section 2, namely that, without controlling for any other variable, women run smaller firms than men.[11]

The parameter μ determines the fraction of women who are excluded from employership when $x = 1$, while the parameter γ determines the change in this exclusion probability when x rises. [12] The more negative is γ, the larger is the aggregate output loss due to the entrepreneurship gender gap, since it increases the probability that more talented women get excluded from employership. Our analysis in Section 2 shows that female-run firms are significantly smaller, which we interpret as evidence that $\gamma < 0$ in the LAC region. While providing direct empirical evidence of this negative selection is difficult, one possible theoretical mechanism that could justify this assumption is the presence of assortative matching in marriage. In a world with assortative matching in marriage, the most skilled women would tend to marry also highly skilled men. In principle, both members of the household would then be equally likely to become entrepreneurs, but when they have children, it is very likely that one of the partners chooses to stop working as an entrepreneur and either withdraws from the labor force or chooses a more flexible and less demanding occupation. In a world with a small but still existent prejudice against women, it is also likely that the woman would indeed be the one that quits her entrepreneur's job. One would then predict that employers optimally decide to pay lower wages to skilled women than to skilled men, since they expect that they would quit their job once they have children. Blau and Kahn (2016) show that indeed the gender wage gap between men and women has decreased over time but has remained quite constant in the top percentiles of the income distribution. While this is not direct evidence that the same pattern takes place in entrepreneurship, we think it is consistent with the negative selection we assume in the model. Moreover, some studies (e.g. Greenwod et al, 2014) show that assortative matching in marriage has tended to increase over time, which would be consistent with female negative selection being more

[11] A different avenue would be to assume that women have the same probability of becoming entrepreneurs but that once they become so they face constraints that limit the size of their firms. For example, everything else equal, if women have less access to credit they would manage smaller firms. Since we do not have strong evidence of such barriers, we do not explore this possibility here. Another explanation could be that female-run firms operate in sectors where firms are smaller. For example, there is a recent literature showing that women tend to be overrepresented in the service sector (Ngai and Petrongolo, forthcoming; Olivetti and Petrongolo, 2014). Since firms in the service sector are often smaller than those in the manufacturing sector this could, in part, explain our findings. In our data, however, non-manufacturing firms are not smaller than manufacturing firms and, moreover, the ratio of firms for men and women is similar in both sectors (2.38 in manufacturing and 2.97 in non-manufacturing).

[12] Since they do not have firm-level information, Cuberes and Teignier (2016) assume that $\gamma = 0$, which means that the probability that a woman is banned from becoming an employer is independent of her managerial talent.

prominent in recent years.

The value of γ can be estimated comparing the cumulative density functions of male and female-run firms. Under the exclusion probability in equation (4), the expected number of workers of a firm run by a female manager with talent x becomes

$$n^f(x) = \mu x^{\gamma+\frac{1}{1-\eta}} \left[\eta(1-\alpha)\left(\frac{\alpha}{1-\alpha}\right)^{\alpha\eta} \frac{w^{\alpha\eta-1}}{r^{\alpha\eta}}\right]^{1/(1-\eta)},$$

which is simply the product of the probability that a woman is not excluded from employership, $\widetilde{\mu}(x)$, and the firms size at given talent level x, $n(x)$. Replacing this into equation (2), we obtain the cumulative density function of female-run firms

$$S^f(n) = 1 - n^{-\frac{\rho(1-\eta)}{1+\gamma(1-\eta)}} \left(\mu^{1-\eta}\eta\left(\frac{\alpha}{r}\right)^{\alpha\eta}\left(\frac{1-\alpha}{w}\right)^{1-\alpha\eta}\right)^{\frac{\rho}{1+\gamma(1-\eta)}},$$

where $S^f(n)$ denotes the density function of female-run firms. We can then compute the statistic Ψ^f, which is the female-equivalent of the one defined in equation (3):

$$\Psi^f \equiv \frac{\partial \ln\left(1 - S^f(n)\right)}{\partial \ln(n)} = -\frac{\rho(1-\eta)}{1+\gamma(1-\eta)}. \tag{5}$$

Taking the ratio between equations (3) and (5), we get

$$\frac{\Psi^f}{\Psi} = \frac{1}{1+\gamma(1-\eta)}, \tag{6}$$

which can be easily estimated using the firm-size distributions of men and women.

4 Numerical results

4.1 Model parametrization

To simulate the model we first need to give values to its different parameters, namely the technology parameters $[\alpha,\ \eta,\ \tau,\ \rho]$, the out-of-necessity entrepreneurs parameter θ, as well as the female exclusion probability parameters$[\mu, \gamma]$. In this section, we describe the procedure and the data moments used to parametrize the model. Table 3 summarizes these values.

Table 3: Parameter values

	Value	Description
τ	0.71	To match the share of male self-employed (27.56%).
η	0.72	To match the share of male employers (5.66%).
ρ	4.41	To match the male firms size distribution.
α	0.08	To match the aggregate capital income share (33.3%).
θ^f	0.88	To match the share of male necessity entrepreneurs (25%).
θ^m	0.87	To match the share of female necessity entrepreneurs (35%).
γ	0.90	To match the females' firms size distribution.
μ	0.67	To match the share of female employers (1.75%).

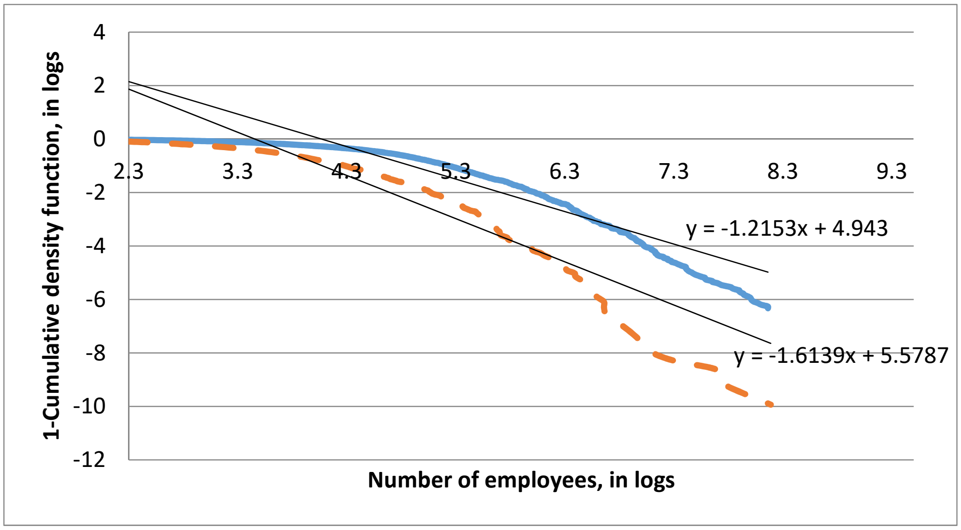
We start by choosing the values of θ^f and θ^m to match the fraction of necessity entrepreneurs, which is 25% in the case of males and 35% in the case of females.[13] We next write the parameters $[\alpha, \rho, \gamma]$, as a function of η. In particular, to get a capital income share equal to one-third, a value that is generally accepted, the value of α must satisfy $\alpha\eta + (1 - \eta) = 1/3$ provided that profits are considered capital income. Similarly, using equations (3) and (5) together with the fact that Ψ is equal to -1.2 and Ψ^f is equal to -1.6 (see Figure 3), we get that $\rho\,(1 - \eta) = -1.2$ and $1 + \gamma\,(1 - \eta) = 0.75$. Finally, we jointly estimate the rest of the parameters $[\eta, \tau, \mu]$ to match the shares of male employers and self-employed, as well as the ratio of female-to-male employers in the working-age population.

Figure 3 shows the ratios of the slopes of the male and female distribution functions in the data. As we can see in this figure, the absolute value of the slope is larger for females than for males , with the female-to-male ratio equal to 0.75.[14]

[13] See the 2015-16 Global Entrepreneurship Report, page 128 for the LAC region.

[14] We do the estimation using the sample of firms with size between 10 or more workers and the largest female-run firm.

Figure 3: Slope of cumulative density functions by gender (females: orange dashed line; males: blue solid line)



4.2 Economic losses due to the entrepreneurship gender gaps

The introduction of the employership gender gap leads to an important fall of aggregate output, both in the short run, when the capital stock is kept fixed, and in the long run, when the capital stock is adjusted to its new steady-state level.[15] Specifically, as Table 4 shows, we estimate a fall of aggregate output of 9.4% both in the short run and in the long run. These losses are almost one-third larger than the ones we would obtain using a model where the exclusion probability was independent of talent (i.e. where $\gamma = 0$) since the fact that $\gamma < 0$ implies that there is a negative selection of women into employership.

Table 4: Output losses due to employership gender gaps in LAC

Short run		Long run	
Baseline sim. (%)	**Ratio to $\gamma = 0$**	**Baseline sim. (%)**	**Ratio to $\gamma = 0$**
8.9	1.3	9.4	1.3

When a woman with good management skills happens to be barred from employership, the demand for labor and capital decreases. As a result, the equilibrium wage and interest rate decreases, which makes it more profitable for less skilled agents to become entrepreneurs. In other words, both occupational thresholds z_1 and z_2 fall, implying that the average talent of both employers and self-employed drops. On top of that, if more talented women face a higher exclusion probability, the average talent of employers falls even more,

[15]To compute the steady-state capital stock, we assume a gross interest rate of 0.125, which is consistent with a depreciation rate of 0.075 and an intertemporal discount factor of 0.05 in a continuous-time model.

which results in a larger fall of total output. Table 5 illustrates this intuition: the introduction of the gender gaps reduces the equilibrium wage rate as well as the talent thresholds z_1 and z_2. If γ is negative, the fall is even larger and, moreover, the gender gap in the average earnings of employers becomes positive because now the average talent of female managers is lower than that of males. Specifically, the talent thresholds and the wage rate fall by almost 10%, while the fall would be 7.5% if we did not take into account the difference in the size distribution (i.e. if we assumed that $\gamma = 0$).

Table 5: Short-run results under different scenarios

	No gender gaps *(normalized at 100)*	**Gender gaps with** $\gamma < 0$	**Gender gaps with** $\gamma = 0$
Workers' wage	100	90.8	92.5
Interest rate	100	91.1	93.1
Talent threshold z_1	100	90.8	92.5
Talent threshold z_2	100	90.8	92.5
Employers earnings gender gap (%)	0	44.0	0

5 Sensitivity analysis

In this section we present our main results for other parameter values in order to see the sensitivity of the results to some of the assumptions made. The first row of Table 6 shows the results under the benchmark simulation, as in Table 4, while the rest of rows show the short and long-run losses under different scenarios.

The first alternative scenario, presented in the second row, shows the loss in per-capita output due to the introduction of the employership gender gaps in a context where the self-employment gender gap is also present. To be precise, we infer from the data that about 16% of women barred from employership can become self-employed while the rest become workers. Taking this into account, we find that introducing the gender gaps in employers generates significantly larger losses, both in the short run and the long run. Intuitively, the output loss is now larger because there is a larger fall in the share of entrepreneurs and because there is larger fall in equilibrium wage and, consequently, on the average talent of entrepreneurs.

The third row displays the losses under the parameter values used in Cuberes and Teignier (2016), namely $[\eta,\ \rho,\ \tau]$=$[0.79,\ 6.5,\ 0.7]$, which were estimated using data for the OECD countries. In this case, the model predicts significantly smaller losses (about one third smaller) as well as a lower difference with respect to the $\gamma = 0$ framework. The main difference with respect to the benchmark parametrization is a somewhat larger value for η, which reduces the contribution of managerial talent to firm productivity, and especially a larger value for ρ, which increases the slope of the probability density function and reduces the thickness of the talent distribution tail. As a result, the fall in the talent threshold due to the introduction of the employership gaps is smaller, which implies a lower fall of aggregate income.

The fourth row, on the other hand, shows the income losses if firm profits (or compensation to managerial talent) were considered labor income instead of capital income (i.e. if $\alpha\eta = 1/3$ and $\alpha = 0.41$). The long-run results are not affected because the capital stock adjusts to its steady-state value, which makes the value of α irrelevant to determine the income fall. In the short-run, however, the income fall is lower than in the baseline simulation because the importance of the fixed factor, namely, capital, is larger. Intuitively, in this case, there is a larger difference between the short and long run results because the long-run capital adjustment increases with α.

Finally, the last row shows the results under an alternative setup where self-employment is never an optimal occupational choice but only a necessity occupation for those unable to find a job as a worker. In this setup, the loss in income would be somewhat lower than in the benchmark simulation, especially in the short run, although the ratio to the $\gamma = 0$ case is the same. The explanation is that the parametrization of this alternative setup leads to larger values for η and ρ which, as discussed above, implies smaller output losses.[16]

[16] In particular, under this alternative setup, matching the fraction of employers as well as the firm-size distribution implies values of $\eta = 7.24$ and $\rho = 0.83$.

Table 6: Output losses due to employership gender gaps in LAC

	Short run		Long run	
	Output loss (%)	**Ratio to $\gamma = 0$**	**Output loss (%)**	**Ratio to $\gamma = 0$**
Benchmark simulation	*8.9*	*1.30*	*9.4*	*1.29*
Self-employment gender gap present	11.8	1.23	12.5	1.23
OECD parameters $(\eta, \rho, \tau) = (0.79, 6.5, 0.7)$	5.56	1.23	6.32	1.23
Profits as labor inc. $(\alpha = 0.41)$	6.37	1.30	9.4	1.29
Only necessity self-employment	6.83	1.30	8.13	1.30

6 Conclusions

In this paper we document that in the LAC region only about one-fourth of the total firms are run by women and that female-run firms are around three times smaller than male-run firms. We quantify the output losses caused by these gender gaps using an occupational choice model where women face barriers to becoming firm managers. We allow these barriers to depend on managerial talent in order to be able to replicate the gender differences in firm-size distribution. In our benchmark simulation, we find that the aggregate long-run output loss due to these gender gaps is 8.9% in the short run and 9.4% in the long run, which is due to the drop in average managerial talent and the resulting fall in aggregate productivity. These losses are about 1.3 larger than the ones estimated under a framework with barriers that are independent of talent. Our sensitivity analyses show that the income losses may take values between 5.6% and 11.8% in the short run, and between 6.3% and 12.5% in the long run.

In our framework, we explain all the existing differences in firm size between men and women by the presence of exogenous barriers in the occupational choices of women and making these barriers correlate positively with the managerial talent of women. Admittedly, the observed gender gaps in entrepreneurship could be the result of other types of barriers, like discrimination in the labor market, differences in experience or education, or differences in access to credit. Or they could also be also the result of differences in preferences, like a stronger taste for family time or higher risk aversion. More work is clearly needed to determine with precision the fundamental causes behind the difference between male and female-run firm distributions.

References

Arellano, P, and Peralta, S., 2015. "Informe de resultados: análisis de género en las empresas Tercera Encuesta Longitudinal de Empresas." Ministerio de Eonomia, Fomento y Turismo. División de Política Comercial e Industrial Agosto.

Blau, F. D., and Kahn, L. M., 2016. "The Gender Wage Gap: Extent, Trends, and Explanations." NBER working paper 21913.

Buera, F. J., and Shin, Y., 2011. "Self-Insurance vs. Self-Financing: A Welfare Analysis of the Persistence of Shocks. *Journal of Economic Theory* 146, 845-862.

Buera, F. J., Kaboski, J. P., and Shin, Y., 2011. "Finance and Development: A Tale of Two Sectors." *American Economic Review* 101(5), 1964-2002.

Cavalcanti, T., and Tavares, J., 2016. "The Output Cost of Gender Discrimination: A Model-Based Macroeconomic Estimate." *The Economic Journal* 126(590), 109-134.

Cuberes, D., and Teignier, M., 2016. "Aggregate Costs of Gender Gaps in the Labor Market: A Quantitative Estimate." Journal of Human Capital, 10(1).

Cuberes, D., and Teignier, M., 2014. "Gender Inequality and Economic Growth: A Critical Review." *Journal of International Development*, 26(2), 260-276.

Galor, O., and Weil, D. N., 1996. "The Gender Gap, Fertility, and Growth." *American Economic Review* 85(3), 374–387.

Greenwood, J., Guner, N., Kocharkov, G., and Santos, C., 2014. "Marry Your Like: Assortative Mating and Income Inequality." *American Economic Review*, Papers and Proceedings 104(5), 348-353.

Hsieh, C., Hurst, E., Jones, C., and Klenow, P., 2013. "The Allocation of Talent and U.S. Economic Growth." NBER Working Paper No. 18693. Cambridge, MA. National Bureau of Economic Research.

IDB, 2016. *Firm Innovation and Productivity in Latin America and the Caribbean.The Engine of Economic Development.* Edited by Matteo Grazzi and Carlo Pietrobelli. Washington, DC: Inter-American Development Bank.

ILO (2014). "Global Employment Trends." Geneva: International Labor Organization.

Lucas Jr., R. E., 1978. "On the Size Distribution of Business Firms." *The Bell Journal of Economics* 9(2), 508-523.

Ngai, R. L., and Petrongolo, B., forthcoming. “Gender Gaps and the Rise of the Service Economy.” *American Economic Journal-Macroeconomics*.

Olivetti, C., and Petrongolo, B., 2014. “Gender Gaps across Countries and Skills: Supply, Demand and the Industry Structure.” *Review of Economic Dynamics*. 17 (4): 842-859.

Poschke, M., 2013. “Entrepreneurs Out of Necessity: a Snapshot.” *Applied Economics Letters* 20(7), 658-663.

World Bank, 2012. “World Development Report 2012: Gender Equality and Development.” Washington, DC: World Bank.

A *APPENDIX*: Model details

The economy we consider has a continuum of agents indexed by their entrepreneurial talent x, drawn from a cumulative distribution Γ that takes values between B and ∞. We assume the economy is closed and that it has a workforce of size N and K units of capital. Labor and capital are inelastically supplied in the market by consumers, in exchange for a wage rate w and a capital rental rate r. These inputs are then combined by firms to produce a homogeneous good. Agents decide to become either firm workers, who earn the equilibrium wage rate w —which we assume to be independent of their entrepreneurial talent—, or entrepreneurs, who earn the profits generated by the firm they manage.[17] In the model, we also include a fourth category, the *out-of-necessity* entrepreneurs, who choose this occupation because they have no other occupational choices apart from running their own business. We denote by $1-\theta$ the fraction of both males and females that are *out-of-necessity* entrepreneurs.

An agent with entrepreneurial talent or productivity level x who chooses to become an employer and hires $n(x)$ units of labor and $k(x)$ units of capital produces $y(x)$ units of output and earns profits $\pi\left(x\right)=y\left(x\right)-rk\left(x\right)-wn\left(x\right)$, where the price of the homogeneous good is normalized to 1. As in Lucas (1978) and Buera and Shin (2011), the production function is given by

$$y\left(x\right)=x\left(k(x)^{\alpha}n(x)^{1-\alpha}\right)^{\eta}, \tag{7}$$

where $\alpha\in(0,1)$ and $\eta\in(0,1)$. The parameter η measures the *span of control* of entrepreneurs and, since it is smaller than 1, the entrepreneurial technology involves an element of diminishing returns. On the other hand, an agent with talent x who chooses to become self-employed uses the amount of capital $\tilde{k}\left(x\right)$, produces $\tilde{y}\left(x\right)$ units of output and earns profits $\tilde{\pi}\left(x\right)=\tilde{y}\left(x\right)-r\tilde{k}\left(x\right)$. The technology he or she operates is

$$\tilde{y}\left(x\right)=\tau x\tilde{k}(x)^{\alpha\eta}, \tag{8}$$

where τ is the self-employed productivity parameter.[18] One interpretation of this parameter is that self-employed workers have to spend a fraction of their time on management tasks, which would imply that τ is equal to the fraction of time available for work to the power $\left(1-\alpha\right)\eta$. As explained below, we estimate this parameter to match the average fraction of self-employed in the data.

[17] In what follows we will refer to an entrepreneur as someone who works as either an employer or self-employed.

[18] The consumption good produced by the self-employed and the capital they use is the same as the one in the employers' problem. However, it is convenient to denote them $\tilde{y}$ and $\tilde{k}$ to clarify the exposition.

A.1 Agents' optimization

A.1.1 Employers

Employers choose the units of labor and capital they hire in order to maximize their current profits π. The optimal number of workers and capital stock, $n(x)$ and $k(x)$, respectively, depend positively on the productivity level x, as equations (9) and (10) show:

$$n\left(x\right)=\left[x\eta(1-\alpha)\left(\frac{\alpha}{1-\alpha}\right)^{\alpha\eta}\frac{w^{\alpha\eta-1}}{r^{\alpha\eta}}\right]^{1/(1-\eta)}, \tag{9}$$

$$k\left(x\right)=\left[x\eta\alpha\left(\frac{1-\alpha}{\alpha}\right)^{\eta(1-\alpha)}\frac{r^{\eta(1-\alpha)-1}}{w^{\eta(1-\alpha)}}\right]^{1/(1-\eta)}. \tag{10}$$

A.1.2 Self-employed

When we solve for the problem of a self-employed agent with talent x who wishes to maximize his or her profits, we find

$$\tilde{k}(x)=\left(\frac{\tau x\alpha\eta}{r}\right)^{\frac{1}{1-\alpha\eta}}. \tag{11}$$

A.1.3 Occupational choice

Figure 2 displays the shape of the profit functions of employers, $\pi_e(x)$, and self-employed, $\pi_s(x)$, as well as the wage earned by workers as a function of talent x. The agents' optimization determines the relevant talent cutoffs for the occupational choices. Here we present the equations that define these thresholds. The first one, z_1, defines the earnings such that agents are indifferent between becoming workers or self-employed and it is given by

$$w=\tau z_1\tilde{k}\left(z_1\right)^{\alpha\eta}-r\tilde{k}\left(z_1\right). \tag{12}$$

If $x\leq z_1$ agents choose to become workers, while if $x>z_1$ they become self-employed or employers. The second cutoff, z_2, determines the choice between being a self-employed or an employer and it is given by

$$\tau z_2\tilde{k}(z_2)^{\alpha\eta}-r\tilde{k}(z_2)=z_2x\left(k(z_2)^{\alpha}n(z_2)^{1-\alpha}\right)^{\eta}-rk\left(z_2\right)-wn(z_2) \tag{13}$$

so that if $x>z_2$ an agent wants to become an employer.

A.2 Competitive equilibrium

We assume that women represent half of the population in the economy and that there is no unemployment. Moreover, any agent in the economy can potentially participate in the labor market, except for the restrictions on women described above. Under these assumptions, in equilibrium, the total demand for capital from employers and self-employed must be equal to the aggregate capital endowment (in per capita terms) k:

$$
\begin{aligned}
k &= \frac{1}{2}\left[\int_{z_2}^{\infty} k(x)d\Gamma(x) + \int_{z_1}^{z_2} \tilde{k}(x)d\Gamma(x) + (1-\theta)\int_{B}^{z_1} \tilde{k}(x)d\Gamma(x)\right] \\
&+ \frac{1}{2}\left[\int_{z_2}^{\infty} \mu(x)\, k(x)d\Gamma(x) + \int_{z_1}^{z_2} \tilde{k}(x)d\Gamma(x) + \int_{z_2}^{\infty} (1-\mu(x))\tilde{k}(x)d\Gamma(x) + (1-\theta)\int_{B}^{z_1} \tilde{k}(x)d\Gamma(x)\right].
\end{aligned}
$$

The upper term is the demand for capital from men and the two lower terms are the women's demand for capital. The demand for capital from male-run firms has three components: the first one represents capital demand from employers, while the second and third terms represent the demand from self-employed (i.e. those who have the right ability to be self-employed plus capital demand by those who become self-employed because they could not find a job as workers).[19] These *out-of-necessity* self-employed demand the optimal amount of capital given their talent or ability.

The demand for capital from female-run firms has four components. The first represents capital demand from female employers (i.e. those with enough ability to be employers and who are allowed to be so). The second term represents capital demand from women who have the right ability to be self-employed and are allowed to work. The third term shows capital demand from women who become self-employed because they are excluded from employership. Finally, the last term shows the fraction of females who would like to be workers but, since they are "excluded" from this occupation, they choose to become *out-of-necessity* self-employed if they are not excluded from entrepreneurship.

Similarly, the labor market-clearing condition is given by

$$
\frac{1}{2}\left[\int_{z_2}^{\infty} n(x)d\Gamma(x)\right] + \frac{1}{2}\left[\int_{z_2}^{\infty} \mu(x)\, n(x)d\Gamma(x)\right] = \theta\Gamma(z_1),
$$

which shows that, in equilibrium, aggregate labor demand is equal to aggregate labor supply. The first term is labor demand from male employers and the second one corresponds

[19] As explained in Section 3, a fraction $(1-\theta)$ of both males and females with ability below z_1 become self-employed because they would like to be workers but are not allowed to do so and choose their second-best option.

to labor demand from female employers (i.e. those women with enough ability to be employers who are allowed to choose their occupation freely). The labor supply shows the fraction of men and women who choose to become workers and are not forced to be necessity self-employed.

A competitive equilibrium in this economy is a pair of cutoff levels (z_1, z_2), a set of quantities $\left[n(x), k(x), \tilde{k}(x)\right]$,$\forall x$, and prices (w, r) such that entrepreneurs choose the amount of capital and labor to maximize their profits, and labor and capital markets clear.

B *APPENDIX*: Details on size-distribution calculations

Given a level of talent x, firms choose to have $n(x) = \left[x\eta(1-\alpha)\left(\frac{\alpha}{1-\alpha}\right)^{\alpha\eta}\frac{w^{\alpha\eta-1}}{r^{\alpha\eta}}\right]^{1/(1-\eta)}$ workers. We can invert this function to find

$$x = n^{1-\eta}\left[\eta(1-\alpha)\left(\frac{\alpha}{1-\alpha}\right)^{\alpha\eta}\frac{w^{\alpha\eta-1}}{r^{\alpha\eta}}\right]^{-1}$$

Substituting this expression into the cumulative density function 2 gives us

$$S(n) = 1 - n^{-\rho(1-\eta)}B^{\rho}\left(\eta\left(\frac{\alpha}{r}\right)^{\alpha\eta}\left(\frac{1-\alpha}{w}\right)^{1-\alpha\eta}\right)^{\rho}.$$