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Macroeconomic costs of gender gaps: the case of Mexico

Costos macroeconómicos de las desigualdades de género en un modelo con emprendimiento y producción doméstica: el caso de México

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Abstract

This paper uses the framework of Cuberes and Teignier (2018) to study the quantitative effects of gender gaps in entrepreneurship and workforce participation in Mexico. The focus on one specific country allows us to have detailed information on men and women's participation in household production and their productivity in that sector. In line with our previous research, the occupational choice model predicts substantial losses in the country's income per capita. Gender gaps in the Mexican labor market, especially in labor force participation, represent a 22% fall in total output. Market output drops by 26.5%, while household output experiences a five-fold increase. The presence of the large gap in labor force participations implies that it is important to introduce the household sector into the model to take the production that takes place outside the market sector into account.

Información del artículo

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Resumen

Este artículo utiliza el modelo de Cuberes and Teignier (2018) para estudiar los efectos cuantitativos de las desigualdades de género en emprendimiento y participación laboral en México. Centrarnos en un país nos permite tener información detallada de la participación laboral en la producción doméstica de hombres y mujeres, así como de su productividad en este sector. Nuestro modelo predice

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pérdidas significativas en el ingreso per cápita del país. Las desigualdades de género en el mercado laboral mexicano, especialmente en participación laboral, representan una caída de la producción del 22%. La producción de mercado cae un 26.5% mientras que la producción doméstica aumenta cinco veces. La presencia de desigualdades de género significativas en la participación laboral implica que es importante introducir un sector doméstico en el modelo para capturar la producción que se da fuera del mercado.

Introduction

Gender inequality is present in many socioeconomic indicators around the world in both developed and developing countries. Although recent decades have witnessed a significant reduction in gender gaps in many countries, the prevalence of gender inequality is still high and it is present in several dimensions, including treatment in the labor market, education, political representation, and bargaining inside the household. In the labor market, for example, women typically receive lower wages, are underrepresented in many occupations, work fewer hours than men, and have less access to productive inputs. We also know that women typically carry out a much larger share of household chores than men[1].

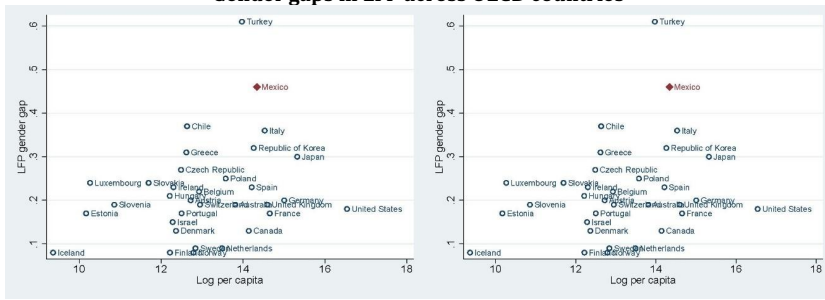
In this paper we calibrate the model in Cuberes and Teignier (2018) using Mexican data. In the model, agents are endowed with a random skill level, based on which they decide to work as either employers, self-employed workers, market workers, or, in the case of women, become household sector workers. We could certainly allow men to work in the household sector too. However, if we make the plausible assumption that women are more productive at home than men, the main results of the paper would still hold.

In our framework, women are identical to men in terms of their managerial skills, but they are subject to several exogenous constraints in their labor market choices. As we show below, these restrictions distort the occupational allocation and reduce aggregate productivity and income per capita.

Mexico is an interesting country to study gender inequality in the labor market and its impact on macroeconomics. In Cuberes and Teignier (2016) we use data from the International Labor Organization to calculate the gender gaps in labor force participation and employership. Figure 1 shows that Mexico is a very clear outlier among OECD countries.

[1] See Cuberes and Teignier (2014) and Olivetti *et al.* (2024).

Figure 1
Gender gaps in LFP across OECD countries



Throughout the paper we compare our results to those of calibrated model for the United States. We think that using the U.S as the benchmark model is useful for two reasons. First, the two economies have very marked differences, both in terms of fundamentals and in terms of the role played by women in the labor market. Second, several of the parameters used to calibrate the model are taken from US data, for which the data are much more reliable than in any other country.

As in our previous work, we find that the income losses associated with gender gaps in the labor market are substantial. In Mexico, these costs amount to about 22% of income per capita, almost twice as high as in the U.S. case (12.8%). An important finding is that most of the income loss of Mexico is generated by the extremely large gap in labor force participation. Since only 46 women participate in the labor market for every 100 men, the income losses associated with the LFP gap are huge (14% vs 4.7% in the US case).

Measuring the household sector output in the model is important because there is a very large fraction of women not working in the labor market who can work in the household. The introduction of labor market gender gaps generates a five-fold increase in household production, much larger than in the US case. With respect to the entrepreneurship gender gap, in the case of Mexico, its role is dwarfed by the LFP gap.

In literature, there are a few theory-based papers that explore how gender inequality has adverse effects on economic growth. Lagerlof (2003), for instance, argues that gender equality in education affects fertility and the human capital of children and has a positive impact on economic growth. Esteve-Volart (2009) presents a model in which the gender gap in employment leads to a reduction in the stock of talent available in the

economy and to distortions in the allocation of talent across different occupations. 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 great effects associated with these wage gaps. Hsieh *et al.* (2019) 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 within the United States accounts for 17 to 20 percent of growth over this period. Cuberes and Teignier (2016) develop a model to calculate the macroeconomic effects of gender inequality in the labor market using data from the International Labor Organization for a large sample of countries.

The rest of the paper is organized as follows. In Section 2 we present the theoretical framework. We show the parameter values and the numerical results in Section 3, while Section 4 concludes.

1. Theoretical framework

In this section, we present the theoretical framework used to generate the quantitative predictions of Section 3, which is an extension of the model proposed by Cuberes and Teignier (2016). The details of the model solution are presented in the Appendix.

1.1 Setup description

The economy we consider has two sectors (market and household) that produce a homogeneous good, as well as a continuum of agents, indexed by their skill level x, who own one unit of time. Talent here should be interpreted more broadly than in Lucas (1978) or Cuberes and Teignier (2016) since now it not only affects the entrepreneurs' profits, but also the workers' earnings.[2] We assume the economy is closed, with an exogenous workforce of size P. Skill-adjusted labor and capital are supplied to firms by the consumers, in exchange for a wage rate per unit of skill, w, and a capital rental rate, r, respectively. These inputs are then combined by firms to produce a unique, homogeneous consumption good. The stock of capital has a steady-state value and, hence, its marginal product is equal to the depreciation rate plus the intertemporal discount factor.

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

Men choose to become either firm worker in the market sector, who earn the equilibrium wage rate w times their skill level x, or entrepreneurs, who earn the profits generated by the firm they manage in the market sector. Women can also become workers or entrepreneurs, but they also have the option of producing in the household sector. As in Lucas (1978) and Buera and Shin (2011), the production function of an employer is given by

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

where x denotes the talent or productivity level of the employer, $n(x)$ is the units of skill-adjusted labor hired by the employer, $k(x)$ is the units of capital rented by the employer, and $y(x)$ represents the units of output produced. The parameter $\eta \in (0,1)$ measures the *span of control* of entrepreneurs and, since it is smaller than one, entrepreneurial technology involves an element of diminishing returns. Since the price of the homogeneous good is normalized to one, employers' profits are equal to $\pi(x) = y(x) - rk(x) - wn(x)$.

On the other hand, an agent with talent x who chooses to become self-employed in the market sector operates a technology given by

$$\tilde{y}(x) = \tau x\left(\tilde{k}(x)^{\alpha} \tilde{n}(x)^{1-\alpha}\right)^{\eta}, \quad (2)$$

where $\tilde{k}(x)$ denotes the units of capital used and $\tilde{y}(x)$ the units of output produced. $\tilde{n}(x) = x$ are the skill-adjusted labor units that the self-employed agents work in his or her own firm.[3] The parameter τ, which is calibrated to match the aggregate share of self-employed workers, captures the fact that self-employed agents must spend some time on management tasks. Self-employed profits are equal to $\tilde{\pi}(x) = \tilde{y}(x) - r\tilde{k}(x)$.

Finally, women can also produce in the household sector, operating the following technology:

$$y_h = (Ak_h + Bn_h)^{\eta}, \quad (3)$$

[3] 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 y and k to clarify the exposition.

where k_h denotes the units of capital rented to produce in the household sector and n_h the units of time allocated to the household sector. Note that this production function can be seen as the perfect substitute of the one in equation (1), with the productivity parameters A and B being independent of the agent talent. Women choose k_h and n_h in order to maximize their total earnings, which are given by their market-sector plus their household sector earnings.[4] Specifically, when the opportunity cost of time is their market wage wx, women choose to allocate their unit of time in the household sector when $\frac{A}{B} < \frac{r}{wx}$, and they choose to allocate it to the market otherwise.[5] Under this household production function, changes in the home technology parameter A (which can be interpreted as an increase in the availability of home appliances or the consumer durable goods revolution mentioned in Greenwood *et al.*, 2005) lead to a rise of female labor participation, as in the model by Greenwood *et al.* (2005) which is empirically assessed by Cavalcanti and Tavares (2008).

1.2 Frictionless Equilibrium

In equilibrium, employers choose the units of labor and capital they hire in order to maximize their current profits, denoted by π_e; while self-employed workers choose the units of capital to rent in order to maximize their profits, denoted by π_s. Market workers earn labor compensation equal to wx. Women also choose the units of capital to rent for the household-sector production and the fraction of their time they want to allocate to this sector. If they choose to become full-time household workers, they earn an income denoted by π_h^{00}, while if they choose to become part-time household workers, they earn an income denoted by π_h^{01}, which includes market-sector earnings plus household-sector earnings.

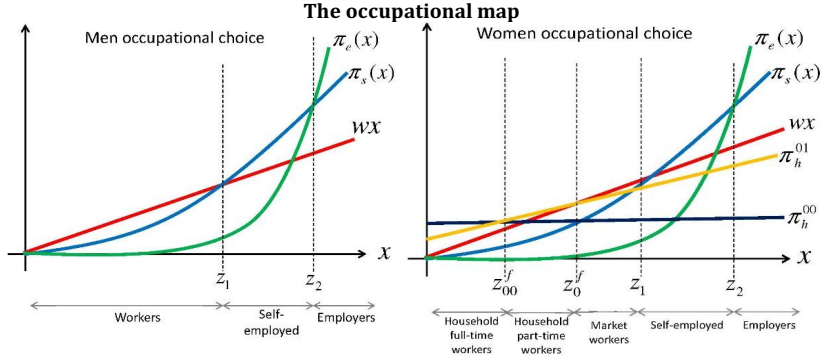
The first plot of Figure 2 displays the payoff of the three market occupations at each talent level and shows the optimal occupational choices in equilibrium for men. Men with the highest skill level (those with talent above z_2)become employers, whereas those with intermediate skill levels become self-employed. Finally, men with a level of talent lower than

[4] Arguably this is a unitary approach to the problem in the sense that a household in this model is effectively composed of only one person who can either be a man or a woman. A more realistic but complicated approach would recognize the importance of intra-household decisions as in Chiappori (1997). We leave this promising avenue for further research.

[5] As explained in Appendix A, depending on the parameter values, women choosing to work at home may still want to rent some capital because their time endowment is limited. At the same time, there may be a group of women who allocate part of their time to the household sector and part of their time to the market sector.

z_1 become market workers. The second plot of Figure 2 displays the slightly more complicated occupational map for women. As it was the case for men, women with talent above z_2 become employers, whereas those with talent between z_1 and z_2 choose to be self-employed. Women work in the market sector if their talent is between z_0^f and z_1. Women with talent below z_0^f allocate their time to the household sector production, either part time (between z_{00}^f and z_0^f) or full time (below z_{00}^f).[6]

Figure 2
The occupational map



In this economy, aggregate (market) production is the sum of output by male employers and male self-employed, as well as output by female employers and female self-employed:

$$Y = N\left[\int_{z_2}^{\infty} y(x)d\Gamma(x) + \int_{z_1}^{z_2} \tilde{y}(x)d\Gamma(x)\right].$$

where $\Gamma(x)$ denotes the talent cumulative density function, which, again, it is assumed to be the same for men and women. The first term inside the bracket represents the production by male and female employers, whereas the second is the corresponding term for the self-employed.

Total production in the economy, Y_T, is the sum of market output (Y) and household output, Y_h.

$$Y_T = Y + Y_h.$$

[6] To be precise, h00 and h01 are defined here as the household production profits by household workers relative to market workers, who may also choose to engage in household production but using only capital.

Y_h is equal to household production by full-time household workers, y_h^{00}, plus household production by part-time household workers, y_h^{01}, plus household production by female market workers, y_h^1 (who use some capital in the household sector in order to produce there):

$$Y_h = \frac{N}{2}\left(\int_B^{z_{00}^f} y_h^{00} d\Gamma(x) + \int_{z_{00}^f}^{z_0^f} y_h^{01}(x) d\Gamma(x) + \int_{z_0^f}^{\infty} y_h^1 d\Gamma(x) \right).$$

1.3 Introducing gender gaps into the framework

The model assumes that women are identical to men in terms of their innate skills, but they face exogenous constraints in their market-sector occupational choice. These frictions may reflect discrimination, or other demand factors, but they might also reflect differences in optimal choices of women, or other supply factors. In this sense, our estimated effects should be interpreted as the result of all the factors that make women behave differently than men in the labor market, including the presence of social norms.

The first constraint we impose is that females face a probability μ of being "allowed" to be an employer and a probability $1-\mu$ of being excluded from employership.[7] Out of the group of women not allowed to be employers, some have the possibility of becoming self-employed while the rest are also excluded from self-employment. In particular, women excluded from employership have a probability μ_o of being allowed to be self-employed and a probability $(1-\mu_o)$ of not being allowed to be self-employed. As a result, a fraction $(1-\mu)(1-\mu_o)$ of women is shut out from entrepreneurship, i.e. both employership and self-employment can only become workers. Appendix B shows a graphical representation of the occupational choice of women taking the just described constraints into account.[8] Finally, the third fraction we introduce is that only a fraction λ of women is allowed to participate in the labor market, while a fraction $(1-\lambda)$ of randomly selected women is excluded from all the possible occupations in the labor market.[9] In this setup, women who do not

[7] Again, this constraint may represent either demand barriers, supply choices, or a combination of the two.

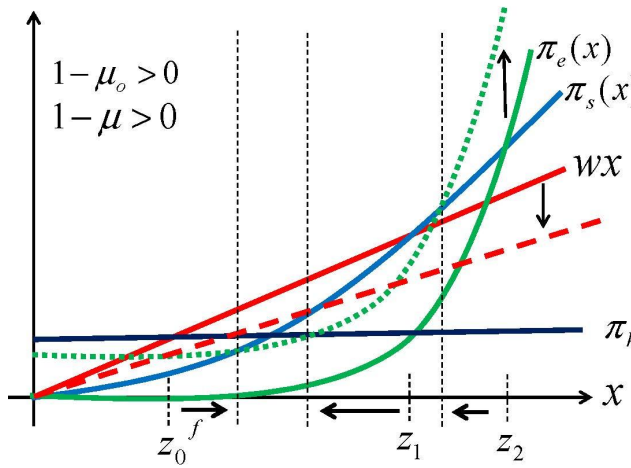
[8] Note that, in this setup, we are not allowing for the possibility of women being excluded from self-employment but not from employership, since we think that whichever are the barriers women face to become self-employed, they should apply even more strongly to become an employer. In terms of the parameters of the model, if =1, then the value of o does not affect the occupational choices of women.

[9] We say that women excluded from the labor force are randomly selected because the talent of these excluded women is drawn from the same distribution as the rest of the population.

participate in the formal labor market become full-time workers in the household sector and, hence, the estimated aggregate income loss due to the λ gender gap depends on the difference between the market participants earnings and the household-sector earnings.

The effects of the entrepreneurship gaps, μ and μ_o, are illustrated in Figure 3 for the case without part-time workers. When some women are excluded from entrepreneurship, the supply of market workers increases, leading to a fall in the wage rate and a rise in the employers' profit function. This makes both z_1 and z_2 fall, implying a lower average talent of entrepreneurs and a lower firm productivity. The capital stock adjusts downwards to keep its marginal product equal to the depreciation rate plus the intertemporal discount factor. Moreover, in the case of women, there is a rise in z_0^f, implying that the number of workers in the market-sector falls and the number of workers in the household sector rises. As a result of all these effects, the market-sector output decreases. If part-time work was also considered, the fall in wages would lead to a rise of both z_{00}^f and z_0^f, implying also a fall in female market labor.

Figure 3
Qualitative effects of entrepreneurship gender gaps



The effects of the labor force participation gap, λ, are more straightforward. When some women get excluded from the market sector, they become household-sector workers, leading to a fall in the market-

sector labor and a rise in the home-sector labor.[10] As before, the capital stock adjusts downwards to keep its marginal product equal to the depreciation rate plus the intertemporal discount factor. These effects clearly reduce total output from the market sector, but they are likely to slightly increase output per worker because the household-sector capital demand falls and, thus, the market sector capital-to-labor ratio increases.

2. Numerical Results

2.1 Data

Data on employment status and working hours is obtained from the National Survey of Occupation and Employment (ENOE) made public by the National Statistics Institute (INEGI). The National Statistics Institute (INEGI) compiles satellite accounts on non-remunerated household work. The data show that this type of work amounted in 2017 to 5.1 billion pesos (0.25 billion US dollars), or about 23% of Mexico's GDP. The estimation of this satellite account is based on two inputs: 1) A measure of time spent on unpaid work, which is approximated through the number of hours of unpaid work and the identification of the individuals who perform it (both indicators being taken from the National Time Use Survey); and 2) The cost per hour spent on unpaid care and domestic work, estimated from the National Occupation and Employment Survey, providing gross values from average earnings by economic activity, according to the North American Industry Classification System (NAICS). The activities included for this estimation are those household's activities defined as productive, if can be delegated to somebody else or provide a product or service that can be exchanged in the market, like provision of food, cleaning and maintenance of a dwelling, cleaning and care of clothes and shoes, shopping and household management, care and support, community services and volunteer work.[11]

2.2 Talent Distribution and Model Parametrization

To simulate the model, we use a Pareto function for the talent distribution, as in Lucas (1978) and Buera *et al.* (2011). The cumulative distribution of talent is, hence, given by

[10] Admittedly, in the case of the Mexican economy, a significant fraction of women not working in the formal labor market do it in the informal one. We could reinterpret our household sector as including not only the output generated at home but also the one in the informal sector. We leave for future research the addition of a well-defined informal sector into the framework.

[11] Due to the very nature of the non-remunerated activities, some degree of measurement error should be assumed.

$$\Gamma(x) = 1 - B^{\rho}x^{-\rho},\ x \geq 0, \tag{4}$$

where $\rho,\ B > 0$.

The values used for the model parameters are shown in Table 1. The parameter B of the talent distribution is normalized to 1, while the parameter η is set to 0.79 as in Buera and Shin (2011).[12] The capital-output elasticity parameter α is set to 0.114 in order to match the 30% capital income share observed in the data.[13] The parameters (ρ, τ, A, B) are estimated to match four different moments of the Mexican data. First, the fraction of employers in the labor force (which is 4.4%), second, the fraction of self-employed workers in the labor force (which is 22.3%), third, the household sector productivity relative to the market-sector one (which is 0.26), and, fourth, the gap between the share of female part-time workers and the share of male part-time workers (which is 12.4%).Compared to the United States case, we observe that Mexico has a slightly larger share of employers (4.4% vs. 3.6%), a much larger share of self-employed workers (22.3% vs 6.5%) and a similar relative household productivity and part-time gap.

Table 1
Common parameter values

Parameter	Value	Explanation
B	1	Normalization
η	0.79	From Buera and Shin (2011)
ρ	7.35	To match the employer's share in Mexico
τ	0.697	To match the self-employed's share in Mexico
A_n	0.307	To match the value of household output
A_k	0.055	To match the share of female part-time workers

The values of the country-specific gender gaps (μ, μ_o, λ) are computed to simultaneously match the female-to-male ratio of employers, self-employed workers, and labor market participation in each country. After matching these moments, we obtain that the value of the employership gender gap, $1 - \mu$, is 0.6 (very similar to the U.S. one), while the self-

[12] Buera and Shin (2011) choose to match the top five percent income share in the U.S., which is 30%. This is a reasonable approximation given that the top earners are entrepreneurs both in the model and the U.S. data.
[13] Entrepreneurs' profits are considered capital income, thus we set αη+1- equal to 30%.

employment gender gap, $(1-\mu)(1-\mu_o)$ is equal to 0.08 (compared to 0.41 in the U.S.), and the labor force gender gap, $1-\lambda$, is 0.44 (compared to 0.14 in the U.S.).

2.3 Numerical Results

The numerical results for Mexico are summarized in Table 2, which shows that gender gaps lead to a fall in total output (market plus household) is much larger in Mexico than in the United States (22% vs. 12.7%). In Mexico, there is an almost five-fold rise in household sector production due to the presence of gender gaps (487% in Mexico vs. 6.5%) which only compensates partially the fact that the fall in market output is much larger in Mexico than in the United States (26.5% vs. 17.3%). The effects of the entrepreneurship gender gaps on market output, however, are greater in the United States, the reason being that the fall in female market sector hours due to the entrepreneurship gender gaps is significantly smaller in Mexico (0.11% vs 11.9%).

Table 2
Average effects of gender gaps in Mexico and the United States

(%)	United States	Mexico
Change in market output due to entrepreneurship gaps	-12.47	-9.44
Change in market output due to all gender gaps	-17.26	-26.50
Change in household output due to all gender gaps	+6.48	+487.27
Change in total output due to all gender gaps	-12.68	-22.01
Change in female mkt hours due to entrepreneurship gaps	-11.87	-0.11
Change in female mkt hours due to all gender gaps	**-23.65**	**-44.19**

Comparing we also the results with the ones for Southern Europe in Cuberes and Teignier (2018) we find that the fall in total output due all gender gaps is 16%, much smaller than in Mexico. The rise in household output is of about 4% only, but the fall in market output is of 20.5%, 6 percentage points lower than in the case of Mexico.

Beyond the mechanical effect of labor force participation gap, the intuition behind the loss in aggregate output is as follows. When a woman with high management skills happens to be "banned'' from becoming an employer, this will result in a decrease of the demand of workers and possibly an increase in the supply of workers, which leads to a reduction of the equilibrium wage rate (as well as the capital rental rate for similar reasons). The model then implies that a less skilled agent will now find it profitable to become an employer and will take her position as manager of the firm. As a result, the firm will be less productive and due to the

nature of the span-of-control technology, also smaller. In equilibrium, aggregate productivity, wages, profits, and output will be lower because of this restriction.

Conclusion

This paper uses a general equilibrium, occupational choice model with a household sector to examine the quantitative effects of gender gaps in entrepreneurship and workforce participation in Mexico. Our main finding is that the presence of gender gaps generates losses of 22% of income per capita, almost twice as high as the case in the U.S. The introduction of a household sector in the model is important because it allows women not participating in the labor market to work at home. Because labor force participation gender gaps in Mexico are huge compared to entrepreneurship gaps, the main consequence of considering the household sector is the gain in household production generated by the LFP gaps.

Our current framework has some limitations. An important one is that our current framework assumes that all women are equally likely to get excluded, while the selection into the labor market or into entrepreneurship might not be talent neutral. If women with low education are more likely to participate in the labor force, there could be negative selection in the labor market participation, which could exacerbate the costs. Another important limitation is that we do not model the informal labor market explicitly. To the extent that the returns in the informal sector might be higher than the ones in the household sector, we could be overestimating the total aggregate costs of the gender gaps in the Mexican economy. More research is necessary to compute the earnings in the informal sector and to model the selection between the formal market, the informal one, and the household sector.

In terms of policy implications, our results underscore that the promotion of women's participation in employment and entrepreneurship can be one of the most promising avenues for fostering Mexico's future development. Important recommendations to achieve this goal include expanding child and aged care with a prioritization of public resources for families in the bottom of the income distribution. At the same time, to improve the share of female entrepreneurs it is important to reform the legal environment so that it is fully aligned with international best practices and to consider the financing and training provided to women owned and-operated businesses. Finally, relevant legal reforms could

include mandating nondiscrimination in employment based on gender and equal remuneration for work of equal value, prohibiting the dismissal of pregnant women, and expanding parental leave entitlements.

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Appendix

Appendix A. Model details

Agents' optimization

Employers

Employers choose the units of labor and capital they hire in order to maximize their current profits π.

$$\max_{k,n}\{x(k^{\alpha}n^{1-\alpha})^{\eta} - rk - wn\},$$

The optimal number of workers and capital stock, $n(x)$ and $k(x)$ respectively, depend positively on the productivity level x, as equations ([eq:nsize]) and ([eq:ksize]) show:

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

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

Self-employed

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

$$\max_{k}\{xk(x)^{\alpha\eta} - rk\},$$

we find

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

Household production

Women can get extra earnings from household production; hence they choose the household units of capital k_h and labor n_h in order to maximize their total earnings, which are given by their market-sector plus their household sector earnings. Specifically, when their optimal occupational choice in the market is to become a worker, their optimization problem is

$$\max_{k_h, n_h}\{(Ak_h + Bn_h)^\eta + wx(1 - n_h)\},$$

with $n_h \in [0,1]$ and $k_h \geq 0$.[14] As a result, when $\frac{A}{B} > \frac{r}{wx}$, women choose to allocate all their time to the market sector and rent $k_h^1 \equiv \left(\frac{\eta A^\eta}{r}\right)^{\frac{1}{1-\eta}}$ units of capital. When $\frac{A}{B} < \frac{r}{wx}$, on the other hand, women allocate at least part of their time endowment to the household sector. In particular, their optimal time allocation to the household sector is $n_h^0 \equiv min\left\{1, \left(\frac{\eta B^\eta}{wx}\right)^{\frac{1}{1-\eta}}\right\}$, which implies that some women with high market productivity may choose to allocate part of their time to the household sector and part of their time to the market sector. Women supplying all their labor to the market sector choose to rent $k_h^0 \equiv max\left\{0, \left(\frac{\eta A^\eta}{r}\right)^{\frac{1}{1-\eta}} - \frac{B}{A}\right\}$ units of capital.

In other words, when $\frac{rB^{1-\eta}}{\eta A} < 1$, women choose their labor allocation as follows:

$$n_h = \{0 \; if \; x > \frac{B}{A}\frac{r}{w} \; 1 \; otherwise$$

and their units of capital used in the household sector are equal to

$$k_h = \{\left(\frac{\eta A^\eta}{r}\right)^{\frac{1}{1-\eta}} \; if \; x > \frac{B}{A}\frac{r}{w} \; \left(\frac{\eta A^\eta}{r}\right)^{\frac{1}{1-\eta}} - \frac{B}{A} \; otherwise \; ,$$

producing the following units of output:

$$y_h = \left(\frac{\eta A}{r}\right)^{\frac{\eta}{1-\eta}}$$

in both cases.

On the other hand, when $\frac{rB^{1-\eta}}{\eta A} > 1$, women choose their labor allocation as follows:

[14] Note that if a woman is an employer or self-employed, it will never be optimal for her to spend time in household production.

$$n_h = \{0 \; if \; x > \frac{B}{A}\frac{r}{w}\left(\frac{\eta B^{\eta}}{wx}\right)^{\frac{1}{1-\eta}} \; if \; \frac{\eta B^{\eta}}{w} < x < \frac{B}{A}\frac{r}{w} \; 1 \; if \; x < \frac{\eta B^{\eta}}{w}$$

and their units of capital used in the household sector are equal to

$$k_h = \{\left(\frac{\eta A^{\eta}}{r}\right)^{\frac{1}{1-\eta}} \; if \; x > \frac{B}{A}\frac{r}{w} \; 0 \; otherwise$$

producing the following units of output:

$$y_h = \{\left(\frac{\eta A}{r}\right)^{\frac{\eta}{1-\eta}} \; if \; x > \frac{B}{A}\frac{r}{w}\left(\frac{\eta B}{wx}\right)^{\frac{\eta}{1-\eta}} \; if \; \frac{\eta B^{\eta}}{w} < x < \frac{B}{A}\frac{r}{w} \; B^{\eta} \; if \; x < \frac{\eta B^{\eta}}{w} \; .$$

Occupational choice

Figure (1) displays the shape of the profit functions of employers $\left(\pi_e(x)\right)$ and self-employed $\left(\pi_s(x)\right)$ along with wage function earned by employees and the female household workers extra earning as a function of talent x.[15] The figure also shows the relevant talent cutoffs for the occupational choices. Here we present the equations that define the three thresholds. The threshold, z_1, determines the earnings such that agents are indifferent between becoming workers or self-employed and it is given by

$$wz_1 = \tau z_1 \tilde{k}(z_1)^{\alpha\eta} - r\tilde{k}(z_1).$$

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

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

so that if $x > z_2$ an agent wants to become an employer.
Finally, the cutoff z_0^f, defines the talent level at which women are indifferent between being household workers, who only get earnings from their household production, and market workers, who get wage income plus household income from the household capital production.

[15] In order to construct this figure, we are implicitly using parameter values so that all occupations are chosen in equilibrium and that part-time work is not optimal.

Specifically, when $\frac{rB^{1-\eta}}{\eta A} < 1$, household workers get earnings $\left(\frac{\eta A}{r}\right)^{\frac{\eta}{1-\eta}} - r\left(\left(\frac{\eta A^{\eta}}{r}\right)^{\frac{1}{1-\eta}} - \frac{B}{A}\right)$, while market workers get their wage income plus household earnings equal to $\left(\frac{\eta A}{r}\right)^{\frac{\eta}{1-\eta}} - r\left(\frac{\eta A^{\eta}}{r}\right)^{\frac{1}{1-\eta}}$. Hence, the difference between the household sector earnings is equal to $r\frac{B}{A}$ and the talent threshold z_0^f is defined as

$$r\frac{B}{A} = wz_0^f.$$

Therefore, if their talent is below z_0^f, women maximize their earnings as household workers, while above z_0^f their earnings are maximized as market workers.

When $\frac{rB^{1-\eta}}{\eta A} > 1$, on the other hand, there are some women working full time in the household sector, some working part-time in the household sector and part-time in the market sector, and some other women working full time in the market sector. Women with ability below z_{00}^f, where $z_{00}^f \equiv \frac{\eta B^{\eta}}{w}$, choose to work full time in the household sector, and earn B^{η}. Women with ability between z_{00}^f and z_0^f , where z_0^f is defined in equation ([eq:cutoff indifference0]), choose to allocate part of their time to the market and part of their time to the household. Their total earnings are $\left(\frac{\eta B}{wx}\right)^{\frac{\eta}{1-\eta}}$ from the household production plus $wx\left(1 - \left(\frac{\eta B^{\eta}}{wx}\right)^{\frac{1}{1-\eta}}\right)$ from the market sector, compared to total earnings of $wx + \left(\frac{\eta A}{r}\right)^{\frac{\eta}{1-\eta}} - r\left(\frac{\eta A^{\eta}}{r}\right)^{\frac{1}{1-\eta}}$ by female workers.

When $\frac{rB^{1-\eta}}{\eta A} > 1$ women have actually five occupational choices, since some choose to work part time in the market and part time in the household sector. In this case, the earning functions are defined as

$$\pi_h^{00} \equiv B^{\eta} - (1-\eta)\left(\frac{\eta A}{r}\right)^{\frac{\eta}{1-\eta}}$$

and

$$\pi_h^{01} \equiv wx + (1-\eta)\left(\left(\frac{\eta B}{wx}\right)^{\frac{\eta}{1-\eta}} - \left(\frac{\eta A}{r}\right)^{\frac{\eta}{1-\eta}}\right),$$

which correspond to the household workers' earnings minus the household production earnings of female market workers.

Competitive Equilibrium in a model with household sector

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 of capital by employers and self-employed must be equal to the aggregate capital endowment (in per capita terms), k:

$$k = \frac{1}{2}\left[\int_{z_2}^{\infty} k(x)d\Gamma(x) + \int_{z_1}^{z_2} \tilde{k}(x)d\Gamma(x)\right] + \frac{\lambda}{2}\left[\int_{z_2}^{\infty} \mu k(x)d\Gamma(x) + \int_{z_1}^{z_2} (\mu + (1-\mu)\mu_0)\tilde{k}(x)d\Gamma(x) + \int_{z_2}^{\infty} (1-\mu)\mu_0\tilde{k}(x)d\Gamma(x)\right] + \frac{\lambda}{2}\left[\int_{B}^{z_0^f} k_h^0 d\Gamma(x) + \int_{z_0^f}^{\infty} k_h^1 d\Gamma(x)\right] + \frac{1-\lambda}{2}\int_{z_0^f}^{\infty} k_h^0 d\Gamma(x).$$

The first line of equation ([eq:mktclear_k]) is the demand for capital by men, while the two lower lines are the women's demand for capital. The demand for capital by male-run firms has two components: the first one represents the capital demand by employers, while the second represents the demand by self-employed.

The demand of capital by women has six components, the first three corresponding to the market-sector firms run by women and the last three corresponding to the household-sector capital. The first one represents the capital demand by female employers, i.e. those with enough ability to be employers and who are allowed to be, while the second term represents the capital demand by women who have the right ability to be self-employed. The third term shows the capital demand by women who become self-employed because they are excluded from employership. The fourth term corresponds to the household-sector capital demand by women who choose to be household-sector workers, the fifth is the household-sector capital demand by women supplying the entire labor supply to the market sector, and the last term is the household-sector capital demand by women who work in the household-sector because they are not allowed to work in the market sector.

Similarly, the labor market-clearing condition is given by

$$\frac{1}{2}\left[\int_{z_2}^{\infty} n(x)d\Gamma(x)\right]+\frac{\lambda}{2}\left[\int_{z_2}^{\infty} \mu(x)n(x)d\Gamma(x)\right]=\frac{1}{2}\int_{B}^{z_1} xd\Gamma(x)+\frac{\lambda}{2}\left[\int_{z_0^f}^{z_1} xd\Gamma(x)+\int_{z_1}^{\infty}\big((1-\mu)(1-\mu_0)\big)xd\Gamma(x)+\int_{B}^{z_0^f} x\big(1-n_h^0(x)\big)d\Gamma(x)\right],$$

where the first line represents the skill-adjusted aggregate labor demand, and the second line represents the skill-adjusted aggregate labor supply in the market sector. The aggregate labor demand is equal to the male employers' demand (first term) and the female employers´ demand (second term), i.e. those women with enough ability to be employers who are allowed to choose their occupation freely. The aggregate labor supply is equal to the male workers supply (first term in second line) plus the female workers supply (second, third, and fourth term in second line). The female workers supply is given by the skill-adjusted labor of women who, given their talent, choose to be full-time workers, plus that of women who have enough ability to be employers or self-employed but are excluded from both occupations. Finally, some women working in the household sector may also choose to be part-time workers in the market sector.

A competitive equilibrium in this economy is a set of cutoff levels $\left(z_{00}^f, z_0^f, z_1, z_2\right)$, a set of quantities $\left[n(x), n_h^0(x), k(x), \tilde{k}(x), k_h^0, k_h^1\right], \forall x$, and prices (w, r) such that entrepreneurs choose the amount of capital and labor to maximize their profits, and labor and capital markets clear.

Appendix B. Women occupational choice map