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Gender Gaps in the Labor Market and Aggregate Productivity*

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Abstract

The gaps between male and female outcomes and opportunities are present in several different dimensions and many countries, especially in developing ones. These gaps are likely to result in lower aggregate productivity because of an inefficient use of women potential. In this paper we examine the quantitative effects of gender gaps in entrepreneurship and labor force participation on aggregate income. To do the analysis, we first present a simple theoretical framework illustrating the negative impact of gender gaps on resource allocation and aggregate labor productivity. We then calibrate and simulate the model to study the quantitative effects of gender inequality. We show that gender gaps in entrepreneurship have important effects on aggregate productivity and labor force gender gaps on income per capita. Specifically, our model predicts that if all women are excluded from entrepreneurship, average output per worker drops by more than 10% and wages fall by even more, while if all women are excluded from the labor force, income per capita falls by almost 40%. Our cross-country analysis shows that gender gaps and income losses are quite similar across income groups but differ importantly across geographical regions, with a total income loss of 27% in Middle East and North Africa, a 23% loss in South Asia, and a loss of around 15% in the rest of the world.

JEL classification numbers: E2, O40.

Keywords: gender inequality, entrepreneurial talent, factor allocation, aggregate productivity.

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1 Introduction

Gender inequality is a pervasive feature in many countries, especially developing ones. Gaps between male and female outcomes and opportunities are present in several dimensions, including education, earnings, occupation, access to formal employment, access to entrepreneurship, access to productive inputs, political representation, or bargaining power inside the household. Dollar and Gatti (1999), for instance, calculate that, in 1990, only 5% of adult women had some level of secondary education in the poorest quartile of countries, half of the corresponding level for men. Although the gaps in employment and pay are closing much faster in developing countries than they did in industrialized ones (Tzannatos 1999), the prevalence of gender inequality is still sizable, especially in South Asia and the Middle East and North Africa (Klasen and Lamanna 2009). Moreover, women are underrepresented among top positions in most countries: even in the most developed countries, the average incidence of females among employers is less than 30% (World Bank 2001).

Everything else equal, a better use of women's potential in the market is likely to result in greater macroeconomic efficiency. When they are free to choose occupation, for example, most talented people - independently of their gender - typically organize production carried out by others, so they can spread their ability advantage over a larger scale. From this point of view, obstacles to women's access to entrepreneurship reduce the average ability of the country's entrepreneurs and affect negatively the way production is organized in the economy and, hence, its efficiency.

There are many empirical articles studying the two-way relationship between economic development and gender inequality, like Goldin (1990), Hill and King (1995), Dollar and Gatti (1999), Tzannatos (1999), Klasen (2002), or Klasen and Lamanna (2009). This literature has reached some consensus on the fact that there is a positive effect of economic growth on gender equality and a negative effect of gender inequality on economic development.[1] With respect of the theoretical literature, several studies have focused on explaining the effects of economic growth on the gender gap, like Galor and Weil (1996), Fernandez (2009), or Duflo (2010). Other theoretical articles analyze the reverse effect, i.e. the impact of gender inequality on development. These theories are, in most cases, based on the fertility and children's human

[1] One remarkable exception is the pioneer study of Barro and Lee (1994). In this paper and in different studies that followed (Barro and Lee 1996, Barro and Sala-i-Martin 2003) the authors find that when they include male and female primary and secondary schooling in their regressions the coefficient associated with female schooling is negative. They interpret this negative sign as a reflection of a large gap in schooling between genders which in turn is a proxy for backwardness.

capital channels, like Galor and Weil (1996), Doepke and Tertilt (2009), Lagerlof (2003) or Blackden et al. (2006).[2] Galor and Weil (1996), for instance, argue that an increase in women's relative wage increases the cost of raising children, which lowers population growth, increases education levels and leads to higher labor productivity and higher future growth.

There has been, however, very little theoretical work on the female labor productivity channel, i.e. on the negative effects of gender inequality in the labor market on current aggregate productivity. Intuitively, assuming that people's ability is distributed randomly, gender inequality in the labor market is expected to distort the allocation of productive resources and impact aggregate productivity negatively. Esteve-Volart (2009) is, to our knowledge, the only paper that highlights this channel. She presents a model of occupational choice and talent heterogeneity, and finds that labor market discrimination leads to lower average entrepreneurial talent, lower female human capital accumulation. This, in turn, has a negative impact on technology adoption and innovation and, so, it reduces economic growth. The model, however, is only used to derive qualitative results but not to perform numerical exercises.

Finally, on the quantitative side, Hsieh et al. (2001) estimates the contribution to U.S. economic growth from the changing occupational allocation of white women, black men, and black women between 1960 and 2008. The paper finds that the improved allocation of talent within the United States accounts for 17 to 20 percent of growth over this period. [3]

In this paper, we develop and calibrate a simple theoretical model illustrating the positive impact of gender equality on resource allocation and aggregate labor productivity. The model is then used to quantify the costs of gender inequality and the effects of the existing gender gaps across countries. We introduce gender inequality into a span-of-control framework based on Lucas (1978), in which agents are endowed with entrepreneurial talent drawn from a fixed distribution and the most talented ones choose to become entrepreneurs. Gender inequality is introduced in the model as an exogenous restriction on women's access to entrepreneurship and participation in the workforce. When women are excluded from entrepreneurship, a larger fraction of men become entrepreneurs and, as a result, the average talent of entrepreneurs decreases. Moreover, since all women are forced to work as employees, the supply of labor increases and the equilibrium wage rate decreases even further.

We parametrize and simulate the model to quantify the negative effects of gender inequality

[2] See Cuberes and Teignier (2011, 2012) for a comprehensive review of the empirical and theoretical literature on this topic.

[3] Rodriguez Mora (2009), Pica and Rodriguez Mora (2011) also study the effects of talent misallocation in different contexts.

on firms size, average productivity and income per capita. We find that if all women are excluded from entrepreneurship, average output per worker drops by more than 10% and wages fall by even more, while if all women are excluded from the labor force, income per capita falls by almost 40%. In the cross-country analysis, we find that gender gaps and their implied income losses are quite similar across income groups but differ importantly across geographical regions, with a 27% loss in the Middle East and North Africa, a 23% loss in South Asia, and a loss around 15% in the other regions.

The rest of the paper is organized as follows. In Section 2, we present the theoretical model; Section 3 explains the calibration and numerical results; Section 4 discusses the quantitative implications of our model for a large set of countries, and, finally, Section 5 concludes.

2 Model

In this section, we present a simple static general equilibrium model of agents with heterogeneous entrepreneurial skills, as in Lucas (1978). Agents are endowed with a specific talent for managing, based on which they decide to work as either entrepreneurs or employees. The model assumes an underlying distribution of entrepreneurial talent in the population, and studies the resulting allocation of productive factors across entrepreneurs as well as the size distribution of firms.

2.1 Model Setup

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 $\underline{z}$ and $\bar{z}$.[4] It is a closed economy with a workforce of size N and with K units of capital. these two inputs are inelastically supplied in the market by consumers and then combined by firms to produce an homogeneous good.

At each period, agents rent the capital stock they own to firms in exchange for the rental rate r, and decide to become either firm workers, who earn the equilibrium wage rate w, or entrepreneurs, who earn the profits generated by the firm they manage.

An agent with entrepreneurial talent level x who manages n units of labor and k units of capital produces y units of output and earns profits $\pi(x) = y(x) - rk(x) - wn(x)$, where the

[4] In the next section, we justify why we need to assume an upper bound in the talent distribution.

price of the homogeneous good is normalized to one. As in Lucas (1978) and Buera and Shin (2011), the production function is given by

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

where $\alpha \in (0,1)$ and $\eta \in (0,1)$. The latter parameter, η, measures the "span of control" of entrepreneurs and, since it is lower than one, the entrepreneurial technology involves an element of diminishing returns.

2.2 Agents' optimization

Entrepreneurs choose the labor and capital they hire in order to maximize their current profits π. The first order conditions that characterize their optimization problem are given by

$$\left(1-\alpha\right)\eta x k(x)^{\alpha\eta}n(x)^{\eta(1-\alpha)-1}=w \tag{2}$$

$$\alpha\eta x k(x)^{\alpha\eta-1}n(x)^{\eta(1-\alpha)}=r. \tag{3}$$

Hence, at the optimum, all firms have a common capital-labor ratio given by equation (4):

$$\frac{k(x)}{n(x)}=\frac{\alpha}{1-\alpha}\frac{w}{r} \tag{4}$$

where $k\left(x\right)$ and $n\left(x\right)$ denote the optimal capital and labor levels for an entrepreneur with talent level x. Intuitively, a higher $\frac{w}{r}$ ratio implies a more intensive use of capital relative to labor. The solution values for $n(x)$ and $k(x)$ for a given firm can be obtained combining equations (2) and (4). Both $n(x)$ and $k(x)$ depend positively on the productivity level x, as equations (5) and (6) show:

$$n\left(x\right)=\left[x\eta(1-\alpha)\left(\frac{\alpha}{1-\alpha}\right)^{\alpha\eta}\frac{w^{\alpha\eta-1}}{r^{\alpha\eta}}\right]^{1/(1-\eta)} \tag{5}$$

$$k\left(x\right)=\left[x\eta\alpha\left(\frac{1-\alpha}{\alpha}\right)^{\eta(1-\alpha)}\frac{r^{\eta(1-\alpha)-1}}{w^{\eta(1-\alpha)}}\right]^{1/(1-\eta)} \tag{6}$$

Given this efficient allocation, agents choose their occupation to maximize their earnings.

Thus, there is a cutoff talent level $z > 0$ such that if $x \leq z$ agents choose to work as employees, and if $x > z$ agents agents become entrepreneurs. At the cutoff level z, the agent is indifferent between the two occupations, so that $\pi(z) \equiv y(z) - wn(z) - rk(z) = w$, that is,

$$z \left(k(z)^{\alpha} n(z)^{1-\alpha} \right)^{\eta} - wn(z) - rk(z) = w. \tag{7}$$

If they become employees they obviously do not hire any capital or labor input, i.e. $k(x) = n(x) = 0 \; \forall x < z$.

2.3 Equilibrium and Aggregation

In equilibrium, the total demand of capital by entrepreneurs must be equal to the exogenously given aggregate capital endowment K, and, in the labor market, the total demand of workers must also be equal to the non-entrepreneurs workforce:

$$\int_{z}^{\bar{z}} k(x) d\Gamma(x) = \frac{K}{N} \tag{8}$$

$$\int_{z}^{\bar{z}} n(x) d\Gamma(x) = \Gamma(z), \tag{9}$$

where N denotes total work force, which is equal to total population in the benchmark case.

Aggregate income per capita is equal to total production per capita,

$$\frac{Y}{N} = \int_{z}^{\bar{z}} x \left(k(x)^{\alpha} n(x)^{1-\alpha} \right)^{\eta} d\Gamma(x) \tag{10}$$

where Y denotes total output.

Plugging (5) and (6) into equation (10) we get total income per capita as a function of the talent distribution Γ and the equilibrium unknowns (z, w, r):

$$\frac{Y}{N} = \left[\eta \frac{\alpha^{\alpha} (1-\alpha)^{1-\alpha}}{r^{\alpha} w^{1-\alpha}} \right]^{\frac{\eta}{1-\eta}} \int_{z}^{\bar{z}} x^{\frac{1}{1-\eta}} d\Gamma(x) \tag{11}$$

A competitive equilibrium in this economy is a cutoff level z, a set of quantities $[n(x), k(x)]_{x>z}$

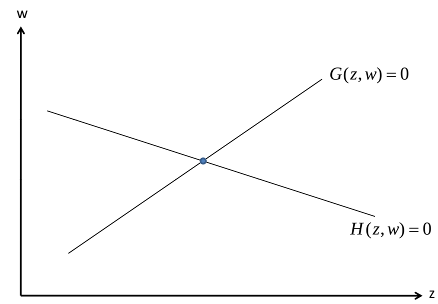

Figure 1: Graphical representation of the equilibrium

and prices (w, r) such that equations (4) - (9) are satisfied, that is agents choose their occupation optimally, entrepreneurs choose the amount of capital and labor to maximize their profits, and all markets clear.

As explained in Appendix A, the three equilibrium conditions in equations (7), (8) and (9) can be summarized in the two equations $G(z,w) = 0$ and $H(z,w) = 0$:

$$H(z,w) = \Gamma\left(z\right)^{\frac{1-\eta(1-\alpha)}{1-\eta}} - \left[\eta\left(1-\alpha\right)\frac{k^{\alpha\eta}}{w}\right]^{\frac{1}{1-\eta}} \int\limits_{z}^{\bar{z}} x^{\frac{1}{1-\eta}} d\Gamma(x) = 0, \tag{12}$$

$$G(z,w) = w^{\frac{1}{1-\eta}} - \Phi z^{\frac{1}{1-\eta}} \left(\frac{\alpha}{1-\alpha}\frac{\Gamma\left(z\right)}{k}\right)^{\frac{-\alpha\eta}{1-\eta}} w^{\frac{-\eta}{1-\eta}} = 0. \tag{13}$$

where Φ is a constant.

Appendix A also shows that, for values of z high enough, the function $H(z,w)$ has a negative slope in the (z,w) diagram, $\frac{dw}{dz}\mid_{H(z,w)=0} < 0$, while the function $G\left(z,w\right)$ has a positive slope, $\frac{dw}{dz}\mid_{G(z,w)=0} > 0$. Intuitively, $H\left(z,w\right) = 0$ is downward sloping because a larger z implies a lower number of entrepreneurs and more workers and, therefore, a lower equilibrium wage to clear the worker's market. $G\left(z,w\right) = 0$, on the other hand, is upward sloping because larger z implies a larger profit $\pi\left(z\right)$ and, therefore, a larger w is needed to get the occupational indifference at z. The intersection of the two equations defines the equilibrium, as figure (1) shows.

2.4 Equilibrium with Gender Gaps

2.4.1 Gender Gaps in Entrepreneurship

We introduce gender inequality in entrepreneurship in our setup by imposing that only a randomly selected fraction $\theta \in (0,1)$ of the population is eligible to be entrepreneur. That is, assuming that men and women have the exact same talent distribution and given that the percentage of women in the population is around 50%, if all women are excluded from entrepreneurship, the parameter θ takes a value equal to 1/2. When a randomly slected fraction $1-\theta$ of the population is excluded from the pool of potential entrepreneurs, the talent distribution becomes

$$\widetilde{\Gamma} = \theta\Gamma, \tag{14}$$

and the labor market clearing condition becomes

$$\int_{z}^{\bar{z}} n(x)d\widetilde{\Gamma}(x) = (1-\theta) + \widetilde{\Gamma}(z). \tag{15}$$

In words, the supply of workers has now two components: those with skill below z, $\Gamma(z)$, and those with skill greater or equal than z who are not allowed to be entrepreneurs, $(1-\theta)(1-\Gamma(z))$. Therefore, the total labor labor supply is equal to

$$\Gamma(z) + (1-\theta)(1-\Gamma(z)) = 1-\theta+\theta\Gamma(z) = (1-\theta) + \widetilde{\Gamma}(z).$$

The capital market clearing condition is the same as before, except for the talent distribution of entrepreneurs, which is now $\widetilde{\Gamma} = \theta\Gamma$:

$$\int_{z}^{\bar{z}} k(x)d\widetilde{\Gamma}(x) = \frac{K}{N}. \tag{16}$$

As before, the three equilibrium conditions in equations (7), (15) and (16) can be summarized in the two equations $\widetilde{G}(z,w) = 0$ and $\widetilde{H}(z,w) = 0$:

$$\widetilde{H}(z,w) = 1-\theta+\tilde{\Gamma}(z) - \left(\frac{\eta(1-\alpha)}{w}\right)^{\frac{1}{1-\eta}} \left(\frac{1-\theta+\tilde{\Gamma}(z)}{k}\right)^{\frac{-\alpha\eta}{1-\eta}} \int_{z}^{\bar{z}} x^{\frac{1}{1-\eta}} d\tilde{\Gamma}(x) = 0, \tag{17}$$

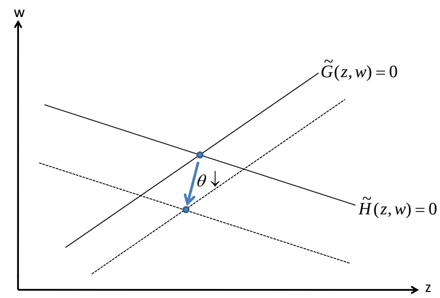

Figure 2: Graphical effects of entrepreneurial inequality

$$\widetilde{G}\left(z,w\right)=w^{\frac{1}{1-\eta}}-\Phi z^{\frac{1}{1-\eta}}\left(\frac{\alpha}{1-\alpha}\frac{1-\theta+\tilde{\Gamma}\left(z\right)}{k}\right)^{\frac{-\alpha\eta}{1-\eta}}=0. \tag{18}$$

As explained in Appendix B, $\widetilde{H}\left(z,w\right)$ is downward sloping in the $\left(z,w\right)$ diagram and $\widetilde{G}\left(z,w\right)$ is upward sloping when z *is not too small*.

Effects of an increase in the gender gap. Graphically, an increase in gender inequality, i.e. a decrease in θ, leads to a downward shift of both $\widetilde{G}\left(z,w\right)=0$ and $\widetilde{H}\left(z,w\right)=0$. As a result, the equilibrium wage w will be always lower under gender inequality, as well as the threshold level z given that the shift in $\widetilde{H}\left(z,w\right)=0$ is larger than the shift in $\widetilde{G}\left(z,w\right)=0$.[5] Figure (2) shows the equilibrium change in this case. Intuitively, an increase in gender inequality reduces the pool of workers eligible for entrepreneurship, which affects negatively the equilibrium productivity of entrepreneurs. This leads to a lower threshold level z and to lower aggregate productivity which clearly affects the equilibrium wage rate negatively.

2.4.2 Gender Inequality in Labor Force Participation

Another type of gender inequality that can be introduced in the model is the exclusion of women from the work force, both as entrepreneurs and employees, as in Esteve-Volart (2011). If we keep the capital stock fixed, when a fraction of women does not supply labor to the market, output per worker mechanically increases. Income per capita, however, decreases. Formally, recalling that N denotes the total labor force and defining P as total population,

[5] See Appendix B for a formal proof.

we have

$$\frac{Y}{P}=\frac{N}{P}\int_{z}^{\bar{z}} x\left(k(x)^{\alpha}n(x)^{1-\alpha}\right)^{\eta}d\Gamma(x).$$

With this formulation, it is then possible to study the impact of reducing the employment-to-population ratio $n=N/P$ below 1.

3 Model Simulation

3.1 Skill Distribution

To simulate the model, we use a Pareto function for the talent distribution, as in Lucas (1978) and Buera, Kaboski and Shin (2011).[6] We assume an upper bound $\bar{z}$ on talent to guarantee that the talent distribution is bounded.[7] Hence, the cumulative distribution of talent is

$$\Gamma\left(x\right)=\frac{1-B^{\rho}x^{-\rho}}{1-B^{\rho}\bar{z}^{-\rho}},\ 0\leq x\leq\bar{z} \tag{19}$$

where $\rho, B>0$, and the density function of talent is

$$\gamma\left(x\right)=\frac{\rho B^{\rho}x^{-\rho-1}}{1-B^{\rho}\bar{z}^{-\rho}},\ ,\ 0\leq x\leq\bar{z}. \tag{20}$$

Using equations (5) and (20), we can derive the density function of the firms' size,

$$\begin{aligned} s\left(n\right) &= \gamma\left(n^{-1}\left(x\right)\right)=\gamma\left(\frac{n^{1-\eta}}{\eta(1-\alpha)}\left(\frac{\alpha}{1-\alpha}\right)^{-\alpha\eta}\frac{w^{-\alpha\eta+1}}{r^{-\alpha\eta}}\right) \\ &= \frac{\rho B^{\rho}}{1-B^{\rho}\bar{z}^{-\rho}}n^{-(1-\eta)(1+\rho)}\left(\eta(1-\alpha)\left(\frac{\alpha}{1-\alpha}\right)^{\alpha\eta}\frac{w^{\alpha\eta-1}}{r^{\alpha\eta}}\right)^{1+\rho}, \end{aligned} \tag{21}$$

which shows that the distribution of firms size is also Pareto and, if $(1-\eta)(1+\rho)=1$, it satisfies Zipf's law.[8]

[6] See Gabaix (2008) for a detailed summary of the applications of the Pareto distribution.

[7] If we want to use an unbounded Pareto distribution, i.e. $\bar{z}\to\infty$, we need to assume that $\rho>\frac{1}{1-\eta}$ so that the integral $\int_{z}^{\bar{z}}x^{\frac{1}{1-\eta}}d\Gamma(x)$ is defined, as explained in Appendix C. Note, however, that this would imply $(1+\rho)>\frac{1}{(1-\eta)}$, which contradicts Zipf's Law for the distrubution of firms' size.

[8] As Gabaix (2008) explains, empirical research has established that, to a good degree of approximation, the distribution of firms' size follows Zipf's Law, at least in the US. See also Axtell (2001).

Table 1: Parameter values

Parameter	Value	Explanation
B	1	Normalization
η	0.8	Buera and Shin (2011)
ρ	4	To satisfy Zipf's Law for firms distribtuion, $-(1-\eta)(-1-\rho) \approx 1$
α	0.375	To match capital share, $\alpha\eta$=0.3
$\bar{z}$	$7.8 * B$	**To match average fraction of entrepreneurs in the data, which is** 3.55%

3.2 Parameter Values

Table (1) shows the values used in the simulations for the different parameters of the model. The parameter B of the Pareto distribution is normalized to 1. The span-of-control parameter η is chosen equal to 0.8, following Buera and Shin (2011).[9] The value used for the parameter ρ is set equal to 4 so that the talent distribution satisfies Zipf's Law.[10] The capital exponent parameter α is set to 0.375 in order to make $\alpha\eta$ equal to 30%, as in Buera and Shin (2011), since 30% is the value typically used for the aggregate income share of capital and we are considering the entrepreneurs' earnings as labor income. Finally, the talent upper bound $\bar{z}$ is chosen equal to 7.2 times B, to make the world-average share of entrepreneurs predicted by the model match the one observed in our data set.[11]

3.3 Quantitative effects of entrepreneurial gaps

To show the effects of gender inequality in entrepreneurship, we now compare the talent distribution and the firms size distribution when there is no gender inequality, $\theta = 1$, with the one in which all women are excluded from entrepreneurship, $\theta = 0.5$. Figure (3) shows that when 50% of the workforce are not eligible as entrepreneurs, the talent threshold z decreases and the entire talent distribution shifts to the left. Figure (4) shows that when there is a

[9] Buera and Shin (2011) calibrate η from the fraction of total income of the top five per cent of earners in the US population, which is 30%, given that top earners are mostly entrepreneurs both in the data and in the model.

[10] This is similar to the value used by Buera, Kaboski and Shin (2011), 4.84, which is chosen to match the employment share of the largest 10 percent of establishments in the US..

[11] The world-average fraction of entrepreneurs in the data is estimated using data on the variable *Employers* from the International Labor Organization, Table 3 - Status in Employment (by sex), where the weights of each country are equal to the country's employment over total employment.

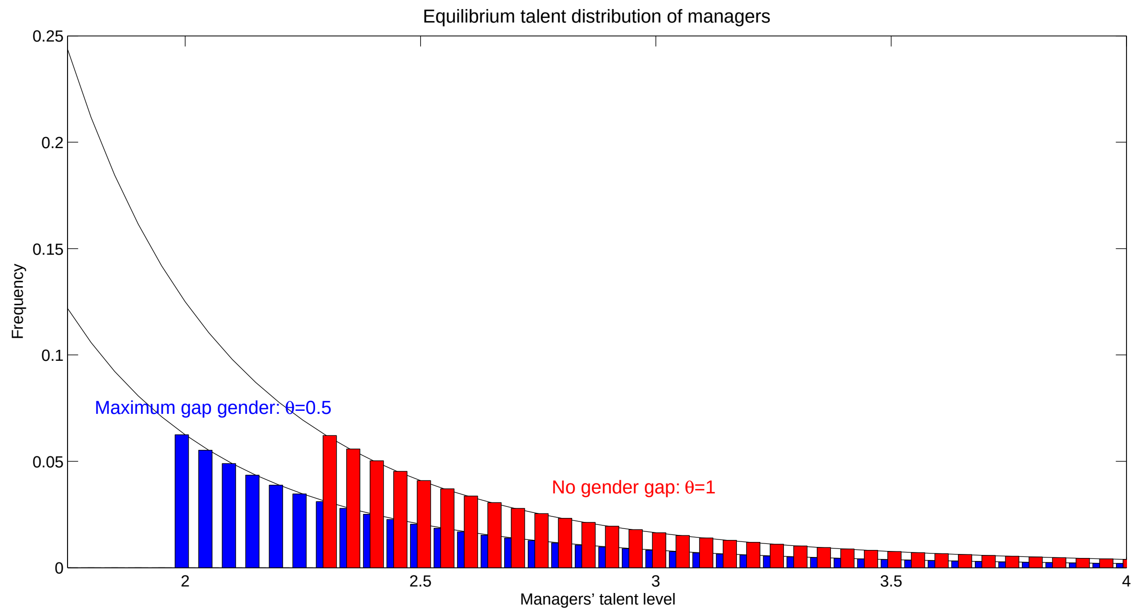

Figure 3: Talent distribution

gender gap in entrepreneurial access, the entire firm size distribution shifts to the left and, at all talent levels, firms are now larger while the density is now lower.

Finally, Figure (5) shows the negative effects of gender inequality on average productivity and workers' wages. The higher is the percentage of population excluded from entrepreneurship, the larger the loss in income per worker with respect to the no-gender-inequality case. We can see that when the fraction of agents excluded from the workforce is 50%, output per worker is 88% of the one with no gender inequality, because of the gender gap effect on productivity. In other words, if the gender gap is the highest possible one, the loss in output per worker is slightly above 10%. The loss in worker wages, on the other hand, is slightly higher since there is a workers' supply increase effect on top of the productivity effect.

When interpreting the results, it is important to keep in mind that we are assuming that men and women have exactly the same talent distribution. This assumption may not be very accurate for some developing countries in which women have less education than men and, as a result, they are likely to be less skilled. These results, thus, are capturing the effects of gender inequality in access to entrepreneurship as well as access to those education programs that give the necessary skills to become entrepreneurs.

Also, it is important to note we are modeling the economy as if there was only one production sector, while in the real world there are many different sectors, probably with different

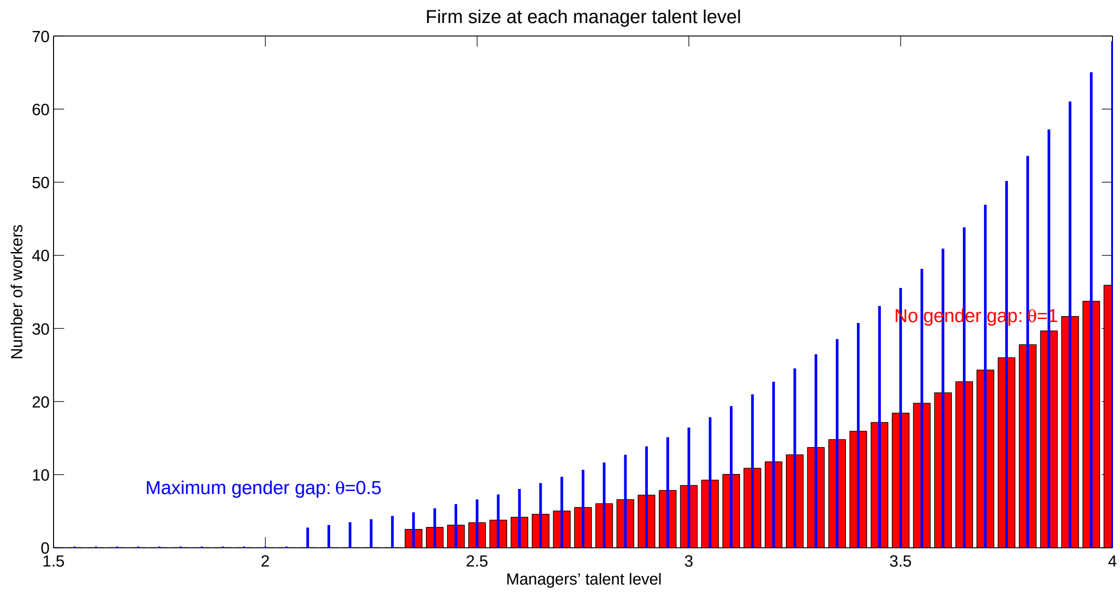

Figure 4: Firms Size

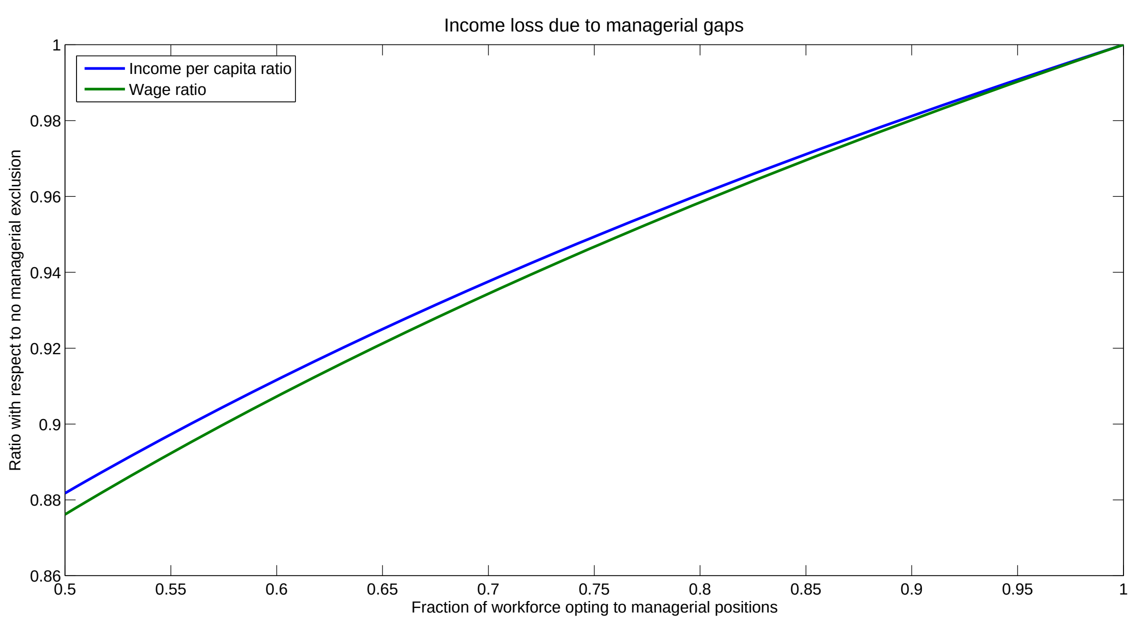

Figure 5: Effects of gender gaps in entrepreneurship

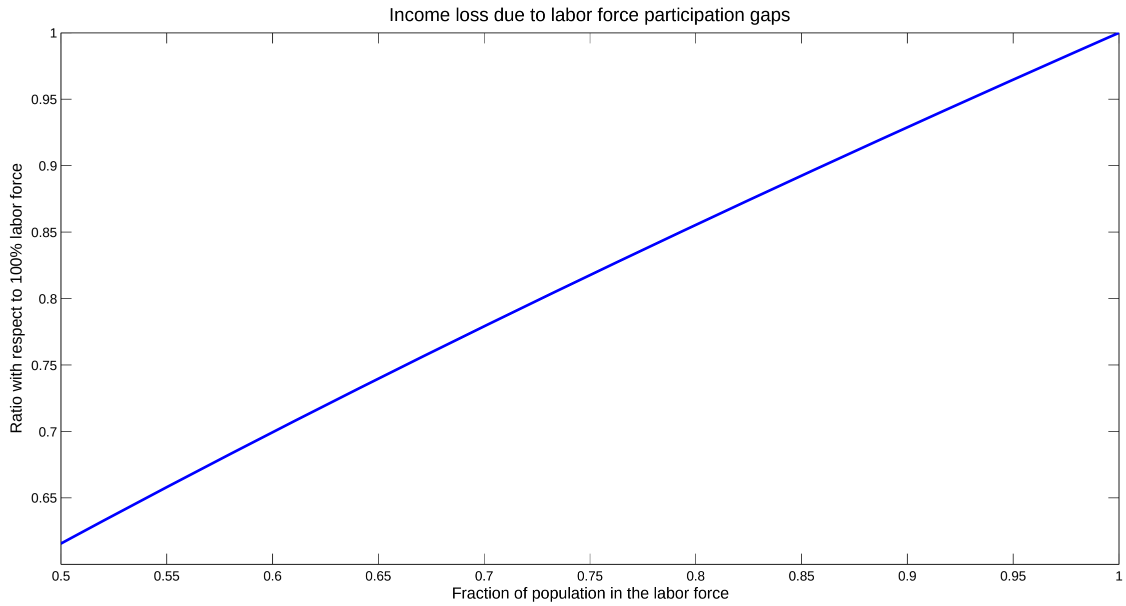

Figure 6: Effects of gender gaps in labor force participation

returns to entrepreneurial ability. To the extent that gender gaps in entrepreneurship are stronger in some sectors than others, the economic losses due to entrepreneurial gaps may be larger or smaller than computed here. If, for instance, entrepreneurial inequality is higher in sectors with larger span of control of entrepreneurs, we would be underestimating the true effects of gender inequality.

3.4 Quantitative effects of labor force gaps

If we simulate the model with a fraction of the population excluded from the workplace, we get that output per worker increases because there are diminishing returns to scale to labor keeping the stock of capital constant. However, income per capita obviously decreases since fewer people actually work. As Figure (6) shows, the larger the gender gap in the labor force - i.e. the further we move to the left of the horizontal axis, the higher is the income loss. When 50% of the population are excluded from the labor force, for instance, the income per capita loss with respect to the no-exclusion case is almost 40%.

3.5 Robustness analysis

In this subsection we compare the parameter values used in previous subsections to other values considered in the literature, in order analyze the sensitivity of our results to other possible specifications. Table (2) below summarizes the results.

Span-of-control parameter η. To our knowledge, Bohacek and Rodriguez-Mendizabal (2011) and Bhattacharya et al. (2011) are the only available studies providing different estimates for the span-of-control parameter. Bohacek and Rodriguez-Mendizabal (2011) use a value of $\eta = 0.912$ for the entrepreneurial control parameter since this is the value estimated by Burnside (1996) using output data. In our setting, we can use $\eta = 0.912$ if we set $\rho = 10.36$ and $\bar{z} = 2 * B$. In this case, we get that the loss in output per worker due to gender gaps in entrepreneurship is only around 4%, while there is no change in the income per capita loss due to gender inequality in labor force participation. Bhattacharya et al. (2011), on the other hand, use $\eta = 0.76$, which imply $\rho = 3.17$ and $\bar{z} = 14 * B$ in our setting. This parametrization leads to a loss in output per worker due to entrepreneurial gender gaps of almost 15%.

Capital share in variable factors parameter, α. Setting α equal to 0.375 in order to make $\alpha\eta$ equal to 30% implicitly assumes that the income of entrepreneurs' income is part of the labor income in the national accounts. Another possibility is that it is considered part of the capital income, which implies making $\alpha\eta + (1 - \eta) = 0.3$ and $\alpha = 0.125$. Using $\eta = 0.8$, $\rho = 4$ and $\bar{z} = 7.2 * B$, as in the baseline simulation, and $\alpha = 0.125$ we get the loss in income per capita due to gender gaps in labor force participation, and a slightly smaller loss in output per worker due to gender gaps in entrepreneurs, 11% instead of 12%.

4 Cross-country results

In this section, we use data on employers and labor force participation by gender to estimate the effects of labor market gender gaps on the income per capita of 88 countries for the latest available year.[12] The data used is from the International Labor Organization (Table 3 - Status in Employment, by sex) for the latest available year, and it includes both developed and developing countries and the World Bank World Development Indicators. It is important

[12] Appendix D shows the results of our simulation by country.

Table 2: Robustness analysis

	Baseline simulation	η**from Bohacek, Rodriguez (2011)**	η**from Battacharya et al. (2011)**	**Capital share** $\alpha\eta + (1-\eta) = 0.3$
ρ	4	10.4	3.17	4
η	0.8	0.912	0.76	0.8
$\bar{z}/B$	7.8	1.94	14	7.2
Productivity loss due to entrepreneurs' gender gaps	0.12	0.045	0.145	0.11
Income loss due to labor force gender gaps	0.38	0.38	0.38	0.46

to note that from we compute the gender gap in entrepreneurship by taking the difference in the fraction of entrepreneurs among male and females and normalizing it using the difference in labor force participation between males and females.[13] If men and women were identical in all dimensions, these two variables could be interpreted as the percentage of women who are discriminated from entrepreneurship and the labor force respectively, but there may be reasons other than discrimination that explain this gap or difference between men and women.[14]

In figure (7), we can see the total income loss caused by the two gender gaps and the relation between the two gender gaps for all countries in our sample. The first plot shows that the total loss in income goes from more than 40% in some countries to less than 5% in some others, and it has a slightly negative relation with the income per capita level. The second plot shows that the relation between the loss caused by the mangerial gender gap and the loss caused by the labor force participation gap is positive.

Tables (3) and (4) below show the results for different groups of countries. The variable *Entrepreneurs' gender gap* is defined as the gap between males and females in the fraction of

[13]Someone could argue that the ratio of male and female entrepreneurs should be compared directly i.e. without normalizing it, but in our model, agents first enter the labor force and then decide to become entrepreneurs. Because of the way we calculate the gender gaps in entrepreneurship, we could then have negative gender gaps (i.e. larger fraction of working women in employer positions), in which case we just proceed as if there was no gap at all.

[14]To make the reading easier, we will refer to the numbers in these variables as the percentage of women *excluded* from entrepreneurship or from the labor force, but we do not know whether this *exclusion* is voluntary or not.

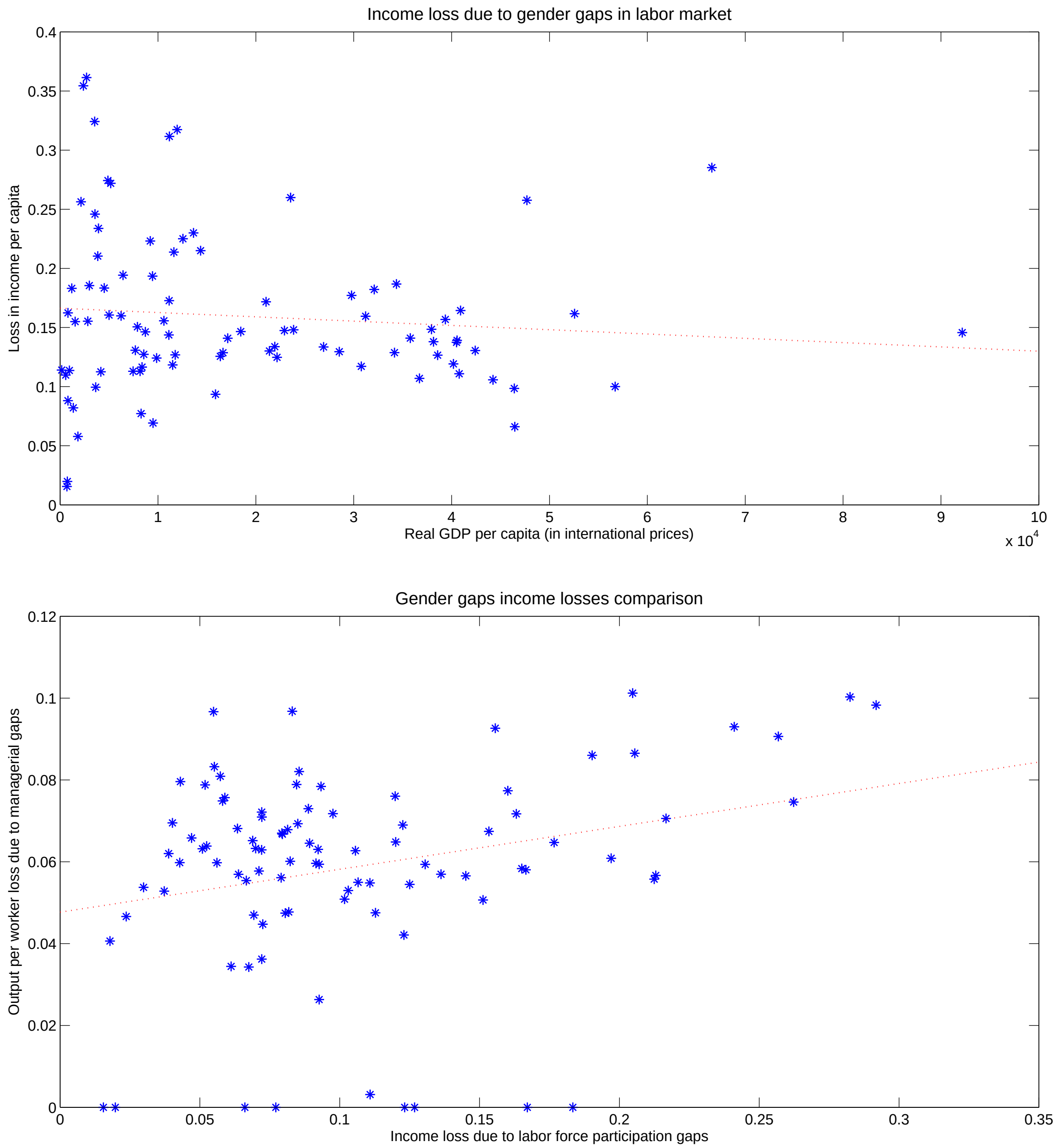

Figure 7: Cross-country income losses caused by gender gaps
Data sources: Penn World Tables, version 7.0; own calculations.

Table 3: Income loss due to gender gaps, by income groups

	Number countries	Entrepreneurs' gender gap	Labor force part. gender gap	Income loss (total)	Income loss (entrepr.)	Income loss (lfp)
Low Income	10	0.53	0.28	0.15	0.05	0.10
Lower-Middle	25	0.58	0.34	0.17	0.05	0.12
Upper-Middle	23	0.56	0.34	0.17	0.05	0.12
High Income	30	0.64	0.25	0.15	0.06	0.09

entrepreneurs in the working population, while the variable *Labor force participation gender gap* is defined as the gap in labor force participation between men and women. The variable *Income loss (total)* gives us the percentage loss in income per capita due to gender gaps in the labor market in the form of entrepreneurs and labor force participation. The variable *Income loss (entrepr.)* gives the percentage loss in income per capita due to the gender gap in entrepreneurship, while the variable *Income loss (lfp)* gives the percentage loss in income per capita due to the gender gap in labor force participation, so it is the difference between the other two.

Table (3) gives the average of these five variables for four groups of countries, according to their income level. In low income countries, for example, more than 50% of women are excluded from entrepreneurship, which , according to our calculations, creates an average income loss of 5%; the percentage of women that are excluded from the labor force, on the other hand, is 28% which generates an output loss of 10%. The sum of these two output losses gives the total income loss due to gender gaps in the labor market. Perhaps somewhat surprisingly, the results for the other three income groups are quite similar to the ones just described. High-income countries, for instance, have a larger gender gap in entrepreneurship, which results in a total output loss of 15%.

In table (4) we split our sample of countries in geographic regions (*East Asia and Pacific*, *Europe and Central Asia*, *Latin America and the Caribbean*, *Middle East and North Africa*, *South Asia*, and *Sub-Saharan Africa*). We find some interesting differences in gender gaps, which lead to some significant differences in the implied income losses. The region with larger income losses due to gender gaps *Middle East and North Africa* where, according to our estimates, the entrepreneurs' gap is 77% whereas the labor participation gap is 53%. These differences between men and women generate an income loss of 7% and 20% respectively, so a total income loss of 27%. *South Asia* has the second largest income losses due to gender gaps (23%), mostly due to its large gender gap in labor force participation (47%), while *Europe*

Table 4: Income loss due to gender gaps, by regional groups

	Number countries	Entrepreneurs' gender gap	Labor force part. gender gap	Income loss (total)	Income loss (entrepr.)	Income loss (lfp)
East Asia & Pacific	12	0.53	0.28	0.15	0.05	0.10
Europe & Central Asia	33	0.63	0.23	0.14	0.06	0.08
Latin America & Caribbean	20	0.54	0.33	0.17	0.05	0.12
Middle East & North Africa	8	0.77	0.53	0.27	0.07	0.20
South Asia	5	0.6	0.47	0.23	0.05	0.17
Sub-Saharan Africa	9	0.44	0.24	0.13	0.04	0.09

and Central Asia display the second largest gap in entrepreneurship (63%).

Obviously, more work needs to be done to interpret these differences across income and geographical levels. It is clear that our measure of entrepreneurs and total labor gaps may reflect differences in the labor market (due to both demand and supply factors) as well as cultural factors. The goal of this exercise is to provide some quantitative estimates of the magnitude of these gaps and of their impact on the aggregate economy.

5 Conclusion

This paper quantifies the effects of gender gaps in the labor market on aggregate productivity and income per capita. Our numerical results show that the gender gap in entrepreneurs has significant effects on resource allocation and aggregate productivity, while the gap from formal employment does not affect productivity but has large effects on income per capita. Specifically, if no women works as an entrepreneur, output per worker would drop by more than 10%, while if the labor force participation of women was zero, income per capita would decrease by almost 40%.

When we do the country-by-country analysis, we find that gender gaps do not differ much across income groups, but there are very important differences across geographical regions. According to our calculations, gender inequality in low income countries creates an average loss of 15% in GDP per capita, which is due to both gaps in entrepreneurs (5%) and in labor force participation (10%). The region with the largest income loss due to gender inequality is Middle East and North Africa, with a total income loss of 27%, 7% coming from entrepreneurs' gaps and 20% from labor force participation. South Asia experiences the second largest income loss due to gender inequality (23%) and Europe and Central Asia display the second largest gap in entrepreneurs (63%).

In terms of future research, we are considering to extend this framework in two different directions. First, introducing a household production sector leading to a division of labor between husbands and wives, as in Becker (1981), which could explain some of the observed differences in labor participation and access to entrepreneurship between males and females without the need to assume gender discrimination. Second, we plan to make a dynamic version of the span-of-control model presented in this paper (see for instance, Caselli and Gennaioli 2012), which would make possible to quantify the effects of gender gaps on capital accumulation and economic growth.

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A Derivation of functions $H(z,w)$ and $G(z,w)$

A.1 Three equilibrium conditions in unknowns (z,w,r)

If we substitute equations (5) and (6) into equations (7), (8) and (9), we get the three equilibrium equations which determine the three unknowns (z,w,r). First, when we replace (5) and (6) into (7),

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

$\Leftrightarrow$

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

$\Leftrightarrow$

$$z^{\frac{1}{1-\eta}}\left(r^{\alpha}w^{1-\alpha}\right)^{-\frac{\eta}{1-\eta}}\Phi=w \tag{22}$$

where Φ is defined as

$$\Phi\equiv\left(\eta\alpha^{\alpha}(1-\alpha)^{1-\alpha}\right)^{\frac{\eta}{1-\eta}}-\left(\eta(1-\alpha)\left(\frac{\alpha}{1-\alpha}\right)^{\alpha\eta}\right)^{\frac{1}{1-\eta}}-\left(\eta\alpha\left(\frac{1-\alpha}{\alpha}\right)^{\eta(1-\alpha)}\right)^{\frac{1}{1-\eta}}.$$

Second, when we substitute (6) into (8),

$$\int_{z}^{\bar{z}}\left[x\eta\alpha\left(\frac{1-\alpha}{\alpha}\right)^{\eta(1-\alpha)}\frac{r^{\eta(1-\alpha)-1}}{w^{\eta(1-\alpha)}}\right]^{\frac{1}{1-\eta}}d\Gamma(x)=\frac{K}{N}$$

$\Leftrightarrow$

$$\left(\frac{r^{\eta(1-\alpha)-1}}{w^{\eta(1-\alpha)}}\right)^{\frac{1}{1-\eta}}\Omega\int_{z}^{\bar{z}}x^{\frac{1}{1-\eta}}d\Gamma(x)=\frac{K}{N} \tag{23}$$

where Ω is defined as

$$\Omega \equiv \left(\eta\alpha\left(\frac{1-\alpha}{\alpha}\right)^{\eta(1-\alpha)}\right)^{\frac{1}{1-\eta}}.$$

Third, when we substitute (5) into (9),

$$\int_{z}^{\bar{z}}\left[x\eta(1-\alpha)\left(\frac{\alpha}{1-\alpha}\right)^{\alpha\eta}\frac{w^{\alpha\eta-1}}{r^{\alpha\eta}}\right]^{\frac{1}{1-\eta}}d\Gamma(x)=\Gamma(z)$$

$\Leftrightarrow$

$$\left(\frac{w^{\alpha\eta-1}}{r^{\alpha\eta}}\right)^{\frac{1}{1-\eta}}\Psi\int_{z}^{\bar{z}}x^{\frac{1}{1-\eta}}d\Gamma(x)=\Gamma(z) \tag{24}$$

where $\Psi$is defined as

$$\Psi \equiv \left(\eta\left(1-\alpha\right)\left(\frac{\alpha}{1-\alpha}\right)^{\alpha\eta}\right)^{\frac{1}{1-\eta}}.$$

A.2 Functions $H\left(z,w\right)$ and $G\left(z,w\right)$

Using then equations (23) and (24) we can write the equilibrium interest rate r as a function of the other two unknowns:

$$r=\frac{\alpha}{1-\alpha}\frac{\Gamma\left(z\right)}{k}w.$$

If we then replace it in equations (22) and (24), the three equilibrium conditions in equations (22), (23) and (24) can be summarized in the two equations $G(z,w)=0$ and $H(z,w)=0$. First, when we substitute $r=\frac{\alpha}{1-\alpha}\frac{\Gamma(z)}{k}w$ into (24),

$$\left[x\eta(1-\alpha)\left(\frac{\alpha}{1-\alpha}\right)^{\alpha\eta}w^{\alpha\eta-1}\left(\frac{1-\alpha}{\alpha}\frac{k}{w\Gamma\left(z\right)}\right)^{\alpha\eta}\right]^{\frac{1}{1-\eta}}\int_{z}^{\bar{z}}x^{\frac{1}{1-\eta}}d\Gamma(x)=\Gamma(z)$$

$\Leftrightarrow$

$$H(z,w)=\Gamma\left(z\right)^{\frac{1-\eta(1-\alpha)}{1-\eta}}-\left[\eta\left(1-\alpha\right)\frac{k^{\alpha\eta}}{w}\right]^{\frac{1}{1-\eta}}\int_{z}^{\bar{z}}x^{\frac{1}{1-\eta}}d\Gamma(x)=0,$$

Second, when we substitute into $r = \frac{\alpha}{1-\alpha}\frac{\Gamma(z)}{k}w$ into (22),

$$z^{\frac{1}{1-\eta}}\left(\left(\frac{\alpha}{1-\alpha}\frac{\Gamma(z)}{k}w\right)^{\alpha} w^{1-\alpha}\right)^{-\frac{\eta}{1-\eta}}\Phi = w$$

$\Leftrightarrow$

$$G(z,w) = w^{\frac{1}{1-\eta}} - \Phi z^{\frac{1}{1-\eta}}\left(\frac{\alpha}{1-\alpha}\frac{\Gamma(z)}{k}\right)^{\frac{-\alpha\eta}{1-\eta}} = 0.$$

A.3 Slopes of $H(z,w)$ and $G(z,w)$

From equation $H(z,w) = 0$, we can obtain the following two partial derivatives:

$$\frac{\partial H(z,w)}{\partial w} = \frac{w^{\frac{\eta-2}{1-\eta}}}{1-\eta}\left[\eta(1-\alpha)k^{\alpha\eta}\right]^{\frac{1}{1-\eta}}\int_{z}^{\bar{z}} x^{\frac{1}{1-\eta}}d\Gamma(x) > 0$$

$$\frac{\partial H(z,w)}{\partial z} = \left(\frac{1-\eta(1-\alpha)}{1-\eta}\Gamma(z)^{\frac{\eta\alpha}{1-\eta}} + \left[\eta(1-\alpha)\frac{k^{\alpha\eta}}{w}\right]^{\frac{1}{1-\eta}} z^{\frac{1}{1-\eta}}\right)\Gamma'(z) > 0$$

which imply that $\frac{dw}{dz}\mid_{H(z,w)=0} = -\frac{\frac{\partial H(z,w)}{\partial z}}{\frac{\partial H(z,w)}{\partial w}} < 0$.

From equation $G(z,w) = 0$, we can obtain the following two partial derivatives:

$$\frac{\partial G(z,w)}{\partial w} = \frac{1}{1-\eta}w^{\frac{\eta}{1-\eta}} > 0$$

$$\frac{\partial G(z,w)}{\partial z} = \frac{\Phi}{1-\eta}z^{\frac{1}{1-\eta}}\Gamma(z)^{\frac{-\alpha\eta}{1-\eta}}\left(\frac{\alpha}{1-\alpha}\frac{1}{k}\right)^{\frac{-\alpha\eta}{1-\eta}}\left(-\frac{1}{z} + \alpha\eta\frac{\Gamma'(z)}{\Gamma(z)}\right)$$

Thus, if $\alpha\eta\frac{z\Gamma'(z)}{\Gamma(z)} < 1$, $\frac{\partial G(z,w)}{\partial z} < 0$ and $\frac{dw}{dz}\mid_{G(z,w)=0} = -\frac{\frac{\partial G(z,w)}{\partial z}}{\frac{\partial G(z,w)}{\partial w}} > 0$. On the other hand, if $\alpha\eta\frac{z\Gamma'(z)}{\Gamma(z)} > 1$, $\frac{\partial G(z,w)}{\partial z} > 0$ and $\frac{dw}{dz}\mid_{G(z,w)=0} = -\frac{\frac{\partial G(z,w)}{\partial z}}{\frac{\partial G(z,w)}{\partial w}} < 0$.[15]

[15] For the talent distribution assumed in section 4, that is the Pareto function, $\frac{z\Gamma'(z)}{\Gamma(z)} = \frac{\rho B^{\rho}z^{-\rho}}{1-B^{\rho}z^{-\rho}} = \frac{\rho}{\left(\frac{z}{B}\right)^{\rho}-1}$. Hence, $\lim_{z\to\infty}\left(\frac{z\Gamma'(z)}{\Gamma(z)}\right) = 0$ so that $\lim_{z\to\infty}\left(\frac{dw}{dz}\mid_{G(z,w)=0}\right) < 0$, and $\lim_{z\to B}\left(\frac{z\Gamma'(z)}{\Gamma(z)}\right) = \infty$ so that $\lim_{z\to B}\left(\frac{dw}{dz}\mid_{G(z,w)=0}\right) > 0$.

B Derivations of functions $\widetilde{H}(z,w)$ and $\widetilde{G}(z,w)$

If we proceed as before and substitute equations (5) and (6) into equations (7), (16) and (15), we get three equilibrium equations which determine the three unknowns (z,w,r). These equations can then be summarized in two equations in the two unknowns (z,w):

$$\widetilde{H}(z,w) = 1-\theta+\tilde{\Gamma}(z) - \left(\frac{\eta(1-\alpha)}{w}\right)^{\frac{1}{1-\eta}} \left(\frac{1-\theta+\tilde{\Gamma}(z)}{k}\right)^{\frac{-\alpha\eta}{1-\eta}} \int_{z}^{\bar{z}} x^{\frac{1}{1-\eta}} d\tilde{\Gamma}(x) = 0$$

$$\widetilde{G}(z,w) = w^{\frac{1}{1-\eta}} - \Phi z^{\frac{1}{1-\eta}} \left(\frac{\alpha}{1-\alpha}\frac{1-\theta+\tilde{\Gamma}(z)}{k}\right)^{\frac{-\alpha\eta}{1-\eta}} = 0$$

Taking the partial derivatives of both functions with respect to z and w, we can easily see that $\frac{\partial\widetilde{H}(z,w)}{\partial w} > 0$, $\frac{\partial\widetilde{H}(z,w)}{\partial z} > 0$, $\frac{\partial\widetilde{G}(z,w)}{\partial w} > 0$, and that $\frac{\partial\widetilde{G}(z,w)}{\partial z} < 0$ if $\alpha\eta\frac{z\Gamma'(z)}{1/\theta-1+\Gamma(z)} < 1$.

Therefore, $\frac{dw}{dz}\mid_{\widetilde{H}(z,w)=0} = -\frac{\frac{\partial\widetilde{H}(z,w)}{\partial z}}{\frac{\partial\widetilde{H}(z,w)}{\partial w}} < 0$ and, if $\alpha\eta\frac{z\Gamma'(z)}{1/\theta-1+\Gamma(z)} < 1$, $\frac{dw}{dz}\mid_{\widetilde{G}(z,w)=0} = -\frac{\frac{\partial\widetilde{G}(z,w)}{\partial z}}{\frac{\partial\widetilde{G}(z,w)}{\partial w}} > 0$, which implies that $\widetilde{H}(z,w)$ is downward sloping and $\widetilde{G}(z,w)$ is upward sloping.

To know the effect of a change in θ on the equilibrium talent threshold z, we can use $\widetilde{H}(z,w)$ and $\widetilde{G}(z,w)$ to obtain a new equilibrium condition in terms of the unknown z:

$$\widetilde{F}(z) = -\theta(\eta(1-\alpha))^{\frac{1}{1-\eta}} \int_{z}^{\bar{z}} x^{\frac{1}{1-\eta}} d\Gamma(x) + z^{\frac{1}{1-\eta}}(1-\theta+\theta\Gamma(z))\left(\frac{\alpha}{1-\alpha}\right)^{\frac{-\alpha\eta}{1-\eta}}\Phi = 0$$

We can now easily see the sign of the partial derivatives of $\widetilde{F}(z,w)$:

$$\frac{\partial\widetilde{F}(z)}{\partial z} = \theta(\eta(1-\alpha))^{\frac{1}{1-\eta}} z^{\frac{1}{1-\eta}}\Gamma'(z) + \left(\frac{\alpha}{1-\alpha}\right)^{\frac{-\alpha\eta}{1-\eta}}\Phi\left[\frac{1}{1-\eta}z^{\frac{\eta}{1-\eta}}(1-\theta+\theta\Gamma(z)) + \theta\Gamma'(z)z^{\frac{1}{1-\eta}}\right] > 0$$

$$\frac{\partial\widetilde{F}(z)}{\partial\theta} = -(\eta(1-\alpha))^{\frac{1}{1-\eta}} \int_{z}^{\bar{z}} x^{\frac{1}{1-\eta}} d\Gamma(x) + z^{\frac{1}{1-\eta}}(-1+\Gamma'(z))\left(\frac{\alpha}{1-\alpha}\right)^{\frac{-\alpha\eta}{1-\eta}}\Phi < 0$$

Hence, there is a positive relation between z and θ:

$$\frac{dz}{d\theta}\mid_{\widetilde{F}(z)=0} = -\frac{\frac{\partial\widetilde{F}(z)}{\partial\theta}}{\frac{\partial\widetilde{F}(z)}{\partial z}} > 0.$$

C Talent distribution

When we write the talent distribution with an upper bound equal to $\overline{z}$,

$$\int_{z}^{\overline{z}} x^{\frac{1}{1-\eta}} d\Gamma(x) = \int_{z}^{\overline{z}} x^{\frac{1}{1-\eta}} \rho B^{\rho} x^{-\rho-1} dx = \int_{z}^{\overline{z}} \rho B^{\rho} x^{\frac{1}{1-\eta}-\rho-1} dx = \frac{\rho B^{\rho}}{\frac{1}{1-\eta}-\rho} \left[\overline{z}^{\frac{1}{1-\eta}-\rho} - z^{\frac{1}{1-\eta}-\rho} \right].$$

As a result, the market clearing conditions in equations (23) and (24) become:

$$\left[\eta\alpha \left(\frac{1-\alpha}{\alpha} \right)^{\eta(1-\alpha)} \frac{r^{\eta(1-\alpha)-1}}{w^{\eta(1-\alpha)}} \right]^{\frac{1}{1-\eta}} \frac{\rho B^{\rho}}{\frac{1}{1-\eta}-\rho} \left[\overline{z}^{\frac{1}{1-\eta}-\rho} - z^{\frac{1}{1-\eta}-\rho} \right] = \frac{K}{N} \tag{25}$$

$$\left[\eta (1-\alpha) \left(\frac{\alpha}{1-\alpha} \right)^{\alpha\eta} \frac{w^{\alpha\eta-1}}{r^{\alpha\eta}} \right]^{\frac{1}{1-\eta}} \frac{\rho B^{\rho}}{\frac{1}{1-\eta}-\rho} \left[\overline{z}^{\frac{1}{1-\eta}-\rho} - z^{\frac{1}{1-\eta}-\rho} \right] = 1 - B^{\rho} z^{-\rho} \tag{26}$$

D Country-by-country results[16]

	Year	Income group	Region group	Entrepr. gender gap	LFP gender gap	Income loss	Loss due to entrepr. GG	Loss due to LFP GG
Algeria	2004	2	MENA	0.7769	0.5603	0.2732	0.0677	0.2055
Argentina	2006	3	LAC	0.5259	0.3474	0.1719	0.0469	0.1250
Australia	2007	4	EAP	0.3645	0.2028	0.1052	0.0331	0.0721

[16] Variable 1: country; variable 2: year; variable 3: World Bank income group (1: Low Income, 2: Lower-Middle, 3: Upper-Middle, 4: High Income); variable 4: World Bank region (EAP: East Asia and Pacific, EUCA: Europe and Central Asia, LAC: Latin America and Caribbean, MENA: Middle East and North Africa, NAM: North America and Mexico, SA: South Africa, SSA: Sub-Saharan Africa); variable 5: gender gap in entrepreneurs (fraction of women excluded from entrepreneurship relative to men; source: own calculations from ILO data); variable 6: gender gap in labor force participation (fraction of women excluded from the labor force relative to men; source: own calculations from ILO data); variable 7: total income loss due to gender gaps (source: own results); variable 8: income loss due to entrepreneurs' gender gap (source: own results); variable 9: income loss due to labor force participation gender gap (source: own results).

	Year	Income group	Region group	Entrepr. gender gap	LFP gender gap	Income loss	Loss due to entrepr. GG	Loss due to LFP GG
Austria	2007	4	EUCA	0.5731	0.2309	0.1366	0.0543	0.0823
Azerbaijan	2007	2	EUCA	0.8488	0.1549	0.1449	0.0900	0.0549
Bangladesh	2005	1	SA	0.6445	0.3407	0.1821	0.0596	0.1225
Barbados	2004	3	LAC	0.7530	0.1557	0.1326	0.0774	0.0552
Belgium	2007	4	EUCA	0.6471	0.2383	0.1474	0.0624	0.0850
Belize	2005	3	LAC	0.4673	0.4457	0.2011	0.0393	0.1618
Bhutan	2005	1	SA	0.5790	0.5383	0.2452	0.0481	0.1971
Bolivia	2002	2	LAC	0.6756	0.2488	0.1543	0.0655	0.0888
Botswana	2003	3	SSA	0.2709	0.2594	0.1161	0.0235	0.0927
Brazil	2006	2	LAC	0.5131	0.2878	0.1498	0.0468	0.1031
Bulgaria	2007	2	EUCA	0.5337	0.1875	0.1175	0.0509	0.0666
Cambodia	2004	1	EAP	0.5197	0.0847	0.0812	0.0513	0.0298
Cameroon	2001	2	SSA	0.4661	0.3143	0.1543	0.0415	0.1128
Canada	2007	4	NAM	0.5980	0.1438	0.1099	0.0590	0.0509
Chile	2007	3	LAC	0.5558	0.4583	0.2142	0.0476	0.1666
Colombia	2007	2	LAC	0.4614	0.1949	0.1123	0.0430	0.0693
Costa Rica	2007	3	LAC	0.5582	0.4544	0.2130	0.0479	0.1651
Cyprus	2007	4	MENA	0.8494	0.2329	0.1704	0.0874	0.0830
Czech Republic	2007	3	EUCA	0.6090	0.2500	0.1471	0.0579	0.0892
Denmark	2007	4	EUCA	0.7199	0.1465	0.1254	0.0736	0.0518
Dominican Rep	2007	2	LAC	0.4655	0.2260	0.1235	0.0429	0.0805
Ecuador	2006	2	LAC	0.4181	0.3418	0.1593	0.0363	0.1229
El Salvador	2006	2	LAC	0.4933	0.4177	0.1936	0.0423	0.1513
Estonia	2007	3	EUCA	0.6964	0.1662	0.1290	0.0701	0.0589
Ethiopia	2006	1	SSA	0.6193	0.1330	0.1088	0.0617	0.0470
Fiji	2005	2	EAP	0	0.5025	0.1834	0	0.1834
Finland	2007	4	EUCA	0.6486	0.1138	0.1059	0.0657	0.0402
France	2007	4	EUCA	0.5986	0.1968	0.1278	0.0579	0.0699
Georgia	2007	2	EUCA	0.7442	0.2397	0.1594	0.0739	0.0855
Germany	2007	4	EUCA	0.6288	0.2227	0.1401	0.0607	0.0793
Greece	2007	4	EUCA	0.6115	0.3338	0.1762	0.0562	0.1200

	Year	Income group	Region group	Entrepr. gender gap	LFP gender gap	Income loss	Loss due to entrepr. GG	Loss due to LFP GG
Guatemala	2002	2	LAC	0.6571	0.5890	0.2711	0.0544	0.2167
Hong Kong, China	2007	4	EAP	0.7207	0.2371	0.1557	0.0711	0.0846
Hungary	2007	3	EUCA	0.5670	0.2593	0.1457	0.0530	0.0926
Iceland	2007	4	EUCA	0.5885	0.1100	0.0975	0.0587	0.0388
Indonesia	2007	2	EAP	0.6321	0.4233	0.2095	0.0562	0.1533
Ireland	2007	4	EUCA	0.7171	0.2611	0.1633	0.0700	0.0933
Israel	2007	4	MENA	0.7357	0.1617	0.1324	0.0751	0.0573
Italy	2007	4	EUCA	0.5668	0.3623	0.1814	0.0508	0.1306
Jamaica	2006	2	LAC	0.4582	0.0672	0.0684	0.0448	0.0236
Japan	2007	4	EAP	0.6990	0.3333	0.1857	0.0659	0.1198
Kazakhstan	2004	2	EUCA	0.6034	0.1480	0.1119	0.0596	0.0524
Latvia	2007	3	EUCA	0.6268	0.2232	0.1400	0.0605	0.0795
Lithuania	2007	3	EUCA	0.6902	0.1639	0.1275	0.0694	0.0581
Luxembourg	2007	4	EUCA	0.5689	0.2563	0.1448	0.0533	0.0915
Malaysia	2007	3	EAP	0.7093	0.4412	0.2241	0.0640	0.1601
Malta	2007	4	EUCA	0.7733	0.5206	0.2589	0.0686	0.1903
Mauritius	2007	3	SSA	0.6659	0.4494	0.2223	0.0591	0.1632
Mexico	2007	3	LAC	0.6104	0.4850	0.2291	0.0525	0.1767
Mongolia	2003	1	EAP	0.4048	0.0508	0.0571	0.0393	0.0179
Morocco	2007	2	MENA	0.8065	0.6912	0.3232	0.0663	0.2568
Namibia	2004	2	SSA	0.3464	0.1900	0.0989	0.0314	0.0675
Nepal	2001	1	SA	0.0340	0.3091	0.1136	0.0027	0.1109
Netherlands	2007	4	EUCA	0.6691	0.2028	0.1380	0.0659	0.0721
New Zealand	2007	4	EAP	0.5465	0.1797	0.1162	0.0525	0.0638
Nicaragua	2006	2	LAC	0.5366	0.5782	0.2557	0.0432	0.2125
Norway	2007	4	EUCA	0.5703	0.1211	0.0991	0.0563	0.0428
Oman	2000	3	MENA	0.6881	0.7050	0.3165	0.0542	0.2623
Pakistan	2007	1	SA	0.8734	0.7553	0.3534	0.0709	0.2825
Panama	2007	3	LAC	0.5434	0.4013	0.1927	0.0476	0.1451
Paraguay	2007	2	LAC	0.5700	0.1583	0.1116	0.0555	0.0561
Peru	2007	2	LAC	0.5396	0.2220	0.1299	0.0509	0.0790

	Year	Income group	Region group	Entrepr. gender gap	LFP gender gap	Income loss	Loss due to entrepr. GG	Loss due to LFP GG
Philippines	2007	2	EAP	0.5468	0.3775	0.1846	0.0484	0.1362
Poland	2007	3	EUCA	0.4678	0.2295	0.1249	0.0431	0.0818
Portugal	2007	4	EUCA	0.5533	0.2000	0.1239	0.0528	0.0711
Qatar	2004	4	MENA	0.8796	0.5582	0.2840	0.0793	0.2047
Romania	2007	3	EUCA	0.6356	0.2283	0.1427	0.0614	0.0814
Russian Federation	2007	3	EUCA	0.3478	0.1725	0.0930	0.0318	0.0612
Singapore	2007	4	EAP	0.5942	0.2947	0.1608	0.0552	0.1056
Slovenia	2007	4	EUCA	0.6141	0.1938	0.1286	0.0597	0.0689
South Africa	2007	3	SSA	0	0.2167	0.0771	0	0.0771
Spain	2007	4	EUCA	0.5288	0.3088	0.1588	0.0480	0.1108
Sri Lanka	2007	2	SA	0.8206	0.4293	0.2327	0.0770	0.1556
Sweden	2007	4	EUCA	0.7260	0.1217	0.1180	0.0750	0.0430
Switzerland	2007	4	EUCA	0.5958	0.2027	0.1295	0.0575	0.0721
Syrian Arab Rep	2001	2	MENA	0.8598	0.7783	0.3604	0.0686	0.2918
Thailand	2007	2	EAP	0.6377	0.1788	0.1263	0.0628	0.0634
Trinidad and Tobago	2005	3	LAC	0.4951	0.2842	0.1467	0.0450	0.1017
Turkey	2007	3	EUCA	0.8230	0.6514	0.3106	0.0695	0.2411
Uganda	2003	1	SSA	0.5119	0.1055	0.0873	0.0501	0.0372
United Arab Emirates	2005	4	MENA	0.5443	0.5796	0.2569	0.0439	0.2130
United Kingdom	2007	4	EUCA	0.6598	0.2029	0.1369	0.0648	0.0721
Uruguay	2007	3	LAC	0.5302	0.2973	0.1549	0.0484	0.1066
Zambia	2003	1	SSA	0.6663	0.2728	0.1613	0.0638	0.0976
Zimbabwe	2002	1	SSA	0.4417	0.2038	0.1133	0.0408	0.0725