Imitation as a social norm that influences the choice of career and labor participation of women

La imitación como norma social que influencia la elección de carrera y de participación laboral de la mujer

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Abstract

In Latin America, labor market indicators still show large gender gaps in access to opportunities and rights. These inequalities persist despite various policy efforts because they emanate from a social system that reproduces stereotypes and gender roles. This contradicts the development vision of the United Nations and the ILO: "*Without gender equality, sustainable development is neither development nor sustainable*". This contribution focuses on the impact of social norms on women's decisions, regarding career choice and labor participation. To this end, we have built and simulated an agent-based model. The model assumes that gender roles are acquired and reproduced through the environment that surrounds women. The results of this social simulation suggest that the environment greatly influences the perception of women about the roles they must assume and the areas in which they must play, so it is pertinent to design policies aiming to change the conceptions of identity and traditional gender roles, since the construction and adoption of new and more equitable values is in part acquired through the imitation of the behavior observed in a woman's environment.

Social norms, gender inequality, agent-based modeling

Resumen

En América Latina, los indicadores del mercado laboral aún muestran grandes brechas de género en el acceso a oportunidades y derechos. Estas desigualdades persisten pese a los diversos esfuerzos de política, porque emanan de un sistema social que reproduce estereotipos y roles de género. Esto contradice la visión de desarrollo de las Naciones Unidas y la OIT: "*Sin igualdad de género, el desarrollo sostenible no es desarrollo ni es sostenible*". Esta contribución se centra en el impacto de las normas sociales en las decisiones de las mujeres, en cuanto a la elección de carrera y la participación laboral. Con este fin, hemos construido y simulado un modelo basado en agentes. El modelo asume que los roles de género se adquieren y reproducen a través del entorno que rodea a las mujeres. Los resultados de esta simulación social sugieren que el entorno influye en gran medida en la percepción de las mujeres sobre los roles que deben asumir y los ámbitos en los que se deben desempeñar, por lo que es pertinente diseñar políticas que busquen cambiar las concepciones de identidad y roles de género tradicionales, ya que la construcción y adopción de nuevos valores más equitativos, se logra en parte a través de la imitación del comportamiento observado en el entorno de la mujer.

Normas sociales, desigualdad de género, modelación basada en agentes

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Introduction

In Latin America, labor market indicators continue to show large gender gaps in access to opportunities and rights between men and women, and this gap has closed only slightly in the last decade. Gender inequalities persists despite the various policy efforts of the governments of the region because they arise from a social system that reproduces gender stereotypes and roles. These structural factors limit women's labor insertion and represent an obstacle to overcoming poverty and inequality , as well as to achieving economic autonomy for women; This problem has been exacerbated by the global contraction in growth of last years and has been aggravated by the economic slowdown derived from the current COVID-19 pandemic.

Despite the heterogeneity in the region, most countries exhibit gender gaps in the employment and occupation rates and, most notably, in the participation rate. In Mexico, the total participation rate in 2018 has been around three percentage points below the Latin American average, standing respectively at 61.1% and 64.1%. This indicates a high labor force participation in both cases, but the rates by gender show large contrasts, both between regions and within the composition of the labor force. For example, in the decade from 1998 to 2007, the gender gap in Mexico was 42.1%; that is, only 39.98% of women participated in the labor force; that is, less than half of the participation of men (82.08%). In contrast, the gender gap in Latin America and the Caribbean was smaller (30.04%), because the male participation rate was like in Mexico, but the female participation rate was 9% higher than in Mexico. In both cases, the gender gap narrowed over time, basically due to the increasing participation of women. However, in 2018 the gap is still considerable: 35.1% in Mexico and 26.5% in Latin America and the Caribbean.[1] This suggest that neither the market nor public policies have been able to recruit and retain in the labor market a group of women who still facing obstacles to improving their economic conditions and those of their families; This dynamic is incompatible with the United Nations and ILO's vision of development:

> "Without gender equality, sustainable development is neither development nor sustainable" (OIT, Notas para la Igualdad No. 22, 2017)

The underlying problem is that women access the public sphere in inferior conditions, whether economic, social, or cultural (Astelarra, 2005). They also participate in segregated spaces; that is, electing jobs, occupations or professions traditionally considered "feminine occupations", which are characterized by lower social and monetary value than the "male ones". In addition, their participation is also shaped by the place they occupy in the private sphere and by their roles as caretakers and unpaid domestic workers. Since the burden of these home-activities are not modified, women support double working hours, with all the difficulties and costs that this implies. (CEPAL, 2019).

In a wider scope, the Gender Inequality Index (GII), which captures inequalities that women face in reproductive health, political representation and the labor market (1 indicates complete inequality and 0 indicates perfect equality) had a total value of 0.441 in 2017 (UNDP, 2018). Likewise, in 2018 the Global Gender Gap Index (GGGI) , which examines the gap between men and women in four fundamental categories (1 means parity): participation and economic opportunity, educational attainment, health and survival, and political empowerment was of 68%, which means that globally there was still a 32% gap to close. (World Economic Forum, 2018). Finally, in 2017 the average global value of the Human Development Index (HDI) for women (0.705) was 4.4% lower than that of men (UNDP, 2018). In short, large gender inequalities persist, especially in the political and economic spheres. These inequalities are due in part to gender discrimination, which derives both from the law and from practice. In the first case, legal and political institutions are used to perpetuate gender divisions, denying women access to the same legal rights as men. In the second case, culture and tradition are translated into social norms that significantly influence the configuration of gender roles. Thereby, the norms and traditions that distribute most of the unpaid work in the home to women, limit their participation in the labor market and even the girls' access to education (UNDP, 2015).

[1] Rates obtained from data from the International Labor Office, ILO Econometric Trend Models (ilo.org/wesodata).

Given that the problem has several dimensions, this contribution focuses on the impact of social norms on women 's decisions, regarding career choice and participation in the labor market. As social norms encompass a variety of behaviors and attitudes, in this work we will simulate a social experiment to study how a woman's social environment affects her decision, whether to choose a career, or to participate or not in the labor market. Our working hypothesis is the following:

Hypothesis: When a woman is surrounded by a certain percentage of women who participate in the labor market, she will be more likely to participate as well. Similarly, being surrounded by women with professions other than those traditionally considered female, encourages women to choose areas usually delegated to men. On the contrary, when the prevailing social norm is that women work in the private sphere, women tend not to participate in the labor market or to train professionally in non-traditional fields, thus reproducing gender inequalities.

Because of the social nature of this phenomenon, in our analysis we will use the Agent Based Modelling. This approach is a form of computational simulation that allows creating, analyzing and experimenting with artificial worlds made up of heterogeneous agents; the basic principle is to provide the various types of agents with simple rules of behavior, in order to investigate how the interactions among themselves, and between the agents and their environment, add up to form the patterns seen in the real world (Hamill and Gilbert, 2016). The use of this approach has become popular in the social sciences, as it allows the analysis of a complex phenomenon in a simplified representation of social reality (Wilensky and Rand, 2015), avoiding the difficulties and ethical problems that would arise from carrying out social experiments in the real world (Gilbert, 2008). Since the social norm regarding women' choices implies the adoption of the cultural costumes that are observed in their social environment, we will model it as an imitation rule. In the case of the labor market participation, the imitation rule will depends on the percentage of women in the environment who carry out activities in the public sphere; and, in the case of career choice, by the percentage of women with no-traditionally female professions.

Our contribution adds to the social research that seeks to identify the underlying causes of a phenomenon, which is very important for the correct design of adequate or pertinent policies that promote gender equality and human development. Moreover, achieving gender equality and the empowerment of women is the Objective 5 of the United Nations Agenda 2030 for Sustainable Development (UNDP, 2016). Our results suggest that the environment greatly influences the perception of women about the roles they must assume and the areas in which they must play, so it is pertinent to design policies aiming to change the conceptions of identity and traditional gender roles, since the construction and adoption of new and more equitable values is in part acquired through the imitation of the behavior observed in a woman's environment.

The remainder of this document is organized as follows. In the following section we develop and simulate the agent-based model. Next, we run OLS regressions with the simulated data and discuss the results. Finally, we present our conclusions.

The Model

The model is constructed in the NetLogo platform, a free disposable software, provided by Uri Willensky, that is specifically constructed for agent-based simulation. The world is populated by women and is represented by a 33x33 square lattice where the 1089 patches are agents; each agent is related to their 8 neighbours. They decide between assuming a traditional role (such as developing activities in the private sphere or choosing "female" professions) or adopting a non-traditional role (either developing activities in the public sphere or choosing “male” professions). We assume a mechanism of choice strictly social that derives from the neighbour’s behaviour.

A proportion of the population has already made their choice. Those who chose a traditional role are shown in pink, while those who chose a non-traditional role are shown in blue; finally, those who have not made their choice yet are shown in white.

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The location of the agents who have already decided is random.

White (undecided) agents observe the behaviour (that is, the colour) of their eight neighbours; and each agent will make her choice according to the most prominent behaviour (given some threshold) in his neighbourhood at that given moment. Once the choice is made it is permanent. This process continues until there are no more white agents willing to make a decision. In other words, undecided agents, which are chosen randomly, may take a decision in an iterative process, mimicking the behaviour observed in their neighbourhood.

Simulations

We run several simulations were the initial portion of agents who already has made their choice, ranks from 5% to 50% of total population (5, 10, 15, 20, 25, 30, 35, 40, 45 and 50%). Threshold ranks between 37.5% (3 neighbours) to 62.5% (5 neighbours) at steps of 12.5% (1 neighbour). The model is simulated for the 300 different parameter configurations resulting from these values.

As a matter of illustration, figure 1 shows in panel (a) the initial disposition of the world, assuming that population is distributed as: Pink agents: 10%; Blue agents: 10%; and white agents: 80%. The threshold for white agents to choose is settled at 37.5%, meaning that a white agent imitates the behaviour (colour) that is showed for more than three of their neighbours.

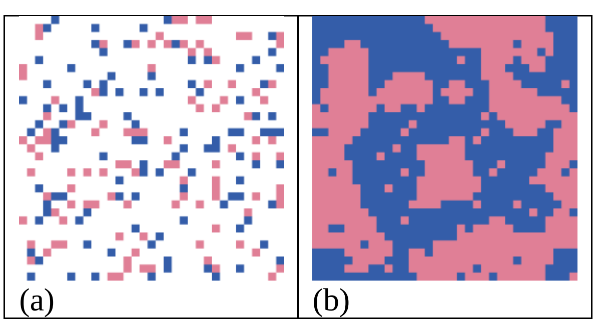

Figure 1 (a) Initial disposition of the world. (b) Final disposition of the world
Source: Own computations

The simulation starts from these values and the model proceeds iteratively, randomly choosing white agents, who check their neighbourhood and imitate the most predominant colour in it, according to the given threshold. At each iteration, the disposition of the world changes, reflecting the new choices made, which in turn influences the decisions of the white agents that will decide in the subsequent iteration. The iteration stops when all the white agents have chosen their role. The panel (b) in Figure 1 shows the distribution of the world at the end of our simulation, given these initial parameter values, with the next proportions: White agents: 0%; Pink agents: 47.4%; and Blue agents: 52.6%. The variations of these percentage at each iteration is showed in Figure 2.

The model is simulated for the 300 different parameter configurations considered. Results are shown in next section.

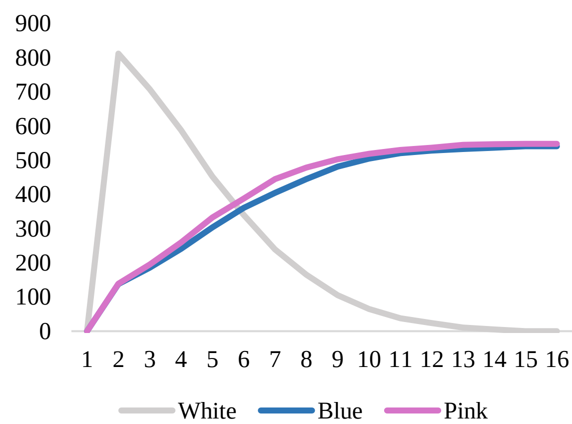

Figure 2 Distribution of agents at the end of simulation
Source: Own computations

Results

Table 1 shows the correlation between the initial and final share of each population (pink or blue).

	Initial blue	Initial Pink	Final Blue	Final Pink
Initial blue	1.0000	0.0000	0.7486	-0.4506
Initial Pink	0.0000	1.0000	-0.4495	0.7481
Final Blue	0.7486	-0.4495	1.0000	-0.6450
Final Pink	-0.4506	0.7481	-0.6450	1.0000

Table 1 Correlations between initial and final population values
Source: Own computations from the simulations

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As expected, for each population, initial and final shares are strongly correlated; and each initial population is negatively correlated with the final share of the other type population. Due to the symmetry of simulations, correlations are nearly identical for each type to himself and to the other type, and any difference is statistically insignificant given the randomness of the simulation process. Thus, we made OLS regressions, using the whole sample of 30,000 simulations, only for the blue population, being the results also applicable to the pink population.

Table 2 shows the results from regressing the final blue population with respect to the initial blue population and the threshold value (as percentages).[2]

Dep. Var. Final blue	Coefficient	St. Deviation	t-statistic	p-value
Constant	0.368810	0.00510165	72.29	<0.0001
Initial blue	1.39492	0.00663239	210.3	<0.0001
Threshold	−0.00640105	9.33858e-05	−68.54	<0.0001
R-Square	0.619953	Adj. R-Square	0.619928	

Table 2 OLS regression of the final blue population with respect to the initial blue population and the threshold level
Source: Own computations from the simulations

This simple linear model adjusts the data quite accurately, obtaining an adjusted R-Square close to 0.62 and all estimated coefficients are significant at the 1% confidence level. The coefficient of the initial blue population is nearly 1.4, implying a spread of 40% of their behaviour among white agents. As expected, the threshold has a negative impact on the imitation of behaviour, since it increases the number of same-type neighbours required to be imitated by white agents.

Separating for threshold levels

For a threshold of 37.5% (3 neighbours) the adoption of the blue values for white agents is easier (remember that the same will occur if we consider the pink population); this generates a higher variation in the end population, which is inversely proportional to the population size, as is shown in figure 3.

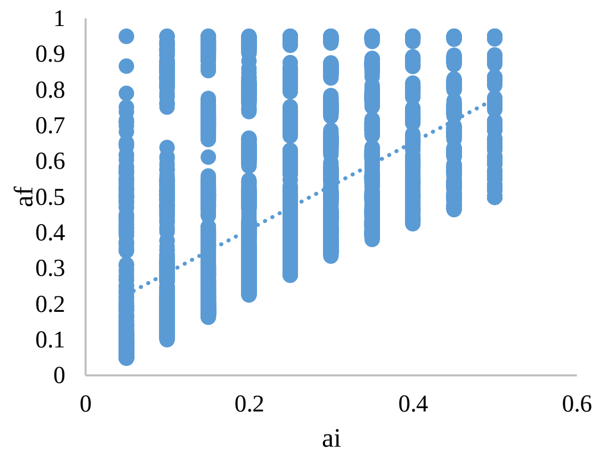

Figure 3 Scatter plot of the initial blue population (a_i) and the final blue population (a_f), for a threshold of 37.5%
Source: Own computations from the simulations

This yields a less accurate regression, as is shown in table 3.

Dep. Var. Final blue	Coefficient	St. Deviation	t-statistic	p-value
Constant	0.165275	0.00437999	37.73	<0.0001***
Initial blue	1.21915	0.0141337	86.26	<0.0001***
R-Square	0.426673	Adj. R-Square	0.426615	

Table 3 OLS regression of final blue population with respect to initial blue population with a threshold level of 37.5%
Source: Own computations from the simulations

As we can observe, the effect of the initial population on the final population is lower than before, representing an imitation effect of roughly a 22% of the initial population, but the adjusted R-Squared is only 0.42.

A higher threshold (50%, 4 neighbours) reduces the variance of results, especially for low levels of initial population, suggesting more difficulties to influence the white neighbours. According to the scatter plot in figure 4, for initial shares of blue population lower than 10 – 15 % it is harder to have the concentration of blue neighbours required to be imitated by white agents.

[2] The initial pink population is omitted due to the by construction collinearity with the initial blue population.

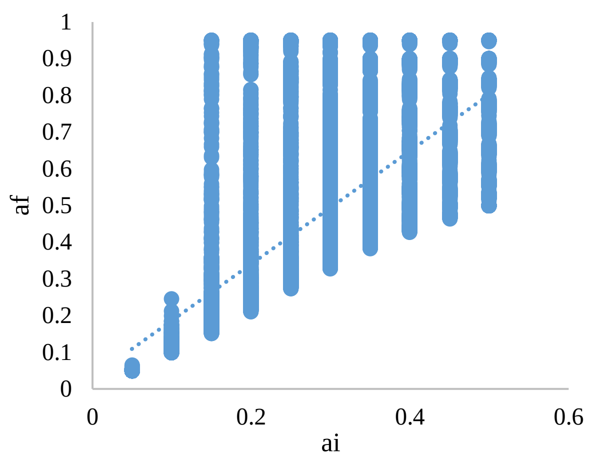

Figure 4 Scatter plot of the initial blue population (a_i) and the final blue population (a_f), for a threshold of 50%
Source: Own computations from the simulations

However, due to the less variance in the results, the regression for this threshold level yields to a slightly better fit of the model, as is shown in table 4.

Dep. Var. Final blue	Coefficient	St. Deviation	t-statistic	p-value
Constant	0.0325045	0.00389538	8.344	<0.0001***
Initial blue	1.53975	0.0125699	122.5	<0.0001***
R-Square	0.600131	Adj. R-Square	0.600091	

Table 4 OLS regression of final blue population with respect to initial blue population with a threshold level of 50%
Source: Own computations from the simulations

In this case, the significance levels remain very high, and the initial share of blue population has a higher coefficient, yielding to a final blue population 54% larger than the initial one. The adjusted R-Square improves to around 0.6.

Finally, the results for the largest threshold used in the simulations, 62.5% (5 neighbours), indicate that it is much more difficult the adoption of the behaviour of blue agents, since white agents need to have more than 5 blue neighbours to imitate their behaviour. In this case, the variance in the final population is further reduced, and it is needed an initial blue population higher than 20% to start noticing the imitation process (see figure 5).

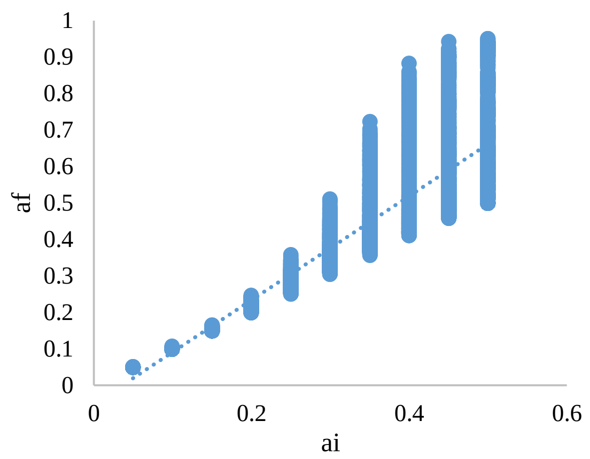

Figure 5 Scatter plot of the initial blue population (a_i) and the final blue population (a_f), for a threshold of 62.5%
Source: Own computations from the simulations

Observe that for an initial population of 5% there is not imitation, and any possible effect remains quite insignificant up to an initial population of 25%; for an initial blue population of 35% and more, there is a notable expansion of blue population (over 50% of the final population); this is explained by the density of the blue population at the beginning of the process. The lower variance produces a better fit, but the effect of the initial population on the final population is lower. Results are reported in table 5.

Dep. Var. Final blue	Coefficient	St. Deviation	t-statistic	p-value
Constant	−0.0515078	0.00166524	−30.93	<0.0001***
Initial blue	1.42587	0.00537351	265.4	<0.0001***
R-Square	0.875661	Adj. R-Square	0.875648	

Table 5 OLS regression of final blue population with respect to initial blue population with a threshold level of 62.5%
Source: Own computations from the simulations

The constant has changed sign but still be highly significant; however, its relevance diminishes considerably. The model adjustment is also higher, over 0.87. Finally, the effect of the initial population is slightly lower but implies an increase of the blue population 42.6% with respect to the initial population; so, even if the higher threshold impede the imitation process, the total effect still remarkable.

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Conclusions

In this work we have constructed and simulated an Agent Based Model to shed light on the social causes of gender inequality observed in various areas, such as participation in the labour market or career choice. The model assumes that gender roles are acquired and reproduced through the environment that surrounds women. The results show that as the population density increases, the values of each type of population, whether traditional or less traditional, are more easily adopted by the population of women who are about to decide their future (white agents).

Every time a white agent adopts the values that he observes in his environment, his decision not only affects him, but also, by increasing the number of agents of that type of population, the probability of change of the remaining white agents is influenced. This is due to the fact that this social phenomenon constitutes a complex system in which the agents are interdependent and the strategies of one agent affect the strategies of the others; moreover, the macroeconomic pattern that emerges from these interactions between agents, and between agents and their environment, is more than the sum of individual actions. Specifically, a complex system is an organized set of interrelated elements and processes whose dynamic interaction over time produces behaviours and macroscopic regularities (or emergent properties) that cannot be deduced linearly from the analytical knowledge of its parts. Thereby, the results of the regressions generally point to a diffusion-imitation effect of the values of a group, even when its initial population is low.

The results of our social simulation suggest that the environment largely influences the perception of women about the roles that they have to assume and the spheres in which they have to play, so that any gender equality policies must take into account the social organization that forms the basis of discrimination against women, as well as their role in that social organization. Thus, by intervening to change the conceptions of identity and traditional gender roles, the construction and adoption of new and more equitable values will be achieved through the imitation of the behaviour observed in a woman's environment.

Annexe. The NetLogo program code

```
Globals [blancosiniciales azulesiniciales rosasiniciales bi% ai% ri% all blancos1 azules1 rosas1 bf% af% rf%]


patches-own [change? go? vecinosrosas vecinosazules vecinosblancos]


to set-up
  ca
  ask patches [set pcolor white]
  let p count patches
  let r round p * rosas / 100
  let a round p * azules / 100
  ask n-of r patches [set pcolor pink]
  ask n-of a patches with [pcolor = white][set pcolor blue]
  iniciales
  reset-ticks
end

to iniciales
  set blancosiniciales count patches with [pcolor = white]
  set azulesiniciales count patches with [pcolor = blue]
  set rosasiniciales count patches with [pcolor = pink]
  set all count patches
  set bi% blancosiniciales / all
  set ai% azulesiniciales / all
  set ri% azulesiniciales / all
end

to valores
  set blancos1 count patches with [pcolor = white]
  set azules1 count patches with [pcolor = blue]
  set rosas1 count patches with [pcolor = pink]
  set bf% blancos1 / all
  set af% azules1 / all
  set rf% rosas1 / all
end

to contar
  ask patches [set vecinosrosas count neighbors with [pcolor = pink] set vecinosazules count neighbors with [pcolor = blue] set vecinosblancos count neighbors with [pcolor = white]]
end

to cambiar
  ask patches [set change? false set go? false]
  ask patches with [pcolor = white][set change? true]
  while [any? patches with [change? = true]] [
    ask one-of patches with [change? = true] [
      set change? false
      if (vecinosrosas / 8) * 100 >= porcentaje or (vecinosazules / 8) * 100 >= porcentaje [
        if vecinosrosas > vecinosazules [set pcolor pink set go? true]
        if vecinosrosas < vecinosazules [set pcolor blue set go? true]
        if vecinosrosas = vecinosazules [set pcolor one-of [pink blue] set go? true]
      ]]]
end

to continuo
  contar
  cambiar
  valores
  tick
  if all? patches [go? = false][stop]
end
```

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