The Impact of Educational Assortative Mating on Income Inequality: Evidence from Argentina

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Abstract

This paper seeks to quantify the impact of educational assortative mating on income inequality among households in Argentina. We use microdata from two household surveys conducted by the National Institute of Statistics and Census: The Permanent Household Survey and the National Survey of Risk Factors. We construct contingency tables and perform a regression analysis to study the existence of educational assortative mating. We also present counterfactual simulations of random re-matching of observations. The results show that a sizeable proportion of couples are educationally homogamous (45%). Comparing the Gini coefficients calculated in the real matching and the simulated scenarios, we observe a reduction of up to 4 points. Thus, the educational assortative mating represents a relevant dimension to explain income inequality. Our results recommend considering this matching pattern when defining optimal income taxes; this is, if there is a high positive covariance between the income of both members of the couple, it seems appropriate, from a redistributive point of view, to define income taxes at the household level and not at the individual level (as is currently the case in most countries, including Argentina).

Keywords

Argentina; educational assortative mating; educational homogamy; income inequality

Introduction

Economics literature has revealed a growing interest in examining the impact of internally homogeneous couples on income inequality between households (Eika et al., 2019). This impact is peculiarly valid when considering the proportion of couples sharing the same educational attainment, i.e., educational homogamy (Greenwood et al., 2014). The above results from educational assortative mating (men and women with a similar level of education pair up more frequently than would be expected if the matching were random concerning education). Given the positive relationship between education and income, we presume an increase in income inequality resulting from educational assortative mating.

Empirical evidence, however, has reported mixed results. For the United States, Greenwood et al. (2014) reported that educational assortative mating contributed to increasing inequality. Thus, they found that 47.6% of couples in 2005 were educationally homogamous. For the same year, they reported inequality estimates that arose from randomly re-matching individuals - that is, independently of their educational attainment. They obtained a reduction in income inequality between households, measured by the Gini coefficient, by one point (0.43 vs. 0.42). The original paper reported a reduction of 9 points (0.43 vs. 0.34). The following year, the authors published an erratum clarifying that the actual estimated effect is one point (Greenwood et al., 2015.)

Also, for the United States, Eika et al. (2019) concurred in reporting evidence consistent with the existence of educational assortative mating. However, they found its impact on inequality is minor. Thus, the Gini coefficient would be only 2 points lower (0.43 vs. 0.41) when considering random re-matching since 2013. The authors justified this result by saying that educational assortative mating is reduced among highly educated people associated with a higher proportion of people with higher education. Hryshko et al. (2017) reported reductions of less than one point in the Gini coefficient when considering random re-matching. Harmenberg (2017) discussed the differences present in these papers. Similar background for the United States includes Breen and Salazar (2011), Cherchye et al. (2020), and Ciscato and Weber (2020).

Evidence for other countries, although scarce, has also reported heterogeneous results. For the case of France, Frémeaux and Lefranc (2020) generated a random re-matching considering observed and potential income (assuming full-time employment for all individuals). They found a reduction in the Gini coefficient of 2-3 points. The size of the effect varies with the method of re-matching and the definition of income used. In contrast, in Switzerland's case in 2011, Kuhn and Ravazzini (2017) provided no significant differences when randomly re-matching. Similar conclusions were obtained by Boertien and Permanyer (2019) when considering a group of 21 European countries. Pereira and Santos (2017) reported a 3-point reduction in Brazil's Gini coefficient (0.57 vs. 0.54) in 2010, after randomly re-matching observations in one of the few precedents for developing countries. The authors highlighted that educational assortative mating has increased between 1970-2010 in that country.

For the case of an Argentinean region (Gran Buenos Aires), Gabrielli and Serio (2017) found evidence of educational homogamy. For the 2014 year, they reported that people with the same educational level form 46% of all couples. The regression analysis found that a one-year increase in the husband's educational attainment is associated with a 0.6-0.9 yearly increase in the wife's educational attainment. Their findings are robust to different parametric and

non-parametric specifications. Consistently, Leal (2015) reported that for 1992-1996 and 2008-2012, 43.8% and 44.4%, respectively, of all couples are educationally homogamous. Examining their effect on income inequality, using a random re-matching following Greenwood et al. (2014), they found a reduction between 5 and 4 points in the Gini coefficient for the same periods. Paz (2019) agreed that married people are more similar than the general population in Argentina.

In this context, this paper seeks to estimate the impact of educational assortative mating on income inequality among households in Argentina. Thus, this paper fits within that literature interested in examining the existence and impacts of assortative mating (Becker, 1993; Bratsberg et al., 2018; Hugh-Jones et al., 2016; Schwartz & Mare, 2005). The results suggest that almost half of all couples (45%) are educationally homogamous. Moreover, as measured by the Gini coefficient, income inequality between households would decrease by 2 and 4 points in 2018 if the matching were random for education. Thus, the findings are robust to multiple specifications and confirm that assortative mating is relevant to explaining inequality between households.

This paper adds value to the assortative mating literature in two respects. First, it provides novel evidence for a developing country like Argentina; previous evidence has typically focused on developed countries (Eika et al., 2019; Greenwood et al., 2014). It updates the latest existing results for Argentina (corresponding to the period 2008-2012, reported in Leal, 2015) using a methodology that allows for successive restrictions to be imposed on random re-matching. Second, the paper explores regional differences in educational assortative mating patterns and their impact on inequality while extending the geographical scope of the estimates by including small urban localities.

Sources of information

We use two sources of information in this article. First, we use microdata from the Encuesta Permanente de Hogares (EPH) [Permanent Household Survey 2021] published by the Instituto Nacional de Estadísticas y Censos (INDEC) [National Institute of Statistics and Censuses]. The EPH is a multi-purpose survey carried out quarterly since 2003 and collects data in 31 urban agglomerates in Argentina. This survey is the official source of data used to estimate poverty and inequality in the country. The EPH, among other dimensions, includes information on income and educational attainment.

The agglomerates surveyed in the EPH are Posadas (Misiones), Gran Resistencia (Chaco), Corrientes, and Formosa in the Northeast region (NEA). For the Northwest region (NOA), Santiago del Estero-La Banda, Jujuy-Palpalá, Gran Catamarca, Salta, La Rioja, and Gran Tucumán-Tafí Viejo are surveyed. The Centro region includes Gran Córdoba, Rio Cuarto, Gran Santa Fe, Gran Rosario, Gran Paraná, Concordia, Bahía Blanca-Cerri, Gran La Plata, Mar del Plata-Batán, and San Nicolás-Villa Constitución. In the southern region (Patagonia), Rawson-Trelew, Comodoro Rivadavia-Rada Tilly, Río Gallegos, Santa Rosa-Toay, Ushuaia-Rio Grande, and Viedma-Carmen de Patagones are surveyed. Gran Buenos Aires includes the City of Buenos Aires and the Buenos Aires bordering districts. The Cuyo region concentrates on Greater Mendoza, Gran San Juan and Gran San Luis.

The EPH is constructed from a stratified probability sampling of urban households. This technique ensures that the EPH is representative of the total of Argentine urban households

and the whole of each of the agglomerates it includes. The combined population of the 31 agglomerates covered is 28.5 million people (9.2 million households) in the last quarter of 2020. The EPH sampling method is available at INDEC (2003). This paper uses microdata from 2018 to achieve temporal coincidence with the second source of information used, although multiple robustness checks are carried out, including different years.

Second, this paper uses microdata from the Encuesta Nacional de Factores de Riesgo (ENFR) [National Survey of Risk Factors, 2018] produced by INDEC. The ENFR aims to provide information on the health conditions and habits of the Argentine urban population. Although it includes income and educational attainment (like the EPH), the ENFR differs geographically. Indeed, it covers large urban agglomerates and includes small urban localities of more than 2,000 inhabitants in the provincial hinterland. Furthermore, like the EPH, the ENFR is constructed from a stratified probability sampling of urban households and is representative of the national urban total.

The use of these microdata allows us to strengthen the findings of this study. Table 1 presents basic descriptive statistics for the EPH and the ENFR. Table 1 shows an adequate balance between men and women in both sources of information. However, there are vast differences in terms of marital status in both sources of information: while the proportion of people in a couple reaches 40% in EPH, it reaches 57% in ENFR. These differences reflect the different geographical scopes of each survey: while the EPH only includes large urban agglomerates (primarily provincial capitals), the ENFR also includes small urban localities.

Table 1: Descriptive Statistics for the EPH and the ENFR (2018)

Indicator	EPH	ENFR
Percentage of women	.521	.524
Marital status		
Single	.484	.284
Married	.235	.326
Living together	.170	.241
Divorced	.058	.085
Widowed	.052	.063
Educational attainment		
Incomplete primary	.226	.071
Complete primary	.138	.178
Incomplete secondary	.202	.178
Complete secondary	.188	.176
Complete higher	.115	.255
Incomplete higher	.128	.318
N	230,083	29,224

Note: Authors, based on EPH and ENFR. The ENFR only includes persons over 18 years, whereas the EPH does not impose a minimum age threshold.

Methodology

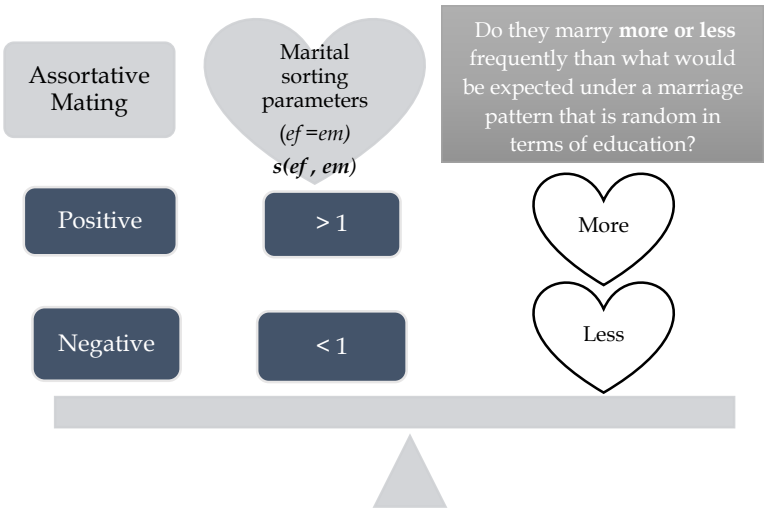
We follow the theoretical framework of Eika et al. (2019, p. 13), who suggested that "the educational assortative mating can be quantified by comparing the contingency table for the wife's and husband's educational levels to a contingency table generated by random matching

for husbands and wives." Thus, the educational assortative as a contingency table shows a share between two probabilities:

$$s(e_f, e_m) = \frac{P(E_f = e_f, E_m = e_m)}{P(E_f = e_f)\Pr(E_m = e_m)} \quad (1)$$

The authors measure the marital sorting between education levels ef and e_m as the observed probability that a husband with education level e_m is married to a wife with education level ef, relative to the likelihood under random matching concerning education. Besides, E_f (E_m) denotes the education level of the wife (husband), and the magnitude of $s(ef, e_m)$ can be interpreted as the probability of a particular match as compared to what the likelihood of the match would be with random matching. Thus, we can interpret results as follows:

Figure 1: Assortative Mating



Note: Authors' interpretation is based on Eika et al. (2019)

Thus, according to Eika et al. (2019, p. 13), "the joint education distribution of the spouses is fully described by the marital sorting parameters and the marginal education distributions of wives and husbands."

To estimate the magnitude of educational assortative mating, we proceeded as follows: First, we constructed the contingency tables by the educational level of each member of the couple. The educational levels are those that emerge from Table 1. The main diagonal elements allowed us to know the proportion of couples with the same educational level. Given the study's objective, the sample was restricted to those in a couple (married or cohabiting) and aged 25-59. These criteria are similar to those proposed by Eika et al. (2019), Gabrielli and Serio (2017), and Greenwood et al. (2014). Second, we proceeded with regression analysis as presented in equation 1. This response to the fact that assortative mating results may be sensitive to clustering in educational levels (Gihleb & Lang, 2016):

$$E_i^w = \alpha + \beta E_i^h + \gamma X_i + \rho_r + \mu_i \quad (2)$$

Where E_i^w is the educational attainment (measured in years of completed schooling) of the wife belonging to couple i. E_i^h is the educational attainment of the husband of the same couple i. X_i is a vector of covariates including the age gap of the couple and a dummy variable capturing the presence of children in the household. ρ_r fixed effects by an agglomerate of residence and μ_i is the model's error term. The coefficient of interest is β, and we expect to be positive in educational assortative mating. The potential presence of endogeneity is addressed following Gabrielli and Serio (2017). This procedure is used because both husbands and wives may consider their pre-marital education decisions as a factor affecting their marital power bargaining. Therefore, income is expected to correlate with their educational attainment but not their partner's educational attainment.

In addition, we considered multiple robustness checks. First, we repeated the estimates for various years (2016-2020) (Column 1 in Table 4). Second, we restricted the sample to married couples only (excluding cohabiting couples) (Column 2 in Table 4). Third, the age group was extended to include those aged 18-64 (Column 3 in Table 4). Fourth, given the possible existence of endogeneity between the educational attainment of both spouses, the husband's educational attainment was instrumented based on his income (Column 4 in Table 4). Fifth, given the wide regional heterogeneity present in Argentina (González, 2020; González & Santos, 2020), we disaggregated by Argentine regions (Table 5).

To estimate the impact of assortative mating on income inequality, we proceeded as follows: First, we generated a random re-matching of individuals. That is an exogenous matching to education and income to simulate a counterfactual scenario. As followed, each man was matched with one, and only one, woman. Therefore, we considered different specifications. It included unconditional random matching (without considering controls of any kind) and random matches subject to restrictions (same agglomerate of residence or same age range). Random re-matching maintains an individual's income constant, varying the household income. Thus, it prevents the loss of information when re-matching. Those observations with missing values in the variables of interest (e.g., age) were excluded from the re-matching. The case of income deserved a particular clarification. As of 2016, INDEC stopped imputation of income for non-response in the income questions. Instead, the EPH includes a new specific weighting for non-response. This correction with reweighting was used throughout the work, avoiding the loss of observations due to non-response. Given that the EPH waves used are after 2016, no comparability issues arise. Readers can find a description of the changes incorporated in the EPH from 2016 onwards in Tornarolli (2018).

Second, the income inequality presented in each simulated scenario was quantified. To do so, we implemented a measure of inequality widely used in the economics literature as the Gini coefficient (equation 2). We expected a higher inequality in the baseline scenario (with the matches observed in the microdata) for the assortative mating case.

The Gini coefficient (GC) takes values between 0 and 1, where 0 indicates absolute equality of all incomes and 1 indicates a situation where one person gets all incomes, and the others get 0. Thus, the Gini coefficient is equivalent to twice the area between the Lorenz curve of the income distribution and the 45° line. Analytically, given microdata, it can be estimated as follows (Medina, 2001):

$$GC = \frac{\sum_{i,j}(y_i - y_j)}{2n^2\bar{y}} \qquad (3)$$

Where y_i and y_j are the incomes of each pair of households i and j, n is the number of households in the population; and $\bar{y}$ is the mean income. Thus, the GC can be estimated for each year for which data are available.

Results and discussion

First, we present the contingency table of educational levels in Argentinean couples (Table 2). The elements of its main diagonal indicate the proportion of couples made up of people with the same educational level (educational homogamy). Thus, 14.46% of couples are made up of men and women with incomplete higher education. Adding the main diagonal elements, 45.43% of all couples are homogamous in terms of education. This result is consistent with Gabrielli and Serio (2017) and Leal (2015). It indicates a widespread presence of educational homogamy in the Argentinean case. This result means couples tend to be made up of people with the same educational level. Therefore, for each educational level and gender (36 possible combinations), the most frequent matching is someone of the same educational level. The exceptions are men with incomplete primary education and women with complete higher education.

Table 2: Educational Homogamy in Argentinean Couples (2018)

		Wife					
		Incomplete primary	Complete primary	**Incomplete secondary**	Complete secondary	**Incomplete higher**	Complete higher
Husband	**Incomplete primary**	1.16	1.28	0.94	0.51	0.13	0.12
	Complete primary	0.81	7.72	3.51	4.39	0.77	0.97
	Incomplete secondary	0.36	2.65	12.82	5.29	1.92	1.99
	Complete secondary	0.39	2.26	3.70	5.62	3.27	5.97
	Incomplete higher	0.04	0.22	0.59	1.80	14.46	4.49
	Complete higher	0.03	0.21	0.41	2.74	2.77	3.69

Note: Authors' elaboration based on EPH. The estimates arise from considering a couple (married or cohabiting) between 25-59 years old. N=52,647

Given that groupings by educational levels can be arbitrary, it is convenient to estimate the existence of educational homogamy based on a continuous specification of educational attainment. This result is presented in Table 3 when considering educational attainment measured by years of completed education in the couples. Again, the results suggest the presence of educational homogamy in Argentinean couples. Thus, each additional year of education of the husband is associated with 0.5 additional years of education in the wife. This finding is robust to different specifications (Table 4) and allows to overcome possible criticisms due to the arbitrariness in the groupings by educational levels. The results are also robust when disaggregated by region (Table 5).

Table 3: Educational Homogamy Considering a Continuous Specification of Educational Attainment (2018)

Dependent: Wife's years of education	(1)	(2)	(3)
Husband´s years of education	.528***	.526***	.504***
	(.010)	(.010)	(.010)
Intercept	6.11	6.40	6.84
	(.123)	(.143)	(.211)
Control	No	Yes	Yes
Fixed effects	No	No	Yes
N	26,328	26,328	26,328
R^2	0.279	0.280	0.289

*Note: Authors' elaboration based on EPH. Robust errors in brackets. * Significant at 10%, ** significant at 5%, *** significant at 1%. We include Married or Cohabiting couples aged 25-59.*

In Table 4 below, Column 1 includes EPH microdata for all years between 2016-2020. Column 2 considers only married couples (excluding cohabiting couples). Column 3 considers couples of individuals aged 18-64. Column 4 instruments the husband's educational attainment from the logarithm of his income (excluding couples who do not report their income).

Table 4: Alternative Specifications of Educational Homogamy Considering a Continuous Specification of Educational Attainment (2016-2020)

Dependent: Wife's years of education	(1)	(2)	(3)	(4)
Husband´s years of education	.395***	.518***	.531***	.803***
	(.008)	(.013)	(.009)	(.029)
Intercept	7.26	6.66	6.68	3.22
	(.204)	(.289)	(.189)	(.400)
Control	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes
N	47,654	14,542	31,571	21,622
R^2	0.182	0.296	0.282	0.206

*Note: Authors' elaboration based on EPH. Robust errors in brackets. * Significant at 10%, ** significant at 5%,*** significant at 1%.*

Table 5: Educational Homogamy in Argentine Regions Considering a Continuous Specification of Educational Attainment (2018)

Dependent: Wife's years of education	Gran Buenos Aires	Centro	Cuyo	Patagonia	NOA	NEA
Husband's years of education	.464***	.467***	.485***	.421***	.394***	.429***
	(.010)	(.010)	(.015)	(.014)	(.010)	(.014)
Intercept	5.28	4.05	4.01	2.76	3.73	3.675
	(.155)	(.169)	(.167)	(.168)	(.156)	(.178)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	21,828	34,649	11,273	14,533	25,460	11,841
R^2	0.1825	0.1360	0.1461	0.1110	0.0979	0.1420

*Note: Authors' elaboration based on EPH. Robust errors in brackets. * Significant at 10%, ** significant at 5%, *** significant at 1%. We include Married or Cohabiting couples aged 25-59.*

Second, Table 6 presents the results for income inequality across households that emerge from randomly re-matching the observations under different restrictions. As measured by the Gini coefficient, the results suggest that income inequality decreases between 2 and 4 points in Argentina. A random re-matching of individuals that do not consider the educational dimension, thus preventing the presence of educational assortative mating, reduces income inequality between households. The above results confirm that assortative mating is relevant in explaining the observed income inequality for the Argentinean case. This result represents a non-negligible reduction in inequality in Argentina: in the R1 re-matching, the reduction is equivalent to 10% of the observed Gini coefficient (i.e., R0 scenario).

The previous results are robust when disaggregating by region in Argentina. Indeed, all regions show reductions in inequality of no less than 3 points (NEA, Cuyo, and Centro). In the NOA region, the decrease is double the previous magnitude. It suggests that assortative mating manifests itself in all regions of Argentina but with different regional intensities.

In Table 6 below, R0 refers to the observed matching; R1 refers to the random re-matching with the restriction of matching a man and a woman; R2 is equal to R1 plus the restriction of the same agglomerate of residence; R3 is R2 plus the restriction of the same age range. The age ranges are up to 35 years, 35-44, 45-54, and over 54.

Table 6: Random Re-Matching of Observations and Income Inequality in Argentina (2018)

Random re-matching:	**Argentina**	**NEA**	**NOA**	**Cuyo**	**Centro**	**Patagonia**
R0. Observed matching	.417	.388	.414	.388	.415	.381
R1. A man and a woman	.377	.351	.359	.357	.383	.341
R2. R1 + same agglomerate of residence	.393	.356	.358	.359	.396	.336
R3. R2 + same age range	.391	.360	.360	.347	.399	.333

Note: Authors' elaboration based on EPH. N=52,647.

Third, we present the estimates that arise from extending the geographical scope to include small localities in the provincial hinterland reported by the ENFR (Table 7). The results reconfirm the existence of assortative mating in Argentina. The proportion of homogamous couples in educational terms is almost identical to those that emerge from using the EPH microdata (45.18% vs. 45.43%). It suggests that assortative mating patterns do not differ significantly between large urban agglomerates and small urban localities in Argentina. However, the comparison of the results between both sources of information should be made with caution, given the discrepancies between educational levels and marital status that arise from each source of information (see Section 2). Moreover, these discrepancies are expected due to the wide heterogeneities between Argentine regions (González et al., 2021).

Table 7: Educational Homogamy in Argentinean Couples, Including Small Localities (2018)

		Wife					
		Incomplete primary	Complete primary	**Incomplete secondary**	Complete secondary	**Incomplete higher**	Complete higher
Husband	**Incomplete primary**	1.56	1.80	0.90	0.70	0.18	0.18
	Complete primary	1.66	8.72	4.00	3.93	0.52	1.53
	Incomplete secondary	0.47	2.58	5.88	5.66	1.46	1.32
	Complete secondary	0.63	1.75	4.23	14.06	3.14	6.39
	Incomplete higher	0.03	0.09	0.49	1.50	2.59	4.62
	Complete higher	0.05	0.23	0.60	2.18	1.98	12.38

Note: Authors' elaboration based on ENFR. The estimates arise from considering a couple (married or cohabiting) between 25-59 years old. N=4,826.

The results of this paper are consistent with previous evidence (Eika et al., 2019; Greenwood et al., 2014; Hryshko et al., 2017). The magnitude of educational homogamy estimated for Argentina (Table 2 and 4) is similar to that found in the United States. Thus, Greenwood et al. (2014) reported, for 2005, that 47.6% of all couples shared the same educational level. Moreover, the findings in terms of educational homogamy are consistent with those reported by Gabrielli and Serio (2017) for the Gran Buenos Aires agglomerate in 2014 and those written by Leal (2015) for earlier periods. However, Torche (2010) warned that the magnitude of educational homogamy may present wide heterogeneities across Latin American countries.

Regarding the impact of assortative mating on income inequality, the effect reported for the Argentinean case operates in the expected direction (Table 6). The counterfactual scenario arising from random re-matching suggests a Gini coefficient between 2 and 4 points lower than that observed for 2018. This result is slightly higher than that reported for the United States (Eika et al., 2019; Greenwood et al., 2014; Hryshko et al., 2017), although it is in the intermediate range of that reported for developing countries (Leal, 2015; Pereira & Santos, 2017). The above suggests that assortative mating may operate more strongly in developing countries. Smits and Park (2009) presented findings consistent with this idea.

Conclusions

Throughout this paper, we have examined the impact of educational assortative mating on household income inequality in Argentina. In the first place, the findings confirmed educational homogamy (couples made up of individuals with identical educational attainment). Second, by simulating a counterfactual scenario, through the random re-matching of individuals, we observed that inequality, as measured by the Gini coefficient, would be significantly lower -a reduction of between 2 and 4 points.

The findings of this paper contribute to understanding the multidimensionality of the phenomenon of inequality. That is, it quantifies the importance of the decision to form a couple on the observed inequality. Its implications are multiple. Gabrielli and Serio (2017) highlighted its significance in terms of optimal tax policy. Thus, if the decision to work

depends on what the couple decides, it is possible to reformulate income tax from the individual to the household.

Three specific issues appear relevant:

1. Given the exploratory nature of this paper, it is helpful to deepen the analysis of the causes of assortative mating.
2. Although traditionally, the literature focuses on heterosexual couples, extending the analysis to same-sex couples seems appropriate. According to Schwartz and Graf (2009), patterns of mating may differ significantly between these groups.
3. It is pertinent to inquire about the robustness of the results when considering different re-matching mechanisms.

In this paper, it has been assumed that the decision to work does not differ when forming new couples. Thus, relaxing this assumption seems relevant. In all cases, periodic micro-data with adequate geographical coverage of the country are necessary. In the future, researchers, statistical institutes could expand the information sources to include qualitative tools such as interviews or a combination of quantitative and qualitative sources.

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