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EL ROL DE LOS ESTUDIOS DE POBLACIÓN TRAS LA PANDEMIA DE COVID-19 Y EL DESAFÍO DE LA IGUALDAD EN AMÉRICA LATINA Y EL CARIBE

Matheus Menezes dos Santos – Cedeplar/UFMG – matheus.menezes@hotmail.com.br

Laura Rodríguez Wong – Cedeplar/UFMG – lwong@cedeplar.ufmg.br

Male fertility in Latin America: an analysis of temporal evolution and nuptiality differentials

Male fertility in Latin America: an analysis of temporal evolution and nuptiality differentials – DRAFT[1]

Matheus Menezes dos Santos[2]
Laura Rodriguez Wong[3]

Introduction

Male fertility, roughly speaking, the intensity with which men have children, is a topic scarcely discussed in the literature in general. This is due, in the first place, to the higher difficulty, compared to women, in collecting the relevant information. Also, it is due to the knowledge - although not always accurate - that one can design models of demographic projections demanding only female fertility. It is generally accepted that female fertility data are preferable to collect because women would report their fertility better than men since pregnancy –that it only happens to women and in a well-defined age interval– is a quite marked event. And the uncertainty about the fatherhood is known to be greater than about the motherhood. (See, among others, Zhang, 2011)

In any case, the importance of bridging the gap about male fertility is justified in our current context of major demographic changes, where simultaneously with female fertility at generalized lower levels, new family structures emerge, including, for instance very late paternity associated to the more frequently, now a days, assisted reproduction (Ferreira et al, 2017.

Today, the availability of information about live births classified by parental age is wider due to the use of administrative statistics, whereas in the past only longitudinal surveys and some other special surveys (such as some DHS editions) collected data on male fertility. Since the use of administrative data to estimate men's fertility would demand still a massive imputation, this paper presents a methodological approach aiming to estimate male fertility in Latin America and supplying this lack of information. The

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[2] Ph.D student at Cedeplar/UFMG – Brazil

[3] Full Professor at Cedeplar/UFMG – Brazil

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methodological proposal is applied to the census data of Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Uruguay, and Venezuela since the 1970s obtained from IPUMS. As a byproduct of this work we show evidence of the male fertility transition of Latin American in the considered period. We believe it will be an important input for a more global understanding of the demographic transition the region is experiencing.

What do we know about male fertility?

Although rare, there are research on male fertility. Usually it focuses more on developed countries (which have better data) than developing ones. (Zhang; 2011, brings a summary of these works). A few papers, such as Paget and Timaeus (1994) and Coleman (2000), form the bibliographic basis of what is known about male fertility. Briefly, the stylized facts, found in different contexts, indicate that the male fertility curve is wider distributed over the life course compared to the female curve, and the modal age of men is higher. These results are explained by the longer reproductive period of men and the age difference of couples (which is reflected in the mean age), the latter explained basically by the influence of context or behavioral attitudes that determine nuptiality patterns.

This is also true for Brazil. Among the few papers applied to the Brazilian case, Wong and Perillo (1986) use administrative data to calculate male fertility in the state of São Paulo in 1983 and Falcão (2016) uses data from the Ministry of Health for some cities in São Paulo in 2013. Both conclude similarly about male fertility: later age in men and greater dispersion of births over the course of life compared to female fertility. In the substantive aspect, the study by Scopetta (2009) through qualitative data from a Colombian population, analyzes, using a gender approach, the female and male role in the process of implementing desired and unwanted fertility.

Dinkel and Milenovic (1983), in a study on Germany, analyzing cohorts of both sexes from the beginning of the last century, finds male fertility systematically higher than female fertility, and attributes this differential to the denominator size. I. e., to a smaller number of men, originated mainly by tragedies of world wars. Schoumaker (2019), in a larger study, calculates the TFR (Total Fertility Rate) of 163 countries using i) administrative data provided by the United Nations Demographic Yearbook (UN, 2017) and ii) application of the Own Children Method (Cho et al, 1986) to diverse sample surveys. The author shows that the TFR of men is almost always higher than that of women, which he explains by two factors. The first is that men have a higher mortality rate than women, which would lead to fewer men exposed to the risk of parenthood. The second is that men tend to bond and have children with women younger than themselves. If these cohorts of men and women were born in a context of positive population growth, then the cohort of men tends to be smaller than that of women, also decreasing the population at risk of paternity.

From the methodological point of view, caution should be taken in relation to the strong Own Children Method assumptions. It is based on the co-residence between parents and children in the child's early years of life, which is problematic in contexts with high rates of divorce or male migration, and the reliability of the results would be supported by the quality of imputation of the age of absent parents. In addition, the method requires knowledge of the survivorship hazards to estimate the number of men and children from the reference date of the research used. The need to know the mortality risks is especially problematic in contexts of high mortality: there is a greater range of errors in estimating those risks and the relationship between mortality and fertility becomes stronger.

Methodology

Period fertility is calculated in surveys by asking if the woman had any live births in the 12 months before the census (or via the age of the youngest child). The question is only asked to women, regardless of marital status. It is not asked to men, which prevents the direct calculation of male period fertility.

This paper is based on an assumption that we consider highly plausible: likely, the spouse/partner of the woman who had a child born alive in the 12 months before the census is child’s father. The chance of both parents not sharing the same household, whether by divorce/separation, death, migration would be small because the reference period of the event is short. Let aside the case of children born outside of union that in Latin America are far from being a majority, it is a reasonable assumption, although it cannot always be tested because many censuses do not differentiate children and stepchildren at home. There is, of course, the issue of parenting uncertainty, that is not corrected in this proposal. Thus, using household composition information, we assume that the possible father of the children born alive in the last year is the women interviewed partner. We will know, therefore, a number of other father characteristics. And among them, his age.

The data source consists of the microdata of the Latin American countries obtained through the IPUMS platform: Argentina (1970, 1980, 1991, 2001); Brazil (1970, 1980, 1991, 2000, 2010); Chile (1982, 1992, 2002); Colombia (1973, 1985, 1993, 2005); Ecuador (1974, 1982, 1990, 2001, 2010); Mexico (1970, 1990, 2000, 2010); Paraguay (1972, 1982, 1992, 2002); Uruguay (1975, 1985, 1996, 2006, 2011); and Venezuela (1971, 1990, 2000). The platform has an algorithm to find the likely spouse of the woman at home and his respective age, which facilitates the exercise proposed here.

To estimate the age of absent fathers, we use imputation conditional to the mother's age. That is, the age of the absent woman's spouse of age *a* is the average age of the spouses present (*b*) of women of age *a* from each country and year:

$$\hat{b} = E[b|A = a]$$

In this application imputation represented less than 25 % of the total number of cases, running from 4.90% in Brazil in 1970 to 24.60% in Paraguay in 2002. We believe that these percentages are low enough to guarantee the reliability of the indicators to be produced.

The age-specific fertility rate (ASFR) is calculated by dividing the birth number by the father / mother's age group by the number of men / women in the same age group.

$$f^{M*}(b,t) = \frac{B^M(b,t)}{N^M(b,t)}$$

$$f^{W*}(a,t) = \frac{B^W(a,t)}{N^W(a,t)}$$

However, the estimate based on census data has several possible sources of bias, such as the error of the reference period, underestimation of the number of children in the household, for example. To correct these errors, we take the female TFR estimated by the UN World Prospects (UN, 2019) for each country and year ($f_{UN}^W(a,t)$) as true, and from them we calculate a correction factor (γ (*t*)), maintaining the age pattern captured by the census data.

$$\gamma(t) = \frac{f^{W*}(t)}{f_{UN}^W(t)}$$

As male fertility is calculated from births reported by women, we assume that the estimation errors will be the same for men and women, and therefore it is possible to use the same correction factor.

$$f^M(b,t) = f^{M*}(b,t) \times \gamma(t)$$
$$f^W(a,t) = f^{W*}(a,t) \times \gamma(t)$$

Still, we perform a decomposition of the difference of the mean age of male fertility between two periods, in terms of change in the female fertility age pattern and change in age patterns of nuptiality. Male ASFR can be described from the female fertility age structure:

$$f^M(b) = \sum_{a=15}^{50} f^M(a,b)$$

Using the decomposition proposed by Kitagawa (1949), it is possible to standardize male fertility by the age of women and thus decompose the change in mean age of male fertility into two effects, the fertility effect and the nuptiality effect. The fertility effect measures the role of the female fertility age structure over the male fertility age structure: keeping the age gap in couples constant, if women postpone their fertility, male fertility is also postponed. The nuptiality effect measures the role of changing this age gap in couples: if women start having children with younger men, then there is a drop in the mean age of male fertility.

Results

Table 1 and Graph 1 synthetizes the results in terms of the TFR and the mean age of fertility by sex for the set of countries. While the changes registered for the female fertility are known in general, these results allow us to compare them with the male fertility estimates.

Male fertility is higher in all cases, in accordance with a number of evidences (Schoumaker, 2019; Zhang, 2011). The explanation is mathematical. Regardless of the calculation by male or female fertility, the total number of births must be the same, and it is the result of the fertility risk (the rates) applied to men or women. Thus, to equal the number of births, male fertility has to be greater than female fertility if the number of men is lower than that of women. If women tend to unite with older men, these men will be from a smaller cohort if in a context of population growth (or past high population growth).

The countries where it is known that fertility transition started before the seventies, like Argentina and Uruguay (and Chile to a lesser extent), present, consequently the least variation in terms of the fertility level among both, male and female; also there is no large difference by sex (Panel 2.c in Table 1). Oppositely, the countries that experienced the transition fertility mainly after se sixties, namely Brazil, Colombia and Mexico register more accentuated decrease in the male fertility; consequently, we observed that, particularly in these cases, the TFR gap decreases over the period (Panel 2.d in Table 1). The most notable case, in relative term is, perhaps, Brazil where Male and Female TFR difference declined from 1,6 children to 0,2. It is worth to mention that also in Chile and Uruguay there are almost no gap in the fertility level. In addition, with the exception of Argentina, in all the other cases, male TFR decrease is sharper than female decrease.

Table 1 - Total Fertility Rate (children per woman), Mean Age of Fertility (in years) by sex and variation over the period of reference (circa 1970-2010) – Selected Latin American countries

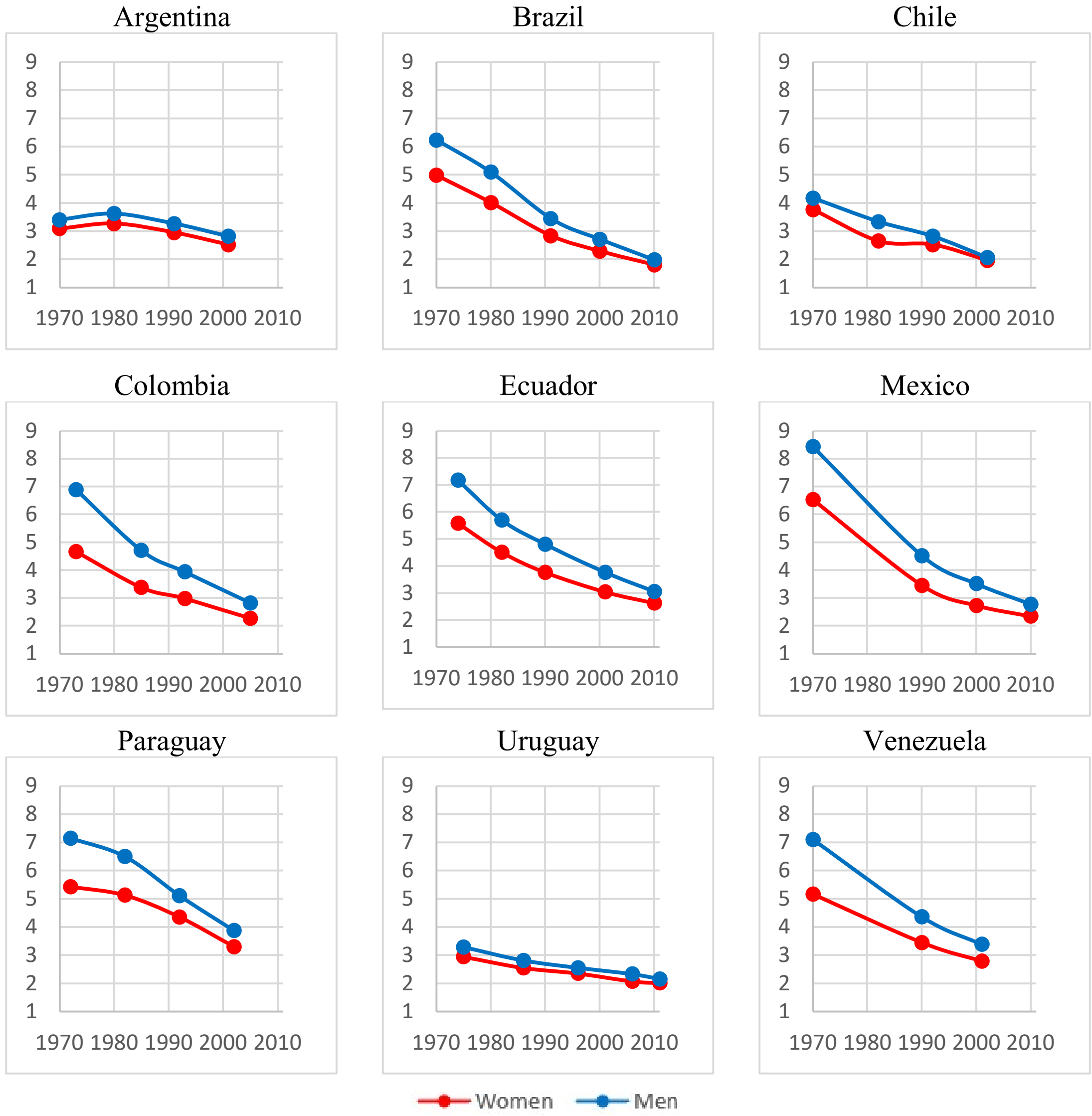
	Country	Argentina	Brazil	Chile	Colombia	Ecuador	Mexico	Paraguay	Uruguay	Venezuela
1.Period	Initial	1970	1970	1970	1973	1974	1974	1972	1985	1971
	Final	2001	2010	2002	2005	2010	2010	2002	2011	2001
	Years	31	40	32	32	36	36	30	26	30
2. Total Fertility Rate	2.a) Female TFR									
	Initial	3,1	5,0	3,8	4,7	5,6	6,5	5,4	2,6	5,2
	Final	2,5	1,8	2,0	2,3	2,6	2,3	3,3	2,0	2,8
	2.b) Male TFR									
	Initial	3,4	6,2	4,2	6,9	7,2	8,4	7,2	2,8	7,1
	Final	2,8	2,0	2,1	2,8	3,1	2,8	3,9	2,2	3,4
	2.c) Average decrease in the number of children over the period of reference (per decade)									
	Female	0,19	**0,79**	0,56	0,75	**0,82**	**1,16**	0,71	0,21	0,79
	Male	0,19	**1,06**	0,66	**1,27**	**1,14**	**1,57**	**1,09**	0,25	1,24
	2.d) Difference in the TFR by sex*									
	Initial	0,3	1,3	0,4	2,2	1,6	1,9	1,7	0,3	1,9
	Final	0,3	0,2	0,1	0,6	0,4	0,4	0,6	0,1	0,6
3. Mean age of Fertility	3.a) Female Fertility Mean Age									
	Initial	28,7	29,8	29,2	29,7	30,2	29,9	30,4	28,1	29,3
	Final	28,2	26,6	28,1	27,2	27,9	26,9	28,6	28,1	26,8
	3.b) Male Fertility Mean Age									
	Initial	33,4	36,2	35,2	36,7	36,2	35,9	37,1	33,1	37,5
	Final	32,6	32,5	31,9	34,0	33,8	31,4	34,1	32,2	33,5
	3.c) Average increase in the fertility mean age over the period of reference (per decade)									
	Female	0,14	**0,81**	0,36	**0,79**	0,64	**0,82**	0,62	0,03	**0,82**
	Male	0,28	0,91	**1,03**	0,83	0,67	**1,26**	1,01	0,34	**1,33**
	3.d) Difference among sexes in the fertility mean age (gap gender)*									
	Initial	4,8	6,4	6,0	7,0	6,0	6,0	6,7	4,9	8,2
	Final	4,3	6,0	3,8	6,8	5,8	4,4	5,5	4,1	6,7

* Values may differ due to the rounding process.
Source: Raw data from IPUMS.

Graph 1 shows the evolution of male and female TFR over time. As expected, they follow a similar trajectory throughout time. TFR is an aggregate result of reproductive decisions of couples, so the curve of men and women follows the same downward trajectory.

In the cases, where the fertility levels by sex are similar, the explanations are associated to a number of demographic components. On the one hand, they are related to a more equilibrated men and women cohorts' size and, in the other hand, to a narrower age reproductive spam among both men and women. These aspects need further developments

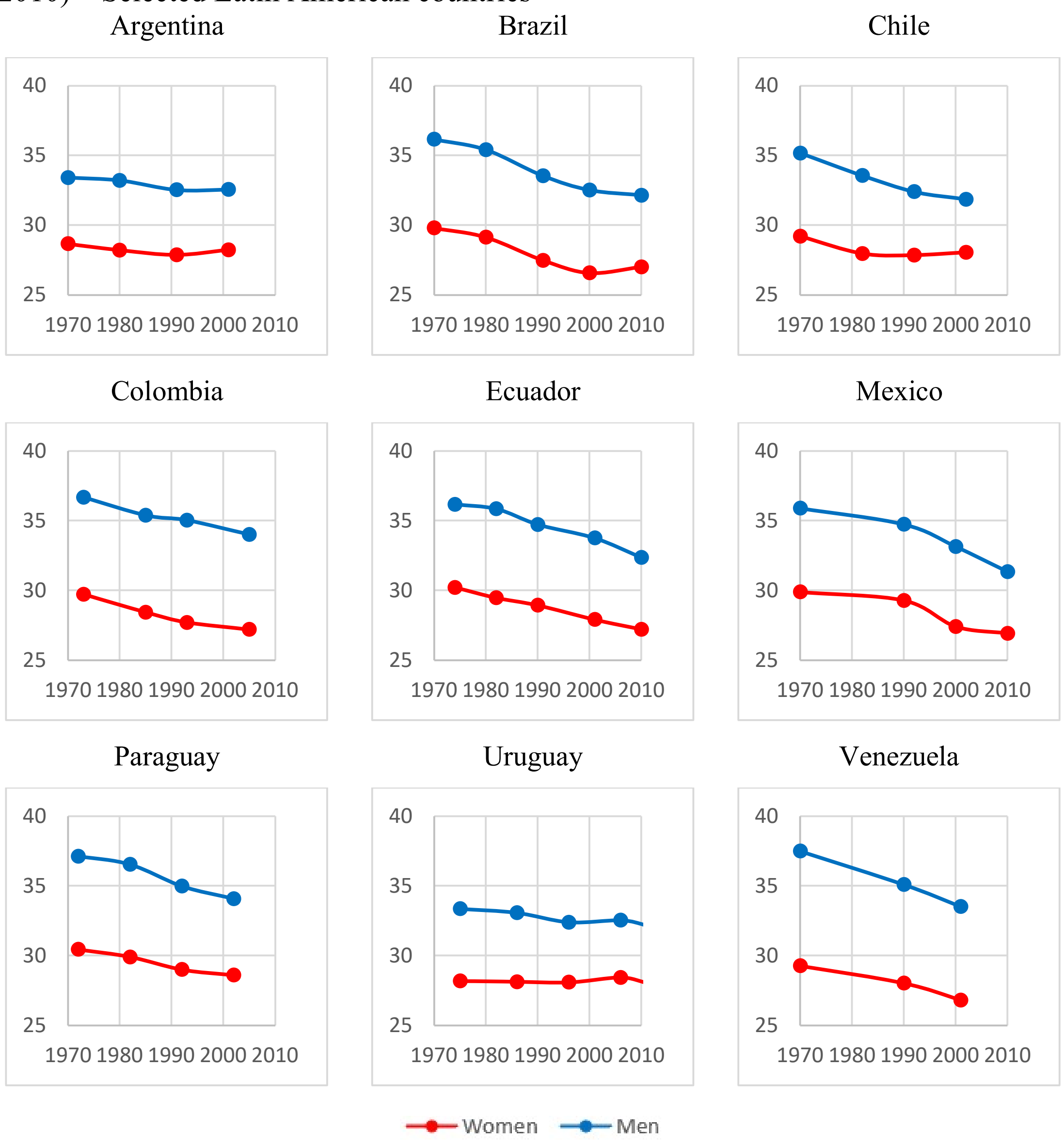
Graph 1 – Male and female TFR by country and year (circa 1970-2010) – Selected Latin American countries



Source: Raw data from IPUMS.

Graph 2 shows the evolution of mean age of fertility of men and women. Again, the trend by sex are similar. The drop in mean age, present in all cases, can be partially explained by the increase in adolescent fertility in Latin America in recent decades which causes rejuvenation of the female fertility pattern. The drop in the mean age can be observed in several cases, particularly in Brazil, Mexico and Colombia whose ASFR at ages 15-19, increased in the previous to the more recent census (Data not showed). Mean age, then recovered previous values (see Brazil) or interrupted decreasing trend (Mexico)

Graph 2 – Male and female mean age of fertility by country and year (circa 1970-2010) – Selected Latin American countries



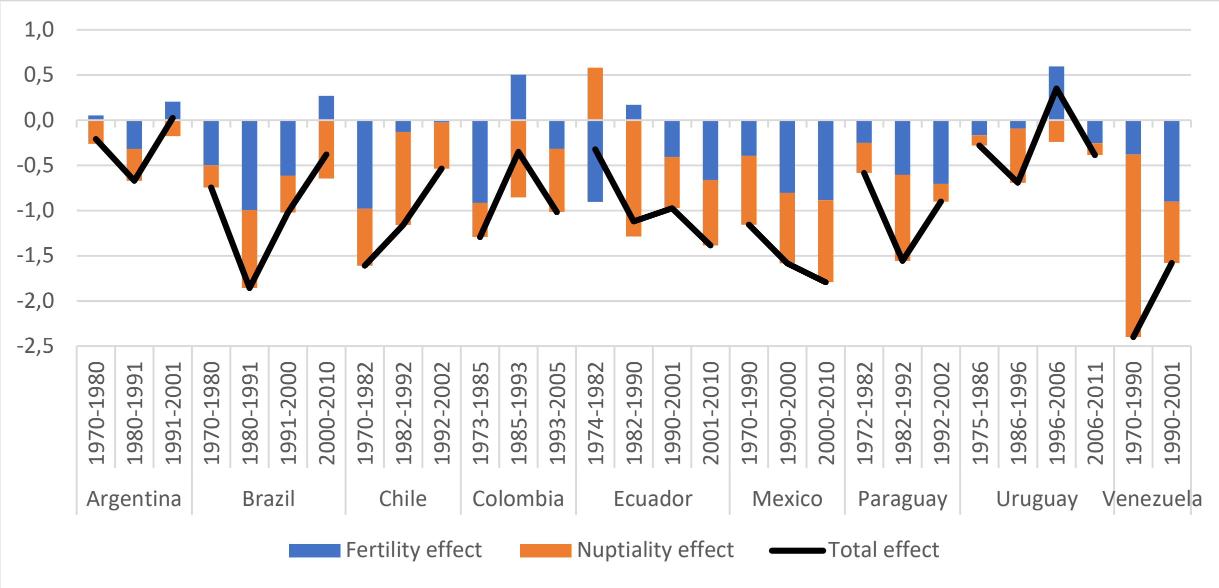
Source: Raw data from IPUMS.

The female mean age of fertility will probably continue the increasing trend if – as data from after 2010 indicates – teenager fertility continues to decrease together with young female adults and plan to have their child at a later ages, experiencing a *tempo* variation in their reproduction behavior with the corresponding reflection in the male fertility.

The age difference among sexes is consequence of the nuptiality pattern which does not indicates, in general, strong changes in the gender pattern. In fact, the gap of fertility mean age is similar at the initial and final year of the period of reference in most of the countries. (Panel 3.d in Table 1). A notable difference is Chile, where the six-year gap at the beginning of the period reduced to less than 4 years at the end of the period at it also should be objective of further research.

Graph 3 shows the change in mean age of male fertility over time as a result of changes in nuptiality (the difference in the age pattern of men and women in couples) and changes in female fertility (the difference in composition age of female fertility on the male fertility curve). For example, between 1980 and 1991, the mean age of male fertility in Brazil decreased in 1.86 years: 1 year of this fall is due to the fertility effect and 0.86 is due to the nuptiality effect.

Graph 3 – Decomposition of the difference in mean age of fertility (in years) (circa 1970-2010) – Selected Latin American Countries



Source: Raw data from IPUMS.

We note that both the fertility and the nuptiality effects are relevant to explain the drop in the male fertility mean age. That is, both phenomena are happening: female fertility is getting younger and women are having children with younger men than in the past regardless of the marital gender age gap. We also highlight that in countries where there was a fall or stagnation of adolescent fertility, such as Brazil, Chile, Uruguay and Argentina, during the most recent periods, there is an increasing or even stable trend in the mean age of male fertility, although the nuptiality effect prevented this fall from being observed.

This result shows that there has been a change in Latin American nuptiality patterns since the 1970s, and that it has contributed to men becoming fathers earlier than in the past simultaneously with what happen among women. The separation of the two effects is an important conclusion to show that this change in the pattern of nuptiality has led to the rejuvenation of male fertility regardless of the changes in the structure of female fertility that have also been experienced in recent decades.

Conclusion

The main objective of this paper is to provide an initial investigation of the little-known male fertility in Latin America and the changes it has undergone in recent decades. This paper privileged the methodological approach, in order to show that it is possible to produce reliable estimates of male fertility from census data.

As a general conclusion, we show that male fertility has shown a downward trend similar to female fertility since the 1970s. However, in line with other studies, male TFR has been consistently higher than female TFR. Considering that we are using period measures, this result is explained by the different age structures of the fertility of men and women, which was already discussed in the early days of demographic studies and was incorporated into what was later called the problem of two sexes. To better explore this result, it is in our research agenda to estimate cohort fertility measures. Also, as administrative data tend to enlarge coverage and be more available in the Latin American context, a number of questions arisen by the results here presented will be susceptible of solution

An additional result of this paper is a decomposition of the decrease in the mean age of male fertility in the Latin American countries into two effects, the nuptiality effect and the fertility effect. Both effects played an important role in the decline of the mean age of male fertility, which shows (through the nuptiality effect) that the fertility of men has rejuvenated in recent decades regardless of female fertility, that is, driven by changes in nuptiality patterns in the region. In order to better understand these changes, it is also in our research agenda, the analyzes of the age specific fertility pattern of both men and women.

By selecting types of countries according fertility transition we will be able of developing better substantive analyses. Our research agenda also includes estimating male fertility measures for population subgroups and further research on nuptiality age patterns. We believe it is a natural path in the search for a better understanding of the changes that the family formation process is undergoing in Latin America.

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