Twin peaks: The emergence of bimodal fertility profiles in Latin America

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Introduction: Uneven fertility transition in Latin America

Demographic transition in Latin America has been more rapid than in most other world regions with relatively low fertility except East Asia. Fertility rates remained high until the 1960s, and even increased in some countries between 1950 and 1960 (Guzmán and Rodriguez 1993). In the early 1960s fertility started dropping rapidly throughout most of the region. Over the last five decades, the total fertility rate (TFR) in the region has dropped from 5.94 children per woman in 1960–1965 to 2.15 children per woman in 2010–2015 (UN 2015), with four countries of South America (Brazil, Chile, Colombia and Uruguay) and two countries of Central America (Costa Rica and El Salvador) reaching below-replacement TFR below 2.1. Furthermore, the annual number of births has peaked at 11.5 million in 1990-95 and then started decreasing due to the continuing decline in fertility.

Fertility decline in the region was not uniform: countries and regions differed considerably in their fertility levels and the pace of their fertility declines. Guzman et al. (2006) identify four models of demographic transition in the Latin America and the Caribbean. The forerunners in the transition were two of the Southern Cone countries – Argentina and Uruguay – that began their transition early, driven by economic and social development and intensive European immigration. Similar to many European countries, the onset of fertility decline there is dated to the beginning of the 20th century. In contrast, in a small group of countries, Guatemala, Honduras, Haiti and Bolivia, the transition took off relatively late and the period TFR is still above 3.0 at present (except in Honduras).

The emergence of sub-replacement period total fertility rates in some countries of Latin America since the early 2000s seemingly suggests that the region is experiencing a shift to low or very low fertility, comparable with the earlier experiences of currently low-fertility countries in Europe, East Asia and North America. But the similarities in the "big picture" may hide important regional specificities; after all, the list of post-transitional period fertility rates currently range from the ultra-low levels in Southern Europe and parts of East Asia, including most Chinese cities, South Korea, and Taiwan and close-to-replacement fertility in France, United Kingdom, United States, Sweden or Australia. While it is too early to speculate whether period fertility in Latin America will fall to lowest-low or only low

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levels, one distinct aspect of Latin American fertility transition may lie in a persistence of high fertility rates at young reproductive ages, including teenage years and, related to that, a relatively slow pace of the postponement of childbearing to higher ages and an increasing social status differentiation in age at first birth (Saad 2009). Trends in age-specific fertility rates show that reduction in fertility has been greatest among women in older age groups, especially those aged 35 to 49, but very limited among adolescents aged 15 to 19. As a result, the share of adolescent fertility on the TFR had almost doubled from 8.5 to 14.3 percent between 1950–1955 and 2000–2005 (Saad 2009). Bozon et al. (2009) call the combination of rapid fertility declines and a lack of evidence of a stronger shift in reproduction towards higher ages a “teenage Latin American paradox.”

In countries with currently low fertility rates, such as Chile and Uruguay, the marked fertility decline over the last 15 years is almost exclusively due to the drop in fertility between ages 20 and 29, while adolescent fertility was decreasing at a slow pace (INE Chile 2004; Varela et al. 2008), after even rising during 1990s (ECLAC 2012). In Brazil, for example, the recent low TFR level is associated with a concentrated fertility at young ages and a high proportion of teenage mothers from low socioeconomic strata (Gupta & Leite 2001; Berquó and Cavenaghi 2005; Rios-Neto 2005). At the same time, Bozon et al. (2009) also indicate that the more educated group of women is starting to show some postponement behavior with an increasing rate of childless women. Rios-Neto and Guimaraes (2014) stressed that tertiary education is the driving force behind new low fertility pattern (see also Petito 2005 for Uruguay) and Rosero-Bixby et al. (2009) suggest that the social imperative of early motherhood and motherhood in general, has been weakening among younger women in the region.

Costa Rica had also experienced one of the earliest and fastest fertility transitions among Latin American countries, with a TFR dropping from from 7.3 to 3.7 births per woman between 1960 and 1976, and the most recent development shows a TFR of 1.83 in 2010 (Li et al. 2014).

One reason fertility in Latin America remains high at young ages is relatively early pattern of union formation which has not historically declined with the expansion of educational attainment. Esteve at al. (2013) indicate that the decline in marriage rates has been counterbalanced by a rise in cohabitation, maintaining a relatively early pattern of union formation in the region. They reckon that in Latin America the “non-conformist transition” marked by a shift away from marriage has preceded the “postponement transition”. Another important factor helping to maintain high teenage pregnancy rates is relatively early sexual debut in the region, combined with a high rate of unplanned and unwanted pregnancies and a very limited legal access to abortion in most countries. Casterline and Mendoza (2009), analyzing surveys conducted in the early 2000s estimate that the share of unwanted births ranged from 21 percent in Paraguay to 60 percent in Bolivia, with two low-fertility countries, Brazil and Colombia still showing over a third of all births as unwanted (Casterline and Mendoza 2009: Figure 1).

This evidence suggests that post-transitional fertility in Latin America might be characterized by a relatively slow (or even stalled) shift towards later motherhood, but also by increasing differences between the persistent pattern of early childbearing typical of women with lower education and lower social status and an incipient pattern of delayed family formation typical of women with higher education. In this regard, Nathan et al. (2014) show the emergence of a bimodal pattern of conditional first birth rates in Uruguay between 1996 and 2011, when the total fertility rate in the country declined below the replacement level. They interpret this shift as a result of a social polarization process in the timing of entry into motherhood (see also Nathan 2013 and Varela et al. 2012).

In this contribution, we look at the shifts in first birth timing and provide a more systematic analysis of the emerging pattern of reproductive polarization in Latin American low-fertility countries. We analyze changes in the age profiles of fertility rates and first birth rates in four Latin American countries that experienced a decline in period total fertility rates below the replacement level in the early 2000s—Brazil, Chile, Costa Rica and Uruguay. For Brazil, Chile and Uruguay we also study the age profiles of first birth rates by level of education. Our study is the first one bringing together detailed order-specific fertility data for different countries of the region. We show that all the four countries display a combination of continuing high rates of childbearing at younger ages coupled with a parallel increase in first birth rates at later reproductive ages, to a lesser extent in Costa Rica. This trend results in a rise in the standard deviation in the age distribution of first birth rates, and the emergence of bimodal fertility schedules by age, especially in Chile and Uruguay. While bimodal fertility patterns have been identified earlier by Chandola et al. (1999; 2002) and Sullivan (2005) for English-speaking countries, such as Australia, Canada, New Zealand, Ireland, United Kingdom and the United States, bimodality in Latin America appears even more pronounced. We suggest that in some Latin American low fertility pattern is linked to a high level of income inequality and wide social status differences in the region, that go hand in hand with a high rate of unplanned early pregnancies and births, especially among women with lower education. We support our argument by showing massive differences in the age profiles of fertility by level of education, which we analyze on the examples of Brazil, Chile, and Uruguay.

In the next section, we will show an overview concerning tempo shifts and new bimodal age pattern observed in Anglo-Saxon, North America and South European countries. In section two, we present the data sets and methods used in the analysis. In the third and final section, we present some preliminary results.

1. Tempo shifts, bimodal age pattern of childbearing and social polarization in fertility timing

Uneven patterns of fertility schedule by age came into the focus of demographers at the end of the 1990s, when these patterns emerged in some Anglo-Saxon populations. Chandola and colleagues (1999; 2002) studied “distorted” patterns of fertility rates in Australia, Canada, New Zealand and the United States, characterized by a “bulge” in early childbearing years. They suggested that the heterogeneity is related to differences in timing of births by marital status. They also indicate that ethnic differences play an important role to explain fertility bimodality in New Zealand and the United States. They proposed that these “distorted” age schedules of fertility can be fitted using Hadwiger “mixture” model with two component distributions.

This model was compared along with other models in a methodological paper by Peristera and Kostaki (2007). They found intense “bulge”, or “hump”, in first birth fertility rates at young ages not only in the United Kingdom, Ireland and the United States, but also in Denmark, Norway, Sweden, Italy and Spain. They link the heterogeneity in first birth patterns to a range of fertility determinants including marital status, religion, educational level and ethnic differences and propose a new mixture model to fit these uneven fertility schedules.

Another study by Garenne et al. (2000) used Coale-McNeil and Coale-Trussell models for decomposing bimodal age pattern of fertility in rural South Africa in 1992-1997 into premarital and marital fertility. According to them, this bimodal fertility pattern can be largely explained by differences in fertility by marital status. Roig Villa and Castro Martin (2007) study of fertility among Spanish and foreign women in Spain in 1998-2002 identified huge differences in fertility timing between native and immigrant mothers, contributing to the widening differences in the age at childbearing in the country.

Using exposure-specific first birth rates (*rates of the first kind*), Sullivan (2005) studied the emergence and the subsequent disappearance of bimodal pattern in first birth rates in the 1990s. She has identified education and ethnic differences in fertility as a key explanation of this pattern, suggesting there was a “bifurcation” of fertility between these groups.

Rendall et al. (2009 and 2010) and Ekert-Jaffé et al. (2002) coined the term "reproductive polarization" to describe heterogeneous pattern in the age at first birth typical of the United Kingdom, United States, but also Southern European countries. They suggest that the polarized pattern of first births is linked to family policies that do not provide sufficient support to the combination of work and motherhood, and which result in vast differences in the timing of first birth by social status. They also note high income inequalities typical of the countries with polarized first birth pattern. Specifically, the policies providing only a limited and means-tested support for families with children were associated with an earlier entry into motherhood among women with lower education (who often qualified for this support), but they also resulted in a delay of motherhood to later ages among women with higher education, for whom having children was particularly difficult to reconcile with their career. In contrast, the authors found that countries with "universalistic regimes" of publicly subsidized childcare integrated with maternity leave experienced more similarities in fertility schedules of different education groups, which included a higher frequency of "on time childbearing" among each group.

Our analysis of fertility pattern in Latin America is inspired by these studies. We look whether the overall fertility schedule as well as the schedule of first birth rates in the four analyzed countries has become characterized by a "hump" at younger ages or even a bimodal pattern. Similar to Rendall et al. (2009, 2010) we link the emergence of bimodal and polarized reproductive patterns in Latin America to the widening differences in first birth pattern between women with different levels of education and speculate that huge income and social status inequalities may largely explain the emergence of Latin American polarized age pattern of reproduction.

2. Data and Methods

2.1. Data

We make extensive use of fertility data by age and birth order collected for the Human Fertility Collection (HFC; http://www.fertilitydata.org), the Human Fertility Database (HFD; http://www.humanfertility.org), and computed from national vital statistics data. In addition, we use census data on children ever born and births in the previous year among women of reproductive age in Brazil, Chile and Uruguay; these census data will later be included in the Cohort Fertility and Education database (CFE-database; http://www.cfe-database.org). The CFE database is a project initiated by the VID and aims to provide high-quality data on completed cohort fertility and parity distribution by level of education.

The HFD and HFC are joint projects of the Max Planck Institute for Demographic Research (MPIDR) in Germany and the Vienna Institute of Demography (VID) in Austria. Both databases are designed to incorporate a variety of international fertility data. The HFD features standardized high quality data for countries with very good quality of vital statistics, and incorporates data on births, exposures, and fertility rates by age, cohort, and birth order in variety of dimensions. In contrast, the HFC includes data series on age specific fertility rates by birth order that are valuable for fertility research but do not necessarily meet all quality standards of the HFD. Currently, the HFD includes data on fertility in Chile for period 1992 to 2005 (Castro and Zeman 2014), whereas the HFC includes age specific fertility rates for Chile, 1952-2011 (Zeman and Castro 2014a; 2014b) and for Uruguay for 1996-2011 (Cabella et al. 2014 forthcoming).

The Brazilian data were computed from censuses 2000 and 2010, provided by the National Statistical Office (IBGE 2000, 2010). The conditional fertility rates computations used in the denominator only childless women, tabulated according to the children ever born information present in both Brazilian censuses. In the numerator, the number of first births were also tabulated according to different educational categories. These rates have also be adjusted the level of registration, based on P/F of Brass estimates.

The data for Chile were computed from two sources. The Ministry of Health (Ministerio de Salud) provided individual birth records for 1990-2011 from which live births by age and birth order were tabulated. The information on female population by age groups on 1st July was taken from INE Chile (2009). Birth data for Uruguay 1996-2011 were computed from the Live-Birth Certificate microdata, provided by the Ministry of Public Health and the National Institute of Statistics of Uruguay. Mid-year female population estimates by single age were provided by the National Institute of Statistics of Uruguay (INE Uruguay 2013). Conditional fertility rates for Uruguay are using exposures from censuses 1996 and 2006, conditional rates for Chile use census data 1992 and 2002.

Although we aimed at constructing comparable education categories for Brazil, Chile and Uruguay, it is important to mention the distinct features of the education system in each country. In Chile the primary or basic education corresponds the first eight years of study, covering children aged 6 to 13 years. The secondary education corresponds to 12 years of education, typically completed by age 18 (OEI, 1993). In contrast, basic education in Uruguay lasts six years and the secondary education there extends over a period of another six years, of which only the first three are mandatory (OEI, 1993).

In Brazil the education categories were constructed according to the definition provided by the Ministry of Education (2015). The primary education corresponds to the first eight years of study, for children aged from 6 to 13 years. Secondary education implies 9 to 11 years of study (covering children from 14 to 17 years of age), while tertiary education implies 12 or more years of study.

2.2. Focus on first birth rates

This study focuses especially on first births rates, because the heterogeneity in fertility timing and its changes over time show up most clearly when the transition to motherhood is studied (Morgan 1996). Moreover, transition to motherhood is a major life course event that is important to be studied and whose timing also determines the progression to later childbearing (Sullivan 2005). When all births are analyzed jointly, the age shape of the fertility schedule may be more affected by the frequency of higher order births which mostly take place at higher childbearing ages rather than by the heterogeneity in the timing of childbearing. Similarly, changes in the overall age pattern of childbearing might be caused by the changing frequency of higher-order births rather than a real shift in the age pattern of childbearing.

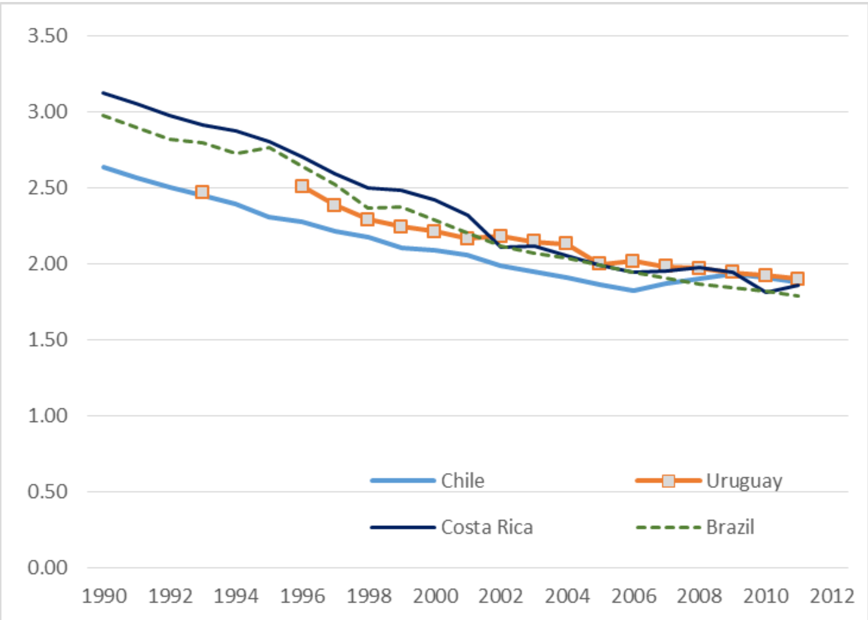
Sullivan (2005) explored bimodality in the first birth rates in the United States using exposure-specific first birth rates (also known as Type 1 rates, rates of the first kind, or occurrence/exposure rates), in which the denominator includes only the population at risk of experiencing a birth of the first child, i.e., childless women of a given age (Kohler and Ortega 2002; Bongaarts and Feeney 2006). We call these rates *conditional fertility rates* and denote them, *m1*, following the HFD methodology. The shape of conditional first birth rates reflects the age pattern of the intensity of first birth by age. Demographers studying fertility also use the rates of the second kind (Type 2 rates, incidence rates), in which the denominator at each age includes all women of a given age in a population. These rates are easy to calculate and more widely available as their computation does not involve the need to estimate the parity distribution of women by age for every year studied. We call them *unconditional rates* and denote them as ASFR1. These rates are reflecting the distribution of first births by age in a synthetic cohort of women unconditional fertility rates are additive, with the sum of age-specific rates for each birth order giving the overall age-specific fertility rate. They are easily interpretable when broken down into two or three components reflecting the distribution of fertility into two or more sub-groups, such as those of married and non-married women.

In this study, we first look at the age distribution at the overall fertility schedule and then inspect in more details the changes in the age pattern of unconditional first birth rates. The unconditional rates have some important advantages —wider data availability and the possibility to split unconditional rates into two sub-populations (Chandola et al. 1999; 2002). Finally, for the periods where the female childless population is available (censuses 1992 and 2002 for Chile, censuses 1996 and 2011 for Uruguay and Brazil 2000 and 2010), we supplement our study with analysis of conditional fertility rates, also in order to provide a direct comparison with study of Sullivan (2005) on the fertility patterns in the United States and for similar comparisons with the hump-shaped fertility schedules in selected countries of Europe.

2.3. Fertility change in the four analyzed countries

Among the four analyzed countries, fertility transition in Uruguay started earliest, already in the early 20th century. In the early 1950s period TFR in the country reached 2.7, the lowest level in Latin America and comparable to the average TFR for Europe at that time (UN 2015; Pellegrino et al. 2008). Subsequently, fertility rates in Uruguay stagnated or even slightly increased until the early 1970s, when a gradual fertility decline set in. Fertility rates in Chile started falling later and from considerably higher level of the TFR of 5.1 in the early 1960s (HFC 2015; Guzman et al 2006). Finally, period fertility decline in Brazil and Costa Rica started from yet higher level and progressed fastest, with both countries having a period TFR above 6 in the early 1960s. Despite these vast contrasts in their initial fertility levels, all the four countries reached sub-replacement fertility levels around 2005 and the most recent estimates of their period TFRs, ranging from 1.8 in Brazil to 1.9 in Uruguay in 2011 (HFC 2015) position them firmly on the global map of low-fertility countries (Figure 1).

Figure 1: Period Total Fertility rates in Brazil, Chile, Costa Rica and Uruguay, 1990-2011



Source: Human Fertility Collection 2015.

No doubt that the mother's education was the most significant variable in identifying differentials in fertility levels, especially in the context where earlier fertility timing has been imperative for many years. Thus, one of the main characteristics of the fertility decline over the last four decades is a forward shift in earlier fertility timing (Guzman et al. 2006). Despite that, recent studies indicate that the more educated group of women is starting to display some postponement behavior and even an increasing rate of childless women (Bozon et al. 2009). The next analysis will try to focus and explain the increase fertility heterogeneity and the role of education differentials of age of first birth in selected Latin American countries.

3. Highlights of selected findings

3.1. Gradual first birth postponement and an increasing heterogeneity in the timing of motherhood

Two basic indicators of first birth timing, the mean age at first birth and the standard deviation in mean age at first birth show a very similar progression of two parallel trends in all the four countries: a gradual increase in the mean age at first birth since the early 2000s (Figure 2a) and a pronounced trend towards ever more differentiated first birth schedule by age, as reflected in rising standard deviation in the age at first birth in the 1990s and 2000s (Figure 2b).

Our analysis gives a clear support for the notion that the low fertility countries in Latin America have experienced an onset of their "postponement transition", which, however, progresses in a slower pace than that in Europe, by about 1 year per decade. This shift also partly explains current low period TFRs, which have been negatively affected by tempo effect in the last 15 years. Uruguay shows the highest mean age at first birth (24.7 in 2011) coupled with the most diverse first birth schedule by age, with Costa Rica showing the opposite pattern of lowest mean age at first birth (23.1 in 2011) and the lowest age differentiation in fertility schedules.

Curiously, neither the shift towards later timing of childbearing nor the rising heterogeneity in the age pattern of fertility can be discerned from the analysis of fertility rates for all birth orders, where the two analyzed indicators essentially show a flat trend (not shown here). As order-specific fertility rates were unavailable in the analyzed countries until recently, the stable mean age at childbearing was at times erroneously interpreted.

Figure 2a: Mean age at first birth in Brazil, Chile, Costa Rica and Uruguay, 1990-2011.

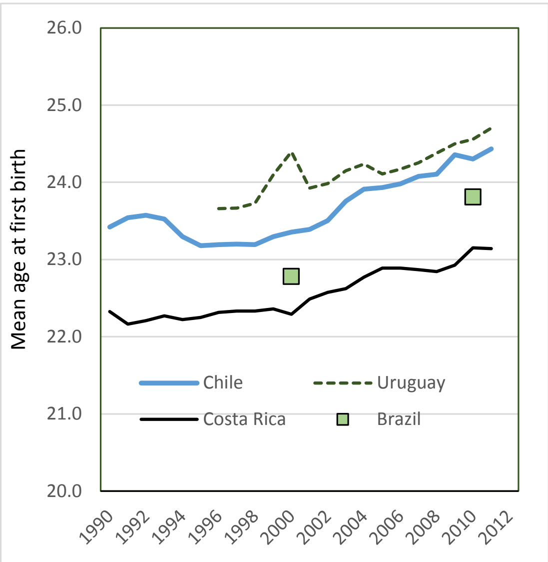
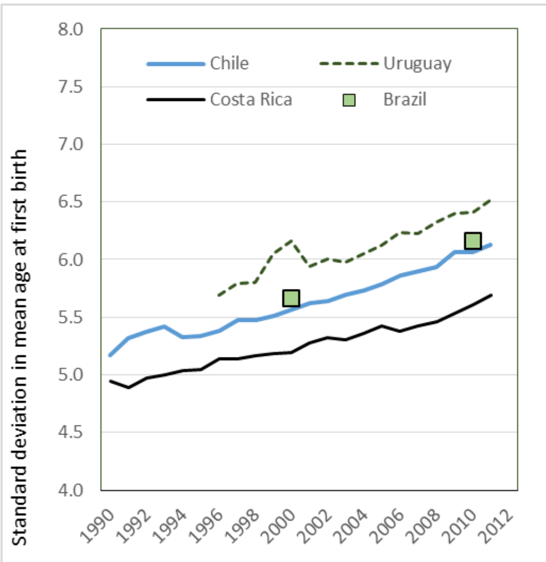


Figure 2b: Standard deviation (variance) in the age at first birth in Brazil, Chile, Costa Rica and Uruguay, 1990-2011.

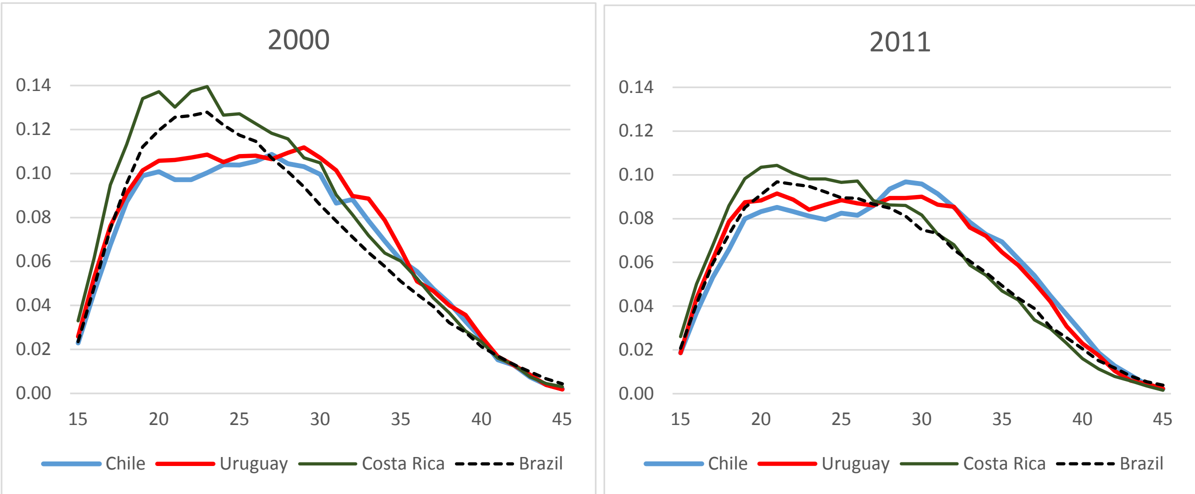


Sources: Human Fertility Collection 2015 and Brazilian censuses 2000 and 2010.

3.2. Diversity in the age profiles of childbearing

Between 2000 and 2011 there was a clear trend towards more age-differentiated and "flatter" profiles of fertility in Costa Rica and Brazil (Figures 3a and 3b). In Chile, which had a relatively flat profile of childbearing already in 2000, a bimodal pattern developed, with a smaller peak at age 21 and a more pronounced peak at ages 29-30. Uruguay shows in both years an unusually flat profile, with a "constant" fertility rate extending from age 19 up to age 32 in 2011.

Figure 3a and 3b: Age-specific fertility rates (women aged 15-44) in Brazil, Chile, Costa Rica and Uruguay, 2000 and 2011



Sources: Human Fertility Collection.

However, the investigation based on unconditional and conditional fertility rates of first births give an extra and interesting picture of the level of heterogeneity in fertility schedules among these countries, as presented in the next section.

3.3. Changes in the age profiles of first births

The profile of first birth distribution by age, captured by unconditional first birth rates (ASFR1) shows a strong concentration into young ages in 2000, peaking at age 19 in all the four countries (Figure 4a). At that time, only Uruguay also displayed somewhat higher first birth unconditional rates after age 25. By 2011, the early peak became less pronounced and more first births have shifted to older ages above 25 (Figure 4b). Chile and Uruguay also show emerging bimodality in unconditional first birth rates, with a minor late hump showing up at ages 29-30.

The bimodal distribution appears more apparent in conditional first birth rates, where we compare the profiles for the four analyzed countries with the bimodal profile of first birth rates in the United States. Uruguay displayed a strong bimodal first birth pattern already in 1996, closely resembling that of the United States at that time and retained it in 2006 and 2011, when the bimodality in first births in the United States was weakening. First birth intensity in Uruguay first peaks at age 19, with a considerably stronger second peak appearing at ages 29-32. Chile initially showed a bimodal profile of conditional first birth rates in 2005, which subsequently evolved into a trimodal profile with the latest peak at age 34. The apparent trimodal pattern might, however, partly be a statistical artifact, due to lower reliability of our estimates based on combining vital statistics data on live births with the parity-specific exposure data originating from the census. Finally, Brazil and Costa Rica show a shift towards relatively flat profile in conditional first birth rates with two less pronounced peaks (the first peak around age 20s and the second around the age of 32 years old) apparent in 2010 and 2011.

Figure 4a and 4b: Age-specific unconditional fertility rates for birth order 1 (ASFR1, women aged 15-40) in Brazil, Chile, Costa Rica and Uruguay, 2000, 2010 and 2011.

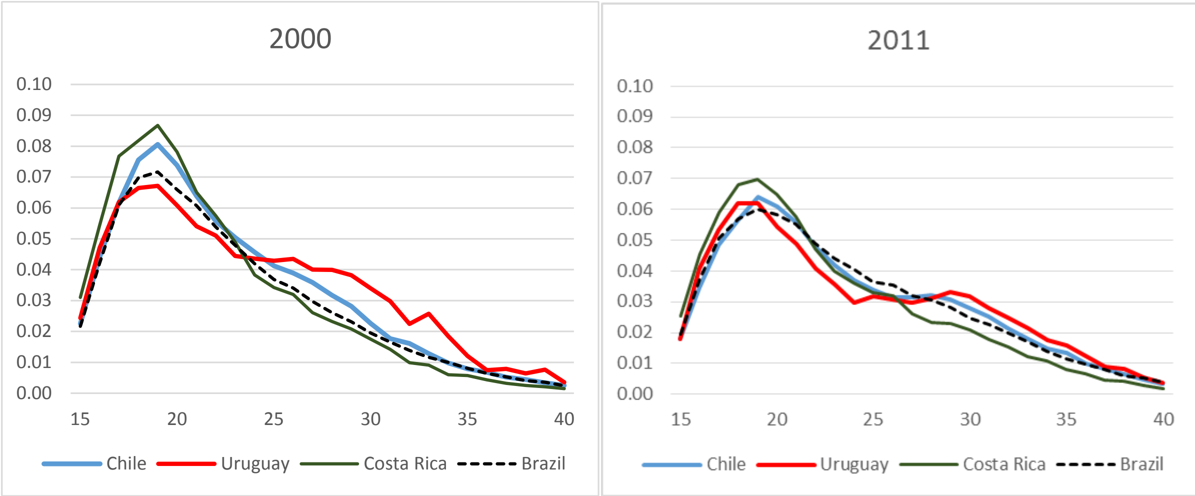
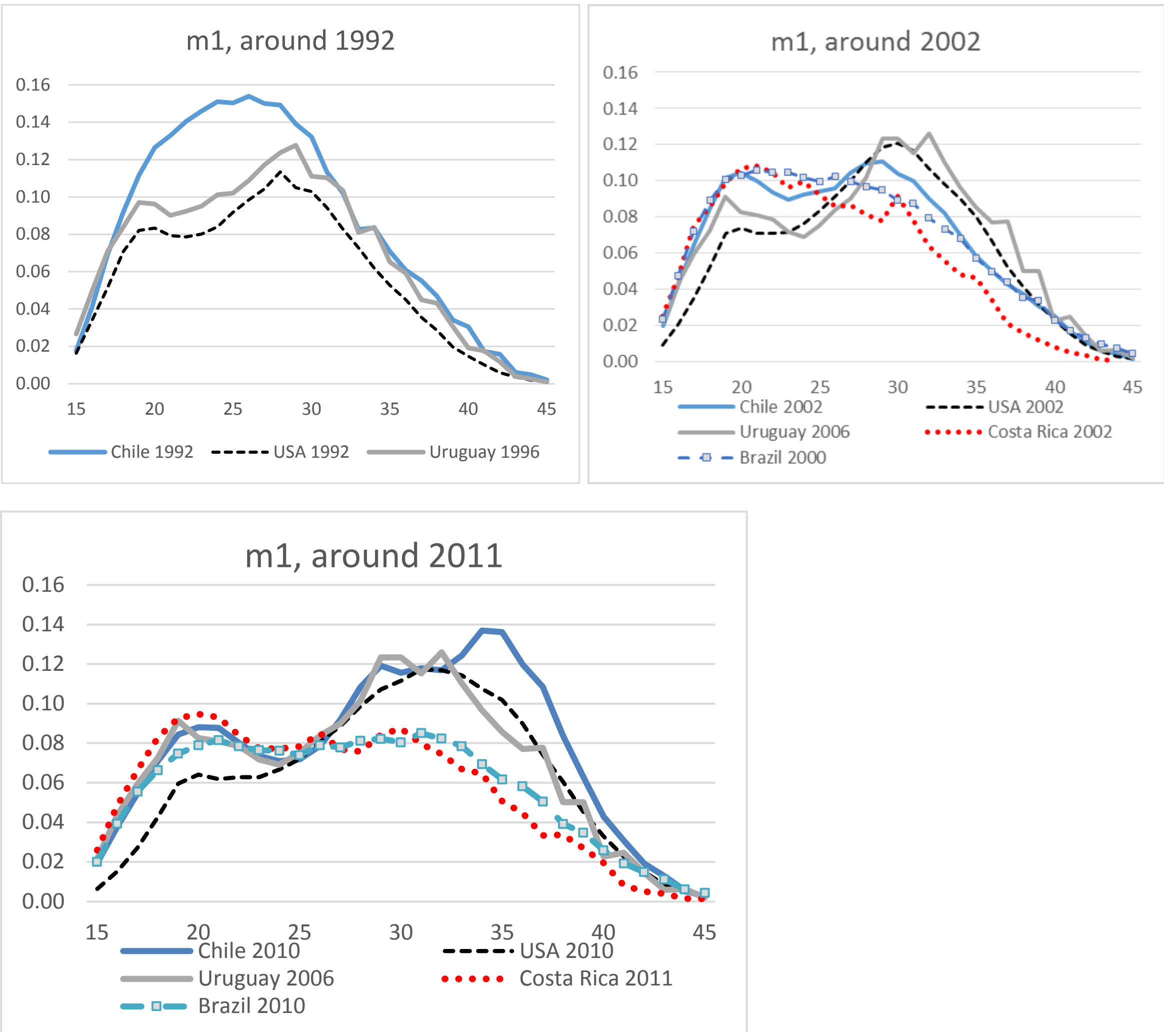


Figure 5a and 5b: Age-specific conditional first birth rates (m1, women aged 15-40) in Chile, Costa Rica and Uruguay as compared with the United States, around 1992, 2002, 2010 and 2011.

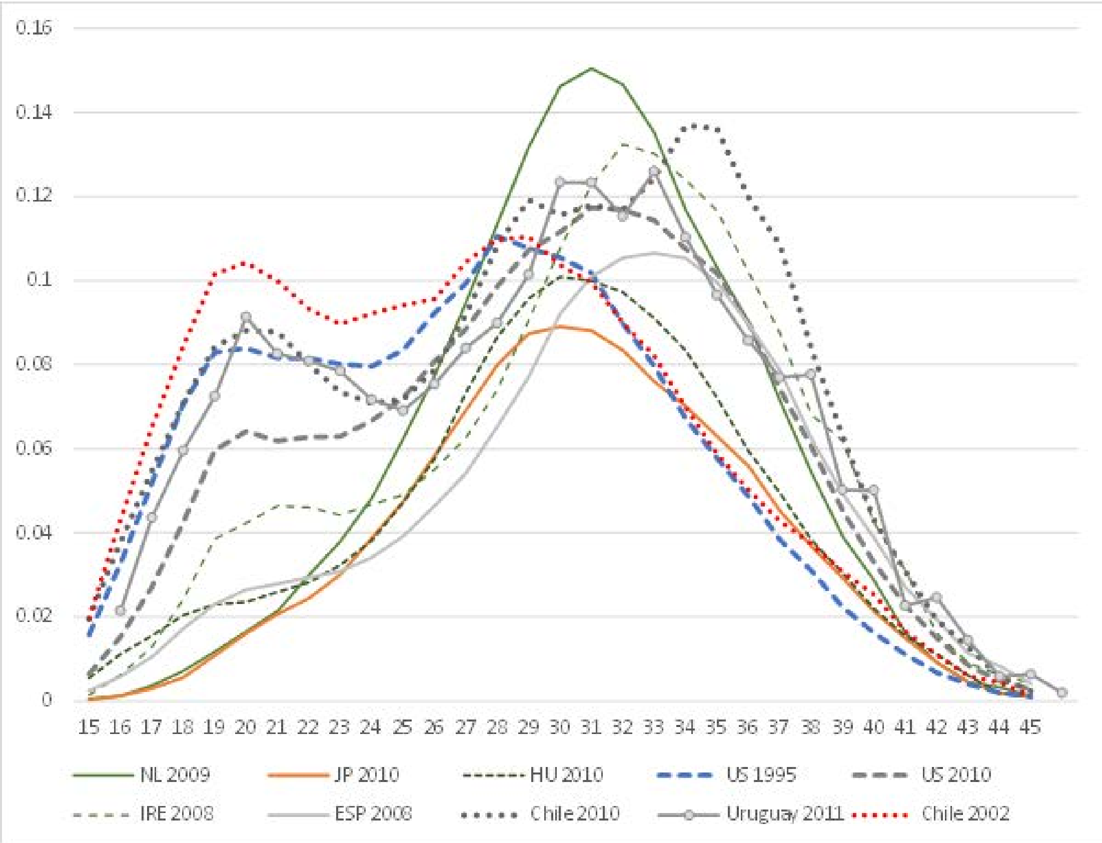


Note: Human Fertility Database (2015) and Brazilian Censuses 2000 and 2010.

3.4. Distorted and bimodal profiles: A comparison with other countries

A more detailed comparison of bimodal profiles of conditional first birth rates in Chile (2002, 2010) and Uruguay (2011) — with bimodal first birth rates profiles for the United States (1995 and 2010), Ireland (2008) and a hump-shaped profile of first birth rates in two European countries known for irregular profiles (Hungary in 2010 and Spain in 2008) — suggests that the bimodality in first birth patterns by age in Chile and Uruguay is much more pronounced than in Europe (Figure 6). Among the low-fertility countries with available data, it is matched only by a bimodal pattern in the United States, which is now in retreat. The distinctiveness of first birth profiles in the two Latin American countries becomes even more apparent when compared with countries with very regular inverted-U shaped fertility profile such as Japan and the Netherlands. This comparison, therefore, supports the idea that Latin American fertility profile is evolving into a polarized pattern.

Figure 6: Age-specific conditional first birth rates (m1) among women aged 15-45 in Chile, Uruguay, United States, Japan, Hungary, Ireland, the Netherlands, and Spain; selected years

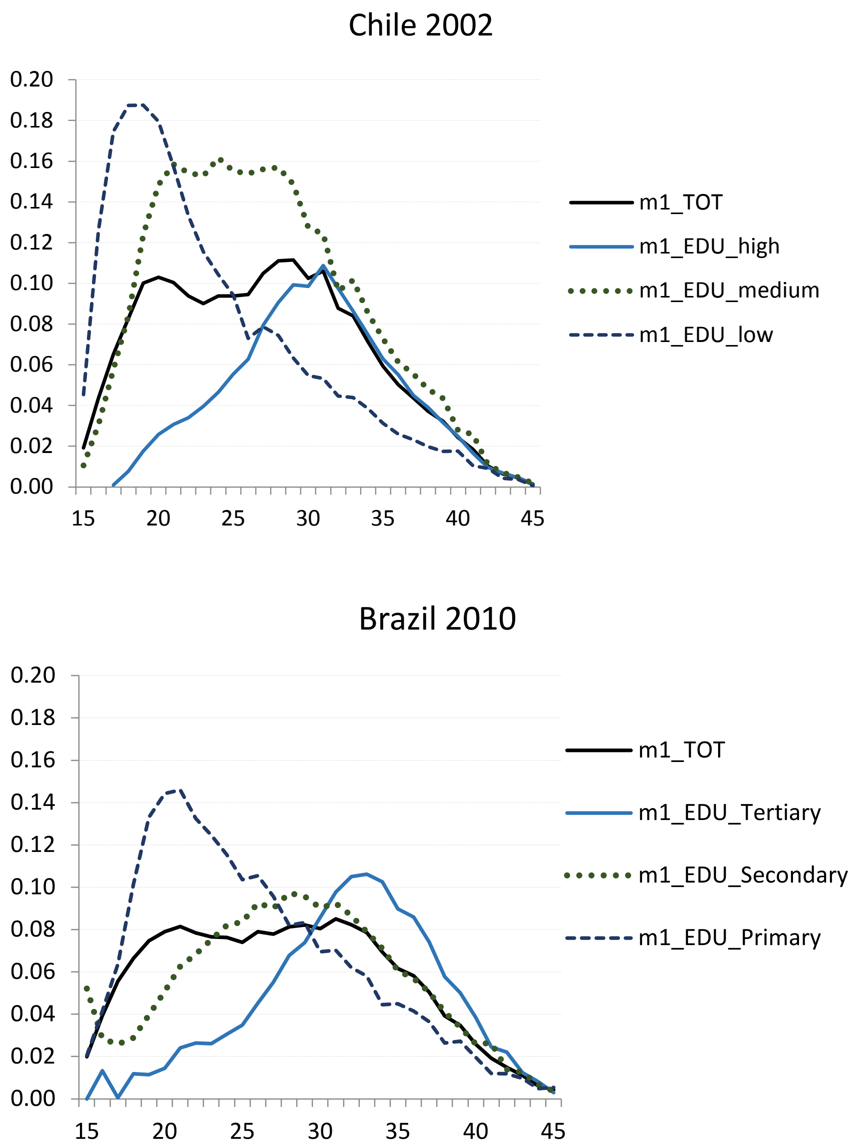


Note: Data for Hungary, Ireland, Japan, the Netherlands, Spain, and the United States originate from the Human Fertility Database (2015)

3.5. Education differences in conditional first birth rates

To shed more light on whether the bimodal age pattern of first birth rates is linked to pronounced education differences in first birth timing, we have estimated the age profile of conditional first birth rates by level of education in Chile (2002) and Brazil (2010). In both countries the overall first birth profile, relatively flat for Brazil at ages 20-33, and flat with two minor peaks in Chile is composed of contrasting groups. In each country there are three very different education profiles, with a major contrast between women with primary and lower education showing a strongly concentrated pattern of first birth with highest first birth rates at ages 18-19 (Chile) and 20-21 (Brazil), and university-educated women, who have the highest intensity of first birth at age 31 (Chile) and 33 (Brazil). These findings give a strong support to our argument that the polarized pattern of age at first birth in Latin America is driven by contrasting age patterns of family formation by social status, especially captured by educational differentials.

Figure 7: Age-specific conditional first birth rates (m1) by level of education among women aged 15-45 in Chile (2002) and Brazil (2010)



Final Remarks

First births fertility schedule show bimodal pattern or nearly bimodal pattern, with strong evidence that the distribution has two distinct components, as we clearly verify since 1996 in Uruguay and since 2002 in Chile. Interesting fact is that this pattern is presented in both conditional and unconditional fertility rates. Conditional and unconditional fertility rates display very different age schedules. While unconditional rates ASFR1 have distinct maximum before age 20, with secondary peak around age 28, conditional rates m1 have inverse shape, with secondary maximum at young ages and primary maximum around age 30 in almost all countries analyzed. While the first component strongly resembles the fertility rates of women with low and medium education and second component is similar to fertility rates of highly educated women. Thus, we see that education gradient has important role in timing of births, translating into heterogeneous fertility schedules, especially visualized in firths births.

As some scholars have pointed out, the fertility transition process in the region has multiple reasons and factors, and the years of education of women played an important role in this process (Petito, 2005; Vignoli, 2013). In addition to that, Petito (2005) highlights, in particular, the clear association existent between fertility and education in Uruguay, where the most educated women clearly have much lower fertility than uneducated women do. Furthermore, the education levels explain in great extent teenage pregnancy and early motherhood. Thus, in the recent period, a great percentage of children are born to teenage and young mothers without education and/or incomplete primary education. According to Petito (2005), 71% of teen mothers in the country have completed only primary education and barely 7% have reached full secondary. The illiteracy rates are around 4% for the entire country, however, the levels of school dropout has significantly increased in recent years. On the other hand, young adult mothers (24-29 years old) appear to have achieved much higher education levels (Petito, 2005). Thus, these education differences might reflect in the bimodal fertility curve, as our analysis has shown.

In Chile, the recent fertility evolution is very comparable to its neighbor country. According to data from INE of 1996 to 2004, we see increase in the postponement of motherhood, specifically observed in the age at first birth. Although, between 20 and 24 years remains the dominant age group in which women have a first son, there has been an increasing number of first-time mothers after this age.

This change is also observed according to many socio-economic characteristics, and the educational gradient has played a very important role to explain heterogeneity in Chilean fertility schedules. According to INE (2007) the number of first-time mothers with more education levels achieved has significantly increased from 1996 to 2004. The educational composition has also changed toward an increase proportion of mothers with more years of education completed. Moreover, in 1996, among all first-time mothers, in the age group of 25-29 years old, we see women with more years of education (10-12 years and 13 or more). However, in 2004, the first-time mothers between 30 and 34 years were the ones that presented more education level, i.e. 13 or more years of school (INE, 2007).

We also noticed changes in the educational level of women who became mothers for the first time, before their 20 years of age. In 1996, most of teen mothers had only nine years of studies completed but, in 2004, we found that mostly teenage mothers have 10 to 12 years of education completed (INE, 2007). However, less educated women still being the group that over-represents teenage pregnancy.

In Brazil, there is a similar scenario, where according to Rios-Neto and Guimaraes (2014) the age specific fertility rates profile differs considerably between women with at least some tertiary education and the women in other education groups. They argue that between 2000 and 2010, the TFR is declining in all age groups, while there is a convergence in fertility schedule among the lower education levels, but the group of women with tertiary education maintained a different fertility shape with the peak of fertility around the age of 30.

The relationship between school attendance and fertility has also been studied by Collado Chaves (2003). According to him, high fertility levels among teenagers 13-17 years of age are positive correlated to school dropout and low levels of education. Rosero-Bixby (2009) established a similar link between education and early pregnancy. Thus, early pregnancies are related to discontinuation of education, as more educational achievements are associated with postponement of sexual initiation and first pregnancies (Rosero-Bixby 2009).

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