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TWIN PEAKS: THE EMERGENCE OF BIMODAL FERTILITY PROFILES IN LATIN AMERICA

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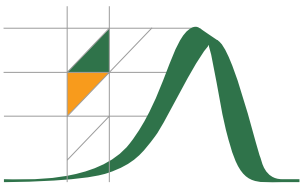

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Abstract

In contrast to most other low-fertility regions, the fall in period fertility to sub-replacement level in Latin America was not accompanied by a sharp decline in fertility rates at young reproductive ages. Reconstructing period fertility rates by age, birth order and level of education, we investigate changes in the age pattern of childbearing 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. Our analysis shows that all the four countries display a combination of continuing high rates of childbearing at younger ages with a parallel increase in first birth rates at later reproductive ages. This pattern is also manifested by the emergence of bimodal schedules of first birth rates by age, especially in Chile and Uruguay. We show that this reproductive polarization is more pronounced than the bimodal profiles identified earlier for selected countries of Europe and the United States. We suggest that 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.

Keywords

First birth, fertility timing, family formation, age schedule of childbearing, Latin America.

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Twin Peaks: The Emergence of Bimodal Fertility Profiles in Latin America

Everton E. C. Lima, Kryštof Zeman, Mathias Nathan, Ruben Castro, Tomáš Sobotka

1. Introduction

Demographic transition in Latin America has been more rapid than in other world regions except East Asia. With a few exceptions (especially Argentina and Uruguay) fertility remained high until the early 1960s, when it started falling rapidly throughout most of the region (Guzmán et al. 2006). Over the last five decades, the total fertility rate (TFR) in the region has dropped from 5.89 children per woman in 1960–1965 to 2.14 children per woman in 2010–2015 (United Nations 2017), with four countries in South America (Brazil, Chile, Colombia and Uruguay) and two countries in Central America (Costa Rica and El Salvador) experiencing TFR declines to levels below 2.1 children.

The emergence of sub-replacement fertility in some countries of Latin America since the early 2000s seemingly suggests that the region is experiencing a shift to low fertility, comparable with the earlier experiences of fertility declines in Europe, East Asia and North America. However, similarities in fertility levels may hide persistent contrasts in parity-specific patterns of family building and in fertility timing. In most countries in Europe and East Asia, the fall in fertility to low levels has been accompanied by a rapid shift towards late family formation and a sharp fall in the frequency of early childbearing, especially among teenage women (Kohler et al. 2002; Sobotka 2017). In contrast, the available evidence for Latin America suggests that the rapid fertility declines have not yet been accompanied by an intensive "postponement transition" (Kohler et al. 2002) typical of Europe and East Asia. Specifically, studies analyzing changes in fertility timing in Latin America suggest three major features characterizing Latin American low fertility in the 1990s–2010s: 1) a very slow trend towards a later timing of family formation (e.g., Rosero-Bixby et al. 2009; Nathan et al. 2016 for Uruguay); 2) a persistence of high teenage pregnancy and fertility rates (Cavenaghi and Alves 2009; Rodríguez 2013; Guzmán et al. 2006; Rodríguez and Cavenaghi 2014); and 3) the evidence of reproductive polarization by social status, where the progressively delayed family formation among highly educated women increasingly contrasts with the persistence of early childbearing among women with lower education (Rosero-Bixby et al. 2009; Saad 2009; ECLAC 2012; Rodríguez and Cavenaghi 2014; Nathan 2015).

Trends in age-specific fertility rates show that the 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 the 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, after increasing during the 1990s (INE Chile 2004; Varela et al. 2012). In Brazil, for example, the recent low TFR level is coupled with a persistence of elevated fertility at younger ages and a high proportion of teenage mothers from low socioeconomic strata (Berquó and Cavenaghi 2005; Rios-Neto 2005; Bozon et al. 2009).

Research considering socio-economic differentials in fertility often highlights the role of tertiary-educated women in driving the trend to the new low-fertility pattern in Latin America (Rios-Neto and Guimaraes 2014; see also Rodríguez and Cavenaghi 2014 and Varela 2005 for Uruguay). Recent findings indicate that college-educated women have started postponing childbearing to higher ages and experience rising childlessness (Rosero-Bixby et al. 2009; Bozon et al. 2009; Lima and Myrskylä 2013). Furthermore, 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.

One reason fertility in Latin America remains high at younger ages is the relatively early pattern of union formation in the region which has not 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" in union formation and fertility. Across the region younger women in cohabiting unions display high fertility rates, almost indistinguishable from fertility rates of married women (Laplante et al. 2015). Another important factor helping to maintain high teenage pregnancy rates is the relatively early sexual debut in the region, combined with high rates of unplanned and unwanted pregnancies and very limited legal access to abortion in most countries (Kulczycki 2011). Surveys conducted in the early 2000s suggest that the share of unwanted births ranged from 21 percent in Paraguay to 60 percent in Bolivia, with over a third of all births still reported as unwanted in two low-fertility countries, Brazil and Colombia (Casterline and Mendoza 2009: Figure 1).

The combination of high teenage fertility and an incipient pattern of delayed family formation typical of women with higher education is likely to result in a widening age schedule of childbearing, especially for first birth, and the emergence of a bimodal pattern of family formation, documented earlier for some European countries (Chandola et al. 1999) and the United States (Chandola et al. 2002; Sullivan 2005). In Latin America, this phenomenon has been analyzed for Uruguay by Nathan et al. (2016), who show that the profile of age-specific fertility rates progressively flattened at ages 20–34, while first birth rates displayed increasingly bimodal age profiles between 1996 and 2011, a period when the total fertility rate in the country declined below replacement level.

We focus on 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, in particular first birth rates, in four Latin American countries that experienced a decline in period total fertility rates below replacement level in the early 2000s—Brazil, Chile, Costa Rica and Uruguay. For Brazil and Chile we also study the age profiles of first birth rates by level of education to analyze whether the achieved level of education is the key factor behind the rising age stratification in first birth timing. Finally, we contrast the Latin American pattern in first birth timing with the age schedules of first births in selected rich low-fertility countries.

Our study is the first one bringing together detailed order-specific fertility data for different countries of the region. We show that all 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 (less pronounced 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. We conclude that first birth rates in the low-fertility countries in Latin America depict pronounced bimodality by age, which is more marked than the bimodal patterns identified earlier in some European countries and the United States, and which is linked to widely differentiated trajectories of first birth timing by education.

2. 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 they were studied in several predominantly English-speaking 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 the timing of births by marital status, with an early bulge linked to extra-marital births, often among solo mothers. They also indicate that ethnic differences play an important role in explaining 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 with other models in a methodological paper by Peristera and Kostaki (2007). They found a distinct "bulge", or "hump", in first birth rates at young ages in the early 2000s in the United Kingdom, Ireland and the United States, but also in Spain, and, to a smaller extent, in Denmark, Norway and Sweden. They link the observed heterogeneity in first birth patterns to a range of fertility determinants including marital status, religion, education level, and the rise of migrant populations together with racial and ethnic differences, and propose a new mixture model to fit these uneven fertility

schedules. Adopting a cohort perspective, Burkimsher (2017) documented the emergence of bimodal first birth curves by age in many European countries, most notably among women born in 1980 in the former state socialist countries of Central and Eastern Europe. She suggests this bimodality is a temporary phase resulting from a rapid shift to a later childbearing pattern after the breakdown of state socialism around 1990.

Garenne et al. (2000) used Coale-McNeil and Coale-Trussell models for decomposing bimodal age patterns of fertility in rural South Africa in 1992–1997 into premarital and marital fertility. They explain the analyzed bimodal fertility pattern largely by the differences in fertility by marital status. Roig Villa and Castro Martin (2007) identified huge differences in fertility timing between native and immigrant mothers in Spain, contributing to the widening differences in the age at childbearing in the country. Sullivan (2005) studied the bimodal pattern in first birth rates in the United States in the 1990s. She has identified education and ethnic differences in fertility as key explanations of this pattern, suggesting there was a "bifurcation" of fertility between these groups. Discussing the rise and the subsequent "disappearance" of the bimodal first birth pattern Sullivan (2005: 271) concludes that bimodality in the US was "a temporary phenomenon based on the uneven adoption of fertility delay across groups of women. The end result, after further diffusion, is likely to be a unimodal pattern with a mode closer to age 30."

Rendall et al. (2009 and 2010) and Ekert-Jaffé et al. (2002) coined the term "reproductive polarization" to describe heterogeneous patterns 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, 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). 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.

Our analysis of recent fertility patterns 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 patterns among 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 patterns of reproduction.

3. Data and Methods

3.1. Data

The official vital registration system in most countries of Latin America suffers from incomplete coverage of births, their late registration, and from incomplete and missing information in the registration forms (Guzmán et al. 2006; Lima et al. 2017; PLoS 2010; AbouZhar and Boerma 2005). As a result, fertility rates in the region are mostly estimated from Census data and from repeated standardized retrospective surveys, especially Demographic and Health Surveys (DHS), and relying on established methods of data adjustment such as the Brass P/F ratio method and the relational Gompertz model[1], among others (Lima et al. 2017). The parallel use of different data sources and different methods to estimate period fertility rates from these data often implies uncertainty about the resulting period fertility estimates (see, e.g., discussion on period fertility estimates in Brazil by Castanheira and Kohler 2015 and Lima et al. 2017) as well as the existence of alternative period fertility estimates for some years and periods.

In this study, with the exception of Brazil, we have selected countries with high completeness of birth registration (United Nations 2000; 2010). This allows us to rely on the annually collected birth data and the official population estimates to derive the indicators of age-specific fertility (total and for first births) as well as the summary indicators of period TFR and mean ages at childbearing for the period between 1990 and 2011. We correct for the undercount of births in birth registration in Brazil by using the adjustment factors provided by the Brazilian National Statistical Office (IBGE 2013), also discussed by Cavenaghi and Alves (2016), Castanheira and Kohler (2015) and Lima et al. (2017).

Although the TFR estimates might not be as accurate as those produced annually for the highly developed countries with complete registration of births, our main interest lies in reconstructing the age pattern of childbearing and its changes over time rather than providing a precise estimate of the summary indicators of fertility. The birth registration data used here are perfectly suitable for this purpose, even if they do not cover all the births in each analyzed country.

We make extensive use of fertility data by age and birth order collected for the Human Fertility Collection (HFC 2017; http://www.fertilitydata.org), the Human Fertility

[1] P/F is a formal demographic method used to correct period fertility estimates (TFRs) based on the ratio of the average parity distribution (P) and cumulated fertility (F) from a period. Under the condition of constant fertility schedule for an extended period of time, this ratio provides adjustment factor for the TFRs (Brass, 1964). The relational Gompertz method is a refinement of the Brass P/F ratio method. It estimates age-specific and total fertility by determining the shape of the fertility schedule from the data on recent births, reported in censuses or surveys, and by estimating fertility levels from the average parities of younger women.

Database (HFD 2017; http://www.humanfertility.org), and computed from national vital statistics. In addition, we use census data on children ever born and births in the previous year among women of reproductive age in Brazil and Costa Rica. The time series of fertility rates by age and birth order come from the HFD (Chile in the period 1992–2005; Castro and Zeman 2014), and from the HFC (Chile in 2006–2011, Zeman and Castro 2014; Uruguay 1996–2011, Cabella et al. 2014). Data for Costa Rica for 1990–2011 come from the Central American Population Center (Centro Centroamericano de Poblacion – CCP). Fertility estimates for Brazil were computed from the 2000 and 2010 census data on births in the previous year (IBGE 2000; 2010). The number of first births was also tabulated by educational categories, and the period fertility rates were adjusted by P/F ratios.

The computations of conditional (exposure-specific) first birth rates by age required additional data on the parity distribution of the female population of reproductive ages, available from population censuses. In Brazil, the last two censuses (2000, 2010) were used (IBGE 2000; 2010). Data for Chile were computed from two sources. The Ministry of Health (Ministerio de Salud, DEIS 2017) provided individual birth records for 1994–2011 from which live births by age and birth order were tabulated, while the data on female population by single years of age on 1st July for years 1990 to 2011 were taken from INE Chile (2017). Exposure-specific rates are based on the parity distribution of the female population reported in the population censuses of 1992 and 2002. 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 years of age were provided by the National Institute of Statistics of Uruguay (INE Uruguay 2014). Conditional fertility rates for Uruguay use the parity structure of the female population from the population census of 1996, and from the Encuesta Nacional de Hogares Ampliada (Expanded national household survey) 2006. For Costa Rica, the births and female population exposure are available in census data 2000 and 2011 (CCP 2017a), and from vital registers and population projections for years 1990 to 2010 (CCP 2017b). These datasets are provided by the Central American Population Center (CCP).

3.2. 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 in the transition to motherhood (Morgan 1996). Moreover, first birth is a major life course event, whose timing is often interrelated with other main transitions (union formation, residential mobility, migration, completing education, entering employment) and which 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. Similarly, changes in the overall age pattern of childbearing might be caused by the changing frequency of higher-order births rather than by a real shift in the age pattern of childbearing.

Sullivan (2005) explored bimodality in 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 the 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 the conditional first birth rates reflects the age pattern of the intensity of first births, but not necessarily the age distribution of first births in the female population. 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 easier to calculate and more widely available as their computation does not involve the estimation of the parity distribution of women by age for every year studied. We call them *unconditional rates* or *incidence 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: for any age, the sum of age-specific rates across all birth orders gives the overall age-specific fertility rate. Because of their additive nature, these rates are also easily interpretable when broken down into two or three components reflecting the distribution of fertility into two or more sub-populations (Chandola et al. 1999; 2002), such as those of married and non-married women.

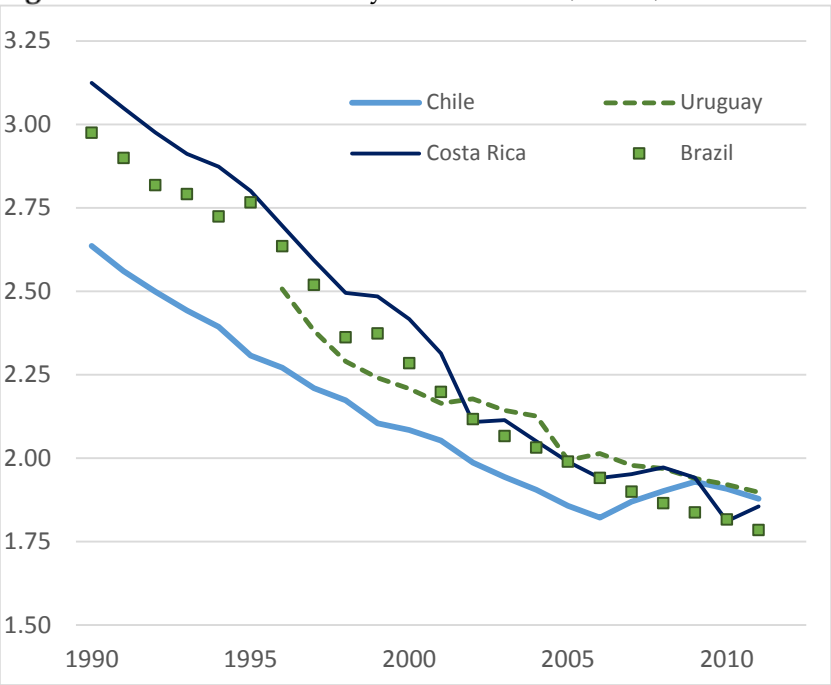
In this study, we first look at the age distribution of the overall fertility schedule and then inspect in more detail the changes in the age pattern of unconditional first birth rates. Finally, for the years when the female parity distribution can be reconstructed (population censuses of 1992 and 2002 for Chile, 1996 and 2006 for Uruguay, 2000 and 2011 for Costa Rica, and 2000 and 2010 for Brazil), we also study conditional fertility rates. This allows us to provide a direct comparison with Sullivan's (2005) research on the United States and also offers comparisons with the hump-shaped first birth schedules by age in selected countries of Europe.

4. Emerging Sub-Replacement Fertility in the Four Analyzed Countries

Among the four analyzed countries, fertility transition in Uruguay started earliest, already in the late 19th century (Pellegrino et al. 2008). 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 (United Nations 2017; 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 at 5.1 in the early 1960s (HFC 2017; Guzmán et al 2006). 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 the onset and the progression of their fertility declines, these four countries are, alongside Cuba, at the forefront of Latin American fertility decline to sub-replacement level. They reached sub-replacement fertility rates in the early 2000s and the most recent estimates of their period TFRs position them within a narrow range of 1.8-1.9 in 2011 (HFC 2017). This puts 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 2017.

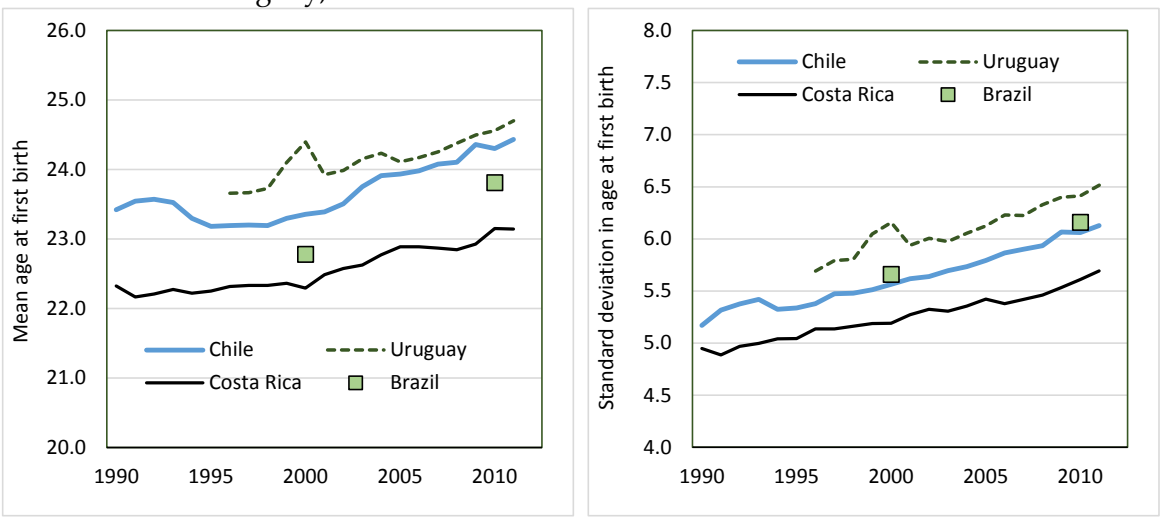
While the analyzed countries share low fertility with most of the highly developed countries, they retain an early timing of childbearing, which clearly contrasts with the late pattern of family formation in Europe, East Asia, North America and Australia (Sobotka 2017). As recently as in the 1990s, many Latin American countries including Brazil, Chile and Uruguay saw an increase in the percentage of women who become mothers before reaching age 20 (Saad, 2009; INE Chile 2007; Varela et al. 2012; Rodríguez and Cavenaghi 2014). Our next analysis focuses on the rising heterogeneity in fertility timing and the role of education differentials in driving this heterogeneity in the four analyzed Latin American countries.

5. Shifts in the Age Profiles of Childbearing and First Births

5.1. Gradual First Birth Postponement and Rising Heterogeneity in the Timing of Motherhood

The analyzed countries share two broad trends in the timing of first birth: a gradual increase in the mean age at first birth since the early 2000s and widening differences in first birth timing, as reflected by the rising standard deviation in the age at first birth in the 1990s and 2000s (Figure 2; see also Nathan et al. 2016). Our analysis gives a clear support to the notion that the low fertility countries in Latin America have experienced an onset of their "postponement transition", which, however, progresses with much slower pace than that in Europe and East Asia (Sobotka 2017), by about 1 year per decade. The gradual shift to delayed parenthood in the analyzed countries also partly explains their current low period TFR levels, which have been negatively affected by the tempo effect during the last 15 years. Uruguay shows the highest mean age at first birth (24.7 years of age in 2011) coupled with the most diverse first birth schedule by age. In contrast, Costa Rica combines the lowest mean age at first birth (23.1 in 2011) with the lowest age differentiation in first birth schedule by age.

Figure 2 Mean age at first birth and standard deviation in age at first birth, Brazil, Chile, Costa Rica and Uruguay, 1990–2011



Sources: own calculations based on data from Human Fertility Collection 2017; IBGE 2000; IBGE 2010; DEIS 2017; INE Chile 2017; CCP2017a and CCP2017b.

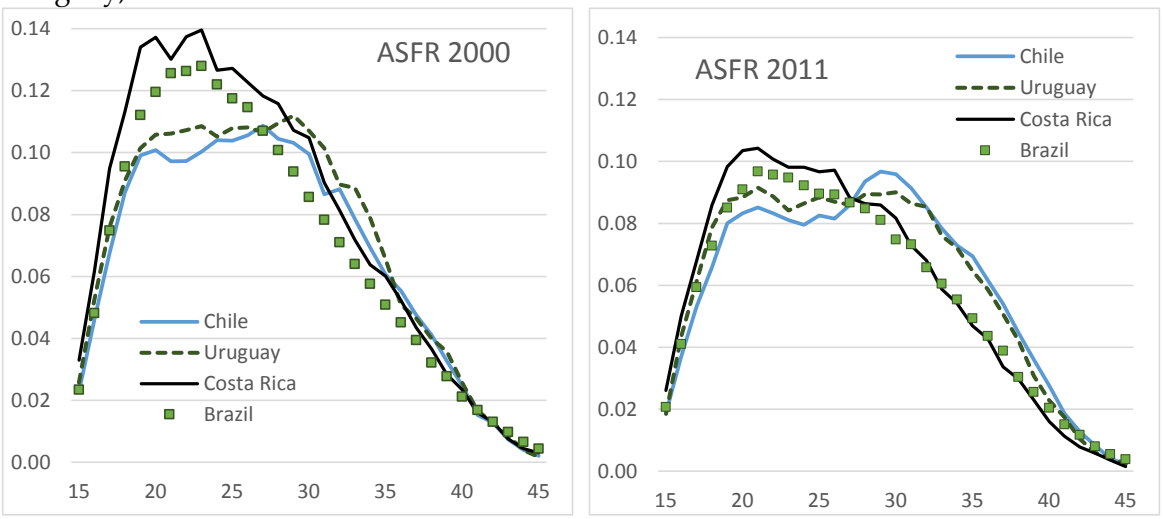
Curiously, neither the shift towards later childbearing nor the rising heterogeneity in the age pattern of fertility can be discerned from the analysis of fertility rates for all birth orders, where the two analyzed indicators essentially show a flat trend (not shown here). As order-specific fertility rates were unavailable in the analyzed countries until recently, the stable overall mean age at childbearing could be erroneously interpreted as a sign of an absence of first birth postponement in Latin America (INE Chile 2004; Paredes 2003;

Rodríguez 2005; Saad 2009; Ciganda 2008; Cavenaghi and Alves 2009; Wong 2009; ECLAC 2012).

5.2. The "Flattening" 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 (Figure 3). 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 almost "constant" fertility rates extending from age 19 up to age 32 in 2011.

Figure 3 Age-specific fertility rates (women aged 15–45) in Brazil, Chile, Costa Rica and Uruguay, 2000 and 2011



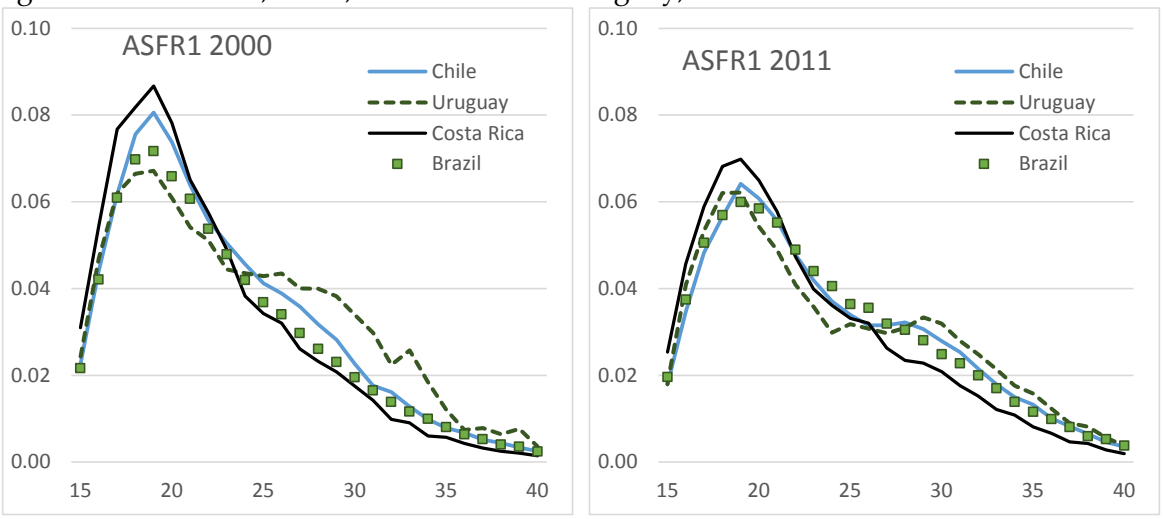
Sources: Human Fertility Collection 2017.
Note: The more recent data for Brazil are for 2010.

6. Twin Peaks: The Changing Age Profiles of First Births

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

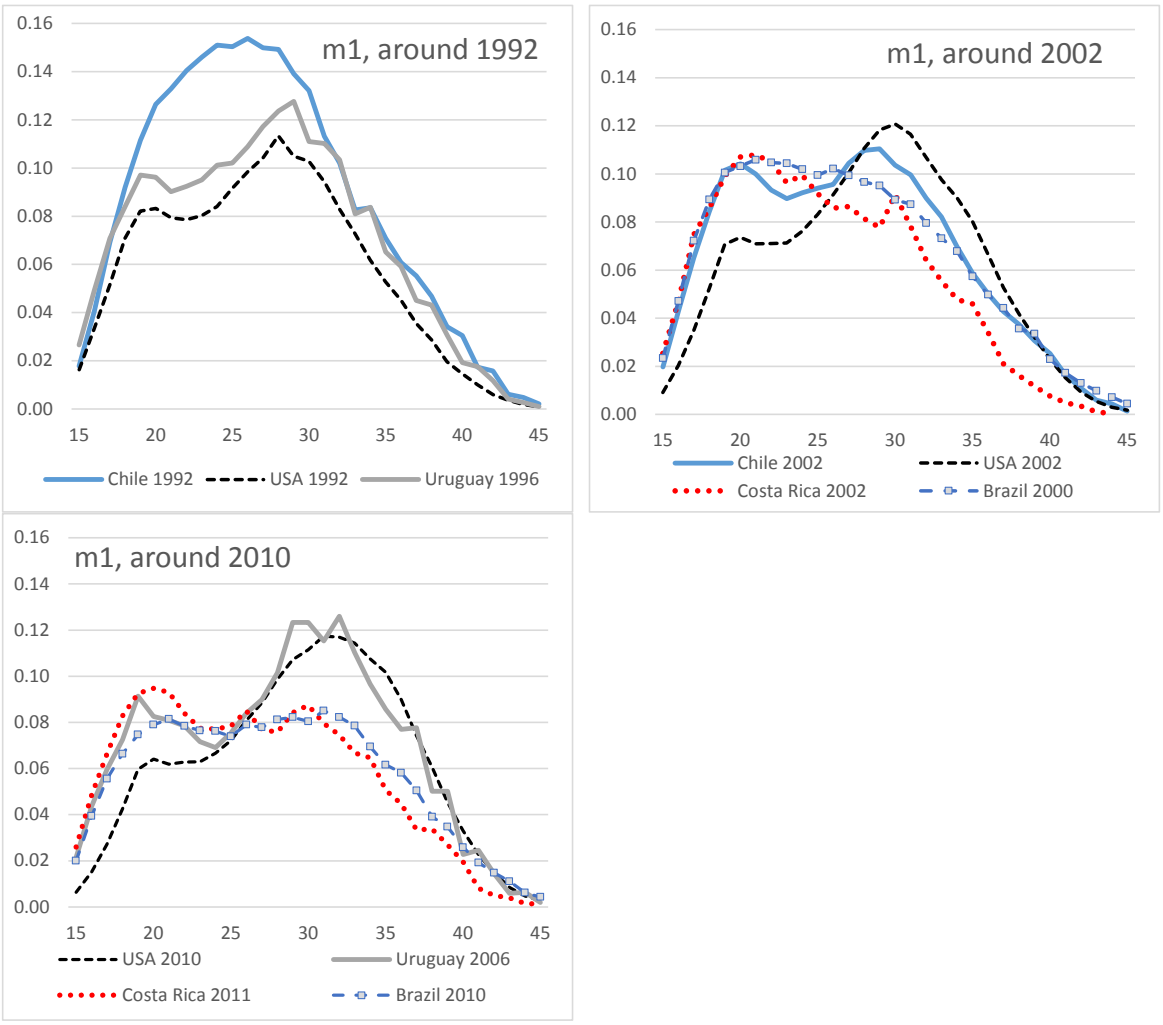
The bimodal age pattern of first birth shows up clearly when analyzing trends in conditional first birth rates between the 1990s and 2010 (Figure 5). We compare the age profiles for the four analyzed countries with the bimodal age profile of conditional first birth rates in the United States. Uruguay 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, when the bimodality in first births rates in the United States was weakening. First birth intensity in Uruguay first peaks at age 19, with a much higher second peak appearing at ages 29–32. Data for Chile depict a symmetrical bimodal profile of conditional first birth rates in 2002. Finally, Brazil and Costa Rica show a shift towards a relatively flat profile in conditional first birth rates with two smaller peaks (around ages 20 and 32) apparent in 2010-2011.

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



Sources: Human Fertility Collection 2017.
Note: The most recent data for Brazil are for 2010.

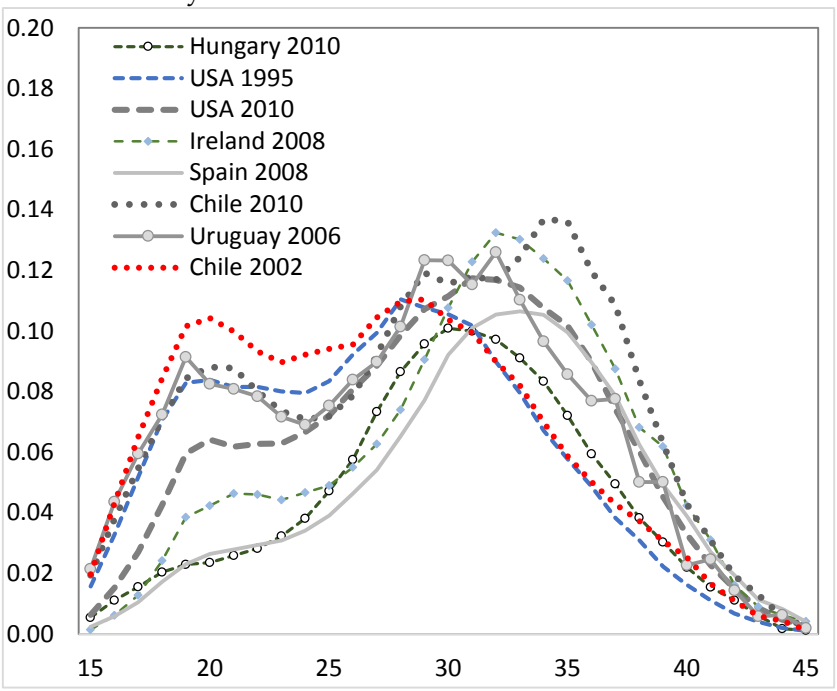
Figure 5 Age-specific conditional first birth rates (*m1*) among women aged 15–45 in Chile, Costa Rica and Uruguay as compared with the United States, around 1992, 2002, and 2010



Sources: own calculations based on data from Human Fertility Collection 2017; Human Fertility Database 2017; IBGE 2000; IBGE 2010; DEIS 2017; INE Chile 2017; CCP2017a and CCP2017b, Chile censuses 1992 and 2002 and Uruguay census 1996 and household survey 2006.

Is the observed bimodality in first birth intensity in some of the analyzed Latin American countries unique among the countries with low fertility? A comparison of conditional first birth rates in two analyzed countries with strong bimodality, Chile (2002, 2010) and Uruguay (2006), with bimodal profiles of first birth rates in the United States (1995 and 2010) and Ireland (2008) and a hump-shaped profile of first birth rates in Hungary (2010) and Spain (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 as fertility rates among adolescents and young adults have been falling rapidly during the last decade (Hamilton and Mathews 2016).

Figure 6 Age-specific conditional first birth rates (*m1*) among women aged 15–45, selected countries and years

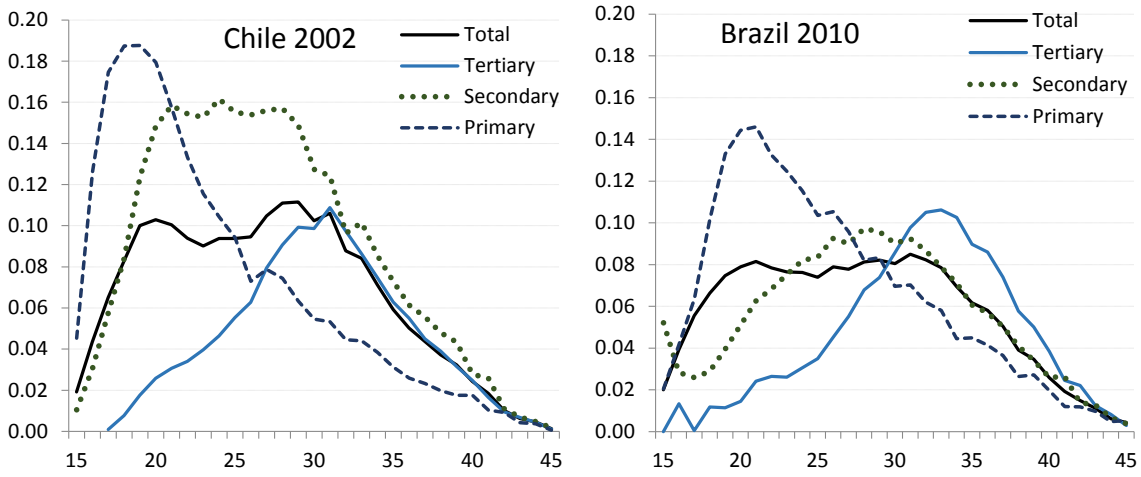


Sources: Human Fertility Database (2017); data for Chile (2010) and Uruguay (2006) computed from Human Fertility Collection (2017) and from census data.

7. Education Differences in Conditional First Birth Rates

Past research has underscored the importance of educational differentials in family formation in explaining the heterogeneity in first birth timing (e.g., Rendall et al. 2010). To shed more light on the role of education in fueling the observed bimodality in conditional first birth rates by age, we have reconstructed these rates by level of education in Chile (2002) and Brazil (2010). In both countries the overall first birth profile by age—relatively flat for Brazil at ages 20–33, and with two minor peaks in Chile—is indeed composed of strongly contrasting profiles by education. A major contrast lies between women with primary and lower education, showing a strongly concentrated pattern of first births with highest first intensity around ages 18–21 and university-educated women, who have the highest first birth intensity around ages 31–33. The group of women with medium (secondary) education shows a less skewed profile with highest first birth intensity in their twenties (Chile 2002) or late twenties to early thirties (Brazil 2010).

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



Sources: Data reconstructed from population censuses of 2002 (Chile) and 2010 (Brazil)
Note: In Chile the primary or basic education corresponds to the first eight years of study, covering children aged 6 to 13 years; secondary education corresponds to 12 years of education and tertiary education 12 or more years of schooling. In Brazil, 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) and tertiary education implies 12 or more years of study.

8. Discussion

Latin America has experienced a shift to low fertility combined with the continuation of an early pattern of childbearing, characterized especially by elevated fertility rates among adolescent women. Their fertility rates are higher than in other countries with similarly low fertility and comparable levels of social and economic development (Rodríguez and Cavenaghi 2014). Our analysis, which focused on four richer countries, where fertility rates fell below the replacement level—Brazil, Chile, Costa Rica, and Uruguay—revealed that a gradual shift towards a later timing of first births has been underway since the early 2000s (see also Rosero-Bixby 2009). The distribution of unconditional first birth rates reveals that this trend progressed through two parallel developments: fewer women having first birth at young ages, especially during adolescence, and more women forming a family at older ages, especially after age 30. While the distribution of first birth rates still shows a pronounced bulge at younger ages, the timing of first birth has become more heterogeneous and uneven. Conditional first birth rates give the strongest indication of the rising differentiation in age at family formation: first birth intensity in the four countries depicts a bimodal pattern, with the highest intensity of first births among the childless women around age 30 and the secondary (lower) peak among the young women around age 20.

The bimodality in first birth rates by age goes hand in hand with wide education differentials in first birth timing (e.g., Nathan 2015 and Varela et al. 2012 for Uruguay; INE 2007 for Chile; Rios-Neto and Guimaraes 2014). Data for Brazil and Chile 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. Whereas lower educated women show the highest first birth intensity in their late teens and early twenties, women with post-secondary education have the highest first birth intensity around age 30 and in their early thirties. In addition, these groups appear to move further apart from each other as first birth postponement among women with secondary and higher education contrasts with the persistently early childbearing among women with primary or incomplete primary education (see also Rios-Neto and Guimaraes 2014). Arguably, the main force behind the gradual shift to a later first birth pattern among the whole population has been the ongoing education expansion, especially the rising share of women with upper secondary and tertiary education (Chioda 2016). Rising age differentiation in fertility has also been manifested in the "flattening" of the overall age profile of childbearing in the region, with similar fertility rates without a pronounced peak found between ages 19 and 30–34.

The bimodal age pattern of first birth is most pronounced in the case of conditional first birth rates, especially in Chile and Uruguay, but it is also discernible in the distribution of unconditional first birth rates in these two countries. The bimodality in conditional first birth rates in the analyzed countries is more pronounced than in other low fertility countries where this pattern has been identified in the past, except in the United States, where it has been waning recently. Latin America thus constitutes a pronounced pattern of reproductive polarization by social status, identified earlier for the United States, United Kingdom, Ireland, and Southern Europe by Rendall et al. (2009; 2010). In these countries and regions, women with low education experience unstable labor market conditions and low-paid jobs, which make early motherhood more attractive, whereas women with a degree postpone childbearing as they face steep opportunity costs of childbearing and high costs of childcare.

Our analysis shows that the reproductive polarization in Latin America is more pronounced than in the countries analyzed by Rendall et al. (2010). From a comparative perspective, the persistence of very early childbearing in Latin America among the still sizeable group of women with low level of education is surprising. At an aggregate level, the polarization in first birth timing in the region is arguably linked to marked income inequality and wide social status differences, which also go hand in hand with a high rate of unplanned early pregnancies and births (Wong 2009; Casterline and Mendoza 2009). Primary education in many Latin American countries is often of poor quality and may not give women necessary knowledge, skills and agency to plan their pregnancies and births and to negotiate contraceptive use with their partners. In addition, lower-educated women in the region experience an early onset of sexual activity, lack adequate sex education, and low contraceptive use (Rodríguez and Cavenaghi 2014). Their control over pregnancies is further limited by restrictive abortion legislation: except for narrowly

defined exceptions, induced abortions continue being illegal in most countries of Latin America (Kulczycki 2011). Possibly, as in the United States poor and low educated women and men often experience unstable and turbulent partnerships where pregnancies and births often "happen" without being much planned, as qualitative research aptly reveals (Edin and Kefalas 2005; Edin and Nelson 2013). Näslund-Hadley and Binstock (2010) argue that early parenthood in Latin America is an outcome of limited education opportunities and aspirations among many girls, for whom early parenthood is a "rational choice".

Is the bimodal pattern in first birth timing in Latin America going to prevail for long? Unlike Sullivan (2005), who predicted that the bimodality in the age at first birth in the United States was a temporary stage, we expect that this phenomenon is likely to become more entrenched in Latin America. Some forces will certainly work to limit the very high rates of adolescent pregnancies: rising education and, possibly, improved knowledge of contraception and wider access to family planning will motivate more women to postpone motherhood. Government programs aiming to reduce early pregnancies and expanding sex education at schools might help as well. At the same time, persistent socioeconomic inequalities in many countries, coupled with a high share of women with incomplete primary education and the existence of sizeable disadvantaged minorities, may slow down the erosion of the early motherhood pattern for several decades. The bimodality in motherhood will probably diminish in the case of exposure-specific first birth rates, but it is likely to increase in the case of unconditional first birth rates which will reflect the shifting parenthood to later ages among the rising group of better-educated women. As adolescent childbearing often leads to the discontinuation of education among mothers, and is related to negative socio-economic and health outcomes for mothers and their children, the region would certainly benefit from an accelerated shift away from its early parenthood pattern.

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