The effects of geography and education on fertility behaviour: The case of Colombia in 1973

Juliana Jaramillo-Echeverri*†

Abstract

Colombia experienced one of the fastest declines in fertility in the world: children per woman fell from 7 in 1960 to 3 in 1985. Despite the stark inequalities of the country, the regional character of the decline has been neglected in previous research. This paper assess the role of culture, geography and education during the Colombian fertility transition. Using individual-level data from the complete census of 1973 and Local Indicators of Spatial Association this paper uncovers pre-transition low and high fertility geographical clusters. Using the Own Child Method this paper provides new fertility estimations for women living in these clusters. The results confirm that between 1958-1970 fertility evolved at a different pace across the country but after 1964 fertility declined at a similar rate in zones with different cultural and historical backgrounds. The results suggest that by 1973 strategies to limit fertility (e.g. starting, stopping) were widespread and were mainly affected by the educational level of a woman, but not so much by her context (e.g. urbanisation). Furthermore, the effect of education is similar across the different contexts and the fertility gap between the lowest and highest educated women existed during the fertility transition while secondary education seems to be the main driver of the gradient.

keywords: *fertility transition, geography, Colombia, census data, clustering*

1 Introduction

Colombia experienced one of the fastest declines in fertility in the world: children per woman fell from 7 in 1960 to 3 in 1985 (Flórez-Nieto, 2000; Flórez, 1992).[1] Countries such as Turkey, Costa Rica and Brasil also experienced rapid changes during the

*Economic History, London School of Economics. Email: j.jaramillo1@lse.ac.uk

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[1]In comparison, for the United Kingdom, it took 90 years for fertility to experience a similar change.

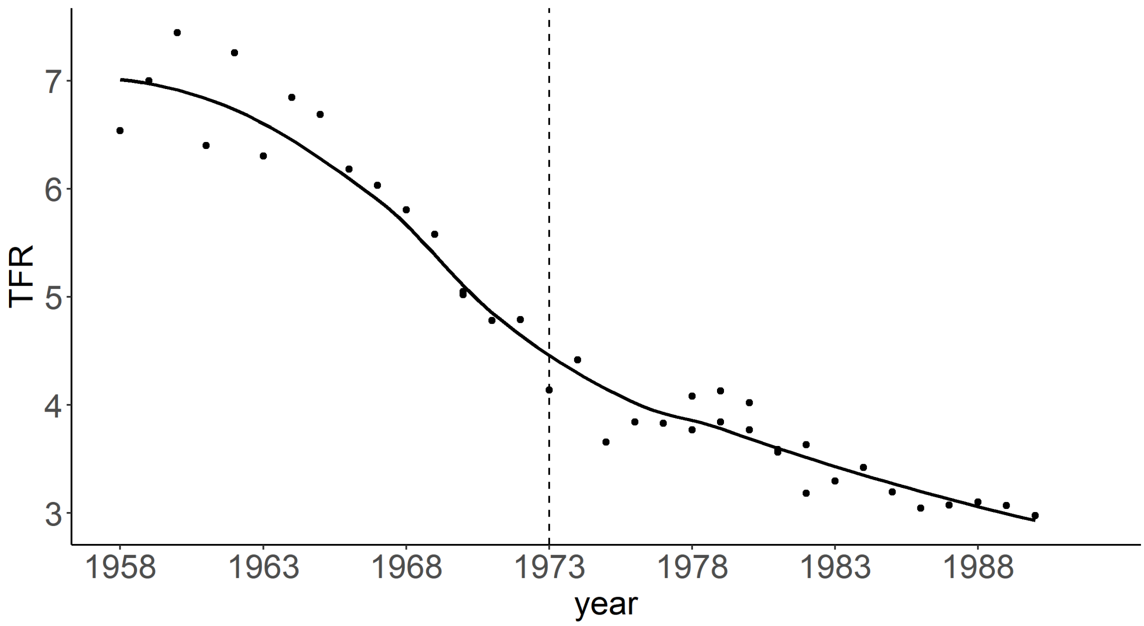
same period (1964-1993). The literature in demography and economics has studied how fertility decisions are affected by resource constraints and how fertility decline is associated with the emergence of economic growth (Galor & Weil, 2000; Voigtländer & Voth; 2006, Clark,2007; Dennison & Ogilvie, 2014, Guinnane, 2011). Cross-country evidence confirms that there are strong correlations between variables such as income and fertility (the highest fertility rates are found in the poorest countries) or fertility and education (women with more years of education have fewer children).

However, regionally disaggregated data shows that in developing countries, these demographic processes do not fully reflect the improvements in socioeconomic conditions. Specifically, convergence in fertility rates is not always linked with convergence in economic development between regions, suggesting a weak relation between demographic outcomes and economic performance. Studies that came after the World Fertility Survey (WFS) in 1973 "casts considerable doubt in the causal primacy of economic forces, either at the societal or family level, in bringing about fertility change in the contemporary third world" (Cleland,1985:5). Despite a generalised decline in fertility, there were important socioeconomic differences among (and within) countries. Overall the survey shows that the fertility transition around the world did not exhibit a unique pattern. For the European case, the European Fertility Project (EFP) finds that among European provinces, there were no regularities in socioeconomic variables and fertility, as fertility declined more or less at the same time, in countries with different economic conditions.

The findings from the EFP and the WFS suggest that to fully understand how fertility patterns and socioeconomic development are related, we have to analyse these relationships at a more disaggregated level.[2]

[2]See Garrett, Reid, Schürer and Szreter (2001) for a discussion on the English case and Dribe, Juárez and Scalone (2017) for Sweden.

Figure 1: TFR 1958-1990, Colombia



Note: Calculations using the OCM. Women between 15 to 78 years old and children between 0 to 14 years old. See Section 4 for a description of the methodology. Sources: Authors' calculations based on 1973 full Census data, and 1985 and 1993 Census samples from IPUMS-International. .

When studying the emergence of the fertility transition in Europe, the European Fertility Project (EFP) argued that the spread of new moral and cultural norms was responsible for the decline in fertility, as it occurred simultaneously in different socioeconomic contexts (Coale & Watkins, 1986). The EFP finds that among European provinces, no evidence supported the idea that economic forces could account for the fertility decline, as much as cultural values.[3] However, most of the studies of the EFP relied on small samples, and particular case studies, making the empirical evidence weak and with no external validity. Recent research has provided empirical evidence on the effect of cultural factors on the fertility transition by tracing how social norms emerge and were spread in French and English speaking countries (Blanc & Wacziarg, 2019; Beach & Hanlon, 2019; Spolaore & Wacziarg, 2014).

For their part, the Unified Growth Theory (UGT) based on Galor and Weil (2000) and Galor (2005) explains the transition from a Malthusian world to a modern growth regime due to a change in parents' preferences, moving from quantity towards quality. The decision of the parents is induced by the economic environment, meaning

[3]See Guinnane, Okun and Trussell (1994) for a methodological critique of the EFP.

that fertility choices are influenced by economic variables.[4] The model suggests that during the Industrial Revolution, as technological innovation took place and returns to human capital increased, investment in children's education grew and fertility declined. The model implies that an increase in income accompanied by higher rates of returns in quality explains the decision of parents to prefer fewer, better-educated children. Nonetheless, this model fails to explain the fertility decline that occurred in France previous to the French Industrial Revolution. Additionally, the empirical literature on the existence of a quality-quantity tradeoff finds mixed results, especially when it studies the historical fertility transition (Guinnane, 2011; Bleakley & Lange, 2009; Tan, 2018; Baez, 2008).

Using the complete registers of the census of 1973 this research presents a more detailed empirical perspective of Colombia's rapid decline in fertility. The main goal of this paper is to assess the role of culture, geography and education during the Colombian fertility transition. In Colombia, cultural traits have been strongly related to geographical aspects. For example, Andean regions have different geographical endowments in comparison to planes, riverside or sea-coastal regions (which lead to different colonisation processes). I am interested in analysing to what extend those cultural/geographical areas are related to different fertility patterns. I identify places with different fertility patterns by testing for high and low fertility geographical clusters using Local Indicators of Spatial Association – LISA, for women with completed fertility before the fertility transition (born between 1910-1920). Following the Own-Child Method, I provide new estimations of age-specific and total fertility rates for women living in high and low fertility clusters. Then, I estimate the effects of education and contextual characteristics on the decision of having a birth and compare the results across the clusters.

The results confirm that before the fertility transition variation in fertility preferences were linked to the differences in cultural and historical characteristics of the regions. However, by 1964 fertility was declining at a similar rate in all historical contexts. By 1973 the probability of having a birth during adolescence or after the age of 40 was mostly related to the educational level of a woman, but not so much to the characteristics of her place of residency.

[4]Similar to the seminal work of Becker and Lewis and Becker that argues that parents maximise a utility function of quantity and expenditure on children (quality) (Becker & Lewis, 1973; Becker, 1991).

2 Fertility transition in Colombia: historical and regional context

During the 20th century, Colombia witnessed important economic, political and social transformations. The population shifted from being mostly rural in 1938 (32% of the population living in urban areas) to mostly urban by 1973 (the urban population was 63%). These changes started during the industrialisation process that began around 1920, and that shifted the sectoral composition of the GDP and the employment structure. For example, agricultural production as a percentage of the GDP went down from 46% in 1938 to 25% in 1973. This agglomeration in the cities significantly differed from the English case during the Industrial Revolution. In Colombia, urban centres enjoyed higher living standards levels accompanied by higher wages.[5] These characteristics of the industrialised urban centres created a differential gap between rural and urban areas, both in wages as in living standards, that persists today. Furthermore, changes from the agricultural sector to the industrial sector happened relatively fast, but there was a faster change towards the services sector, which implies that industrialisation was not supported by increases in value-added. As a result by 1980, the sector with higher participation in the GDP was services with 48% of the GDP. In terms of GDP per capita, the economy grew significantly during this period as it increased from 1,808 Geary-Khamis international dollars in 1938 to 3,546 in 1973 and 5,938 in 2015. These economic transformations were accompanied by large gains in human development, most importantly in life expectancy (Jaramillo-Echeverri, Meisel-Roca & Ramírez-Giraldo, 2018).

The first Colombian plebiscite was held in 1957 being one of the elections with the highest turnout in the history of the country and the first time that women voted. The plebiscite included the compromise of the government to spend no less than 10% of its budget on public education. This increase in public expenditure triggered a sharp increase in enrolments in primary, secondary and tertiary education. The increase in enrolment rates was particularly significant for women, and by 1970 the proportion of women in education was 49% of the total (Ramírez-Giraldo & Téllez-Corredor, 2006)..

Linked to these impressive social changes, in the 1960s Colombia experienced one of the fastest fertility transitions in the world, in only 25 years the number of

[5]During the industrial revolution London had higher mortality rates than the country-side, but migration was triggered by higher wages.

children per woman fell from 6.8 to 3.[6] The evolution of this decline has been widely documented in the literature as several surveys were carried out during the second half of the sixties. A wide range of analyses of these data showed that the fertility decline started around 1964 and by 1985 there was a deceleration of the decline, especially for urban women. Both rural and urban women experienced the decline and the fertility differential between rural and urban narrowed from 4 live births in 1969 to 2 live births in 1986 (Prada-Salas, 1996).

The contemporary literature has mainly focused on understanding the patterns in the decline, concluding that although all age groups participated in the decline, it was greater in older women, and was possible by having longer birth intervals between births (Batyra, 2016; Parrado, 2000), pointing to the importance of fertility control. The decline in fertility was tied to the increase in the knowledge, availability and use of contraceptive methods after the mid-1960s. By 1978 90% of women of reproductive age knew of at least one contraceptive method (Prada & Ojeda, 1987), 91% approved family planning practice in Bogota in 1974 (Bailey, Measham & Umana, 1976) and by 1969 43% of urban women were practising contraception. Analysing data from the DHS Prada and Ojeda (1987) showed that there was an increase in the use of contraceptive, and this increase was more pronounced among rural residents (the proportion went from 15% in 1969 to 53% in 1986). The authors also highlighted that these changes were achieved due to a bigger demand for the pill, female sterilisation and intrauterine devices (IUD). This increase in the demand for more modern contraceptive methods was matched by the increase of supply that arises by the end of 1965 when oral contraceptives became available worldwide and when the Colombian Association for Family Welfare (PROFAMILIA) was founded in Colombia, being one of the oldest and largest private family planning organisations in the world.

The effect of family planning provision in the Colombian fertility decline was addressed by Miller (2010). His paper exploits the differences in timing and the geographical patterns of the spread of the family programmes and compares women living in cities that were exposed to the family planning programme at different ages. He finds that family planning explains between 6% and 7% of the fertility decline in these cities between 1964-1993. These results suggest that women living in urban areas with high levels of development were able to achieve their desire

[6] López Toro (1968) analyses fertility during the intercensal period 1951 - 1964 and shows a high proportion of children between 0 - 5 years old. This evidence suggests that the fertility decline started after 1965, as suggested by Potter, Ordoñez and Measham (1976).

number of children using other contraceptive methods such as the rhythm or abortion. Abortion was commonly practised in the country during the 60s, becoming one of the first pathological cause of hospital admissions (Mendoza-Hoyos & Campbell, 1968). According to Mendoza, more than 60% of abortions happened in women with seven or more births, suggesting then that abortion was a common practice to attain (or limit) the desired number of children. Interestingly, induced abortion was mainly present in main cities, the induced abortion rate per pregnant women was around 20%, while only 8% of women living in rural areas practised induced abortion (Requena, 1968)

Different studies looked into the relationship between fertility and education. Using a 4% sample of the 1973 census Potter et al. (1976) show that fertility declined faster for women with education, and highlight that despite the remarkable expansion of schooling in the country the differences in fertility between educational groups remained unchanged. The authors conclude that Colombia presented important differentials in fertility between social classes. Heaton and Forste (2010) study the effect of education on fertility for Colombia, Peru and Bolivia and find that by 1990 the gap between uneducated and educated women was closing for Colombia, as declines in fertility were larger for the least educated women. In a recent paper, Batyra (2019) uses the 2005 census of Colombia and finds that differences in rates of first birth between the lowest and highest educated women are still evident in Colombia, both for younger and older ages. In this research, I provide supportive evidence of the negative relationship between education and fertility, and I document that the fertility gap between the lowest and highest educated women existed during the onset of the fertility transition.

A key factor in the fertility decline was the role of the Government in setting an agenda to reduce population growth. This strategy started during the Presidency of Alberto Lleras Camargo between 1958-1962, as the Government began to worry about the potential negative consequences of rapid population growth on the development of the country. A more consolidate effort towards a national family planning system came from the Colombian association of medical schools (ASCOFAME) and its Division of Population Studies founded in 1964, the Minister of Health and PROFAMILIA. By the end of 1969, the Government adopted an official population policy as part of its national development planning (Ott, 1977). The main objective of this population policy was to reduce the rate of population growth by lowering fertility. The strategies to achieve this were divided into: societal and familiar. The first dealt with the need for creating new social roles by increasing the educational level of the population and increasing the participation of women in the labour force. The second acknowledged the fundamental right of the family to choose the number of children they wanted to have. Moreover, the Government recognised that to guarantee this right, it was essential the access to family planning information, as well as medical services (CONPES, 820, p.36). This population policy was also supported by the incoming Government of Misael Pastrana, who besides created the National Population Council in 1970.

These policies were accompanied by a gradual change of the Church's attitude towards family planning. By 1969, a study showed that almost 60% of the priests interviewed considered population growth a serious problem in Colombia and 80% considered that family limitation was necessary.(Shea et al., 1971) However, almost 70% thought that contraceptive methods such as the pill or the IDU should never be permitted.

These changes in the attitudes towards family planning were also reflected in changes in family formation. Although cohabitation and marriage have coexisted in Latin America since colonial times, between 1973 and 2005, the percentage of 25–29-year-old cohabiting women increased from 20% to 66% (Esteve, Saavedra, López-Colás, López-Gay & Lesthaeghe, 2016).

Most of the research that has been done on the fertility decline in Colombia uses aggregated data, neglecting the regional character of the decline. Two main exceptions are the pioneering work of Gutiérrez de Pineda in 1968 and the work of Wills Franco (1976). The ethnographic work of Gutiérrez de Pineda (1968) argues that differences in cultural and historical legacies are reflected in the differences in the process of family formation and characterised the country in four regions or complejos: *negroide*, *andino*, *antioqueño* and *santandereano*. The work of Wills Franco (1976) concludes that fertility choices depend on the economic opportunities and on the social norms of each region which affect the net price of the children (Wills Franco, 1976). However, these works provide little empirical evidence and addressed the geographical variation of the fertility decline in a more descriptive manner. For their part, Potter et al. (1976) in a paper on the fertility decline of Colombia briefly mention that although fertility varies considerably between departments and social groups, the variation between regions is small. On the contrary, I found considerable variation both at the departmental and at the regional level.

Traditionally the literature of regional studies in Colombia divides the country into 5 macroregions: Caribbean, Pacific, Andean, Orinoquia, and Amazonia. These macroregions share similar historical, geographical, and cultural characteristics. Table 1 describes these macroregions, and Appendix Fig. 5 shows the map of Colombia placing these regions.

Table 1: Colombian macroregions

Region	Location	Historical legacy	Departments
Caribbean	Along the Caribbean Coast	Important cities and ports during the colonial period. Historically defined by weak property rights which translates in high levels of poverty and informality. *Mestizo* (mix of Indigenous and Hispanic), black and traces of indigenous population.	Atlántico, Bolívar, Cesar, Córdoba, La Guajira, Magdalena, Sucre
Pacific	Along the Pacific Coast	Sparsely populated during the colonial period. The northern part was historically the mining district, while in the southern part haciendas were established. After the Independence free slaves settled in the northern part of region.	Chocó, Valle del Cauca, Cauca, Nariño
Andean	Andean mountain range	Inhabited by indigenous that later served to established the encomienda. The region was the centre of the colonial bureaucracy. The western Andean region remained isolated from the rest of the colony. Expansion of the territory during the 19th century. Mainly Spanish origin.	Antioquia, Boyacá, Caldas, Cundinamarca, Huila, N. de Santander, Quindío, Risaralda, Santander, Tolima
Orinoquia	Located in the Orinoco River watershed	Sparsely populated as it includes 4 protected areas with presence of indigenous. Recent expansion of the frontier and discovery of oil reserves resulted in high land concentration. Indigenous people, Hispanic, and a mix of both (*mestizos*)	Arauca, Casanare, Meta, Vichada
Amazonian,	Amazon rainforest	Covers about 40% of the Colombian territory and is the least populated area in the country. Predominantly indigenous population	Amazonas, Caquetá, Guainía, Guaviare, Putumayo, Vaupés

Notes: If the division is made only in geographical terms some departments would appear in two macroregions.
For example, the higher municipalities in Valle del Cauca are geographically located over the mountain Andean range, and share similar cultural traits.

3 Data description: census 1973

My empirical analysis is based on individual-level data from the complete census of 1973. Most of the Colombian literature has provided measures with surveys that are representative only at the national level.[7] Furthermore, the vital registration data in Colombia is weak with high levels of under registration. On the contrary, Colombian censuses are of good quality, and in terms of census coverage, their record is superior to that of most Latin American countries (Vejarano & McCaa, 2002). Colombia has a longstanding tradition of implementing censuses, and since the Independence in 1820, 18 censuses had taken place in the country, most of them with an interval of 10 years. Therefore, this census provides the most complete source of the Colombian

[7] One of the exceptions is Miller (2010) that uses the census of 1973 and 1993. Similarly, Potter et al. (1976) use samples of the 1973 census to study the fertility decline at the national level.

population and allows me to explore fertility using detailed socioeconomic variables, as it is the first census that collects information about enrolment to schooling, fertility (measured as children ever born, and children surviving) and housing construction materials. Table 2 presents the main summary statistics of the census.

The 14th Colombian population census was made on October, 24th 1973, and showed a total population of 21'500.000 people, comparable to that in the United Kingdom in 1851 (around 23 million people). The urban population was held at home during the whole day of the census, while the rural population was enumerated days before (Potter & Ordoñez, 1976). According to the National Agency of Statistics (DANE), the national coverage of the census was 92.8%. In an review of the completeness of enumeration of the census Potter and Ordoñez (1976) show that the coverage of the enumeration for women was 94.1% and for men 91.8%.

Regarding the limitations of this source, censuses can be affected by under enumeration, misreporting of ages, and more importantly by differences in groups characteristics. For example, age heaping seems to be particularly persistent in people with low levels of education, and under registration is likely to affect children between 0 and 1 year old. Additionally, the census does not report the mother's age at birth, which is a key variable to estimate age-specific fertility rates. The next section explains in detail how I deal with this.

Table 2: Descriptive statistics: 1973 census

	Private households
Mean age (sd)	21.93 (18.17)
Mean family size (sd)	7.32 (3.24)
Mean numb. children ever born (sd)	3.77 (3.85)
Mean numb. children surviving (sd)	3.18 (3.16)
Urban (%)	61.99
Share with electricity (%)	60.68
Share with sewage (%)	48.83
Share with aqueduct (%)	65.59
Share with primary schooling (%)	45.42
Share with secondary schooling (%)	12.84
Total population	19'867,719

I do not include in my analysis data for the military forces or institutions such as hospitals.
In this research I also do not include the data for indigenous living in indigenous communities.
Source: National statistical office (DANE)

4 The OCM and fertility measures

With the 1973 census, I present new estimations of fertility for Colombia, at the national and the regional level. I calculate the Age-Specific Fertility Rate –ASFR– and the Total Fertility Rate –TFR– for the complete census, for the regions and different levels of education of the mother. I also calculate the age at first birth for women between ages 10 and 30. The results provide a new picture of the fertility decline highlighting important regional patterns. This is especially important in a country like Colombia that is characterised by its stark regional inequalities (Bonet & Meisel-Roca, 2001). I estimate the ASFR because it measures fertility taking into account that differences in fertility depend on the age of the woman, accounting by differences in the age structure of women, which can provide a better picture of fertility behaviour than children ever born. Furthermore, the TFR allows me to observe the dynamic aspect of the fertility decline.

Given the nature of my data, I use the Own Child Method (OCM) to link mothers to children to obtain the mother's age at birth and then calculate the ASFR, the TFR and the Age at first birth. The OCM method was developed in the 1960s to calculate fertility rates when birth registration data is incomplete or unavailable, or when the mother's age at birth of the child is not registered, as is the case in the census. This method has been widely used to estimate fertility in historical censuses and for developing countries, see for example Reid, Jaadla, Garrett and Schürer (2019) for England and Wales in 1911, Avery, St. Clair, Levin and Hill (2013) for a cross-county comparison, and Dribe and Scalone (2014) for Sweden between 1880-1970.

The method is based on two key elements of the census: the recorded age of people in the household, and, when available, the relationship of each member of the household to the household head. One advantage of the 1973 census over other data sets is its detailed information about the relationship to the household head, which allowed me to match children with their biological mothers, and to a rich set of socioeconomic variables for both the household and the person.[8] I pair a potential child to a potential mother following different rules depending on the relationship of both to the head of the household, their age and the fertility reported by the potential mother. All persons in the sample are eligible to receive a mother's link if they have a specified relation to the head. Additionally, all women over age 15 are eligible to be

[8]The 1973 census provides 10 different categories for relation to the head of household: head, spouse, child, parent, grandchild, another relative, domestic employee, lodger, other non-relative and unknown.

a mother if they do not explicitly report having no children. As the census reports the number of children born and surviving for each woman, I use these variables as a cap to the number of children I assign to each woman.

The set of rules to link a potential mother with a potential child are defined following Sobek and Kennedy (2009). The Integrated Public Use Microdata Series - IPUMS used these rules for their samples (including the 1973 sample of Colombia) to create links between partners, and parents and children.[9] The set of rules is explained in Appendix Table 6.

After obtaining the links between mother and children, I calculate the mother's age at birth as the difference between her age and her child's age. Following Reid et al. (2019), I calculate single years ASFR to compute the TFR for 1958 to 1972, as shown in Eq. (1) and Eq. (2). These rates are calculated using children between 0 to 14 years old, and mothers between 15 and 78 years old in 1973. For these estimations, I define the ASFR of each year as the ratio between all children born in year y (children age 0 in the census were born between 1972 and 1973 and children age 14 were born between 1958 and 1959) to women age 15 to 64 at each year y. I adjust the number of women at each year by the probability of surviving of the mother using the single-year life table of 1970 for Colombia. I also adjust the number of children at each age.[10] Given that I am estimating the ASFR based only on those pairs of mother-child that I was able to link, I adjusted the number of children for the proportion of children at each age that I did not link: in other words, I adjust for the proportion of matched children.[11] Finally, I calculate the Total Fertility Rate as the sum of the ASFR at each year.

$$ASFR_y = \frac{\text{Adjusted number of children age 0 in year } y}{\text{Adjusted number of women age 15 to 64 in year } y} \tag{1}$$

$$TFR_y = \sum_{n=15}^{64} ASFR_y \tag{2}$$

[9] I compared my results with Sobek and Kennedy (2009) results using a 10% sample of the 1973 Colombian census from IPUMS-international and I find similar results.

[10] The life-table comes from DANE. This is an abridged national table and to obtain single-year survivorship probabilities I use the `MORTPAK` package from the United Nations. For details about the package and other forms of expanding an abridge life table see Kostaki and Panousis (2001) and Heligman and Pollard (1980).

[11] On average I linked 87% of children age 0 and 81% of children between 5 to 14 years old.

Fig. 1 shows the Total Fertility Rate for Colombia for the period 1958 to 1990. The results show a clear drop from around 7 children per woman to less than 4. However, important caveats about these results have to be discussed. The fluctuations from 1958 to 1964 can indicate age heaping among older children reported in the census, especially those aged 10 and 12. The values for 1971 and 1972 were removed from the graph as they were considerably smaller than the ones for 1973. This could be the result of misreporting of the age of children that are about to turn one or two years old. Another possible explanation is that there are unrecorded births and under-enumeration of zero-years-old (Reid et al., 2019). Potter et al. (1976) find a similar issue when analysing a 4% sample of the 1973 census. They adjust the missing births by comparing invalid and valid responses to the question regarding "last live birth". After this adjustment, they estimate a TFR of 4.36, which is close to the one that I estimated using the complete census.

These results confirm that the national level fertility declined rapidly around the mid-19060s, as the TFR shows. Appendix Fig. 6 shows the geographical distribution of children ever born across the country at the municipal level. This includes children for all women older than 15 years old. By 1973, the average woman had 4.34 children, but in some municipalities women older than 15 years old were having 2.72 or 5.66 children. Accounting for this regional variation is the main objective of the next sections.

5 Geographical variation and fertility

In this section, I exploit the geographical variation of the fertility decline. In particular, following the idea of "social forerunners", I test for pre-transition geographical clusters for women with completed fertility and born between 1910 and 1920. Looking at these women, I can observe fertility preferences before the fertility transition and I can test if fertility preferences persisted over time. This idea is similar to that from the work of Livi-Bacci (1986) for the EFP. Livi-Bacci argues that usually certain groups of the population preceded the fertility decline due to their urban connection, lower mortality, delay in marriage and their cultural context.

To address the role of geography and culture in fertility preferences I estimate a Poisson regression following equation 3. The β coefficients of this equation capture the variation in fertility that is explained by the municipality in which women are currently living.[12] Then, I include a set of individual characteristics in order to remove observable demographic and socioeconomic characteristics, and therefore adjusting the effect of culture on fertility preferences (see Eq. (4)).

$$\text{children born}_i = \alpha + \beta * municipality_i + \epsilon_i \tag{3}$$

$$\begin{aligned}\text{children born}_i = &\alpha + \beta * municipality_i + \text{age}_i + \text{marital status}_i + \text{urban location}_i + \\ &\text{schooling}_i + \text{access to public services}_i + \text{ownership of house}_i + \epsilon_i\end{aligned} \tag{4}$$

The average number of children per woman in the 1910 - 1920 cohort is 6.75. While women living in Ospina, Nariño, a small rural town located near the frontier with Ecuador, had on average 3.78 children, women from the same cohort living in Betulia, Antioquia, also a small town 50 km. away from Medellin, had 9.1 children. These examples and the geographical distribution of the β coefficients shown in Fig. 2a and Fig. 2b confirm the existence of fertility forerunners in certain towns. Overall both maps show similar patterns that are consistent with the historical and cultural patterns described in Table 1. Most of the pre-transition low fertility municipalities are found over the mountain Andean range while municipalities in the Pacific and some part of the Caribbean region appear as high-fertility municipalities. These patterns are more pronounced once the effect of the municipality is adjusted by the observable socioeconomic characteristics. On average, a woman located in a pre-transition low fertility municipality had 1 fewer child than the average woman from the same cohort, while a woman located in a pre-transition high-fertility municipality had 1.7 children more.

To determine if the geographical patterns found in Fig. 2 have a significant positive or negative association with each other, I use the Local Indicators of Spatial Association – LISA. This statistic was developed by Anselin (1995) and allows the identification of those locations or sets of contiguous locations that are significantly positively correlated, and those that can be characterised as outliers (negative correlation).

[12] 58% of the women born between 1910 and 1920 were born in a different municipality but they have been living in that municipality for more than 36 years, and only 17% migrated in the previous 10 years which implies that they moved before completing their fertility life.

The results from the LISA tests reported in Fig. 3 uncover significant geographical patterns of pre-transition low and high fertility. Notably, the results of the adjusted cultural effects reveal more defined areas of low and high fertility. As these results should reflect a more clean effect of culture on fertility preferences, the rest of the analysis will be focused on the municipalities that appeared in Fig. 3b. The results show that pre-transition low fertility clusters are found in municipalities of Cundinamarca, Boyacá, Santander, Cauca and Nariño, while pre-transition high fertility clusters are found in the departments of Antioquia, Bolivar, Caldas, Caqueta, Cesar, Chocó, and the northern part of Valle del Cauca.[13]

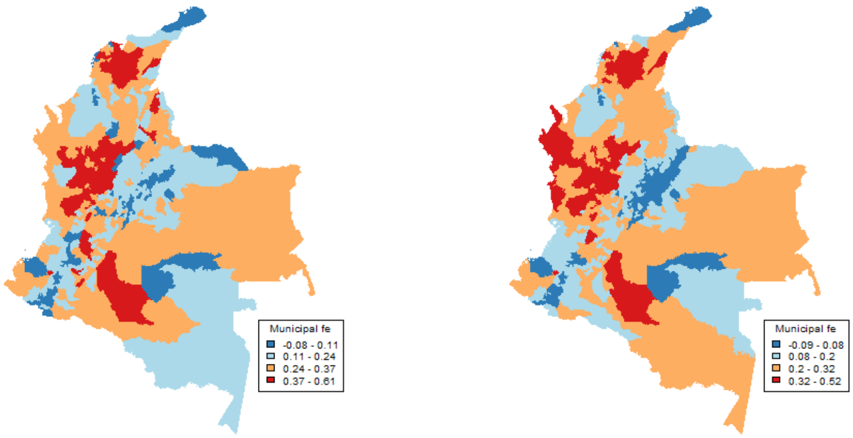
Pre-transition high fertility clusters share two main historical and geographical characteristics: these municipalities witnessed the expansion of the frontier at some point after the mid-19th century, and they are mostly located in lowlands. The northern cluster is composed of municipalities of Bolivar and Cesar that belong to the Caribbean region and share cultural characteristics and ethnic composition. Then, municipalities of Antioquia, Caldas, Chocó and Valle de Cauca North form a unique cluster. During the late 18th and 19th centuries, there was a process of expansion of the frontier from Antioquia to the Northern part of Valle del Cauca and Chocó. The departments of Caldas, Risaralda and Quindio were founded and populated by people from Antioquia, as well as some towns in Valle del Cauca (Parson, 1950). In the Amazonian macroregion, we see the cluster of Caqueta which is also a territory that experienced an expansion of the frontier during the 1940s.

Pre-transition low fertility clusters also reflect similar historical and geographical characteristics. Most of the municipalities in this cluster are found along the Andean mountain range (on average these municipalities are located over 2,500 Mts. above sea level) and all of them are close to important colonial centres and urban areas in the 20th century. The departments of Cundinamarca, Boyaca and Santander form a unique cluster that includes Bogota, the capital city of Colombia, where women born between 1910-1920 had on average 4.81 children. In the Southern part of Colombia, close to Ecuador, the municipalities in the departments of Cauca and Nariño form a unique area. These municipalities are around Popayan and Pasto, two important colonial centres of 16th century and the main cities of these departments.

[13] Appendix Table 8 and appendix Table 9 present the complete list of the municipalities in high and low clusters by department.

Figure 2: Geographical patterns in fertility preferences

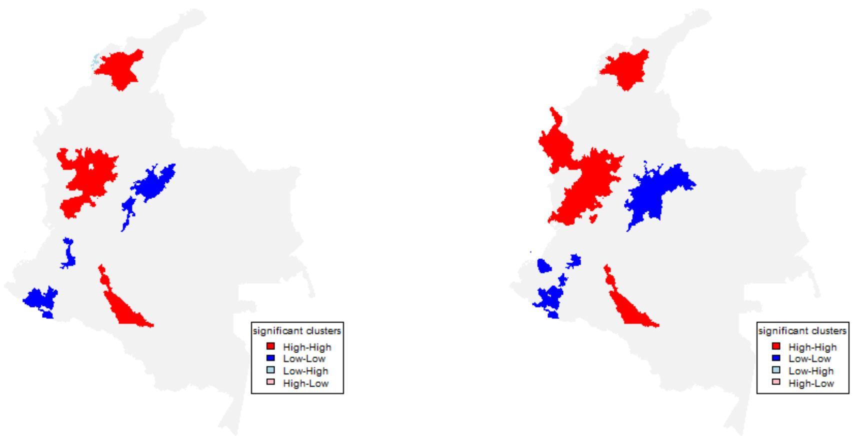
(a) Municipality effect (b) Adjusted Municipality effect



Notes: Fig. 2a plots the β coefficients from the estimation of Eq. (3) and Fig. 2b shows the results after adjusting for individual characteristics following Eq. (4). The abbreviated results of the equations are found in Appendix Table 7. Sources: Authors' calculations based on 1973 Census data.

Figure 3: Significant spatial association in fertility preferences

(a) Municipality effect (b) Adjusted Municipality effect



Notes: The clusters are defined by the effect of the municipality of residence on the number of children ever born to women born between 1910-1920. Fig. 3a shows the results of the LISA test for the β coefficients of Eq. (3) and Fig. 3b shows the results of the LISA test for the β coefficients of Eq. (4). Sources: Authors' calculations based on 1973 Census data.

These geographical patterns reflect differences in historical and cultural legacies. Also, we observe differences in fertility preferences before the onset of the fertility transition. As Appendix Fig. 7 shows there were persistent differences in completed fertility for women born between 1905 and 1920 across the clusters. Interestingly, Table 3 displays that in 1973 the contexts had similar levels of development when measured by urbanisation and access to public services. A higher proportion of women in the pre-transition low fertility areas had completed secondary schooling and this difference is partially reflected in the percentage of women that appear registered as paid employees, although in both contexts the female labour force participation is very low.[14] The share of married women and the sex-ratio is not very different in the contexts.

Table 3: Summary statistics of the contexts

	Low context	**High context**
Children born (sd)	3.2 (3.3)	4 (4.4)
Children surviving (sd)	2.9 (2.9)	3.2 (3.5)
Urban (%)	69.4	61.5
Share with electricity (%)	68.5	65.1
Share with sewage (%)	63.6	57.3
Share with aqueduct (%)	70.3	73.9
Women with secondary schooling (%)	17	13
Women payed employees (%)	13.9	9.9
Women married (%)	47.4	45.9
Sex-ratio (men/women) age 15 to 50	0.9	0.94
Total women older than 15 years old	**1,414,845**	**1,111,908**

Urbanisation and access to public services is based on the complete population of the municipalities.
Women enrolled in secondary education and in the labour market are based on women older than 15 years old.
Source: Authors' calculations based on 1973 Census data.

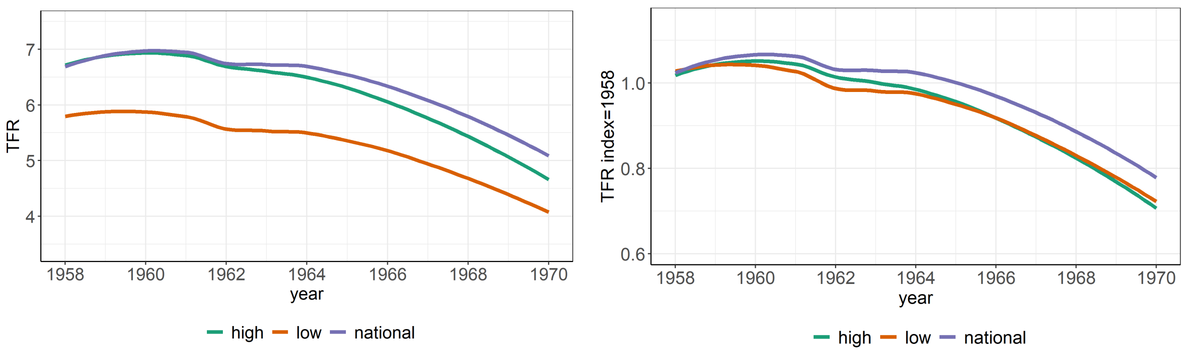
Fig. 4 displays the Total Fertility Rate from 1958 to 1970 in levels and indexed to 1958. Fig. 4a corroborates that by 1958 there were significant differences in fertility levels between the clusters and there was a gap of one child between the contexts. Additionally, it shows that fertility declined consistently at the national level, but also in pre-transition high and low fertility contexts. Fig. 4b confirms that the national drop in the Total Fertility Rate started around 1962 and accelerated in 1964, and this seems to be the case also for pre-transition low fertility context. Fertility in pre-transition high fertility context declines at a consistent rate after 1958 and by 1964 it follows a similar trajectory than low fertility contexts reducing the

[14]When looking at the type of employment of women older than 15 years old, 72.4% do not report any occupation in low fertility contexts while 89.1% do not report occupation in high fertility clusters.

initial gap found in 1958, although without achieving convergence in 1970. These results show that fertility declined fast in places where women had traditionally low fertility as well as in places where women had higher fertility. By 1970 the gap between contexts with high and low fertility was closing which confirms the rapidness of this phenom. Overall, this is a remarkable finding as it shows that after 1964 fertility declined at a similar rate in zones with different cultural and historical backgrounds.

Figure 4: Total Fertility Rate across groups, 1958-1970

(a) TFR (b) Indexed TFR



Notes: Fig. 4a shows the lowess smooth curve of the Total Fertility Rate. The TFR is calculated using women between 15 to 78 years old and children between 0 to 14 years old following the OCM. Fig. 4b shows the lowess smooth curve of the indexed TFR. Sources: Authors' calculations based on 1973 Census data.

6 Fertility behaviour, geographical location and education

To study fertility behaviour and preferences in 1973 I look at the prevalence of two fertility control strategies: starting and stopping. Starting refers to the age at which a women starts her maternal life, and commonly an earlier starting age would translate into higher fertility. Stopping corresponds to the age at which a woman stops having children (usually once she attained her desired number of children). I estimate the probability of having a child at age 15 to 19 (starting) and 45 to 50 (stopping) conditional on the educational level of a woman, the percentage of women with secondary education living in that municipality and the level of urbanisation as described in Eq. (5). This specification allows me to study the effects of women's education and geographical location on fertility decisions.

$$\begin{aligned}\text{logit}(P(Y=1|x_1,..,x_k)) =& \beta_0 + \beta_1 * \text{education level}\\ &+ \beta_2 * \%\ \text{women with secondary education}\\ &+ \beta_3 * \text{urbanisation rate} + \delta * \text{controls} \qquad (5)\end{aligned}$$

As for starting, Table 4 shows two important results. First, there is a clear and significant educational gradient. Second, the effects of education are similar across all contexts. In all cases, obtaining primary schooling reduces the probability of having a birth for women that are between 15 to 19 years old but the effect is bigger when looking at secondary schooling. On the contrary, the percentage of women with secondary education and the level of urbanisation of the municipality of residence plays a small role. These results imply that for young women living in Colombia in 1973, having access to secondary education had a key effect on the probability of starting their maternal life in adolescence, and this is true even in municipalities with traditionally high fertility levels.

The results from Table 5 suggest that the decision of stopping is mainly affected by having secondary education and the effect is similar across the contexts. The effects of primary schooling, the percentage of women with secondary education and the degree of urbanisation in the municipality of residence vary across the different contexts but the coefficients are smaller in size in comparison to the effects of secondary education. The results also show that in 1973 the majority of women across the contexts started their fertility life after the age of 19, while few of them experienced a birth when they were 40 to 50 years old. We can conclude then that strategies to limit fertility (e.g. 'starting' and 'stopping') were widespread in the country.

Table 4: Starting

	Any birth			
	Full sample	Rest	High	Low
mean of dependent variable:	0.11	0.13	0.09	0.08
no schooling (reference)				
primary	-0.4299***	-0.3929***	-0.4433***	-0.5634***
	(0.0187)	(0.0226)	(0.0380)	(0.0429)
secondary	-1.406***	-1.451***	-1.449***	-1.380***
	(0.0481)	(0.0322)	(0.0493)	(0.0858)
% of women secondary	-0.0080**	-0.0070	-0.0032	0.0018
	(0.0036)	(0.0043)	(0.0084)	(0.0041)
urbanisation	0.0012	0.0006	0.0011	-0.0030*
	(0.0018)	(0.0020)	(0.0030)	(0.0018)
(Intercept)	-1.058***	-1.083***	-1.304***	-0.7026***
	(0.0518)	(0.0568)	(0.0931)	(0.0643)
S.E Clustered	Municipality	Municipality	Municipality	Municipality
Observations	1,191,903	651,768	244,542	295,593
Pseudo R^2	0.44716	0.43566	0.47808	0.44655

Note: All women between 15 to 19 years old. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1
Individual controls: age, urban location, access to public services, SES, marital status.

Table 5: Stopping

	Having one more birth			
	Full sample	Rest	High	Low
mean of dependent variable:	0.06	0.06	0.06	0.06
no schooling (reference)				
primary	-0.0574***	-0.0450*	-0.0775*	-0.0485
	(0.0201)	(0.0235)	(0.0401)	(0.0381)
secondary	-0.5216***	-0.4155***	-0.5155***	-0.6842***
	(0.0577)	(0.0592)	(0.1474)	(0.0412)
% of women secondary	-0.0053**	-0.0116***	-0.0010	-0.0148**
	(0.0025)	(0.0034)	(0.0047)	(0.0066)
urbanisation	-0.0023**	-0.0004	-0.0033*	0.0013
	(0.0009)	(0.0011)	(0.0019)	(0.0028)
(Intercept)	-1.884***	-1.896***	-1.869***	-1.810***
	(0.0335)	(0.0375)	(0.0856)	(0.1567)
S.E Clustered	Municipality	Municipality	Municipality	Municipality
Observations	382,477	213,532	71,854	97,091
Pseudo R^2	0.05861	0.05616	0.05205	0.07115

Note: All women between 40 to 50 years old. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1
Individual controls: age, urban location, access to public services, SES, marital status.

The results support the existence of a link between women's education and fertility for every group as all groups show a significant difference in fertility levels between having less than primary schooling and secondary schooling, and this is true in the complete sample as in pre-transition high fertility municipalities and pre-transition low fertility municipalities.[15] So, which education was more important? The difference between having no education and primary education is mostly insignificant for the decision of stopping. Thus, this could suggest that access to secondary education was the key factor behind the differences in fertility decisions.

7 Conclusions

Colombia experienced one of the fastest declines in fertility in the world: children per woman fell from 7 in 1960 to 3 in 1985. However, the regional character of the decline has been neglected in previous research. This research focused on the geographical variation of Colombia's fertility decline because aggregated fertility measures can hide important regional patterns, especially in a country like Colombia that is characterised by its stark regional inequalities. This paper assesses the role of culture, geography and education during the Colombian fertility transition. Using individual-level data from the complete census of 1973 I observed the completed fertility of women born between 1910-1920 and tested for high and low pre-transition fertility geographical clusters using Local Indicators of Spatial Association – LISA, as cultural traits have been strongly related with geographical aspects. Following the Own Child Method (OCM) I provided new estimations of the age-specific and total fertility rates disaggregated at the regional level.

I found considerable regional variation in fertility preferences among women born between 1910 and 1920 and I uncover geographical clusters of pre-transition low and high fertility that match with regions that shared a similar cultural background. Nevertheless, in the 1960s fertility declined across all historical contexts. The fertility decline although rapid did not close the fertility gap completely and the gap persists until today.

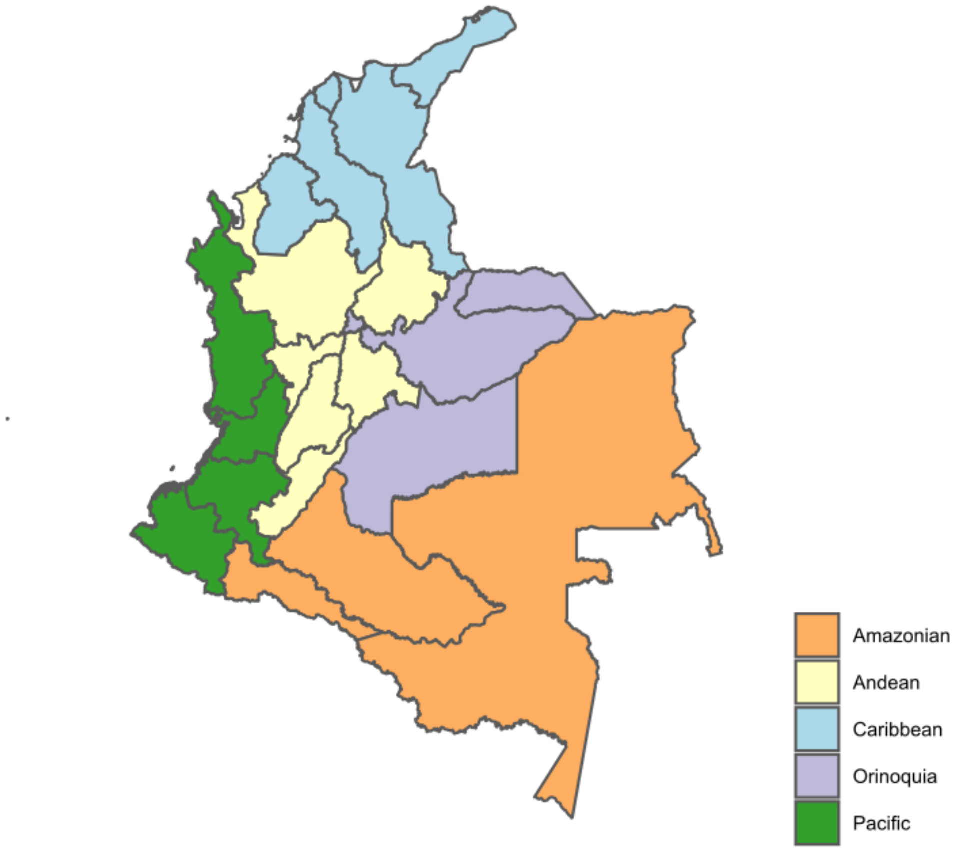
By 1973 strategies to limit fertility (e.g. 'starting' and 'stopping') were widespread and differed marginally across women living in different geographical locations. The probability of starting during adolescence was strongly related to the educational

[15] The effects of education change little when I include municipality fix effects instead of percentage of women with secondary education and the urbanisation rate, as shown in Appendix Table 10 and Table 11.

level of a woman, but not so much to the context she is in. Stopping was also linked to access to secondary education and in some cases to the percentage of women with secondary education and the degree of urbanisation in the municipality of residence. This research confirms the existence of an educational gradient across the country during the fertility transition. I find that more educated women start their maternal life later and I show that the difference between having no education and primary education is virtually nonexistent for the decision of stopping. I conclude that access to secondary education seems to be the main explanation of the gradient.

Appendices

Figure 5: Colombia divided into 5 macroregions



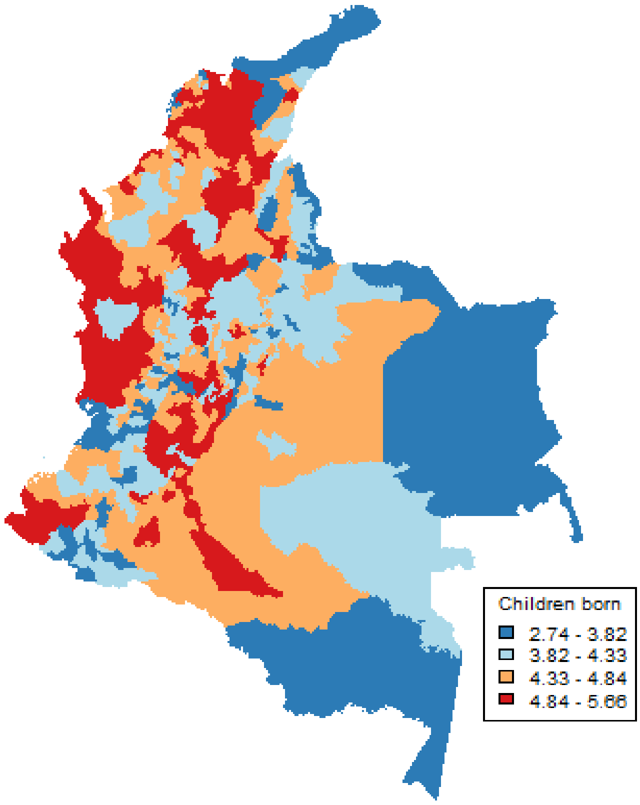
Notes: These macroregions are defined in Table 1 grouping departments by their geographical location and historical context. The boundaries are those of 1973.

Table 6: Linking rules: Mothers and children in 1973 census.

Rule	**Description**	**Age difference**	**Number of links in 1973**
Rule 1	If the relationship of the candidate children to the head of household is children and the candidate mother is the head of household.	10-69	2,244,250
Rule 2	If there are more than one female heads in the household, the candidate mother is the woman that appears first.	10-69	13,650
Rule 3	If the relationship of the candidate children to the head of household is children and there is no female head, the candidate mother is the woman whose relationship to the head of household is spouse.	10-69	6,868,250
Rule 4	If the conditions are similar to rule 12 but the head of the household appears with two or more spouses.	10-54	80,880
Rule 5	If the candidate children is the head of the household the candidate mother would be that whose relationship to the head of household is parent.	10-69	207,351
Rule 6	If the relationship of the candidate children to the head is grandchildren then the candidate mother is a woman whose relationship to the household is child, grandchild or other relative.	15-44	486,057
Rule 7	If the relationship of the candidate children to the head is other relative, other non relative or unknown and the relationship to the household of the candidate mother is other relative.	15-45	263,253
Rule 8	If the relationship of the candidate children to the head is other relative, other non relative or unknown and the relationship to the household of the candidate mother is grandchild.	15-45	3,977
Rule 9	If the relationship of the candidate children to the head is other relative, other non relative or unknown and the relationship to the household of the candidate mother is other non relative.	15-45	109,596
Rule 10	If the relationship of the candidate children to the head is other relative, other non relative or unknown and the relationship to the household of the candidate mother is domestic employee.	15-45	41,641

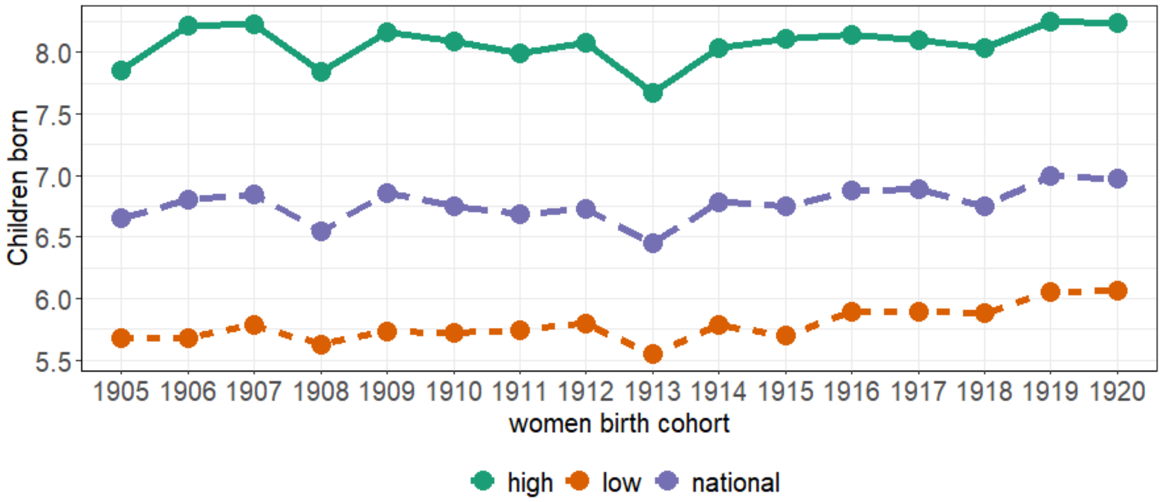
Notes: The rules are based on Sobek and Kennedy (2009).
Source: National statistical office (DANE)

Figure 6: Geographical variation of children ever born. Women older than 15 years old in 1973.



Notes: The map shows the average number of children ever born by municipalities of 1973 to women older than 15 years old. Sources: Authors' calculations based on 1973 Census data.

Figure 7: Pre-transition completed fertility



Notes: Average number of children ever born by cohort. Sources: Authors' calculations based on 1973 Census data.

Table 7: Abridged results from Eq. (3) and Eq. (4)

	children ever born	
	Eq. (3)	Eq. (4)
(Intercept)	1.729***	1.546***
	(0.0224)	(0.0220)
Individual Controls	No	Yes
S.E Clustered	Municipality	Municipality
Observations	363,318	363,318
Squared Correlation	0.05950	0.11823
Pseudo R^2	0.02379	0.04966

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1
The results of the municipality effect are shown in Fig. 2
Note: Results based on children ever born to women born between 1910-1920
Individual controls: age, urban location, access to public services, SES, marital status.

Table 8: Municipalities in high clusters, by department

Departament	Municipalities
Caldas	Filandia, Quimbaya, Buenavista, Cordoba, Genova, Pijao, Pereira, Condoto, El Canton del San Pablo, Tado, Pueblorico, Marsella, Santa Rosa de Cabal, Unguia, Carmen del Darien, Guatica, Quinchia, Novita, San Jose del Palmar, Sipi, Balboa, La Celia, Santuario, Apia, Belen de Umbria, La Vrginia, Aranzazu, Filadelfia, Neira, Anserma, Palestina, Chinchina, Aguadas, Salamina, Belalcazar, San Jose, Viterbo, Riosucio, Marmato, Supia, Manzanares, Marquetalia, Marulanda, Pensilvania, La Merced, Pacora
Cesar	El Reten, Ariguani, Cerro San Antonio, El Piñon, Fundacion, Pedraza, Pivijay, Nueva Granada, Remolino, Salamina, Sanzenon, Pijiño del Carmen, Chibolo, Bosconia
Antioquia	Medellin, Bello, Itagui, Envigado, Rionegro, Angostura, Carolina, Entrerrios, Gomezplata, Guadalupe, Santa Rosa de Osos, Guadalupe, Abejorral, Argelia, Nariño, Sonson, Fredonia, Valparaiso, Venecia, Caldas, Copacabana, El Carmen de Viboral, La Union, Santafe de Antioquia, Anza, Caicedo, Giraldo, Liborina, Olaya, Alejandria, Concepcion, Granada, Guatape, San Rafael, Sanroque, Concepcion, La Estrella, Andes, Pueblorrico, La Ceja, Ebejico, Heliconia, San Jeronimo, Sopetran, Sabaneta, Marinilla, Caracoli, Maceo, San Carlos, Yolombo, Abriaqui, Murindo, Urrao, Girardota, Betania, Ciudad Bolivar, Barbosa, Peñol, San Vicente, Don Matias, San Pedro, Guarne, Angelopolis, Concordia, Titiribi, Amaga, Jardin, Jerico, El Santuario, Montebello, Retiro, Salgar, Tarso, Caramanta, Tamesis, San Francisco, Armenia,Belmira, Sabanalarga, San Andres de Cuerquia, San Jose de la Montaña
Bolivar	Calamar, Mahates, Maria la baja, Campo de la Cruz, El Guamo, San Juan Nepomuceno, Manati, Repelon
Valle del Cauca	Alcala, Cartago, Ulloa, Ansermanuevo, Argelia, Toro, La Uunion, Caicedonia, El Aguila, El Cairo, Versalles, Bolivar, El Dovios
Caqueta	Puerto Rico
Choco	Bagado, El Carmen de Atrato, Lloro, Mistrato, Bahia Solano, Bojaya, Jurado

Notes: Municipalities in high fertility clusters as defined in Fig. 3b

Table 9: Municipalities in low clusters, by department

Departament	Municipalities
Cundinamarca	Facatativa, Zipaquira, Chia, Mosquera, Madrid, Funza, Cajica, Cogua, Nemocon, Suesca, Cachipay, Sasaima, Cucunuba, Lenguazaque, Sutatausa, Villa Pinzon, Gachancipa, Tocancipa, Fuquene, Guacheta, Simijaca, Susa, Cota, Tenjo, Choachi, La Calera, Gachala, Medina, Ubala, Ubate, Carmen de Carupa, Paime, San Cayetano, Tausa, Topaipi, Villagomez, Guasca, Junin, Macheta, Guatavita, Choconta, Sesquile, El Rosal, Fomeque, Gutierrez, Quetame, Bojaca, San Antonio del Tequendama, Zipacon, Pacho, Caqueza, Ubaque, Chipaque, Fosca, Une, Gacheta, Gama, Manta, Tibirita, Sopo, Tabio, Bogota
Santander	Chipata, Guavata, Guepsa, Puente Nacional, San Benito, Velez, Charala, Gambita, Suaita, Albania, Jesus Maria
Boyaca	Cucaita, Sogamoso, Duitama, Combita, Cuitiva, Firavitoba, Iza, Siachoque, Sotaquira, Toca, Tuta, Viracacha, Chiquinquira, Garagoa, Guateque, Guayata, Somondoco, Sutatenza, Tenza, Briceño, Saboyá, Santa Sofía, Arcabuco, Caldas, Coper, Buenavista, Gachantivá, Villadeleyva, Raquira, Sachica, San Miguel, Sutamarchan, Tinjaca, Chita, Mongua, Mongui, Sativasur, Socota, Topaga, Pajarito, Paya, Pisba, Labranzagrande, La Salina, Nunchía, Pore, Sácama, Támara, Paz de Río, Betéitiva, Corrales, Floresta, Gameza, Busbanzá, Socha, Tasco, Paz De Rio, Socha, Paipa, Nobsa, Tibasosa, Belen, Cerinza, Santa Rosa de Viterbo, El Cocuy, Jerico, La Uvita, Sativa norte, Susacon, Tutaza, Moniquira, Gachantiva, Samaca, Turmeque, Ventaquemada, Busbanza, Boyaca, Cienega, Jenesano, Nuevo Colon, Ramiriqui, Aquitania, Pesca, Tota, Berbeo, Chinavita, Miraflores, Rondon, San Eduardo, Zetaquira, Chivor, Campo hermoso, Macanal, San Luis de Gaceno, Santamaria, La Capilla, Pachavita, Tibana, Umbita
Cauca	Popayan, Almaguer, Sucre, Silvia, Totoro, Piendamo, Caldono, Timbio, Guapi
Nariño	Ipiales, Samaniego, Santacruz, Sapuyes, Providencia, El Peñol, Linares, Taminango, Buesaco, El Tablon de Gomez, San Bernardo, Alban, San Pedro de Cartago, San Lorenzo, Gualmatan, Ospina, Pupiales, Aldana, Cuaspud, Guachucal, Contadero, Iles, Yacuanquer, Imues, Funes, Puerres, Tangua, Colon, San Pablo, Consaca, La Florida, Cumbal, Ancuya, Guaitarilla

Notes: Municipalities in low fertility clusters as defined in Fig. 3b.

Table 10: Starting - Without contextual variables

	any birth			
	Full sample	Rest	High	Low
mean of dependent variable:	0.11	0.13	0.09	0.08
no schooling (reference)				
primary	-0.4709***	-0.4564***	-0.4455***	-0.5282***
	(0.0161)	(0.0207)	(0.0386)	(0.0372)
secondary	-1.452***	-1.511***	-1.448***	-1.351***
	(0.0501)	(0.0299)	(0.0508)	(0.0787)
(Intercept)	-1.282***	-0.5409***	-1.229***	-0.6860***
	(0.0453)	(0.0506)	(0.0676)	(0.0840)
Municipality f.e	Yes	Yes	Yes	Yes
S.E Clustered	Municipality	Municipality	Municipality	Municipality
Observations	1,192,058	651,923	244,542	295,593
Pseudo R^2	0.45370	0.44219	0.48277	0.44968

Note: All women between 15 to 19 years old. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1
Individual controls: age, urban location, access to public services, SES, marital status.

Table 11: Stopping - Without contextual variables

	Having one more birth			
	Full sample	Rest	High	Low
mean of dependent variable:	0.06	0.06	0.06	0.06
no schooling (reference)				
primary	-0.0570***	-0.0459**	-0.0988**	-0.0571
	(0.0195)	(0.0225)	(0.0397)	(0.0378)
secondary	-0.5088***	-0.3942***	-0.5184***	-0.6802***
	(0.0595)	(0.0573)	(0.1489)	(0.0444)
(Intercept)	-2.255***	-0.9427***	-2.205***	-1.474***
	(0.0498)	(0.0350)	(0.1291)	(0.2899)
Municipality f.e	Yes	Yes	Yes	Yes
S.E Clustered	Municipality	Municipality	Municipality	Municipality
Observations	382,506	213,561	71,854	97,091
Pseudo R^2	0.06535	0.06395	0.05642	0.07621

Note: All women between 45 to 50 years old. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1
Individual controls: age, urban location, access to public services, SES, marital status.

References

Anselin, L. (1995). Local indicators of spatial association—lisa. *Geographical analysis*, *27*(2), 93–115.

Avery, C., St. Clair, T., Levin, M. & Hill, K. (2013). The 'own children'fertility estimation procedure: A reappraisal. *Population Studies*, *67*(2), 171–183.

Baez, J. (2008). Does More Mean Better? Sibling Sex Composition and the Link between Family Size and Children's Quality. *Ssrn*(3472).

Bailey, J., Measham, C. & Umana, M. (1976). Fertility and Contraceptive Practice: Bogota, 1964-74.

Batyra, E. (2016). Fertility and the changing pattern of the timing of childbearing in Colombia. *Demographic Research*, *35*(1), 1343–1372.

Batyra, E. (2019). Increasing educational disparities in the timing of motherhood in the Andean region: a cohort perspective. *Population Research and Policy Review*.

Beach, B. & Hanlon, W. W. (2019). Censorship, family planning, and the historical fertility transition.

Becker, G. (1991). *A treatise on the family* (Enlarged ed.). Cambridge, Massachusetts: Harvard University Press.

Becker, G. & Lewis, G. (1973). On the interaction between the quantity and quality of children. *Journal of Political Economy*, *81*(2), S279–S288.

Blanc, G. & Wacziarg, R. (2019). *Change and persistence in the age of modernization: Saint-germain-d'anxure 1730-1895.*

Bleakley, H. & Lange, F. (2009). Chronic disease burden and the interaction of education, fertility, and growth. *The review of economics and statistics*, *91*(1), 52–65.

Bonet, J. & Meisel-Roca, A. (2001). La convergencia regional en colombia: una visión de largo plazo, 1926-1995. *Capítulo 1. La convergencia regional en Colombia: una visión de largo plazo, 1926-1995*, 11–56.

Cleland, J., John; Hobcraft. (1985). *Reproductive change in developing countries: Insights from the world fertility survey.* Oxford University Press.

Coale, A. J. & Watkins, S. C. (1986). *The decline of fertility in europe.* Princeton University Press.

Dribe, M., Juárez, S. P. & Scalone, F. (2017). Is It Who You Are or Where You Live? Community Effects on Net Fertility at the Onset of Fertility Decline: A Multilevel Analysis Using Swedish Micro-Census Data. *Population, Space and*

Place, *23*(2).

Dribe, M. & Scalone, F. (2014). Social class and net fertility before, during, and after the demographic transition: A micro-level analysis of Sweden 1880-1970. *Demographic Research*, *30*(1), 429–464.

Esteve, A., Saavedra, A. C., López-Colás, J., López-Gay, A. & Lesthaeghe, R. J. (2016). The boom of cohabitation in colombia and in the andean region: Social and spatial patterns. In *Cohabitation and marriage in the americas: Geo-historical legacies and new trends* (pp. 187–215). Springer.

Flórez, C. E. N. (1992). The Fertility Transition and Family Urban Income Distribution in Colombia. *Sociological Inquiry*, *62*(2), 169–184.

Flórez-Nieto, C. E. (2000). *Las transformaciones sociodemográficas en colombia durante el siglo xx*. Banco de la Republica de Colombia.

Galor, O. (2005). From Stagnation to Growth: Unified Growth Theory. In P. Aghion & S. Durlauf (Eds.), *Handbook of economic growth* (Vol. 1, pp. 171–293).

Galor, O. & Weil, D. N. (2000). Population , Technology , and Growth : From Maithusian Stagnation to the Demographic Transition and Beyond. *American Economic Review*, *90*(4), 806–828.

Garrett, E., Reid, A., Schürer, K. & Szreter, S. (2001). *Changing family size in england and wales: Place, class and demography, 1891–1911*. Cambridge University Press.

Guinnane, T. W. (2011). The historical fertility transition: A guide for economists. *Journal of Economic Literature*, *49*(3), 589–614.

Guinnane, T. W., Okun, B. S. & Trussell, J. (1994). What do we know about the timing of fertility transitions in europe? *Demography*, *31*(1), 1–20.

Gutiérrez de Pineda, V. (1968). Familia y cultura en colombia. tipologías, funciones y dinámica de la familia. manifestaciones múltiples a través del mosaico cultural y sus estructuras sociales. *Universidad Nacional de Colombia, Tercer Mundo Editores, Bogotá*.

Heaton, T. B. & Forste, R. (2010). Education as policy: The impact of education on marriage, contraception, and fertility in Colombia, Peru, and Bolivia. *Social Biology*, *45*, 194–213.

Heligman, L. & Pollard, J. H. (1980). The age pattern of mortality. *Journal of the Institute of Actuaries*, *107*(1), 49–80.

Jaramillo-Echeverri, J., Meisel-Roca, A. & Ramírez-Giraldo, M. T. (2018). More than 100 years of improvements in living standards: the case of colombia. *Cliometrica*, 1–44.

Kostaki, A. & Panousis, V. (2001). Expanding an abridged life table. *Demographic Research*, *5*, 1–22.

Livi-Bacci, M. (1986). Social-group forerunners of fertility control in europe.

López Toro, A. (1968). *Análisis demográfico de los censos colombianos, 1951 y 1964*. Ediciones Universidad de los Andes.

Mendoza-Hoyos, H. & Campbell, A. A. (1968). Research Studies on Abortion and Family Planning in Colombia. *The Milbank Memorial Fund Quarterly*, *46*(3), 223–236.

Miller, G. (2010). Contraception as development? New evidence from family planning in Colombia. *The Economic Journal*, *120*(545), 709–736.

Ott, E. R. (1977). Population policy formation in colombia: The role of ascofame. *Studies in family planning*, *8*(1), 2–10.

Parrado, E. A. (2000). Social change, population policies, and fertility decline in colombia and venezuela. *Population Research and Policy Review*, *19*(5), 421–457.

Parson, J. (1950). La colonización antioqueña en el occidente de colombia. *Imprenta Departamental de Antioquia, Medellín*.

Potter, J. & Ordoñez, M. (1976). The Completeness of Enumeration in the 1973 Census of the Population of Colombia. *Population Index*, *42*(3), 377–403.

Potter, J., Ordoñez, M. & Measham, A. (1976). The Rapid Decline in Colombian Fertility. *Population and Development Review*, *2*(3), 509–528.

Prada, E. & Ojeda, G. (1987). Selected findings from the demographic and health survey in colombia, 1986. *International Family Planning Perspectives*, 116–120.

Prada-Salas, E. (1996). The fertility transition and adolescent childbearing: the case of colombia.

Ramírez-Giraldo, M. T. & Téllez-Corredor, J. P. (2006). La educación primaria y secundaria en colombia en el siglo xx. *Borradores de Economía; No. 379*.

Reid, A., Jaadla, H., Garrett, E. & Schürer, K. (2019). Adapting the Own Children Method to allow comparison of fertility between populations with different marriage regimes. *Population Studies*, 1–22.

Requena, M. (1968). The Problem of Induced Abortion in. *Demography*, *5*(2), 785–799.

Shea, G. A., Burch, T. K., Perez, G., Ordoñez, M., Van Kemanade, J., Hutjes, J. & Hellegers, A. E. (1971). *Catholic Parish Priests and Birth Control: A Comparative Study of Opinion in Colombia, the United States, and the Netherlands* (Vol. 2; Tech. Rep. No. 6). Retrieved from `https://www.jstor.org/stable/`

1965357

Sobek, M. & Kennedy, S. (2009). The development of family interrelationship variables for international census data. *University of Minnesota Population Center Working Paper Series*(02).

Spolaore, E. & Wacziarg, R. (2014). *Fertility and Modernity.*

Tan, H. R. (2018, apr). More is Less? The Impact of Family Size on Education Outcomes in the United States, 1850–1940. *Journal of Human Resources*.

Vejarano, F. & McCaa, R. (2002). *Homologacion de los microdatos censales colombianos, 1964-1993* (DANE, P. C. U. of Minnesota & CIDS, Eds.).

Wills Franco, M. (1976). *Diferencias regionales de la fecundidad en colombia*. Asociación Colombiana de Facultades de Medicina, División de Medicina Social.