SES and Fertility During the Fertility Transition
Evidence from Micro-Level Population Data in a Global and Historical Perspective

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Abstract

This paper looks at socioeconomic differentials in fertility in a global and historical perspective. We rely on individual level data from contemporary and historical census data (IPUMS), using a common social class scheme, and data on education. We use data from 306 census samples from 85 countries covering both the historical transition in the West and the ongoing transition globally. In the analysis, we chart fertility differentials by class and education across populations, looking at the extent of the geographic and temporal variations. The SES differentials are then related to different stages of the fertility transition. Preliminary findings show clear differences in fertility social class and education, quite independently of each other. We also find substantial heterogeneities by region, time period, and fertility regime. When looking at phases of the fertility transition, the class gradient was strongest and most consistent in mid transition, and least visible in post-transition contexts.

This is a first draft of the paper presenting theory, data, and methods as well as an analysis of the global south. In the final paper we will add and integrate an analysis of the patterns in a number of historical Western contexts as well. In this analysis we will define phases of the fertility transition and look at SES differences across these phases. The cut-offs to define different phases in terms of fertility levels will be somewhat different due to the lower pre-transitional fertility levels in the West, but the phases will be comparable across contexts (pre-transition, early-transition, mid-transition, late transition, post-transition).

Introduction

Understanding the global fertility transition has been one of the main research tasks in demography for decades. An important part of this research has focused on social differences in fertility in a broader sense. The importance of women's education has been at the forefront of this literature (Caldwell 1982; Jejeebhoy 1995; Cleland 2002; Bongaarts 2003; Castro Martín and Juárez 1995; Schultz 1997), even though there has also been research on other dimensions of socioeconomic status (SES). Social fertility differentials are important for a number of reasons. On a more general level, they tell us something about the living conditions of men and women in different groups in society. Exactly what they tell us is, however, highly context dependent. In some contexts, high (male) fertility reflects high status and living standards (see Skirbekk 2008), while in other contexts it may reflect low standards of living and insecure living conditions, or possibly lack of agency and control over living conditions. Social differences in fertility could also be important for socioeconomic mobility and stratification by affecting social-group specific human capital investments in children (Blake 1989) and by affecting the social structure of the population with implications for socioeconomic inequality (Mare 1997, 2011; Mare and Maralani 2006). Moreover, fertility differentials by SES, and how they evolved over the fertility transition, are important to fully understand the causes of the fertility decline; one of the most important discontinuities in human history (Dribe et al. 2017).

Social class has not received as much attention as women's education in the analysis of fertility differentials, or in analyses of fertility inequality more generally (e.g. Giroux et al. 2008; Eloundou-Enyegue et al. 2017). Even though class and education partly overlap they are best viewed as separate dimensions of SES (e.g., Bollen et al. 2001), with potentially independent associations with fertility. In previous research, the conventional wisdom seems to be that the social class differences in fertility reversed during the Western fertility transition: i.e., the upper classes had higher fertility prior to the transition, and lower fertility after the transition (Skirbekk 2008). This change has been explained by the higher social classes acting as forerunners in the decline (Livi-Bacci 1986; Haines 1989). More recent studies of historical populations have, however, questioned the universality of high fertility for high-status groups before the transition, while at the same time confirming that the high-status groups were forerunners in the transition (e.g. Dribe et al. 2014; 2017; Dribe and Scalone 2014).

Even though there are a number of previous studies looking at social class differentials in fertility in individual countries or comparing a group of countries (e.g.

Rodriguez and Cleland 1981), there is not much research taking a broader comparative perspective on this issue in both time and space. An important exception is Skirbekk (2008), who aimed at such a long-term comparison in a meta analysis of previous studies and using data from the Demographic and Health Surveys (DHS), the Family and Fertility Survey (FFS) and the World Value Survey (WVS). In this study most of the analysis was made comparing fertility of high-status and low-status groups in the different samples to get an idea of how the differentials developed globally from pre-transition to post-transition.

In this paper we extend this research by looking at SES differentials in fertility in a global, less-developed, perspective, to test hypotheses regarding a reversal of class differences during the fertility transition. Our aim is to establish the basic patterns of differences in fertility by social class and women's education across a large number of populations in the global South. The analysis is based on a large number of nation-wide micro-level census data from the International Integrated Public Use Microdata Series (IPUMS) for the period 1960-2015. These data include information on children ever born, children surviving, education, and occupation of the household head, which we use to estimate completed fertility by SES in different phases of the fertility transition. Based on husband's occupation we measure social class by the man's occupation and view it as one dimension of SES, education of the woman being the other.

Background

Our study deals with fertility differentials by social class and women's education in a micro-level perspective. It means that we look at these measures of SES at the individual level and estimate associations between SES and children ever born while controlling for some other variables, and then study how these associations differ temporarily and across world regions, as well as by transition phase. We do not aim to chart or explain what in the literature is sometimes referred to as fertility inequality, where not only fertility differentials are included but also the relative size of different SES groups (see, e.g., Giroux et al. 2008; Eloundou-Enyegue et al. 2017). In this research, the aim is to get an overall measure of inequality in fertility in a society, similar to income inequality, and how this inequality develops during the transition. A small group with a highly deviant behavior will then not contribute much to overall inequality, while a deviation in a large group will have a much bigger impact. For example, high fertility in a tiny elite group will not affect overall fertility inequality very much, while lagging high fertility among farmers early in the fertility transition have a great impact on these kinds of measures. When looking at fertility differentials, deviant behavior of small groups could be of equal importance as that of larger population groups, even if their overall impact at the population level is not as large. Hence, fertility differentials and fertility inequality are best seen as complements, providing valuable insights from different perspectives.

A major issue in this research area is what we mean by SES and how it should be measured. We follow a common approach in demography by considering SES as a composite measure with several important components, most notably social class, education, and income (see Bollen et al. 2001). These dimensions are partly overlapping but also partly distinctive. Social class is related to income, but not perfectly so. Some individuals in lower classes may well out-earn some individuals in higher classes, some high earners have only basic education while some with academic degrees only have medium earnings, and high social class is not necessarily a function of high education. Studies on demographic differentials by different measures of SES have also often found independent associations between the different dimensions (see, e.g., Torssander and Erikson 2010 on mortality differentials in contemporary Sweden).

In this study we only have information on two of the components, social class and education, as income data are not available in the censuses. We measure social class based on occupation, and the class scheme we use is similar to what is used in many other studies in social demography and social stratification research (e.g., EGP, HISCLASS). The class scheme is based on skill level, degree of supervision, and whether manual or non-manual, and is expected to capture differences in life chances more broadly, related both to economic power and prestige. We expect this measure to capture basic differences in living standards, but also differences in attachment to formal labor markets, costs and benefits of children, exposure to external influences and other factors of great importance for fertility decisions. Mother's education is used as a different dimension of SES, not primarily related to economic living standards, but more to values and ability to acquire and process information. In the empirical analysis, we look at the associations between these two dimensions of SES both separately and simultaneously.

From a theoretical point of view, Coale (1973; later developed by Lesthaeghe and Vanderhoeft 2001) identified three conditions for fertility decline, namely that people must be 'ready, willing, and able' (the RWA model). To be considered 'ready', a population must view family limitation as advantageous from both an economic and social perspective, which would lower their demand for children. Both the demand and supply of children are important in explaining the high levels of pre-transitional fertility as well as the decline in fertility once the transition began (Easterlin 1975; Easterlin and Crimmins 1985). The supply of children reflects natural fertility and child survival. High mortality in pre-transitional populations (low supply) alongside a high demand for children implies that demand may well exceed supply, especially in Western contexts where levels of natural fertility were moderate and infant- and child mortality was high. Following the mortality decline, the supply of children increased, which most likely contributed to the decline in marital fertility in the West, even though it is challenging to estimate the effect empirically (Haines 1998; Reher 1999; Reher and Sanz-Gimeno 2007; Reher et al. 2017; Schultz 1997). In this paper we will not discuss mortality differentials in detail, but will compare the patterns for completed fertility (children ever born) with children surviving to show that the SES patterns discussed are not driven by mortality differences.

A declining demand for children is often viewed as a crucial factor for fertility decline (Schultz 1997, 2001). The demand for children depends on family income and the cost of children in relation to other goods that are directly related to SES. Especially the value of women's time is important as it is a major determinant of the opportunity costs of children in most societies (e.g. Schultz 1997). Following the process of development (e.g., industrialization, urbanization, and modernization in a wider sense), the motivation for childbearing change, and this can be expected to affect SES groups differently. On the one hand, higher consumption aspirations among high-status groups increase opportunity costs of childbearing and therefore contribute to a lower demand for children. On the other hand, because children could help working in the fields or assisting in supplementary activities from a relatively early age, the economic benefits of children may be higher among low and middle class families in rural contexts (i.e. among farmers and agricultural laborers). Therefore, we would expect a delayed fertility decline among the latter groups.

To the extent that economic development increase the returns to education, demand for child quality can be expected to increase as well (Becker 1991; Schultz 1997). Larger family size could imply a dilution of resources - parental time and money - available for investments in children's human capital, which in turn would hamper children's chances of upward social mobility (Blake 1989). This association should lead families to substitute quality for quantity by having fewer children and investing more in each child. In economic models, this quantity-quality trade-off is a major explanation of fertility decline and a strong contributor to the transition to modern economic growth (Galor 2011). We would expect this quantity-quality trade-off to emerge in the aspiring middle class first, partly because of higher returns to education and partly because of better knowledge and information concerning the new social and economic conditions. In the urban working class, children's labor contribution remain important for longer and may contribute to a delay in their fertility decline. Empirical studies of historic Western contexts have also confirmed that smaller family sizes in the demographic transition became increasingly associated with socioeconomic upward mobility for children (Van Bavel 2006; Bras et al. 2010; Van Bavel et al. 2011).

The ability to control fertility requires knowledge about contraceptive methods, which most research seems to assume had existed well before the fertility decline, though it is unclear to what extent such methods were actually practiced within marriage in Western societies (McLaren 1990; Santow 1995; Van de Walle and Muhsam 1995; Van de Walle 2000). It is important to note that the fertility transition in the Western world took place before the widespread introduction of modern contraceptives (David and Sanderson 1986; Szreter 1996: 389–424; Szreter and Garrett 2000). In the developing world the situation is quite different. Fertility decline has always been much more tightly connected to contraceptive use than in the West, and family planning programs, including information about, and dissemination of, contraceptive devices has played an important role (Hirschman 1994; Cleland 2001; Montgomery and Casterline 1993; Rosero-Bixby and Casterline 1993; Bongaarts et al. 1990; Westoff et al. 1989). This larger role played by contraception in developing contexts, has also led to a strong focus on women and women's education as important for the ability to control fertility. Literate, and better educated, women are expected to be more open to information about contraception and how to use it, and also better able to process such information and put the new methods to use (Castro Martín and Juárez 1995; Cleland 2002).

The distinction between 'willing' and 'able' is crucial. The fact that people are able to limit fertility does not mean that they are willing to do so. What is required is a change in attitudes making it socially and culturally acceptable to practice contraception within marriage (Carlsson 1966; Lesthaeghe 1980; Cleland and Wilson 1987; Lesthaeghe and Surkyn 1988; Cleland 2001). This process necessitates considerable social interaction in communities or networks that transcend geographical boundaries (Bongaarts and Watkins 1996; Montgomery and Casterline 1996; Szreter 1996; Casterline 2001; Garrett et al. 2001; Kohler 2001; González-Bailón and Murphy 2013). In his more general theory of innovation-diffusion, Rogers (1962) identifies the following five groups in the diffusion process, that can be linked strongly to SES: innovators (highest SES); early adopters (high SES); early majority (average SES); late majority (below average SES); and laggards (lowest SES). Viewing deliberate family limitation in marriage as an innovation, we would expect a clear gradient in the decline of marital fertility going from highest to lowest SES. For historical Western contexts, it has also been argued that higher-status groups are more likely to formulate and adopt these new ideas because they are culturally more open, and they increasingly feel it important to distinguish themselves from the lower classes (Frykman and Löfgren 1987; Van de Putte 2007). Similarly, better-educated women can be expected to be more open to new ideas about family size and the role of children, as well as to deliberately plan family size and promote child development (Caldwell 1982; Castro Martín and Juárez 1995). Empirical studies on developing contexts also confirm a positive association between education and contraceptive use, as well as with the use of more effective modern methods (Castro Martín and Juárez 1995; Cleland 2002)

A crucial feature of the RWA model is that all three conditions need to be fulfilled in order to initiate fertility decline. In other words, family size is only reduced when families in a SES group perceive it as beneficial to give birth to fewer children because the costs exceed the benefits, and limiting family size is acceptable from an ethical, cultural, and religious standpoint, and families have the necessary knowledge and means to control fertility. This implies that the latest fulfilled condition determines the start of the transition (Lesthaeghe and Vanderhoeft 2001; Lesthaeghe and Neels 2002). In relation to SES this implies that the group which first experiences the fulfilment of all conditions becomes the forerunner. It is also important to stress that all aspects of this model, including readiness, can be diffused in a population much like a contagion process (Lesthaeghe and Neels 2002; for similar views see also Bongaarts and Watkins 1996; Montgomery and Casterline 1996; Casterline 2001).

So far, we have mostly been discussing fertility differentials in relation to marital fertility and deliberate fertility control through the use of contraception. Completed fertility is also affected by other proximate determinants, most notably age at marriage and age at first birth. Even though its role for overall fertility decline differs between contexts, there seems to be strong evidence that more education is related to later starting, which has an immediate impact on completed fertility in high-fertility contexts (Cleland 2002).

Based on theory and previous research we expect SES differences – both in terms of class and education – in completed fertility to be limited in pre-transition contexts, and then to widen when fertility starts to decline as vantage groups reduce their fertility first while other groups remain laggards (Rodriguez and Cleland 1981; Bongaarts 2003; Eloundou-Enyegue et al. 2017). As the transition proceeds more groups enter and there will be a more of a uniform fertility decline. Towards the end of the fertility transition, we expect differences in fertility to become smaller, but not to completely disappear, as there are remaining differences in demand for children also in modern societies where costs of fertility regulation and child mortality are both very low. More specifically, we expect higher social classes to be forerunners, as well as women with higher education, followed by the middle classes and women with medium-level education, and finally lower social classes, farmers and lowly educated women.

Data and methods

In this study, we rely on census micro data from IPUMS International to look in more detail at socioeconomic differentials in fertility among several contemporary developing countries. These data are high-density micro data samples of twentieth-century censuses with a sample density ranging from 2% to 15%.

The great advantage of this approach is the coverage and the possibility of comparing fertility differentials by social class across space at a global level. We use all IPUMS samples reporting information on fertility (number of own children under age five in the household, children ever born, children surviving) and social class based on husband's occupation, covering the period 1960-2015. The collected datasets include more than 120 census samples from 53 countries, considering almost 250 million individuals. In total, we selected about 46 million married/in union women aged 15 to 54.

Harmonized sample designs, consistently constructed variables, and uniform variable coding greatly facilitates the analysis and ensures nonbiased comparisons, making it possible to examine class differences in considerable detail. The IPUMS data offer quite detailed information on occupation according to the ISCO classification (International Standard Classification of Occupations). Based on these occupations we group occupations into the following classes: "Higher managers and professionals", "Lower managers, professionals, clerical and sales personel", "Skilled workers", "Farmers and fishermen", "Unskilled workers" (see Table 1).

Table 1 here

In our main analysis we study children ever born for women aged 45-54, which we view as a reasonable measure of completed fertility. The number of children ever born is modeled using negative binomial regressions. The reason for choosing this model is that data are overdispersed, thereby violating the assumptions of the Poisson model (Cameron and Trivedi 2009: 555-556). Stata 13 was used for the statistical analyses, applying the `nbreg` command, which estimates the over-dispersion parameter (alpha) and then performs an LR test for alpha = 0, since a Poisson regression model is assumed to be a special case of the negative binomial model with alpha equal to zero. In our case, as these tests confirmed over-dispersion (see table 4 and 5), the negative binomial regression model was preferred to the Poisson regression model (Long and Freese 2001: 246-247). Robustness tests, however, show a high similarity between the results from Poisson and negative binomial regressions, and also modeling the number of children ever born with simple linear regression shows the same patterns (see Table 6).

The main covariates are social class and mother's education. The models also include controls for individual characteristics (age, age differences between spouses), world regions (Latin America, Middle East, East Asia, South-East Asia, Sub-Saharan Africa, Northern Africa) and census years from 1960 to 2015. The census year categories refer to 1960, 1970 (census years from 1965 to 1974), 1980 (1975 to 1984), 1990 (1985 to 1994), 2000 (1995 to 2004), 2010 (2005 to 2014), 2015. For each census, the mean number of children ever born at age 45-54 were calculated as a categorical variable (less than 2.5, 2.5-3.4, 3.5-4.4, 4.5-5.4, 5.5-6.4, 6.5 and more children) to include also a cohort fertility measure to reflect the fertility regime, or the phase of the demographic transition the country is in at the time of the census. Completed fertility over 6.5 is considered pre-transition, 5.5-6.4 early transition, 4.5-5.4 mid transition, 3.5-4.4 mid/late transition, 2.5-3.4 late transition and less than 2.5 post-transition (see Bongaarts 2003 and Eloundou-Enyegue et al. 2017 for similar but not identical categorizations of transition phases). Fixed effects at country level are also included to account for unobserved factors. The aim is to control for possible explanatory variables and geographical heterogeneity in estimating the association between class and fertility.

In our main analysis, regressions are estimated for children ever born as the dependent variable and selecting only married/in union women aged from 45 to 54. Further models include interactions between class/education and world regions, period and fertility regime. In the interaction models no country-level fixed effects are included. A second set of regression models include married/in union women aged from 15 to 54 as well as surviving children instead of children ever born as the dependent variable. These models are used for comparison, to check the robustness of the main specification.

At the beginning, the number of selected women aged 15-54 and 45-54 are equal to 45,765,770 and 8,398,308, respectively. These numbers reduce when the regressions are estimated since in a number of cases information on children ever born and surviving children are not available.

Results

Table 1 shows distributions of the different fertility measures: number of children under five in the household (C<5), number of children ever born (CEB) and number of surviving children (CSUR) for the two samples (15-54 and 45-54 respectively). Table 2 displays the mean number of children by social class for the two different samples of women (15-54 and 45-54). Overall, completed fertility was 4.8 children per woman, and net fertility 4.3 children. The average number of children under five in the household was 0.6 for the entire sample. Farmers and fishermen have the highest mean number of children ever born (5.5) and the higher managers and professionals have the lowest (3.4).

Table 1-2 here

Table 3 shows the distributions for the other variables in the two samples. Latin America dominates the sample with almost 44 percent of the observations in the main sample (45-54), East and Southeast Asia have about 36 percent, and Africa about 15 percent. There are rather few observations for the 1960s and 1970s (less than 5 percent), and most of the observations refer to the 1990s-2010s. 83 percent of women in the age group 45-54 live in households with children age 5 or older. 18 percent of the women are in the age range 45-54, which is the sample for which completed fertility can be studied. 15 percent of women in the main sample are older than their husbands, and 25 percent are the same age or less than 3 years younger. More than 60 percent are more than 3 years younger than their husbands, and as much as 34 percent are more than 6 years younger. It clearly shows the predominance of female age hypergamy in large parts of the global South. Turning to social class, the elite group of higher managers and professionals constitute about 6 percent of the observations in the full sample and 7 percent in the age group 45-54. Farmers and fishermen are about 35 percent in the full sample and 37 percent among women aged 45-54. Only 6 percent are unskilled workers and 25 percent have no information on their class. A majority of women have only short education; about 85 percent of women in both samples have primary education or less, and only 3 percent have a university degree. Finally, turning to the measure of fertility regime – the mean number of children ever born in ages 45-54 in the country of residence – 6 percent of women in the full sample and 8 percent in the age group 45-54 live in countries with mean children ever born less than 2.5, and 10 percent of the main sample live in countries with more than 6.5 children ever born on average. Thus, the sample include women in all phases of the fertility transition, from pre-transition to post-transition.

Table 3 here

Table 2 shows that there are social class differences in completed fertility, as well as in child woman ratios and net fertility (children surviving). The differences seem to align well with what we would expect; high status women have fewer children than low status women, and that especially farmers have high fertility. However, SES differences are likely to differ across contexts and in order to take such factors into account we turn to the multivariate regression models. Table 4 displays results for children ever born for women aged 45-54. The numbers reported are incidence rate ratios (IRR) which can be interpreted as relative completed fertility rates. Model 1a only include woman's education, model 1b only husband social class, and model 1c both dimensions at the same time. Model 1d is the full model with country fixed effects.

Looking first at model 1a, there is a strong gradient in completed fertility by woman's education. Compared to the reference category (completed primary education), women with less than primary education have 30 percent higher fertility, while the fertility of women with secondary education is about 25 percentage points lower, and those with university degree 35 percentage points lower. Thus, women with less than primary education have about twice as many children, on average, than women with a university degree. Missing occupational information is associated with more children ever born, and both groups of missing education have similar completed fertility as women with less than primary education, suggesting that missing education means no or very limited schooling.

Table 4 here

Turning to social class in model 1b, there is a similar gradient. Compared to skilled workers in the reference category, the top class of higher managers and professionals have almost 20 points lower fertility, and unskilled workers about 13 points higher fertility. Farmers and fishermen have the highest fertility of all groups. The fertility in the top group is about 40 percent higher than among the unskilled workers, indicating somewhat narrower differentials for class than for education.

In model 1c both education and class are included at the same time. The basic patterns are the same as in the separate models, but the differences between groups are a bit muted. For education the difference between less than primary and university education is now 56 percent, and for social class the difference between the unskilled and the higher managers is 15 percent. Finally, in model 1d, country fixed effects are included, which picks up all unobserved heterogeneity at the country level, and hence we constrain identification to SES differences within countries. The results are highly similar to those in model 1c, indicating a very robust association between both education of the woman and social class of the household and children ever born.

Completed fertility is highest in Sub-Saharan Africa and lowest in East Asia. Female age hypogamy (women married to younger men) is associated with lower completed fertility, and women married to moderately older men (3-6 years) have the highest completed fertility.

Table 5 shows comparisons of regression estimates for children ever born in the two different samples and for children surviving in the age group 45-54. Looking first at education the pattern is very similar across the different models. Most notably the gradient is highly similar between children ever born and children surviving, and also very similar for these two measures when looking at all married women 15-54 and only those in the age group 45-54. The results for social class are also similar between children ever born and children surviving, as well as between all women and only the women in the age group 45-54.

Table 5 here

Table 6 shows some further robustness tests. One possible concern is that SES patterns differ considerably between urban and rural locations and that the overall patterns shown in Table 4 would be affected by not controlling for urbanity. There is not a variable indicating urban/rural place of residence in all censuses, but for a reduced sample the control variables can be included. As seen in the middle panel of table 6, the inclusion of the urban control does not affect the SES patterns in any noticeable way. It is also clear from table 6 that results are highly similar using three different statistical models: OLS, negative binomial, and Poisson. It further indicates the robustness of the main analysis.

Table 6 here

Having established consistent differences in fertility for both woman's education and household social class, we turn to an analysis of how these differentials vary by region, focusing on social class while controlling of woman's education. Figure 1 shows estimates from different interaction models and 95 percent confidence intervals. All estimates are based on the full model as in 1c of Table 4. Panel A displays results for region and class with skilled workers in Latin America as the reference category (the vertical line). Only in two of the regions do we find a clear social class gradient in children ever born: Latin America and the Middle East. In all regions except the Middle East, farmers have the highest completed fertility. Apart from this there are only small class differences in East Asia, Southeast Asia and North Africa, and also in Sub-Saharan Africa.

Figure 1 here

Panel B gives estimates for interactions between period and social class with skilled workers in the period 1995-2004 as the reference category. Overall, the class differences seem to decline over time as completed fertility declines. In particular, the high fertility of farmers is reduced substantially, but they are always the group with the highest completed fertility. A full gradient emerges in the 1985-1994 period; before that there were no major differentials between the two top groups of higher and lower managers/professionals, which probably indicates a changed social stratification as much as real changes in the fertility differentials.

Panel C shows estimates for fertility regime and class with skilled workers in mid transition (3.5-4.4) as the reference category. As before farmers stand out as a high-fertility group regardless of regime. The class gradient in fertility is most pronounced in high- and moderately-high fertility regimes (3.5 and higher). In the 2.5-3.4 group, unskilled workers have about the same fertility level as farmers, and the lower white-collar group and the skilled workers have the lowest completed fertility, even lower than the higher-status white collar group. In the low-fertility regime the unskilled workers have the lowest fertility levels, farmers the highest and the high-status white-collar group the next highest fertility levels. Thus, as fertility declines class differentials first seem to get larger and a clear social gradient is established, and then the gradient disappears, and the differentials narrow substantially.

In panel D of table 2 we turn to interactions between woman's education and region. There is a clear educational gradient in all regions, with university-educated women having the lowest fertility and women with less than primary education having the highest. Panel E also shows that this educational gradient is visible in all periods. Between 1960 and the 1990s fertility of women with university degrees did not change much, and if anything it actually increased somewhat, while a substantial decline took place between the periods centered in 1990 and 2000. For the women with less than primary education from 1960 to 1980, and then dropped much faster up to 2010, when there was a bit of a reversal.

Finally, panel F displays estimates for education by fertility regime. There is a clear education gradient in all transition phases, from pre-transition to post transition. There is no sign of a convergence in fertility similar to what we saw for social class in panel C. The university-educated always have the lowest fertility and the women with less than primary education the highest. The differentials are also of a similar order of magnitude from pre-transition to post-transition, implying roughly 80 percent higher fertility in the less than primary group compared to the university group.

Conclusion

In this paper we have looked at fertility differentials by socioeconomic status across the global south from 1960 to 2015, using data for almost 46 million women. Of course, such a wide scope have forced us to use quite crude indicators and abstracting from much of the context specificities which are necessary for a full understanding of the process. Similarly, not all regions have passed through the entire fertility transition, which means that we cannot study the association between SES and fertility across all transition phases for all regions. Nonetheless, some general patterns have been uncovered. Looking at the entire sample of women, we found clear differences in fertility by both social class and education of the woman. Not only were there differentials but clear gradients from low status (high fertility) to high status (low fertility) both in terms of education and social class (when leaving farmers outside the hierarchical scheme, as they are difficult to fit in a class scheme in such different contexts as studied here). These two dimensions of SES were associated with completed fertility rather independently of each other, which shows the importance of not viewing SES as a unidimensional phenomenon that can be reduced to either education or class.

We also found substantial heterogeneities in the fertility differentials by region, time period, and fertility regime. Latin America and the Middle East were the regions with the clearest class differences in fertility, while all regions showed a gradient in fertility by women’s education. Both social class and educational gradients were quite uniform over time, but when looking at phases of the fertility transition, the class gradient was strongest and most consistent in mid transition, and least visible in post-transition contexts.

These results do not give much support for the idea that fertility was high in high-status groups before the fertility transition, as has been suggested in previous research. A similar conclusion was reached in a recent comparative study on class differences in Western fertility transitions (Dribe at el. 2017). There are two possible reasons for our different findings. First, there might have been an earlier fertility transition in the very elite group which we do not capture as it occurred before our period begins. European elite groups often showed declining fertility well before such change was apparent in the general population, which was connected at least partly to urban residence (Livi-Bacci 1986; Bardet 1990; Perrenoud 1990). Similarly, Clark (2007) showed that the number of surviving children was higher among wealthier people (at the time of their death) in pre-industrial England, but that these differences diminished long before the beginning of the fertility transition (see also Clark and Cummins 2009). Similar findings have been shown for France (Cummins 2013) and for England using occupational data from family reconstitutions (Boberg-Fazlic et al. 2011). Second, there may be some tiny elite group with a highly deviant behavior, which is masked by our more aggregate categories, similar to the nobility in pre-transitional Europe. Regardless of the explanation, however, our findings give no support for the idea that high socioeconomic status was related to high fertility just before the start of fertility decline.

Our findings give more support to the hypotheses that the higher-status groups were forerunners in the transition by reducing their fertility first, with lower status groups lagging behind initially. The patterns are, however, not as clear as for pre-industrial Europe (see Dribe et al. 2017). There is some increase in class differentials in the early stages of the transition, followed by a strong convergence in the later stages. For woman's education, however, these patterns are not as clear.

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Table 1. Distribution of children under 5, children ever born, and surviving children (%)

	C<5	CEB	CSUR	CEB	CSUR
	15-54	15-54	15-54	45-54	45-54
0	58.0	9.1	0.8	3.4	0.5
1	28.6	18.6	19.5	5.7	6.6
2	11.2	22.1	23.2	13.7	15.3
3	1.9	15.9	16.5	14.9	16.5
4	0.2	10.1	10.3	12.0	13.5
5	0.0	6.6	6.6	9.5	10.6
6	0.0	4.8	4.4	7.9	8.2
7	0.0	3.3	2.7	6.2	5.8
8	0.0	2.5	1.8	5.2	4.3
9+	0.0	4.5	2.1	12.1	5.9
NA	0.0	2.7	12.1	9.4	12.8
N	45 765 770	45 765 770	45 765 770	8 398 308	8 398 308

Table 2. Mean number of children under 5, children ever born and children surviving

	C<5	CEB	CSUR
Age of woman	15-54	45-54	45-54
Social class			
Higher managers and professionals	0.5	3.4	3.3
Lower managers, professionals, clerical and sales	0.5	3.8	3.6
Skilled workers	0.6	4.2	3.9
Farmers and fishermen	0.7	5.5	4.8
Unskilled workers	0.7	5.0	4.6
NA	0.5	4.8	4.4
All	0.6	4.8	4.3
N	45 764 770	7 613 475	7 613 475

Table 3. Descriptive statistics of variables in analysis. (%)

	Age range of sample	
	15-54	45-54
World Regions		
Latin America	42.6	44.4
Middle East	4.7	4.7
East Asia	15.5	17.6
South-East Asia	17.2	18.0
Sub-Saharan Africa	16.7	12.7
Northern Africa	3.2	2.6
Year		
1960	1.0	0.9
1970	3.8	3.4
1980	11.9	12.0
1990	23.4	21.0
2000	28.6	29.0
2010	26.9	28.5
2015	4.4	5.2
Children > 4 years in household		
No	33.4	16.9
Yes	66.6	83.1
Age		
-19	4.9	-
20-24	14.0	-
25-29	18.1	-
30-34	16.9	-
35-39	15.3	-
40-44	12.5	-
45-49	10.3	55.9
50+	8.1	44.1
Age Difference		
Wife Older	11.8	15.4
Husband same age or < 3 years older	24.8	24.6
Husband 3-6 years older	27.9	26.3
Husband >6 years older	35.5	33.7
Social class		
Higher managers and professionals	6.3	6.7
Lower managers, professionals, clerical and sales	12.6	10.5
Skilled workers	19.0	14.4
Farmers and fishermen	34.7	37.0
Unskilled workers	7.2	5.9
NA	20.2	25.5
Educational attainment		
Less than primary	45.8	57.7
Primary completed	38.6	30.5
Secondary completed	11.9	8.2
University completed	3.2	3.1
NA	0.5	0.5
Fertility regime		

< 2.5	6.0	8.0
2.5-3.4	12.7	15.9
3.5-4.4	22.2	23.7
4.5-5.4	17.8	16.9
5.5-6.4	31.2	27.9
>6.5	10.0	7.5
N	45 765 770	8 398 308

Table 4. Negative binomial estimates Children ever born. Married/in union women aged 45-54

	Model 1.a		Model 1.b		Model 1.c		Model 1.d	
	IRR	p	IRR	p	IRR	p	IRR	p
Region								
Latin America	1.000	ref	1.000	ref	1.000	ref	1.000	ref
Middle East	1.000	0.795	0.975	0.000	0.992	0.000	0.943	0.000
East Asia	0.940	0.000	0.923	0.000	0.903	0.000	0.879	0.000
South-East Asia	0.979	0.000	0.959	0.000	0.952	0.000	0.836	0.000
Sub-Saharan Africa	1.013	0.000	0.985	0.000	0.988	0.000	1.025	0.000
Northern Africa	0.934	0.000	1.002	0.091	0.948	0.000	0.965	0.000
Age of woman								
45-49	1.000	ref	1.000	ref	1.000	ref	1.000	ref
50-54	1.044	0.000	1.064	0.000	1.045	0.000	1.047	0.000
Age difference between spouses								
Wife Older	0.899	0.000	0.906	0.000	0.902	0.000	0.900	0.000
Husband same age or < 3 years older	1.000	ref	1.000	ref	1.000	ref	1.000	ref
Husband 3-6 years older	1.034	0.000	1.044	0.000	1.034	0.000	1.036	0.000
Husband >6 years older	1.003	0.000	1.036	0.000	1.014	0.000	1.014	0.000
Fertility regime								
< 2.5	0.645	0.000	0.600	0.000	0.637	0.000	0.643	0.000
2.5-3.4	0.775	0.000	0.759	0.000	0.773	0.000	0.788	0.000
3.5-4.4	1.000	ref	1.000	ref	1.000	ref	1.000	ref
4.5-5.4	1.146	0.000	1.173	0.000	1.135	0.000	1.120	0.000
5.5-6.4	1.284	0.000	1.374	0.000	1.279	0.000	1.283	0.000
>6.5	1.484	0.000	1.606	0.000	1.468	0.000	1.375	0.000
Woman's education								
Less than primary completed	1.287	0.000			1.235	0.000	1.257	0.000
Primary completed	1.000	ref			1.000	ref	1.000	ref
Secondary completed	0.745	0.000			0.774	0.000	0.760	0.000
University completed	0.640	0.000			0.674	0.000	0.665	0.000
NA	1.262	0.000			1.221	0.000	1.211	0.000
Social class								

Higher managers and professionals			0.815	0.000	0.942	0.000	0.950	0.000
Lower managers, professionals, clerical and sales personel			0.906	0.000	0.961	0.000	0.964	0.000
Skilled workers			1.000	ref	1.000	ref	1.000	ref
Farmers and fishermen			1.245	0.000	1.173	0.000	1.178	0.000
Unskilled workers			1.133	0.000	1.091	0.000	1.076	0.000
NA			1.031	0.000	1.025	0.000	1.020	0.000
Const	3.791	0.000	3.128	0.000	3.468	0.000	3.524	0.000
alpha	0.104		0.116		0.099		0.097	
LR test of alpha=0:								
Prob>=chibar2	0.000		0.000		0.000		0.000	
Number of obs	7613475		7613475		7613475		7613475	

Notes:

Models 1.d also includes country of residence as fixed effects.

If CEB is equal to "unknow" or "not in universe", cases are exluded.

Table 5. Negative binomial estimates of different fertility outcomes. Married/in union women aged 45-54

	M2 - CEB for married/in union women 15-54		M2 - CEB for married/in union women 45-54		M2 - CSUR for married/in union women 45-54	
	IRR	p	IRR	p	IRR	p
Region						
Latin America	1.000	ref	1.000	ref	1.000	ref
Middle East	0.853	0.000	0.943	0.000	0.887	0.000
East Asia	0.662	0.000	0.879	0.000	0.854	0.000
South-East Asia	0.720	0.000	0.836	0.000	0.843	0.000
Sub-Saharan Africa	0.922	0.000	1.025	0.000	1.078	0.000
Northern Africa	0.854	0.000	0.965	0.000	1.059	0.000
Age of woman						
-19	0.207	0.000				
20-24	0.451	0.000				
25-29	0.729	0.000				
30-34	1.000	ref				
35-39	1.215	0.000				
40-44	1.372	0.000				
45-49	1.488	0.000	1.000	ref	1.000	ref
50+	1.564	0.000	1.047	0.000	1.034	0.000
Children >4years in household						
No						
Yes						
Age difference between spouses						
Wife Older	0.893	0.000	0.900	0.000	0.915	0.000
Husband same age or < 3 years older	1.000	ref	1.000	ref	1.000	ref
Husband 3-6 years older	1.057	0.000	1.036	0.000	1.034	0.000
Husband >6 years older	1.071	0.000	1.014	0.000	1.015	0.000
Fertility regime						
< 2.5	0.748	0.000	0.643	0.000	0.671	0.000
2.5-3.4	0.826	0.000	0.788	0.000	0.821	0.000
3.5-4.4	1.000	ref	1.000	ref	1.000	ref
4.5-5.4	1.106	0.000	1.120	0.000	1.098	0.000
5.5-6.4	1.270	0.000	1.283	0.000	1.184	0.000
>6.5	1.371	0.000	1.375	0.000	1.206	0.000
Woman's education						
Less than primary completed	1.246	0.000	1.257	0.000	1.202	0.000
Primary completed	1.000	ref	1.000	ref	1.000	ref
Secondary completed	0.745	0.000	0.760	0.000	0.784	0.000
University completed	0.624	0.000	0.665	0.000	0.699	0.000
NA	1.153	0.000	1.211	0.000	1.182	0.000
Social class						
Higher managers and professionals	0.953	0.000	0.950	0.000	0.967	0.000
Lower managers, professionals, clerical and sales personel	0.966	0.000	0.964	0.000	0.975	0.000
Skilled workers	1.000	ref	1.000	ref	1.000	ref
Farmers and fishermen	1.159	0.000	1.178	0.000	1.153	0.000
Unskilled workers	1.063	0.000	1.076	0.000	1.064	0.000
NA	0.972	0.000	1.020	0.000	1.030	0.000
Const	2.918	0.000	3.524	0.000	3.576	0.000
alpha	0.040		0.099		0.020	
LR test of alpha=0:						
Prob>=chibar2	0.000		0.000		0.000	
Number of obs	44538467		7613475		7322162	

Notes:

Models also include country fixed effects

If CEB or CSUR is equal to "unknonw" or "not in-universe", cases are excluded.

Table 6. Comparing models with/without urban variable. Women 45-54, reduced sample census with urban variable

	OLS CEB				Negative binomial, IRR				Poisson, IRR			
	No urban control		With urban control		No urban control		With urban control		No urban control		With urban control	
	b	p	b	p	IRR	p	IRR	p	IRR	p	IRR	p
Woman's education												
Less than primary completed	1.091	0.000	1.003	0.000	1.266	0.000	1.243	0.000	1.264	0.000	1.243	0.000
Primary completed	ref		ref		1.000	ref	1.000	ref	1.000	ref	1.000	ref
Secondary completed	-0.804	0.000	-0.737	0.000	0.770	0.000	0.780	0.000	0.767	0.000	0.780	0.000
University completed	-1.107	0.000	-1.025	0.000	0.678	0.000	0.690	0.000	0.675	0.000	0.690	0.000
NA	0.975	0.000	0.903	0.000	1.219	0.000	1.200	0.000	1.219	0.000	1.200	0.000
Social class												
Higher managers and professionals	-0.228	0.000	-0.245	0.000	0.944	0.000	0.941	0.000	0.942	0.000	0.941	0.000
Lower managers, professionals, clerical anc	-0.159	0.000	-0.151	0.000	0.958	0.000	0.959	0.000	0.958	0.000	0.959	0.000
Skilled workers	ref		ref		1.000	ref	1.000	ref	1.000	ref	1.000	ref
Farmers and fishermen	0.817	0.000	0.524	0.000	1.182	0.000	1.112	0.000	1.179	0.000	1.112	0.000
Unskilled workers	0.329	0.000	0.246	0.000	1.080	0.000	1.061	0.000	1.078	0.000	1.061	0.000
NA	0.064	0.000	-0.020	0.000	1.022	0.000	1.002	0.002	1.023	0.000	1.002	0.002
N	6 157 464		6 157 464		6 157 464		6 157 464		6 157 464		6 157 464	

Models control for region, age, age-difference, fertility regime, country

Appendix 1. Observatiions in countries included in the analysis.

Country	Freq.	%
argentina 1970	78 959	0.17
argentina 1980	436 201	0.95
armenia 2011	57 869	0.13
bolivia 1976	71 256	0.16
bolivia 1992	98 540	0.22
bolivia 2001	123 470	0.27
botswana 1981	9 486	0.02
botswana 1991	13 199	0.03
botswana 2001	18 939	0.04
botswana 2011	25 268	0.06
brazil 1960	448 108	0.98
brazil 1970	722 173	1.58
brazil 1980	931 300	2.03
brazil 1991	1 383 363	3.02
brazil 2000	1 708 760	3.73
brazil 2010	1 692 073	3.70
cambodia 1998	182 017	0.40
cambodia 2008	238 818	0.52
cameroon 2005	263 158	0.58
chile 1982	176 195	0.38
chile 1992	227 681	0.50
chile 2002	248 535	0.54
china 1982	1 836 829	4.01
china 1990	2 500 545	5.46
china 2000	2 765 700	6.04
colombia 1973	265 732	0.58
costa rica 1973	25 220	0.06
costa rica 1984	37 146	0.08
costa rica 2000	63 784	0.14
costa rica 2011	71 163	0.16
dominican republic 1981	66 252	0.14
dominican republic 2002	138 426	0.30
dominican republic 2010	148 325	0.32
ecuador 1974	88 638	0.19
ecuador 1982	119 158	0.26
ecuador 1990	153 997	0.34
ecuador 2001	203 297	0.44
ecuador 2010	239 663	0.52
el salvador 1992	72 585	0.16
el salvador 2007	88 230	0.19
ethiopia 1994	785 317	1.72
palestine 1997	38 358	0.08
palestine 2007	34 547	0.08
ghana 2000	297 288	0.65
ghana 2010	383 957	0.84
guinea 1996	137 055	0.30
haiti 1982	16 049	0.04
haiti 2003	127 102	0.28
indonesia 1971	108 676	0.24
indonesia 1976	46 299	0.10
indonesia 1980	1 326 786	2.90
indonesia 1990	167 070	0.37
indonesia 1995	135 079	0.30
iran 2006	268 014	0.59
iran 2011	329 232	0.72
iraq 1997	273 096	0.60
jamaica 1982	11 830	0.03
jamaica 2001	12 914	0.03
kenya 1989	155 895	0.34
kyrgyz republic 1999	80 483	0.18
liberia 2008	52 262	0.11
malawi 1998	175 691	0.38
malawi 2008	212 608	0.46
malaysia 1970	26 561	0.06
malaysia 1980	28 955	0.06
mali 1987	148 356	0.32
mali 1998	174 849	0.38
mali 2009	241 143	0.53
mexico 1990	1 330 931	2.91
mexico 2000	1 733 805	3.79
mexico 2010	2 056 259	4.49
mexico 2015	2 005 900	4.38
morocco 1982	159 547	0.35
morocco 1994	197 459	0.43
morocco 2004	237 829	0.52
mozambique 1997	280 364	0.61
mozambique 2007	343 079	0.75
nicaragua 1971	26 447	0.06
nicaragua 1995	64 027	0.14
nicaragua 2005	82 667	0.18
pakistan 1973	240 308	0.53
panama 1980	28 912	0.06
panama 1990	36 058	0.08
panama 2000	46 130	0.10
panama 2010	56 232	0.12
paraguay 1972	29 853	0.07
paraguay 1982	42 835	0.09
paraguay 1992	62 558	0.14
paraguay 2002	77 614	0.17
peru 1993	342 852	0.75
peru 2007	462 349	1.01
philippines 1990	947 154	2.07
rwanda 2002	101 611	0.22
senegal 2002	171 371	0.37
sierra leone 2004	88 828	0.19
vietnam 1999	446 987	0.98
vietnam 2009	3 000 042	6.56
south africa 2001	454 821	0.99
south africa 2007	107 292	0.23
south sudan 2008	97 675	0.21
sudan 2008	887 786	1.94
thailand 1970	112 897	0.25
thailand 1980	64 541	0.14
thailand 1990	90 086	0.20
thailand 2000	123 596	0.27
turkey 1985	463 181	1.01
turkey 1990	529 281	1.16
turkey 2000	664 442	1.45
uganda 1991	249 687	0.55
uganda 2002	363 900	0.80
tanzania 1988	371 073	0.81
tanzania 2002	593 729	1.30
tanzania 2012	698 392	1.53
burkina faso 1996	189 768	0.41
uruguay 1975	47 631	0.10
uruguay 1996	50 966	0.11
venezuela 1990	251 770	0.55
venezuela 2001	363 823	0.79
zambia 1990	122 682	0.27
zambia 2000	147 570	0.32
zambia 2010	183 643	0.40
Total	45 765 770	100.00

Country	Freq.	%
argentina	515 160	1.13
armenia	57 869	0.13
bolivia	293 266	0.64
botswana	66 892	0.15
brazil	6 885 777	15.05
cambodia	420 835	0.92
cameroon	263 158	0.58
chile	652 411	1.43
china	7 103 074	15.52
colombia	265 732	0.58
costarica	197 313	0.43
dominican republic	353 003	0.77
ecuador	804 753	1.76
el salvador	160 815	0.35
ethiopia	785 317	1.72
palestine	72 905	0.16
ghana	681 245	1.49
guinea	137 055	0.3
haiti	143 151	0.31
indonesia	1 783 910	3.9
iran	597 246	1.31
iraq	273 096	0.6
jamaica	24 744	0.05
kenya	155 895	0.34
kyrgyz republic	80 483	0.18
liberia	52 262	0.11
malawi	388 299	0.85
malaysia	55 516	0.12
mali	564 348	1.23
mexico	7 126 895	15.57
morocco	594 835	1.3
mozambique	623 443	1.36
nicaragua	173 141	0.38
pakistan	240 308	0.53
panama	167 332	0.37
paraguay	212 860	0.47
peru	805 201	1.76
philippines	947 154	2.07
rwanda	101 611	0.22
senegal	171 371	0.37
sierra leone	88 828	0.19
vietnam	3 447 029	7.53
south africa	562 113	1.23
south sudan	97 675	0.21
sudan	887 786	1.94
thailand	391 120	0.85
turkey	1 656 904	3.62
uganda	613 587	1.34
tanzania	1 663 194	3.63
burkina faso	189 768	0.41
uruguay	98 597	0.22
venezuela	615 593	1.35
zambia	453 895	0.99
Total	45 765 770	100.0