Fertility Decline in Urban and Rural Areas of Developing Countries

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Introduction

The analysis of fertility by residence is crucial for a better understanding of contemporary demographic change in developing countries. In particular, it elucidates the process of urbanization as an outcome of the demographic transition (Dyson 2011). As mortality has declined at a fast pace in developing countries since 1950, urban growth has been predominantly driven by the excess of the number of births over deaths (Preston 1979; Chen et al. 1998; Jedwab et al. 2017; Jiang and O'Neill 2018). The rate of this endogenous population increase depends on the pace of the urban fertility decline. But at the same time the role played by rural-to-urban migration in urban growth has been increasing as urban fertility has reached low levels in a number of developing countries (Gebreselassie 2011; Liang et al. 2008). In this context, developments in rural fertility offer information about population pressure and, thus, potential for migration toward cities. Furthermore, the combined trends in fertility decline and in-migration to urban areas determine the extent to which population is concentrated in working ages (Menashe-Oren and Stecklov 2018). Knowledge about the timing and magnitude of this demographic dividend is crucial for development policy. The investigation of the spatial diffusion of fertility transition within countries also helps to improve our understanding of the international variation in fertility trends (Casterline 2001). In this article, we reappraise the patterns of urban and rural fertility change in developing countries, where the world's future urban growth, fertility decline, and demographic dividend will be concentrated.

Although the theory of the demographic transition links the emergence of a small family ideal to the rise in urban living (Notestein 1953), the role of urbanization in fertility change remains a matter of debate. Demographers of the structuralist school tend to consider rural-urban fertility differences merely as a spatial manifestation of the differential paces of structural changes in society (Galloway et al. 1998). When compared to rural areas, urban living not only increases the direct financial costs of childrearing, but also its opportunity costs, due to the numerous avenues for socioeconomic mobility. These are associated with the rise of non-agricultural employment and the higher education infrastructure. Moreover, city economies are more exposed to the negative effects of economic downturns. Urbanization's effect on the cost-risk structure is an integral part of the role of urbanization in the fertility transition (Martine et al. 2013; Findley 1980).

Scholars from the social diffusion school, by contrast, see rural-urban fertility differentials as secondary manifestations within a system of homogeneous cultural regions across which fertility decline spreads (Cleland and Wilson 1987; Sharlin 1986; Coale 1973). Yet, urban societies are characterized by distinct features that accelerate the diffusion of new behaviors (Tabutin 2000). Through social, economic, transport, and communications connections, urban societies interact intensively with foreign countries that are more advanced in the fertility transition. Social interaction is also intensified within cities, as propinquity leads to the individualization, anonymization, and cultural diversification of societies. This erodes old systems of social control, accelerates the diffusion of new reproductive values, and enhances the legitimacy of modern means of birth control (Bongaarts and Watkins 1996; Caldwell 2001). Compared to rural populations, urban inhabitants are also better able to implement fertility preferences because of improved access to family planning services.

According to spatial diffusion theory, these structural and ideational changes, as well as the new fertility behaviors, should spread through the settlement hierarchy into remote rural areas via established communication and transport networks (Hägerstrand 1952; Klüsener et al. 2017). Cross-sectional assessments of the period total fertility rates (TFR) by residence in developing countries support this model of a center-periphery diffusion of behavioral change. A three-stage evolution in the rural-urban fertility differential has been observed (Findley 1978; Rodriguez 1996; Shapiro and Tambashe 2000; United Nations 1987). Starting from similar fertility levels by residence, the excess of rural over urban fertility increases sharply in the opening phase of the demographic transition due to an earlier and faster decline in cities (see also Garenne and Joseph 2002; Garenne 2008). Later, rural fertility declines markedly and converges on the lower urban standard. However, two main issues preclude a general conclusion.

First, there is much uncertainty about the trends in sub-Saharan Africa, where the fertility transition started most recently. In the 1990s, the rural-urban fertility differential diminished, in part because the decline in the urban TFR decelerated (Shapiro and Tambashe 2000). This is surprising, given the improvements in human development in African cities throughout the second half of the twentieth century (Kirk and Pillet 1998), which should have intensified the fertility decline (Bryant 2007; Bongaarts and Watkins 1996). More recent data, however, reveal substantial urban-rural fertility gaps (i.e. of one child or more per woman) that tend to be wider at more advanced stages of the fertility transition (Corker 2016; Eloundou-Enyegue and Giroux 2012). Evidence on long-term fertility trends by residence in other world regions would be useful to understand and predict trajectories in sub-Saharan Africa, where a large share of the world's future urban population growth and fertility decline will be concentrated.

Second, international assessments of long-term fertility trends by residence are scarce and have failed to identify patterned regularities (Montgomery et al. 2003: 228). This has been related to the inability of predominantly cross-sectional research approaches to account for international differences in context (Martine et al. 2013). Countries diverge not only in terms of their demographic development, but also in terms of the stages and quality of urbanization. The size and importance of urban slum areas, tending to decelerate the fertility transition, varies significantly across countries (Gries and Grundmann 2018). Moreover, the definition and delineation of urban versus rural areas is country-specific, which is likely to bias international comparisons.

In this article, we question whether the inverted U-shaped evolution in the excess of rural over urban fertility—as implied by cross-sectional research—is confirmed for the developing world when considered from a longitudinal perspective. Our assessment adds to the discussion in several respects. First, it covers a larger geographical and temporal spectrum of fertility change when compared to previous studies. We analyze up to 80 birth cohorts in 60 developing countries spanning Africa, Asia, Latin America, and the Caribbean. Second, we estimate the average trend in the fertility gradient by residence while controlling for the international variation in urbanization contexts, as well as for heterogeneity in the stages attained in the national fertility transitions. Third, we dissect this trend by assessing the underlying dynamics in the sector-specific transitions. We describe the average pace of the earlier fertility decline in urban areas, the time lag until rural fertility starts to drop significantly, the rural-urban variation in the speed of the sector-specific transitions, and the role played by rural-to-urban migration.

The next section introduces the analytical strategy, the data, and the methods used. In the empirical section, we describe the evolution of the average rural-urban fertility ratio and the underlying dynamics in the two types of residence. Our results confirm an inverted U-shaped evolution in the rural-urban fertility ratio over the course of the national fertility transition. This trend can be explained mainly by the urban-rural time-lag in the onset of the transition and, to a lesser extent, by the differential pace of fertility decline. Rural-to-urban migrants also play a role at different stages of the fertility transition. Finally, the implications of these results, for urban population growth and for our understanding of the international variation in the pace of fertility transitions, are discussed.

Analytical strategy, data, and methods

Cohort perspective

We compared long-term trends in urban and rural fertility over cohorts, rather than periods. There has been much debate between demographers favoring either of these two perspectives. Ryder (1965) argued that the transformation of social structures (such as the spread of schooling and public health) and of the modes of socialization runs across cohort lines. However, the actual constraints and opportunities of the living context during childbearing ages (i.e. costs of living and economic and leisure opportunities) can change substantially over periods, leading to stronger fertility variations from a period perspective (Ni Bhrolchain 1992). The process of social interaction that affects individual childbearing behavior can be either a cohort or a period process, depending on whether it happens between generations or among peers. The two analytical approaches are complementary because they account for social change through different lenses (Schoen 2004).

Our choice of the cohort perspective was determined by at least two reasons (see also the online Appendix). First, cohort measures are better suited to gauge long-term fertility trends because they smooth out the short-term variations determined by the changing period circumstances individuals face throughout their life course. Second, the conventional measure of period fertility—the TFR—is problematic in contexts where there are important migration flows between rural and urban areas, especially when the decisions to move and have children are interlinked. In order to facilitate geographic relocation, migrants tend to postpone (or bring forward) births, which are then recuperated (or followed by a pause) at the destination. As the TFR at destination only measures the behavior after migration, it tends to overestimate (or underestimate) the intensity of childbearing in times of comparatively large migration flows (Toulemon 2004). These biases should not be neglected, as recent rural-to-urban migrants represent between 16 percent and 32 percent of the urban populations in Latin America and Africa, respectively (Montgomery et al. 2003). The slowing down of the decline in urban period fertility in Africa in the 1990s (Shapiro and Tambashe 2000) may have been caused by the arrival of more fertile women from the countryside. Because in many countries we lack the data to control for these tempo effects of migration on the measurement of period fertility, we estimated cohort indicators based on data about the total number of children ever born. This information, obtained at advanced reproductive ages, is not affected by tempo effects.

Data

We used 278 World Fertility Surveys (WFS) and Demographic and Health Surveys (DHS) for a total of 60 developing countries. For 11 countries, in which the first or last WFS or DHS do not cover the initial or latest stages of the fertility transition, we relied on recent waves of the Multiple Indicator Cluster Surveys (MICS; conducted by the United Nations International Children's Emergency Fund or UNICEF) and on the Integrated Public Use Microdata Series (IPUMS) of the earliest or most recent population censuses (Minnesota Population Center 2017). This minimizes the analytical problems related to unbalanced panels of country series. We relied on a total of 295 surveys/census-samples, with a range of 1 to 12 per country; see Table A-1 in the online Appendix). The surveys interviewed reproductive-age (15–49) women, collecting information on parity (number of children ever born) and full birth histories. Some MICS only provide information on parity, as do the IPUMS census data (but including for women aged 50 to 64). In these cases, we used the own-children method to reconstruct women's recent birth histories (Cho et al. 1986; see online Appendix).

To increase the geographic and temporal coverage of this study, we also used data from surveys that excluded never-married women. At the ages at which we measure fertility (30 and above), the overwhelming majority of women in our sample of countries were or had been married. The cross-validation of our estimates with external fertility indicators did not reveal significant biases (see Figure A-2 in the online Appendix). We excluded countries from the former Soviet Union and small island states because of the importance of international migration, which significantly recomposed, in terms of socioeconomic characteristics and ethnicity, these urban and rural populations over time. This cannot be controlled for with the data at hand.

The sample of women was classified by rural-urban residence at the time of the survey or the census, and by country. Although sub-Saharan African countries are overrepresented in the sample, the data cover the whole spectrum of urbanization. According to estimates from the United Nations (2015), the median percentage of the national population living in urban areas increased from 12 percent in 1950 to 34 percent in 2000 in the full sample of countries, with the minimum percentage increasing from 2 percent to 8 percent and the maximum percentage from 43 percent to 81 percent.

The definitions of the urban/rural status of the current residence are often not specified in the survey documentation and are not harmonized in the data. We have to assume that national definitions of "urban areas" were relied upon. Yet, these may change over time, and city boundaries move out into formerly rural areas as the population sprawls. Given that the urban and rural fertility trends estimated on the basis of subsequent surveys/census-samples within a given country align with one another (see Figure A-1 in the online Appendix), we ruled out the possibility of major analytical biases due to the reclassification of populations. International differences in the definition of urban areas represent another major challenge in comparative analyses, as discussed in more detail in the online Appendix. Slum areas may be excluded in the official urban definitions of some countries, while in others large populations with agricultural livelihoods in the cities' vicinities may be included. Urban fertility decline would be overestimated in the first case and underestimated in the latter. We controlled for these (unobserved) international differences by using country fixed effects in our regression-based estimation of average fertility trends by residence (see method section).

Method

Our measure of interest is the total cohort fertility (TCF). More specifically, the average life-time parity of cohorts is computed based primarily on parity data. We used cohort parity-progression ratios (PPR) which measure the proportion of women who have already had a given number of children (i.e. parity) and who go on to have an additional one. The TCF is then estimated as a weighted average of the parities attained, with the weights being the parity distribution of women as implied by chaining the progression ratios from nulliparous to the first birth up to the progression from the fifth to the sixth birth[1] (see online Appendix).

Survey-specific series of PPRs were computed for five-year age cohorts to increase the robustness of the results. For the cohorts that had completed childbearing at the time of the interview (i.e., aged 40 years or more), we directly estimated the PPRs based on the distribution of women according to the reported parity at the survey date. Figures for cohorts with fewer than 60 women (in the unweighted sample) were discarded to avoid excessive noise in the estimation series due to sampling biases. To fill inter-cohort estimation gaps and extend the series with more recent cohorts, we also estimated truncated PPRs for the cohorts aged 30–34 and 35–39 at the survey dates, and projected their completed PPRs.

To project these PPRs, the Brass-Juarez paired-cohort comparison procedure was applied (Moultrie et al. 2012; Brass and Juarez 1983). The truncated PPRs for the younger cohorts are projected forward in time by adjusting the completed PPRs of older cohorts for the cohort trend in fertility. The intercohort differences are estimated at equivalent ages and parities in order to control for the truncation of the fertility career and the selection of more fertile women in higher parity groups among younger cohorts: in each pair of cohorts, the fertility of the older women is truncated as of five years before the survey, using information from the birth histories, and compared with the similarly truncated fertility of younger women at the survey date (see the online Appendix). The method assumes that the recent fertility differentials between two adjacent cohorts stay constant in the second half of the reproductive career. The recuperation of births which have been forgone at younger ages is assumed to be completed in the early thirties, and no further differential postponement is allowed. These assumptions are reasonable. Few countries in our sample experienced a strong postponement of first births, and the delay of higher order births has only limited tempo effects. Survey weights were applied.

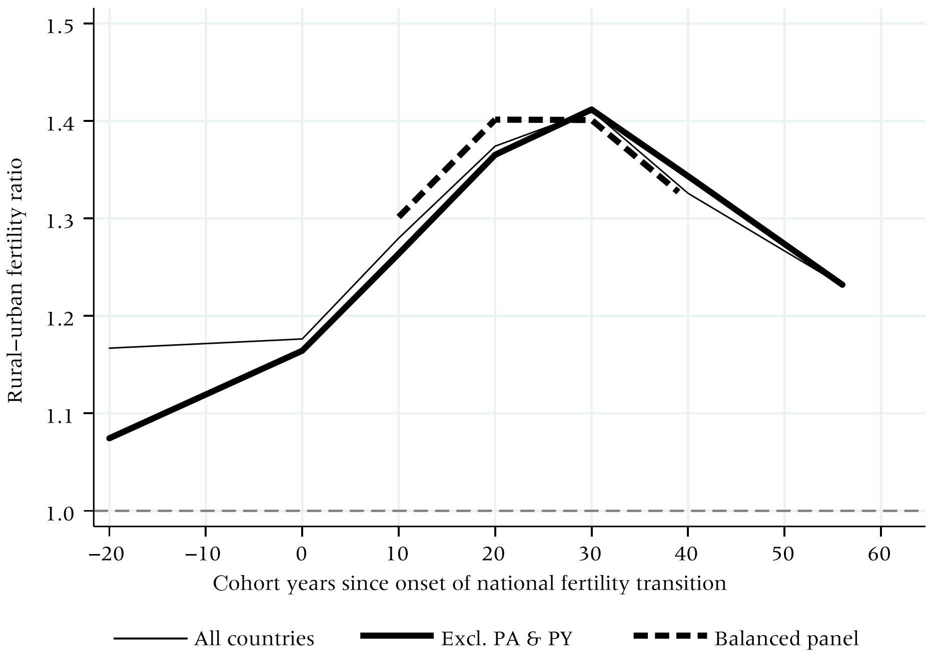
Information about the number of children ever born may be biased due to omission or incomplete recalling of births by older interviewees, as well as sample selection biases related to past mortality and migration (Moultrie et al. 2013; United Nations 1983). We performed two quality assessments of our estimates: an internal and an external plausibility test. Both confirmed the good quality of our estimates—even in countries where only ever-married women have been interviewed (see online Appendix Figures A-1 and A-2). To smooth annual series of TCF, we thus averaged the PPRs obtained from successive surveys for overlapping cohorts, annually and linearly interpolated the figures, and smoothed the country-specific series by rural-urban residence (see the online Appendix for technical details).

Our estimation series covers the cohorts born between 1896 and 1982. We thus observed the urban fertility transition until advanced stages in Asia and Latin America, as well in a number of countries in sub-Saharan Africa (see online Appendix Table A-1). The average country contributes 41 birth cohorts, with a range from 15 cohorts (i.e., countries with only one survey) to 80 cohorts (i.e., 12 surveys).

Controlling for the heterogeneity in the demographic and urbanization context

To control for the different stages attained by each country in the fertility transition, we describe average urban and rural fertility trends by cohort-years relative to the onset of the national transition. Following Casterline (2001), we defined the onset of the transition as the calendar year in which the national TFR peaked last before the first 10 percent decline, according to the United Nations' World Population Prospects estimations (United Nations 2017) and the compiled estimates for periods before 1950 (included in the R-package wpp2012; (Sevcikova et al. 2014)). This definition was preferred over the year in which the TFR fell to below 10 percent of its peak value, because this latter more conventional definition excludes the initial period of fertility decline, which was mainly concentrated in urban areas. The calendar year of the onset was then back-translated by subtraction of the period mean age at childbearing (United Nations 2017) in order to get a cohort indicator.

FIGURE 1 Average trend in the rural-urban cohort fertility ratio over the course of the national fertility transition (onset = year 0), cohorts 1896–1982 in 60 developing countries



SOURCES: WFS, DHS, MICS, IPUMS, UN historical and World Populations Prospects estimates (2017).
NOTES: PA = Panama, PY = Paraguay; the onset of the transition corresponds to the calendar year in which the national-level TFR peaked, which was then back-translated by the mean age at birth to get a cohort indicator.

We summarized the results for all developing countries following the approach of Casterline & Odden (2016). Using linear spline regression models stratified by rural and urban areas, we estimated the pace of fertility change over cohorts (with knots at the onset of the transition and 10, 20, 30, and 40 cohorts later). Models included country fixed effects to control for the unobserved heterogeneity in the national contexts of urbanization (e.g., relative importance of slums) and the definitions of urban and rural areas. The regression coefficients were then used to predict the average within-country trend.

Results

The trend in the rural-urban fertility ratio

Figure 1 shows the average trend in the rural-urban ratio of cohort fertility over the course of the national fertility transition. If urban and rural fertility were to decline at the same time and same pace, all cohorts would align on the gray and dashed horizontal line at unity. Observations situated above (below) that reference line indicate the extent of higher (lower) rural fertility, relative to the urban level in a given cohort.[2]

The results support the hypothesis of an inverted U-shaped trend in the fertility ratio by residence. In the full sample of countries, rural fertility is almost 20 percent higher than the urban level on average in the pre-transitional cohorts. Two countries (Panama and Paraguay) are clear outliers with very low pre-transitional urban fertility (around 3.5 children per woman). After exclusion of these countries, the average trend in the rural-urban fertility ratio rises from 1.06 to 1.16 before the transition onset. The ratio increases sharply in the first 20 transition cohorts to 40 percent, stabilizing at this level in the subsequent 10 cohorts. After 30 cohort years have elapsed since the transition onset, the average rural-urban ratio has dropped monotonically down to 1.23 (in the 55th transition cohort). This inverted U-shaped evolution is confirmed in a balanced panel including 22 countries[3] (with observations from the 10th to the 39th transition cohorts).

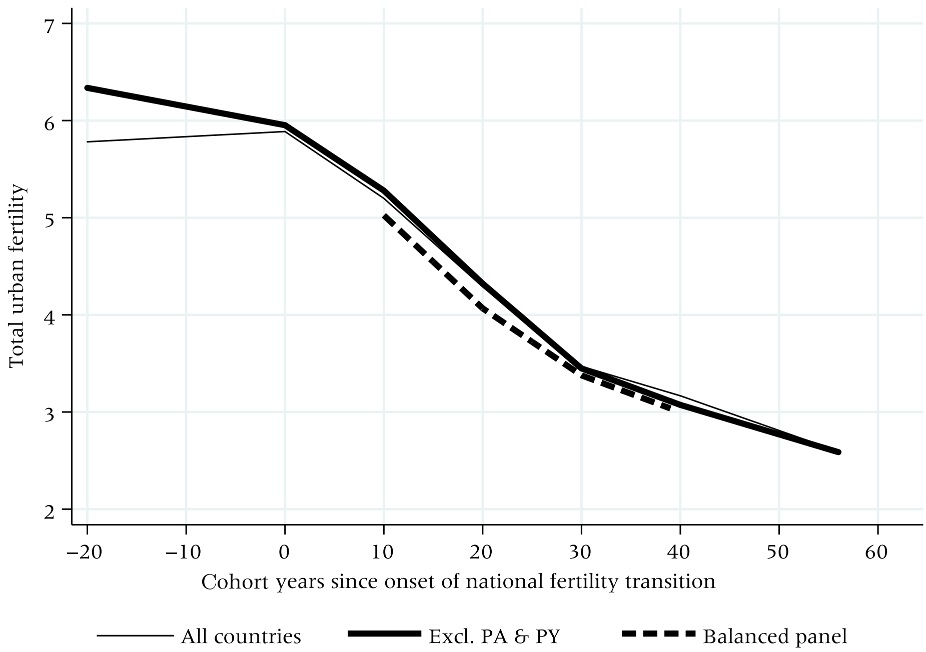
The trend in the fertility differential by residence is determined by the pace of the initial fertility decline in urban areas, the time interval until the fertility transition starts in rural areas, and the subsequent speed of the rural when compared to the urban fertility change. We analyze each of these dynamics in the following sections.

The urban fertility decline

Fertility starts to drop earlier in urban than in rural areas in all countries. We therefore expect the increase in the rural-urban fertility ratio to be driven by the pace of the urban fertility decline, in particular during the period that precedes the onset of the fertility transition in rural areas. Figure 2 shows the average trend in urban fertility over the stages of the national fertility transition.

Pre-transitional levels of urban fertility tend to rise, which can be related to improved health conditions and the abandonment of traditional practices of birth regulation (such as sexual abstinence and prolonged breastfeeding) in the early stages of modernization (Dyson and Murphy 1985). However, this initial trend is not statistically significant. In the sample excluding Panama and Paraguay, which experienced huge pre-transitional rises (i.e. more than one birth per woman), fertility declines slightly but significantly. At the national transition onset, average urban fertility is already six children per woman. The subsequent decline is continuous, from 5.9 to 2.6 over the 55 transition cohorts. The pace is monotonic and fast in the first 30 cohorts, which explains the early rise in the rural-urban fertility ratio. In more advanced stages of the transition, however, the average pace of urban fertility decline slows down. This deceleration is also confirmed in the balanced panel of countries and is consistent with observations from a period perspective in sub-Saharan Africa in the 1990s.

FIGURE 2 Average trend in urban cohort fertility over the course of the national fertility transitions (onset = year 0), cohorts 1896–1982 in 60 developing countries



SOURCES: WFS, DHS, MICS, IPUMS, UN historical and World Populations Prospects estimates (2017).
NOTES: PA = Panama, PY = Paraguay; the onset of the transition corresponds to the calendar year in which the national-level TFR peaked, which was then back-translated by the mean age at birth to get a cohort indicator.

The urban-rural lag in the transition onset

Demographers from the structuralist and spatial diffusion schools would explain the peak in the rural-urban fertility ratio by the time lag between the urban and rural onsets of the diffusion of the structural and behavioral transformations that trigger fertility decline. We estimated the quartile years elapsed between the urban and rural onsets of advanced fertility decline. These country- and sector-specific onsets are defined by the first cohort years in which total fertility drops below the threshold of six children per woman in urban and rural areas (in the few urban areas in which fertility was never above six, the onset is defined by the cohort with the highest fertility). We consider only those countries where our total fertility series starts at the latest with the 10th cohort year following the national transition onset (10 countries are excluded from the sample[4]). The quartile lag durations between the urban and rural onset were estimated via survival analysis to include also the right-truncated series in eight countries of sub-Saharan Africa, which have not yet experienced the rural onset of advanced fertility decline.

The median lag between the sectoral transition onsets is 16 years. The interquartile range of 15 years reveals an important diversity across countries.[5] This lagged onset of the rural fertility decline accounts for the stabilization of the average rural-urban fertility ratio at its peak level in the middle of the national-level transition.

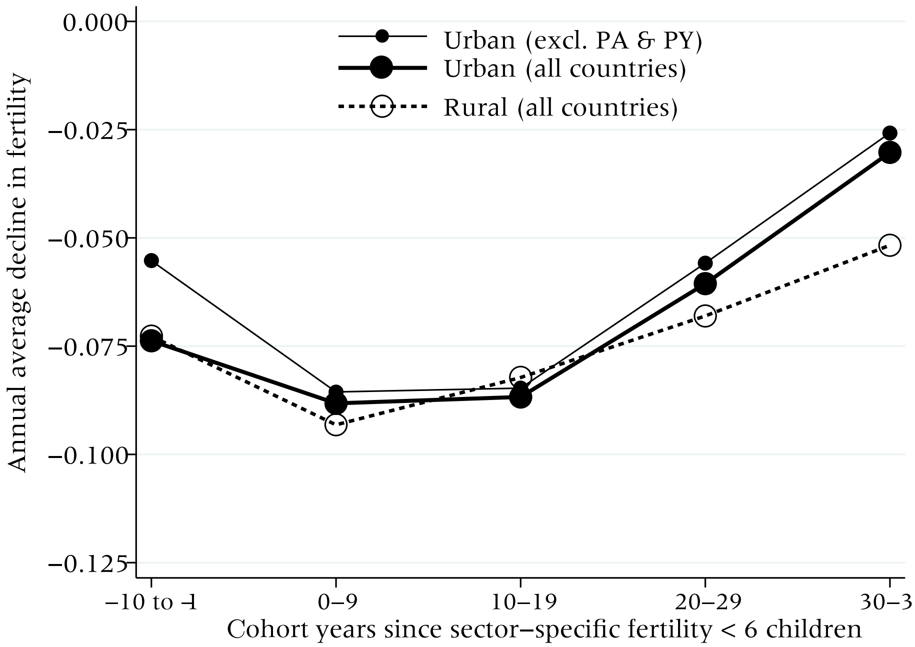
Rural-urban differences in the pace of fertility decline

The comparative pace of the urban and rural fertility transitions is important in terms of the trend in the rural-urban ratio after its peak value. Three scenarios can be envisaged. From a strictly spatial diffusion perspective, the structural and behavioral changes can be expected to spread at the same pace within each sector. In the first case, involving a slowing down of the pace of fertility decline over the course of the transition, the rural-urban ratio should drop sharply immediately after reaching its peak. This pattern arises from the stronger drop in the initial phase of the lagged rural transition, when compared to the more muted decline in the more advanced phases attained in urban areas. By contrast, in the second case, involving an accelerating pace of fertility decline over time, the rural-urban ratio should continue increasing over a longer time period. The early drop in rural fertility would be inferior to that characteristic of the more advanced stages of the urban transition. However, the concentration and diversity of urban populations intensifies social interaction (Tabutin 2000). Structural transformations also tend to be faster in urban when compared to rural areas (Galloway et al. 1998). In this third case, the overall pace of rural fertility decline would thus be slower than the urban one. This should lead to the most pronounced increase in the rural-urban fertility ratio, long after the rural fertility transition has started.

To evaluate which of these scenarios apply, we plotted (see Figure 3) the average annual rates of fertility change over the course of the country- and sector-specific fertility transitions (with the rural and urban onsets of advanced decline again defined by the first cohorts with a fertility level below six children per woman). The estimates are based on linear spline regression models stratified by residence with country fixed effects. As in many rural and (to a lesser extent) urban areas, fertility started to decline from peak levels around or above seven children per woman, Figure 3 also shows the pace of decline for the 10 cohorts born before the country- and sector-specific onsets of advanced fertility decline.

In general, the average pace of fertility change is similar in urban and rural settings. It follows a U-shaped curve over the course of the respective transitions. Starting from an initial drop of about −0.075 child per woman and cohort, the pace accelerates to about −0.093 in the first 20 cohorts of advanced fertility decline. This is followed by a slowing down over the subsequent cohorts (to −0.030 in urban areas). Consequently, after rural fertility

FIGURE 3 Average annual pace of cohort fertility decline in urban and rural areas (full and dashed line, respectively) over the course of the sector-specific fertility transitions, cohorts 1896–1982 in 60 developing countries



SOURCES: WFS, DHS, MICS, IPUMS.
NOTES: PA = Panama, PY = Paraguay; the onset of the sector-specific transition corresponds to the first cohorts with total fertility below six children per woman.

starts to drop, the pace of decline is much faster in rural than in urban areas (given the median lag of 16 years between the sector-specific transition onsets). This explains the bulk of the decrease in the rural-urban fertility ratio from its peak level.

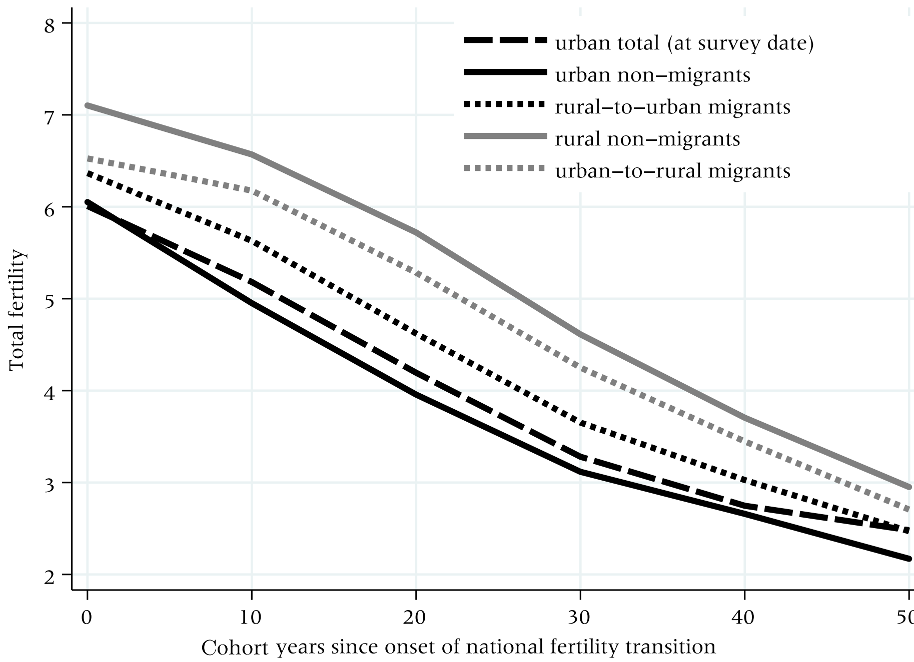
The sector-specific pace of fertility decline diverges significantly only in the initial and late stages of the transitions. While fertility remains above six children per woman, the average pace of decline is faster in rural than in urban areas of the full sample of countries (i.e. respectively –0.072 and –0.055 birth per cohort). Yet this difference is essentially due to the important pretransitional rises in urban fertility in Panama and Paraguay. If we exclude these two countries, the average pace of decline before the sector-specific transition onset is identical in urban and rural areas. However, 20 cohorts after the onsets of advanced fertility decline, the deceleration of the trend is less pronounced in rural than in urban areas. The pace of annual decline is respectively –0.052 and –0.026 births per cohort in the fourth decade of advanced decline. This sustains the reduction of the excess of rural over urban fertility in later stages of the fertility transition.

The role of rural-to-urban migration

We have focused so far on urban and rural cohort fertility trends, which are not disturbed by tempo effects of migration between the two areas. However, the results refer to women's residence at the survey dates and may not be representative for the urban and rural populations at childbearing ages. Migration flows redistribute populations with different fertility behaviors across sectors. Although rural-to-urban migrants are often selected from women with lower fertility preferences at origin, they have been socialized to the high fertility norm in the countryside. As the migrants integrate within the destination society, they adapt to the lower fertility standards in urban areas. This process of adaptation is generally completed only among the migrants' descendants, who have been socialized in cities (White et al. 2005; Goldstein and Goldstein 1981; Brockerhoff 1998). Conclusions about the role of structural and ideational change in urban fertility trends, as presented above, may thus be misleading because numerous in-migrants are included although they have been socialized in the countryside. In particular, the more pronounced slowing down of the advanced urban when compared to the rural fertility transition may be due to the in-migrants' higher level of childbearing. As a robustness test of our results, we therefore analyzed average trends in fertility by migrant status. We expected urban in-migrants to be characterized by fertility levels between the rural and urban standards and, thus, to decelerate the urban fertility decline.

We distinguished rural-to-urban and urban-to-rural migrants from those women who have been socialized (until age 12 or 15) in the same type of residence in which they have been interviewed—referred to hereafter as the non-migrants in urban or rural areas. To identify these subpopulations, we used the information about either the urban/rural status of the childhood place of residence as reported in the WFS and some DHS, or the status of the previous place of residence and the duration of residence in the current location, which are available in a number of DHS (see online Appendix). Although this information is self-reported, and thus subject to even larger biases than the urban/rural status of the current residence, it reflects women's perception of the environment of socialization, which is relevant for analyzing the diffusion of cohort fertility change. We estimated average fertility trends according to the type of residence and migrant status by linear spline regression with country fixed effects (Figure 4), based on 146 DHS and WFS with information on migration covering 55 countries. The country series are considerably shorter (with a median of 22 cohorts) and are more concentrated in the early and middle stages of the fertility transition, when compared to the full panel analyzed above, because only a limited number of recent DHS include information on migration. To evaluate the impact of in- and out-migrants on the urban fertility trends, we

FIGURE 4 Trends in cohort fertility among migrant and non-migrant women in urban and rural areas over the course of the national fertility transitions (onset = year 0), cohorts 1925–1978 in 60 developing countries



SOURCES: WFS and DHS with information on migration and/or the urban rural status of the previous or childhood place of residence.
NOTES: The onset of the transition corresponds to the calendar year in which the national-level TFR peaked, which was then back-translated by the mean age at birth to get a cohort indicator.

compared the developments among the non-migrants with those among the total population interviewed in urban areas.

The fertility levels of urban-to-rural migrants are more similar to those observed among the non-migrants at destination than at origin (i.e. considering the whole course of the transition, migrants' fertility is on average 7 percent below and 26 percent above the rural and urban standards, respectively). The fertility level of the more numerous rural-to-urban migrants, by contrast, is situated between the two non-migrants' estimates: we found that migrants had a 14 percent higher and a 16 percent lower fertility when compared, respectively, to the urban and rural standards. In-migration inflates the level of urban fertility, especially in the early and late stages of the urban fertility transition (by 5 percent and 14 percent respectively). The significance of migrants' childbearing in the first 10 transition cohorts is confirmed in a balanced panel, including 16 countries with data covering the onset until the 19th transition cohort (not shown). This early inflation of urban fertility levels arises from the widening fertility gap between urban in- and non-migrants and from the relatively low level of urbanization (i.e. in-migrants made up a larger share of the smaller city populations).

An even stronger impact of migration is observed when urban fertility is already low. While the declining trend levels off among the total urban population, it barely does so among those urban residents who have been socialized in cities. Migrants inflate urban fertility by 0.3 births per woman born at least 44 years after the transition onset. This result must be treated with caution, as only 10 countries contributed observations to this late transitional stage.

In summary, the indirect demographic effect of in-migrants (through their higher fertility) explains the deceleration of the urban fertility decline in the early and late stages of the transition. Consequently, migration tends to minimize the rise and to accentuate the subsequent drop in the rural-urban fertility ratio. Rural-to-urban migration thus constitutes an additional factor in the evolution of the fertility differential by residence over the course of the national fertility transition. Of course, its importance varies by country according to the intensity of rural-to-urban migration.

Discussion and conclusion

Evidence about the speed of urban fertility decline and its diffusion to the countryside is crucial for a better understanding of population change in developing countries. Based on multiple fertility surveys covering a large set of countries, we reassessed the trends in urban and rural fertility from a long-term and longitudinal perspective. While controlling for the international variation in the demographic and urbanization context, as well as in the definitions of urban areas, we tested the hypothesis of a curvilinear evolution in the fertility differential by residence and investigated the underlying dynamics in the urban and rural areas.

This descriptive analysis confirmed an inverted U-shaped evolution in the ratio of rural to urban fertility over the course of the national fertility transition. The initial rise in the rural-urban fertility ratio is explained by the earlier and sustained decline in urban fertility. The turning point is caused by the lagged onset of the transition in rural areas. The convergence of rural fertility toward the urban level is determined by three factors. First and foremost, the lag between the sector-specific transition onsets implies a more intense decline in rural fertility when compared to the muted drops in the more advanced phases of the transition in urban areas. Second, the rural-urban fertility ratio is further depressed by a more sustained fertility decline in the advanced stages of the transition in rural when compared to urban areas. Third, the higher intensity of childbearing among rural-to-urban migrants decelerates the urban fertility decline.

The results confirm the idea that the fertility transition is a consequence of a process of structural and ideational changes in society, which is intimately related to, and intensified by, population concentration. Not only did urban fertility start to decline earlier when compared to the rural trend in all countries, but the average urban level also remains inferior in the late transitional stages. This persistently higher fertility in rural areas has been noted in highly-developed countries, too (see Kulu 2013). We also found evidence consistent with the primary role that spatial diffusion theory attributes to the geographic spread of structural and ideational transformations for the fertility gradient by residence. The urban-rural lag in the transition onsets and the similar trajectories of fertility decline in the two residence areas indeed play a major role. Yet the similar (or even faster) pace of (the late) fertility decline in rural areas, as compared to urban, is surprising. It is at odds with the slower socioeconomic transformations and with a social context that is less conducive to the diffusion of new reproductive behavior within rural than urban areas. The rural pace of decline may be speeded up by social interaction with the more advanced urban society. Rural-to-urban migrants who gradually adapt to the urban fertility standards and stay in contact with their societies of origin may be instrumental in this regard. More research is needed to better understand how the urban and rural fertility transitions are interlinked, how the patterns vary between countries, and what socioeconomic factors are associated with these differences.

The results of this study help to think about future fertility trajectories in high fertility countries, which are predominantly located in sub-Saharan Africa. Future trends at the national level will depend on the time lag until birth-limiting behaviors are widely diffused from cities to the countryside (and on structural effects related to the share of national populations living in either type of area). More efforts should be invested in strengthening rural-urban interactions and family planning programs in rural areas. This study also has implications for our understanding of urban demography. As urban fertility continues its decline, especially among the population which has been socialized in cities, the direct and indirect demographic effects of migration in the urban growth process will increase (Lerch 2014). This can be expected in Asia and sub-Saharan Africa, where only half or less of the national populations is so far living in cities. In the very low urban fertility contexts of China and southeast Asia, net rural-to-urban migration has already become the main component of recent urban growth and postponed the onset of advanced population aging in cities (Hugo 2014; Zheng and Yang 2016). In sub-Saharan Africa, persistently high levels of fertility will further exacerbate the demographic pressure for large scale rural-to-urban (and international) migration in the future.

The observed pattern of the rural-urban fertility dynamics in developing countries is consistent with classic demographic theory. Yet the underlying data suffer from a number of limitations. We avoided the (unobserved) biases attributable to the lack of information on, and international comparability of, urban definitions by estimating average within-country fertility trends. A rigorous cross-country comparison, however, must rely on an internationally standardized urban definition. To enable its implementation, survey data could be enriched with information on the density and socioeconomic structure of the population, as well as on the availability of services, in the respondents' survey cluster. The urban-rural definition should at least be clearly stated in the survey documentation. Moreover, information on migration is not available in a large number of surveys and the existing information is not standardized. Montgomery et al. (2003) recommend the systematic (re-)introduction of two questions: the previous residence location and the duration of residence in the current location. This would ensure an adequate retrospective allocation of births and populations by urban and rural area and allow the estimation of migration flows, thereby facilitating period-specific analyses. This would improve the evidence base for a better understanding of (urban) population change in the context of low fertility that characterizes an increasing number of developing countries.

Notes

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1 (Truncated) cohort fertility could also be estimated based on age-specific birth rates relying on information in the birth histories. As the quality of the reporting of birth events in the period immediately preceding the surveys is problematic in several countries (Schoumaker 2014), we decided to rely primarily on parity data.

2 We computed the rural-urban ratio, rather than the difference, because it provides us with a standardized measure of the fertility differential over the course of the fertility transition. Results based on the rural-urban differences are qualitatively the same, although the differentials shrink to a larger extent in later stages of the fertility transitions (not shown).

3 The balanced panel includes the following countries: Bolivia, Brazil, Colombia, Dominican Republic, Ecuador, Egypt, Ghana, Indonesia, Jordan, Kenya, Lesotho, Madagascar, Mexico, Nepal, Panama, Paraguay, Peru, Philippines, Thailand, Tunisia, Vietnam, Zimbabwe. Although the trends in the excess of rural over urban fertility were similar by major world regions, the peak value differed. Latin America and the Caribbean and sub-Saharan Africa reached the highest peak rural-urban fertility ratio, followed by the Middle East and Northern Africa. The evolution in the rural-urban fertility differential was the flattest in Asia.

4 Cambodia, Guatemala, Guyana, Honduras, India, Mozambique, Nicaragua, Swaziland, Tanzania, and South Africa.

5 Regional differences are indeed pronounced: the median lags are shorter in Asia and, to a lesser extent, the Middle East and Northern Africa, and the longest in sub-Saharan Africa.

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