Identifying fertility stalls by place of residence in sub-Saharan Africa

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Preliminary version

1 INTRODUCTION

Fertility transition in sub-Saharan Africa (SSA) is different from other low- and middle-income countries. To begin, it started later than other regions (Bongaarts 2017). While in Latin America and Asia the decline began in the mid-1960s, in SSA it did not begin until the late 1980s. Also, the decrease in fertility rates occurred at a slower pace. By 2010, Asia and Latin America had almost reached the replacement rate, while in SSA fertility was still around 5 children per woman (Bongaarts and Casterline 2013). Moreover, traditional theories on fertility transition recognize an inverse relationship between socioeconomic indicators and fertility (Bryant 2007). In the case of SSA, regarding the level of development at the time, the transition started earlier than in the other regions (Bongaarts 2017).

The first signs of the slowdown in fertility rates in Africa were noted in the early 2000s. Furthermore, not only that fertility decreased slightly but in several cases it even stagnated. The first documented cases were those of Ghana and Kenya, where the decline in the fertility rate was observed to have stopped at 4.7 children per woman (Bongaarts 2006, Westoff and Cross 2006). After this research, studies in about 20 countries classified them under the fertility stall category at some point over time (e.g., Bongaarts 2008; Shapiro and Gebreselassie 2008; Garenne 2009, 2011; Ezeh, Mberu, and Emina 2009; Machiyama 2010; Kebede, Goujon, and Lutz 2019; Schoumaker 2019). Recent literature shows that fertility stalls in SSA are not as widespread as thought, but they are not as exceptional either (Schoumaker 2019).

Fertility stalls in SSA are of particular interest given the implications for the development of the region. However, research has mainly focused at the national level while the transition in urban and rural areas have received little attention (Shapiro and Tambashe 2002; Garenne 2011). In a stylized description of fertility transitions, fertility is expected to decline fairly smoothly and reach replacement level, first in urban areas –especially in the capital cities–, and later in rural areas (Shapiro and Tambashe 2002). Nevertheless, almost 20 years ago, there were

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already signs of a slowdown in the decline of fertility rates in urban areas in SSA (Shapiro and Tambashe 2002), suggesting that SSA could be an exception to this pattern.

In terms of urban demography, as fertility declines the direct and indirect demographic effects of migration in the urban growth process will increase (Lerch 2014); therefore, a potential increase in fertility could be expected since fertility rates in rural areas are higher than in urban areas (Bocquier and Schoumaker 2018). Moreover, the particular case of SSA of having the most part of population living in the rural areas and high levels of fertility could exacerbate the increase of the rural-to-urban migration (Lerch 2019). In other words, fertility stalls in SSA urban areas could be due to the higher fertility of immigrants, as such stalls were not found when fertility trends were estimated excluding migrants (Lerch 2017). However, this may not necessarily apply to capital cities.

Capital cities have usually been at the forefront of fertility transitions. Reasons for earlier declines and lower fertility in capital cities, compared to other urban and rural areas, include better education, higher costs of children, lower child mortality, better availability of family planning services, or diffusion effects (Lerch 2017). In SSA, very low fertility rates have been found in capital cities such as Addis Ababa (Kinfu 2000) and Accra (Blanc and Gray 2002), and fertility is lower in capital cities than in other urban areas and rural areas in most SSA countries. Capital cities are expected to pave the way for fertility transitions, and by the end of the fertility transition fertility should be similar in capital cities, urban and rural areas.

In this paper, we focus on fertility trends by place of residence in SSA. Trends are compared between capital cities or the largest city, other urban areas, and rural areas since we are interested in going beyond the rural-urban dichotomy (Corker 2017). Cities are expected to be leaders in fertility trends, indicating possible future trends for other urban areas and rural areas. We first reconstruct fertility trends by place of residence, in order to identify slowdowns in fertility declines. Next, we analyze if immigration has an effect on fertility in capital cities.

2 DATA AND METHODS

Our goal is to analyze how fertility of SSA countries has changed over the last 40 years in capital cities, urban areas, and rural areas. Also, we focus on capital cities to determine how many, where, when, and at what levels fertility has been stalling. For our purpose, we use 125 Demographic and Health Surveys (DHS surveys) from 33 SSA countries. These surveys allow distinguishing the three categories of place of residence: (1) Capital city or largest city (e.g., Lagos in Nigeria or Abidjan in Côte d'Ivoire) (see list in the appendix Table **A1**), (2) other urban areas, and (3) rural areas. Urban and rural areas are defined using country-specific criteria. In many surveys, two or more variables need to be combined to create these three categories. While it is possible in a few countries to use more detailed classification, this 3-category definition is the only that allows comparisons over time in most countries.

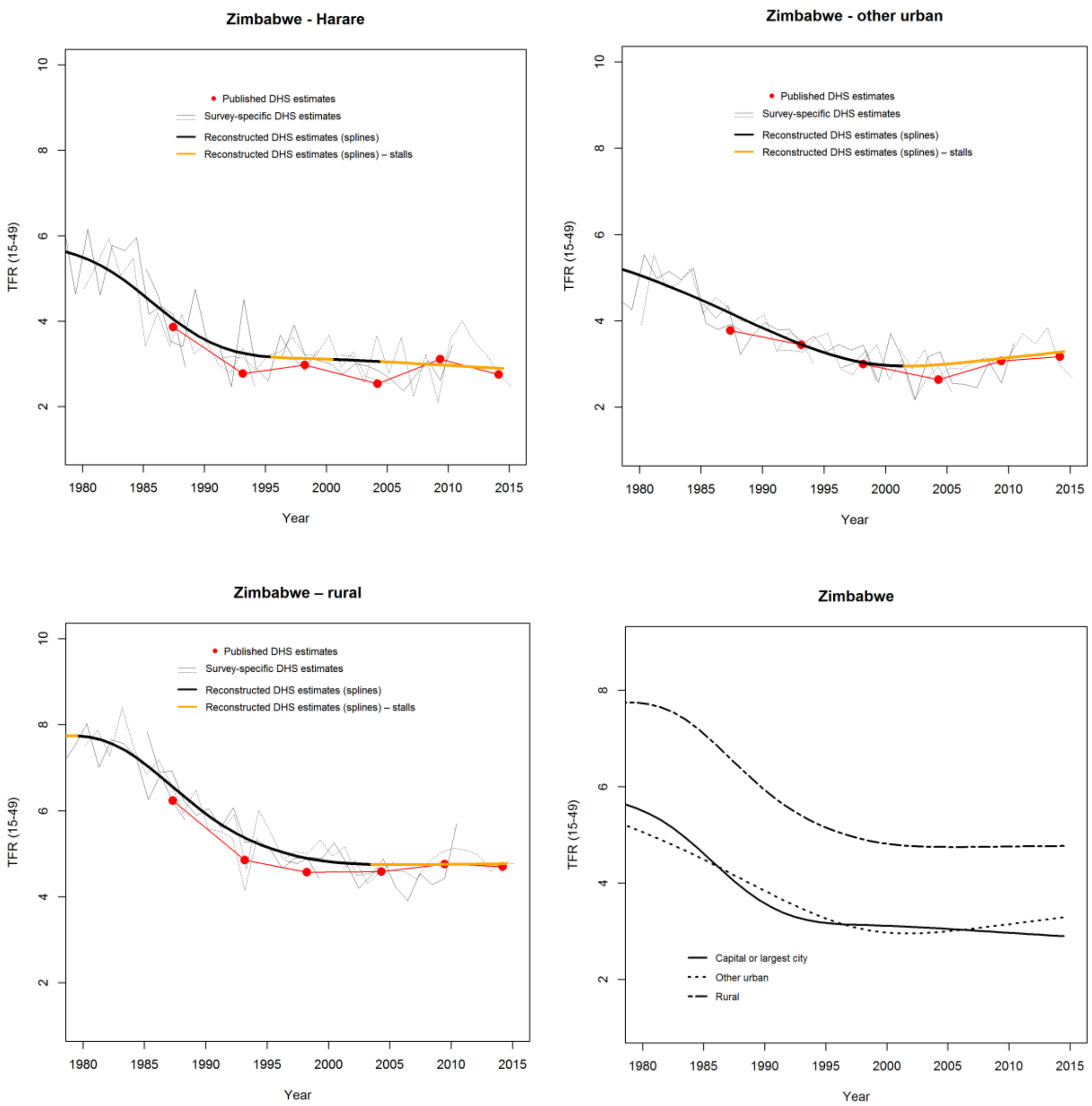
Fertility is reconstructed by place of residence in each of the 33 countries. In most of these countries, at least two surveys are available, and in some countries (e.g., Ghana or Kenya) up to 6 surveys are used. The method relies on creating tables of births and exposure by 5-year age groups and by single calendar year using the birth history data in each survey. When several surveys are available in the same country, these tables are appended. Fertility rates are estimated with Poisson regression, with age and time periods included as independent variables (Schoumaker 2013a). The age pattern of fertility is considered to be constant for each survey. This is done by computing a pattern of proportional age-specific fertility rates for each survey; the pattern is multiplied by exposure and controlled for in the offset. Total fertility rates are smoothed by using restricted cubic splines (Schoumaker 2013b, 2014). This method provides an average TFR estimate based on data from all the surveys combined. With this method, total fertility rate can be reconstructed over the last 15 years with a single survey; in countries such as Ghana, with six surveys, total fertility rates can be reconstructed over almost 40 years.

Besides the estimates by country, fertility is also reconstructed by place of residence between 1980 and 2018 for SSA as a whole. This is done by pooling all the surveys together and including a random effect at the country-level in the Poisson model. A survey-specific age pattern of fertility is used. The data are weighted using the population of the capitals, other urban areas or rural areas. These population are obtained from the United Nations World Urbanization Prospects (DESA 2018).

In addition, the impact of migration to capital cities on these trends is also assessed by computing trends for different subpopulations. The comparison of fertility trends is made for four groups. The first includes the fertility of people living in the city (FPLC), including births before migration. The second, the fertility in the city (FC), which only includes births and exposure occurring in the city. The third refers to the fertility of non-migrants and migrants from city (FLRC). This group includes, on the one hand, non-migrants and people who lived in a city before and, on the other hand, data on the place of previous residence. For the last group we compute fertility of people born in the city (FBC), which means non-migrants only and data people who always lived in the city.

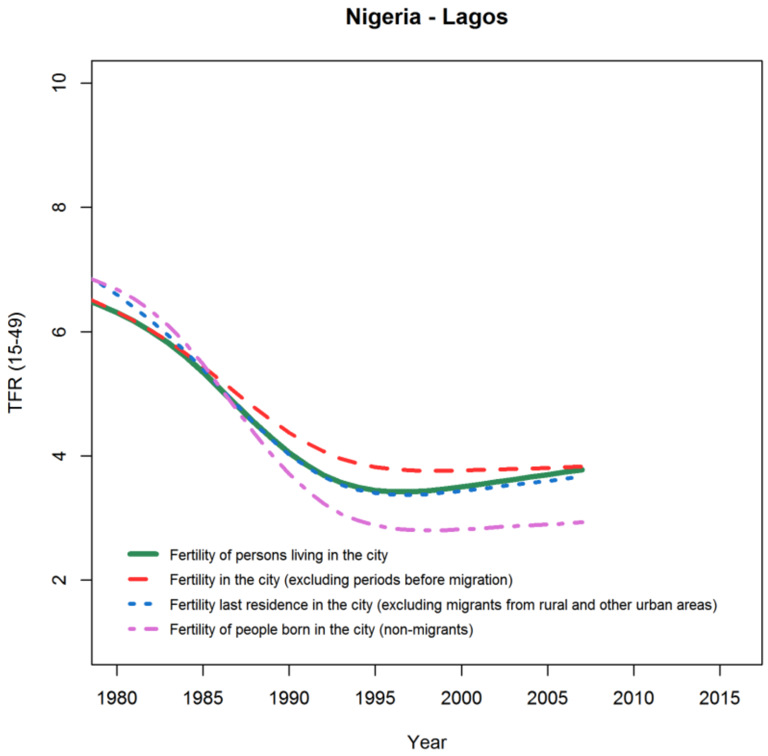
Following the explanation given above, Figure **1** illustrates the reconstruction of fertility trends in Harare, other urban areas, and rural areas from Zimbabwe. It shows the good consistency of estimates across surveys, as well as the stalling fertility, in this particular case, at around 3 children in the capital city and other urban area and over 4 in the rural area. The same procedure is repeated for the 33 countries included in the sample, in order to summarize them individually as in the last table in Figure **1**.

Figure 1. Reconstructed fertility trends in Zimbabwe by place of residence from 6 Demographic and Health Surveys



Regarding migration, Figure **2** shows fertility trends in Lagos, Nigeria, for different subpopulations using information on migration status and timing. From this analysis, it is possible to confirm if there are fertility stalls occurring also among non-migrants. In this particular case, fertility stalls exist despite migration. Stagnation persists even when we reconstruct the fertility trend for the born-in-the-city population only.

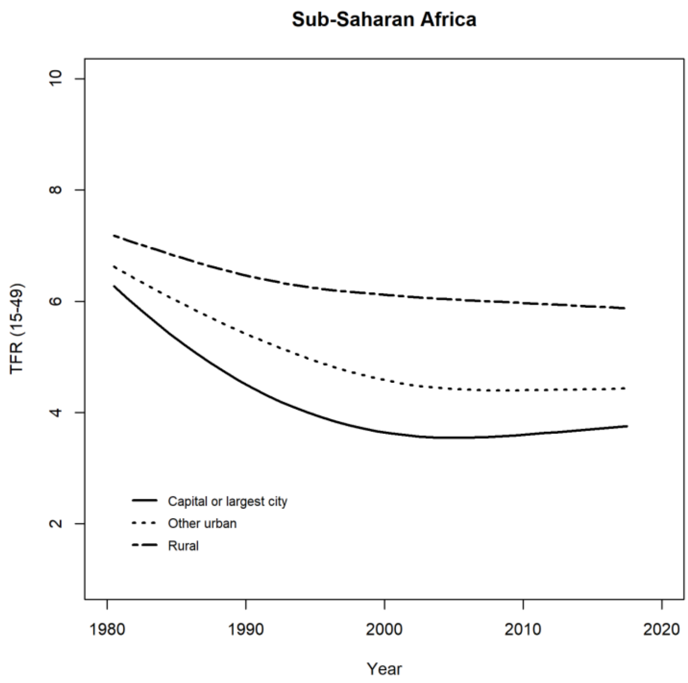
Figure 2. Reconstructed fertility trends in Lagos, Nigeria, from 4 Demographic and Health Surveys, for different sub-populations.



3 RESULTS

The fertility stall is clear in capital cities of SSA. Figure **3** shows fertility trends by place of residence for SSA as a whole. To illustrate the fit of the restricted cubic splines to the data, both smoothed fertility trends and data by single calendar year are shown. While fertility decreased by about 40% in capital cities between 1980 and the early 2000s, fertility decline has considerably slowed down in capital cities of SSA over the last fifteen years. Since the early 2000s, it has decreased by only 0.15 children, almost 10 times more slowly than in the previous two decades. As fertility approaches the replacement level, the decline in fertility is expected to slow down. However, fertility in the capital cities of SSA has stalled, on average, at 3.4 children per woman, which means that it is still not close to replacement level.

Figure 3. Trends in total fertility rate in sub-Saharan Africa by place of residence, 1980-2018.



Regarding the other urban areas, the speed with which fertility has declined since the 1980s is quite similar to that of capital cities. Nevertheless, the slowdown started a little later than in the capital cities of SSA, roughly since 2005. Fertility declined from 6.9 children per woman in the 1980s to 4.5 children in the 2000s. Between the 2000 and 2005, fertility fell by 0.3 children, from which it has remained stagnated. Again, the decrease in fertility can be expected to slow down as it approaches the replacement level; however, in this case it has stalled at double. In contrast, fertility has slowly but continuously decreased in rural areas. In the 1980s, fertility in rural areas of SSA was 7.5 children per woman. Currently, it is approaching 6 children.

Appendix Figure **A1** shows reconstructed fertility trends by place of residence in 33 countries. In virtually all sub-Saharan African countries, fertility starts declining in capital cities, followed by other urban areas, and it finally decreases in rural areas, if it decreases at all. As a result, fertility in SSA capitals is almost always lower than in both, other urban and rural areas. Since the 1980s, fertility has been lower, on average, in capital cities, and the decline has been overall faster in capitals than in rural areas and, to a lesser extent, than in other urban areas.

However, a striking feature of fertility declines by place of residence is the widespread stagnation of the TFR in capital cities. In almost two-thirds of the capital cities (20 out of 33) fertility has been stalling in recent years (see Table **1**). In contrast, recent stalls in rural areas are only found in two countries, Zimbabwe and Namibia. Stalls in SSA are thus mainly an urban phenomenon. Stalls are found in cities from all parts of SSA, and in countries at very different stages of the fertility transitions and with different levels of development. In Western Africa, the large majority of capitals have experienced fertility stalls, including in cities at the forefront of the fertility transitions, like Accra, and in very large cities, such as Lagos. Fertility may stall at high levels, as in Bamako and Niamey, or at lower levels, as in Accra. In many of these capitals, stalls started in the mid-1990s and in the early 2000s. Burkina Faso, Côte d'Ivoire, and Liberia are the only countries not experiencing stagnation in any of the areas.

Table 1: List of countries and stalls by place of residence

	Capital	**Other urban**	**Rural**
Western Africa			
Benin	X	-	-
Burkina Faso	-	-	-
Côte d'Ivoire	-	-	-
Burundi	X	X	-
Gambia	X	-	-
Ghana	X	X	-
Liberia	-	-	-
Guinea	X	-	-
Mali	X	-	-
Niger	X	-	-
Nigeria	X	-	-
Senegal	X	X	-
Togo	X	X	-
Central Africa			
Central African Republic	-	-	-
DR Congo	X	-	-
Congo	X	X	-
Cameroon	X	-	-
Chad	-	-	-
Gabon	X	X	-
Eastern Africa			
Comoros	-	-	-
Ethiopia	End	-	-
Kenya	X	X	-
Madagascar	-	-	-
Mozambique	-	-	-
Malawi	-	-	-
Rwanda	-	-	-
Tanzania	X	-	-
Uganda	X	-	-
Zambia	X	-	-
Zimbabwe	X	X	X
Southern Africa			
Lesotho	End	End	-
Namibia	X	X	X
South Africa	-	-	-
Number of stalls	**20**	**9**	**2**

Regarding Central Africa, with the exception of Bangui and Ndjamena, all capital cities have experienced fertility stalls since the early 2000s. Furthermore, all of them have stagnated around 4 children per woman. In the case of Congo and Gabon, they also present fertility stalls in other urban areas. There has not been stalls at all only in Central African Republic and Chad. In contrast, there has been fertility stalls in less than half of the capital cities of Eastern African countries. Moreover, in Addis Ababa the period of stagnation has ended and fertility is starting to decline again. The characteristics at plateauing varies among cities. Nairobi and Harare has been stalling since the 1990s at 3 children per woman. On the other hand, Dar es Salam, Lusaka, and Kampala since the early 2000s at 4 children. Kenya and Zimbabwe are the only countries experiencing stalls in other urban areas. As for Southern Africa, in Lesotho the period of stagnation has ended in Maseru and in other urban areas. In Namibia, Windhoek, other urban areas, and rural areas have stalls since 2005. Finally, there are no signs of recent fertility stagnation in any area of South Africa.

Urbanization consist in internal migration from rural to urban areas, mainly to capital cities. Capital cities usually account for more than 30 or 40% of a country's population. First, women coming from rural areas, mostly having higher rates of fertility, could increase the fertility in the capital cities. Later, as the result of more education, access to contraceptives, and exposure to family planning programs, fertility declines. We compare fertility trends in capital cities with and without migrants. We use women born in the city as the reference group for non-migrants. Unfortunately, not all surveys include data on migration, so it is not possible to compare the same time periods in all cases. However, there are sufficient numbers of surveys with data on migration, and covering roughly the same period as the other surveys. Results by country are shown in Annex Figure **A2**.

Black dashed lines in Figure **A2** show non-migrant fertility trends in the capital cities. In most cases, non-migrant fertility is below total fertility. The exception are Freetown and Dar es Salam. There are cities, such as Lilongwe, Conakry, or Lagos, where fertility was higher among non-migrant women, mainly during the 1990s. Currently, their fertility is lower than the city average. In all cases, migration explains the level of fertility, but not the trend. In other words, migrations does not account for fertility stalls.

4 DISCUSSION

This is the first article reconstructing fertility trends in SSA by place of residence from the 1980s. We show that, on average, fertility has been stalling in African urban areas, especially capital cities, for 15-20 years. While fertility has continued decreasing in some capital cities, it has stalled in two thirds of them, often at levels well above 3 children. These stalls should be connected to fertility preferences since the demand for children in SSA remains at high levels (Casterline and Agyei-Mensah 2017). Therefore, the stalls in capital cities seem, at last partly, to result from a high demand for children that has not changed in recent years. These trends suggest fertility changes in urban areas in the coming years will be limited, unless fertility preferences decrease quickly and are accompanied by a rapid uptake of contraception. Future trends will depend mostly in birth-limiting behaviors.

Low urbanization in SSA masks fertility stalls in capital cities. For instance, in countries such as Benin, Ghana, Senegal, or Uganda, evidence does not support the existence of fertility stalls (Schoumaker 2019); however, their capital cities show plateauing over time. Also, in Gabon, Nigeria, and Tanzania, there only is moderate evidence of stagnation; nevertheless, our results confirm it in their capital cities. In this regard, it is necessary to look at the territorial level to observe the real dynamics of fertility transition.

Since capital cities have mainly experimented the slowdown in the decline of fertility rates, fertility could be expected to grow rapidly in urban areas in SSA in the forthcoming years. On the other hand, although fertility rates have decreased in rural areas, they still remain at high levels. Therefore, trends at the national level will be subject to how quickly the desire for fewer children spreads from urban to rural areas. Strengthening rural-urban interactions and family planning programs in rural areas could help to modify fertility preferences (Lerch 2019).

Fertility estimates in urban areas show that fertility stalls are not necessarily happening after excluding migrants (Lerch 2017). However, most capital cities are different. Our results confirm the plateauing even when fertility rates are only estimated for people born in the city. Since capital cities are expected to lead the path in fertility transitions, it could be expected to be slower and longer in SSA than in other non-African countries.

Further research is needed in order to understand the determinants of stalls in capital cities; for example, fertility preferences (i.e., desired number of children, wanted fertility), the demographic mechanisms (i.e., proximate determinants), or socioeconomic conditions (i.e., education, wealth, infant and child mortality). In this regard, the decrease in child mortality and increasing education (Kebede, Goujon, and Lutz 2019) could predict the decline in fertility; however, since the case of SSA has been proved to be different than other regions, there are no clear clues as to how long the stalls will last.

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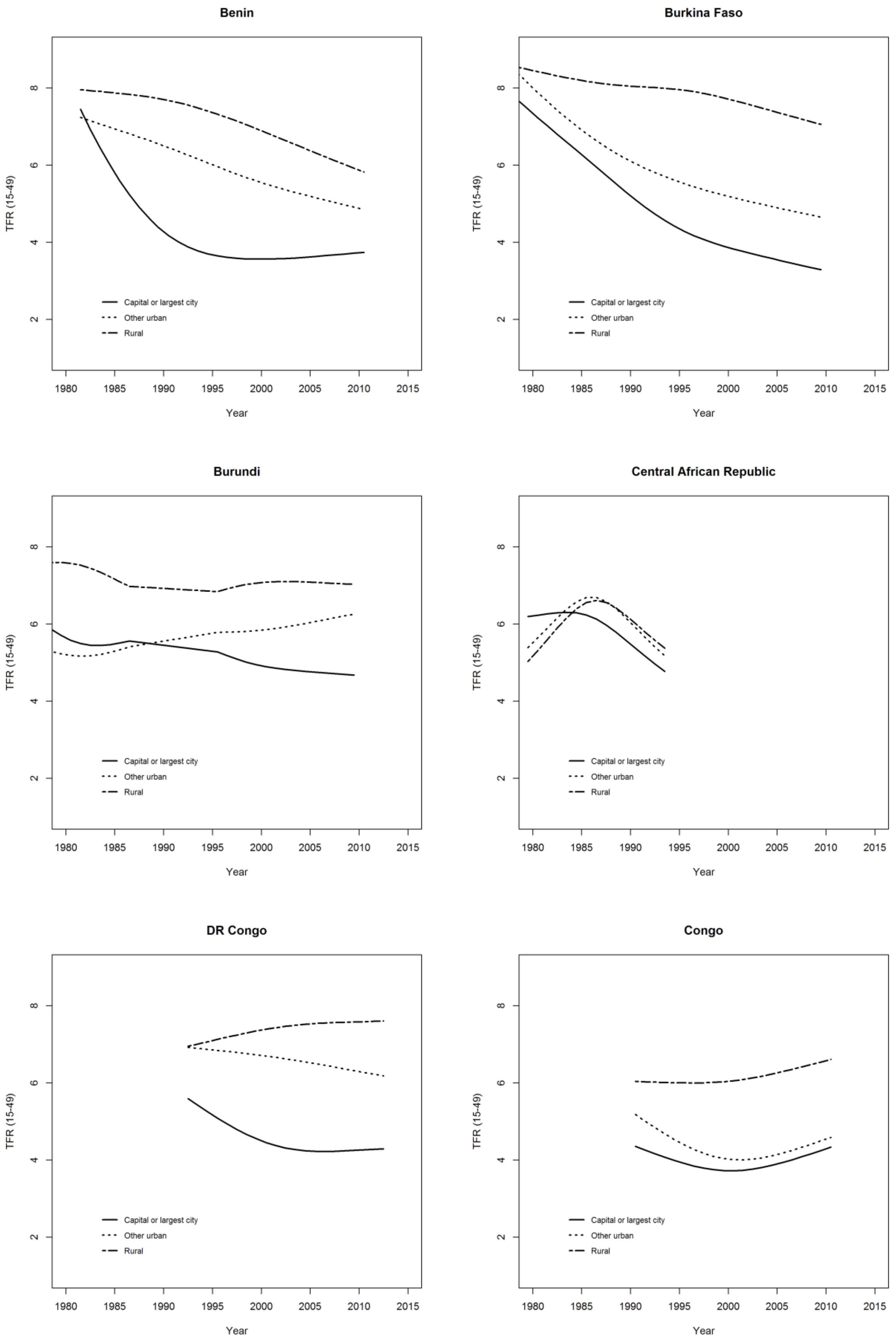
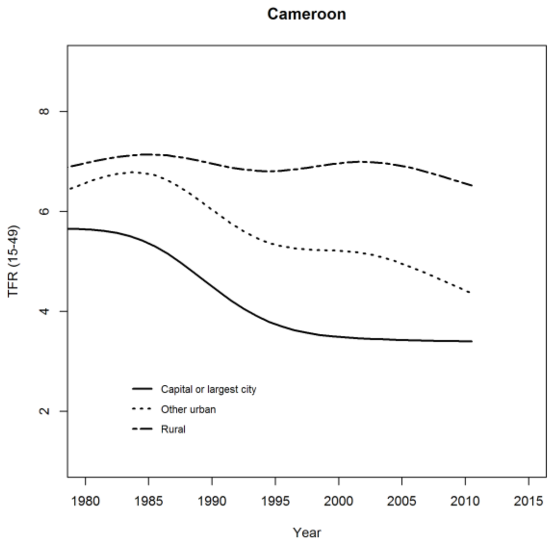
APPENDIX

Table A1: List of countries and capitals or largest city included in the sample

Country	Capital or largest city
Benin	Cotonou
Burkina Faso	Ouagadougou
Burundi	Bujumbura
DR Congo	Kinshasa
Central African Republic	Bangui
Chad	Ndjamena
Congo	Brazzaville
Cote d'Ivoire	Abidjan
Cameroon	Yaounde-Douala
Ethiopia	Addis Ababa
Gabon	Libreville-Port Gentil
Ghana	Accra
Gambia	Banjul
Guinea	Conakry
Kenya	Nairobi
Liberia	Monrovia
Lesotho	Maseru
Madagascar	Antananarive
Mali	Bamako
Malawi	Lilongwe
Mozambique	Maputo
Niger	Niamey
Nigeria	Lagos
Namibia	Windhoek
Rwanda	Kigali
Senegal	Dakar
Sierra Leone	Freetown
Togo	Lomé
Tanzania	Dar es Salam
Uganda	Kampala
South Africa	Johannesburg
Zambia	Lusaka
Zimbabwe	Harare

Figure A1: Trends in total fertility rate in 33 sub-Saharan African countries by place of residence




Cameroon
TFR (15-49)
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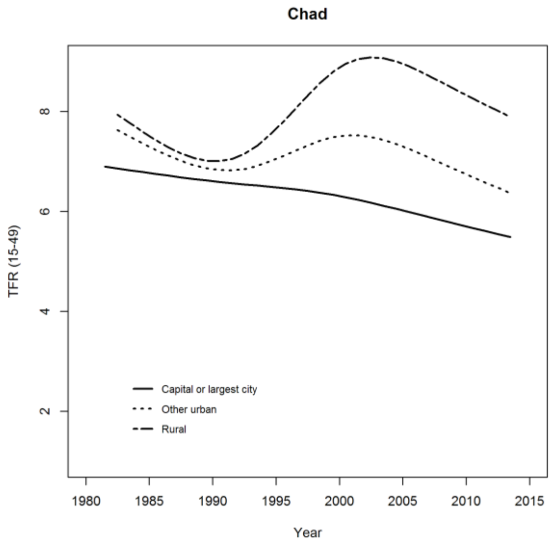
Year
Capital or largest city
Other urban
Rural


Chad
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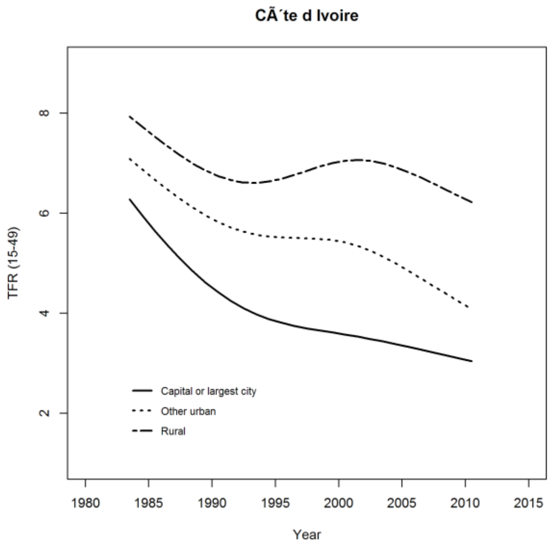
CÃ´te d Ivoire
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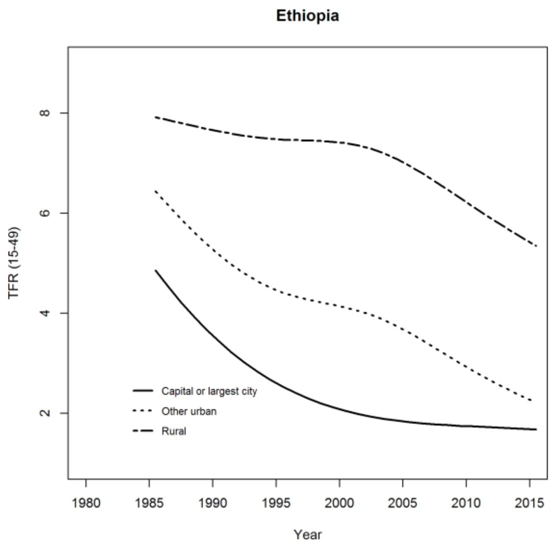
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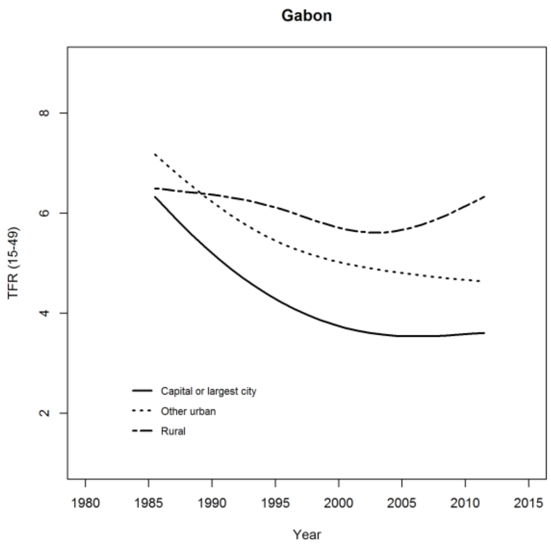
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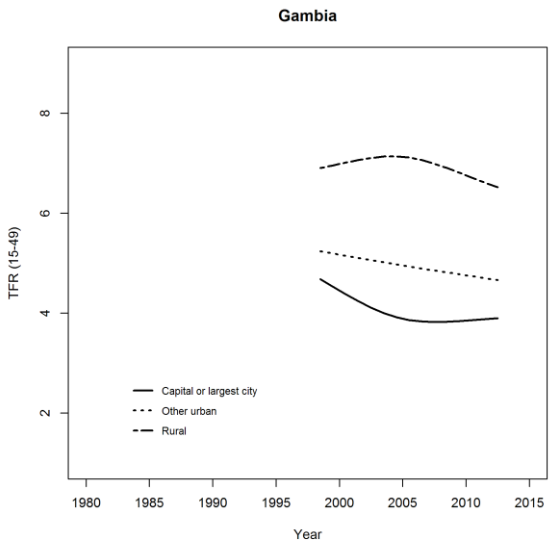
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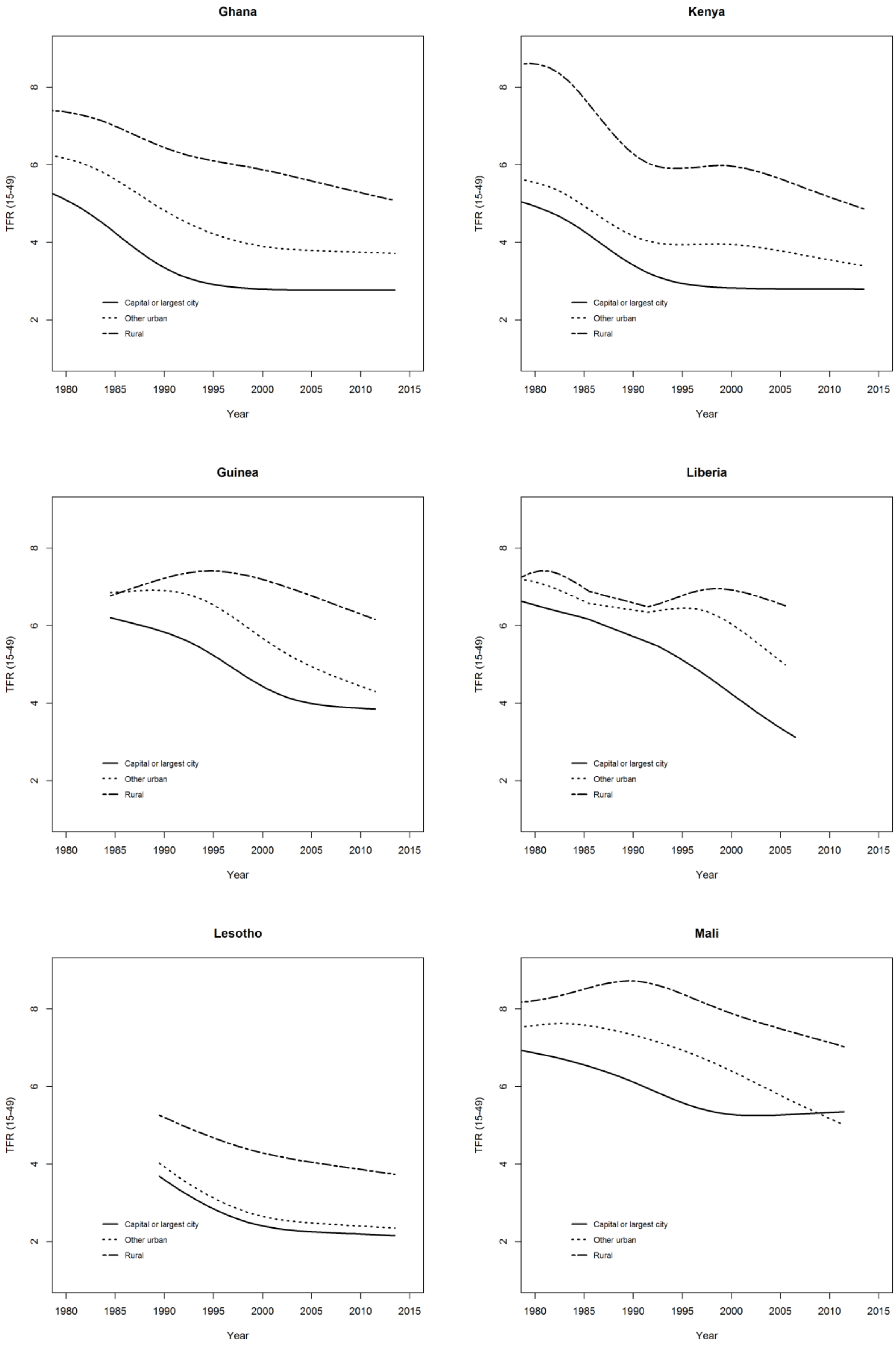
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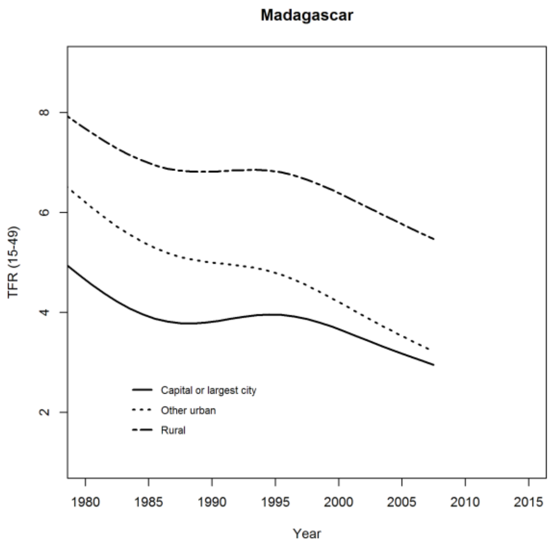
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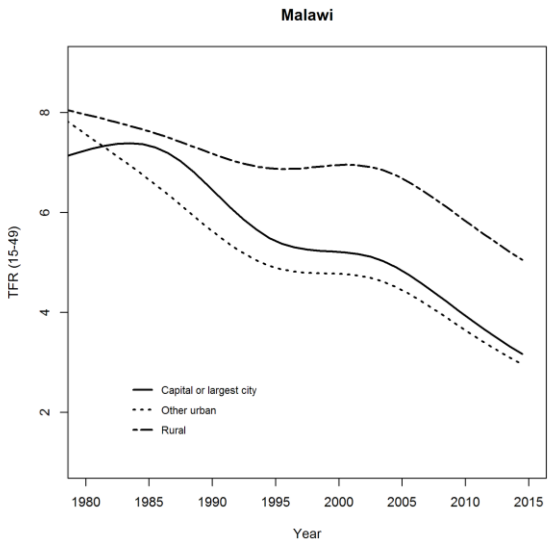
Other urban
Rural


Malawi
TFR (15-49)
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1980
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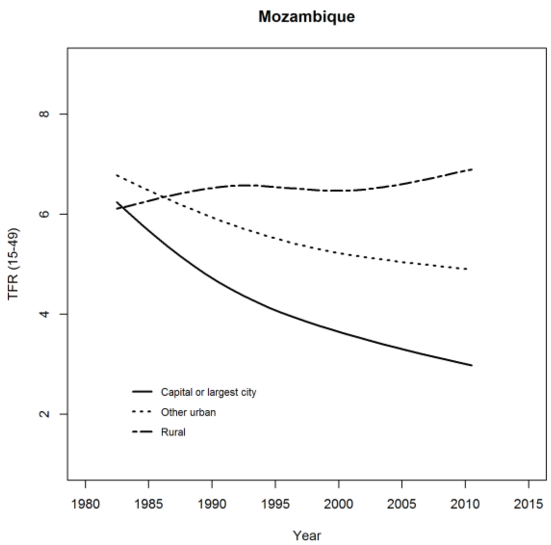
2010
2015
Year
Capital or largest city
Other urban
Rural


Mozambique
TFR (15-49)
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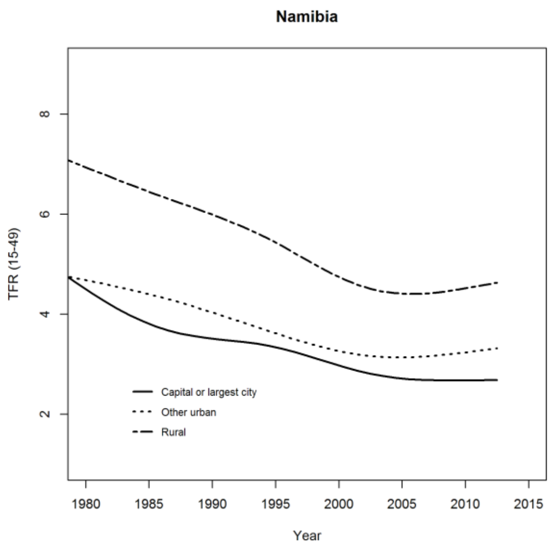
Year
Capital or largest city
Other urban
Rural


Namibia
TFR (15-49)
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1980
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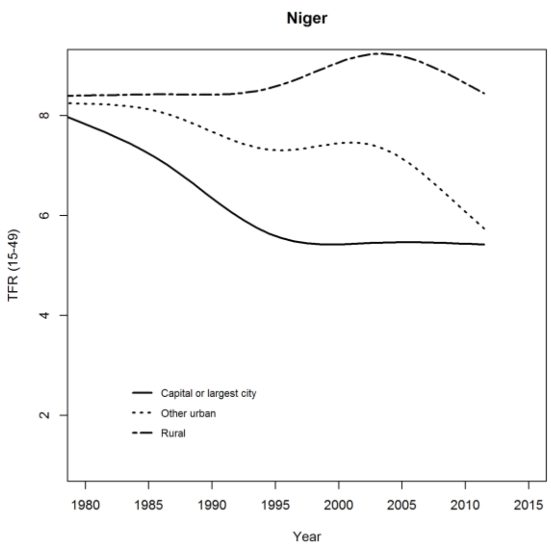
Year
Capital or largest city
Other urban
Rural


Niger
TFR (15-49)
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1980
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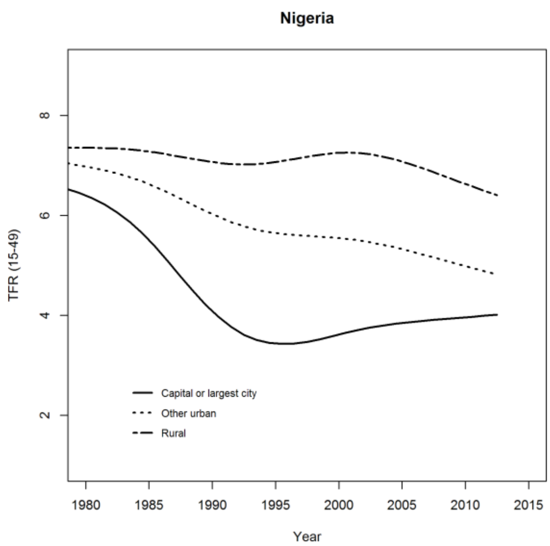
Year
Capital or largest city
Other urban
Rural


Nigeria
TFR (15-49)
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1980
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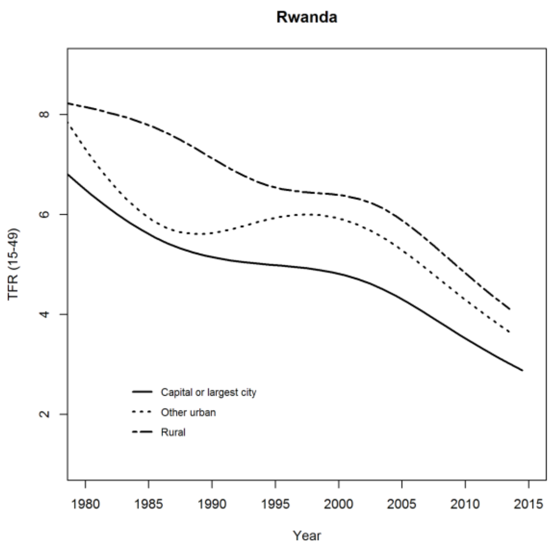
2015
Year
Capital or largest city
Other urban
Rural


Rwanda
TFR (15-49)
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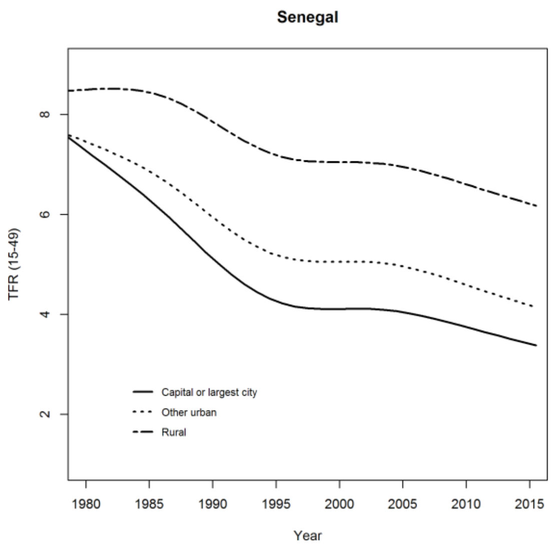
2015
Year
Capital or largest city
Other urban
Rural


Senegal
TFR (15-49)
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1980
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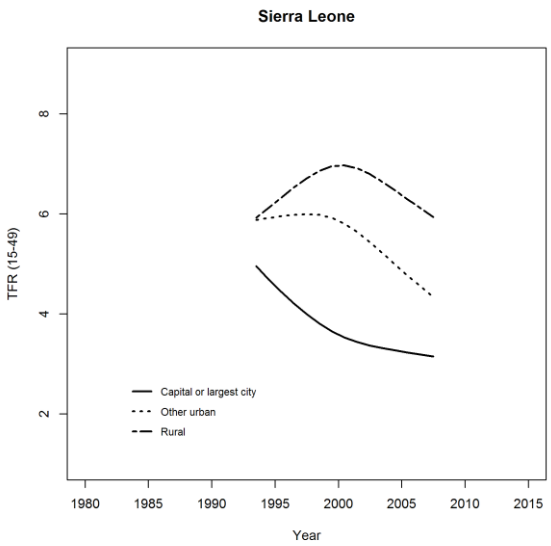
2015
Year
Capital or largest city
Other urban
Rural


Sierra Leone
TFR (15-49)
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1980
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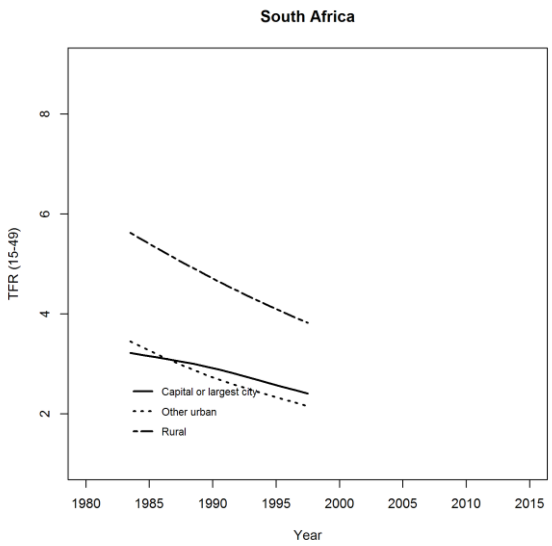
2015
Year
Capital or largest city
Other urban
Rural


South Africa
TFR (15-49)
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1980
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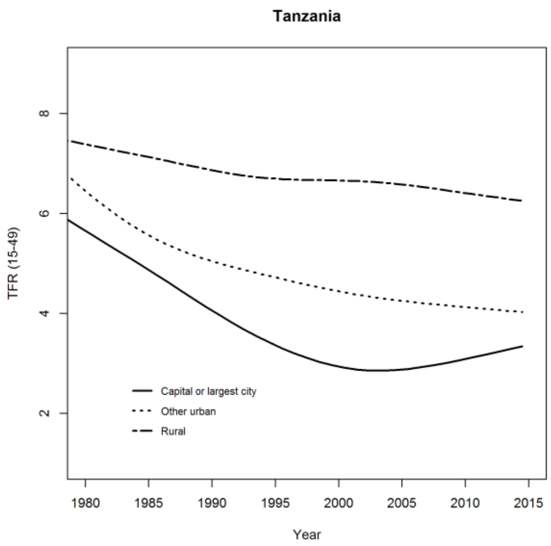
2015
Year
Capital or largest city
Other urban
Rural


Tanzania
TFR (15-49)
2
4
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1980
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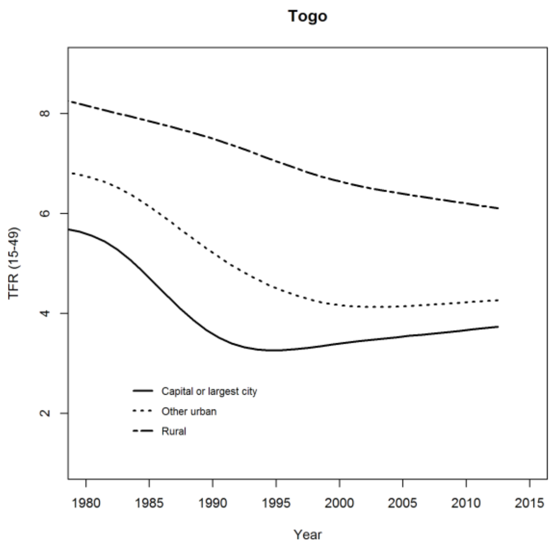
2015
Year
Capital or largest city
Other urban
Rural


Togo
TFR (15-49)
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1980
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1990
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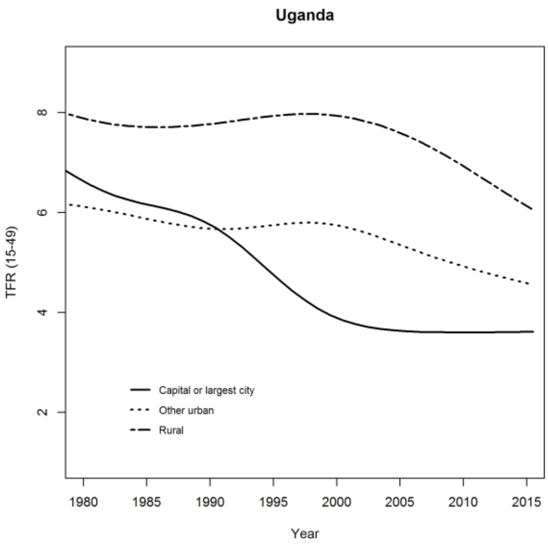
2015
Year
Capital or largest city
Other urban
Rural


Uganda
TFR (15-49)
2
4
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1980
1985
1990
1995
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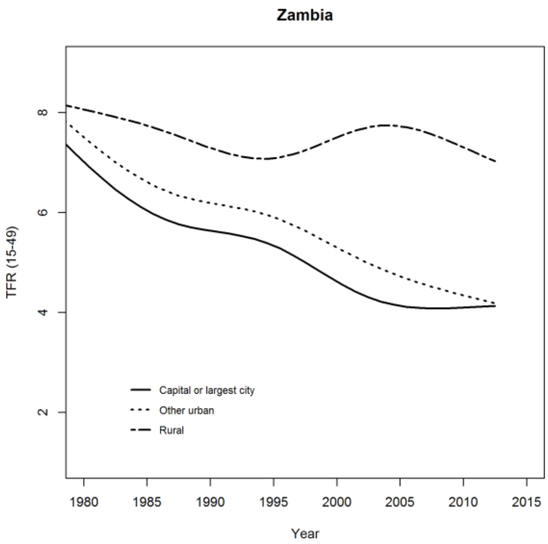
2010
2015
Year
Capital or largest city
Other urban
Rural


Zambia
TFR (15-49)
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1980
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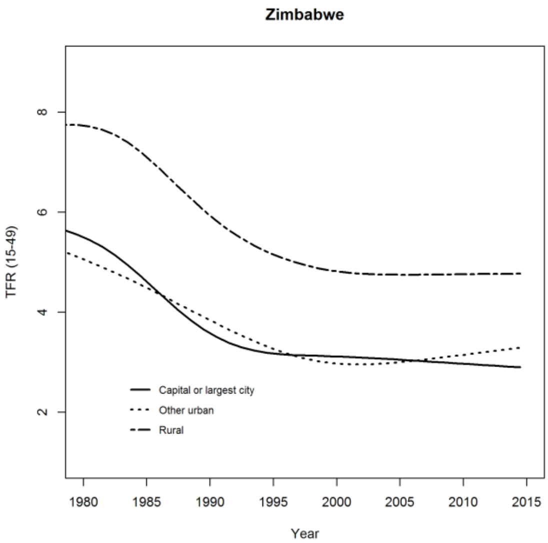
2005
2010
2015
Year
Capital or largest city
Other urban
Rural


Zimbabwe
TFR (15-49)
2
4
6
8
1980
1985
1990
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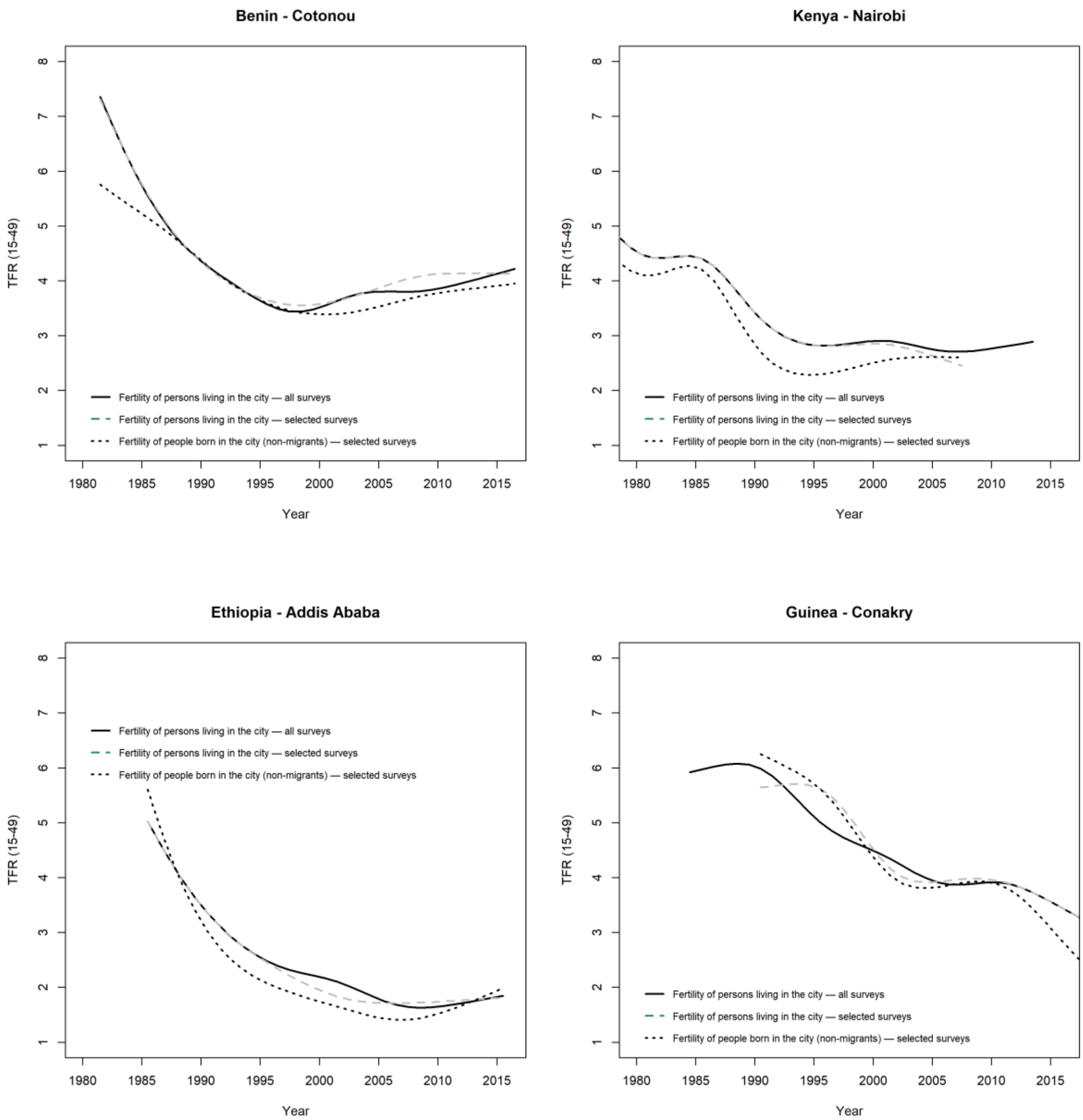
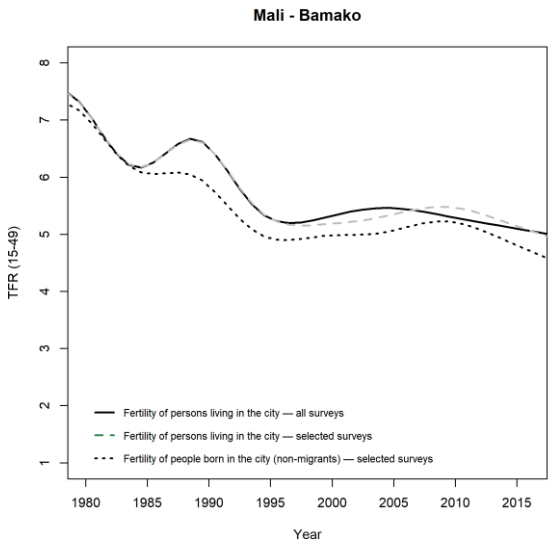
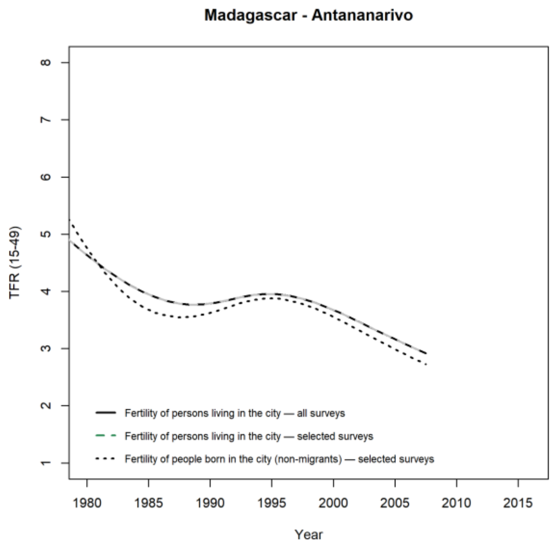
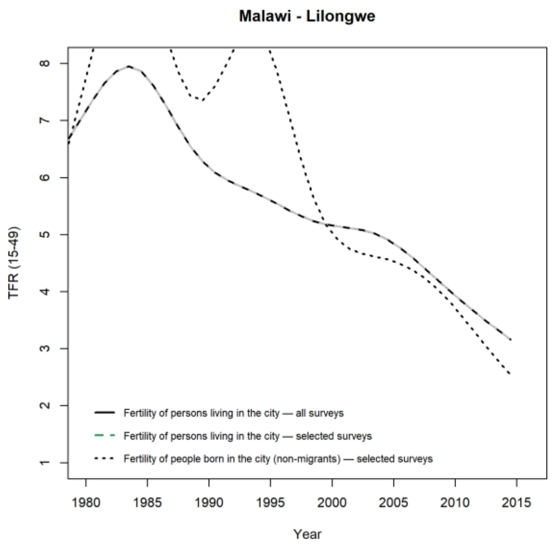
2010
2015
Year
Capital or largest city
Other urban
Rural

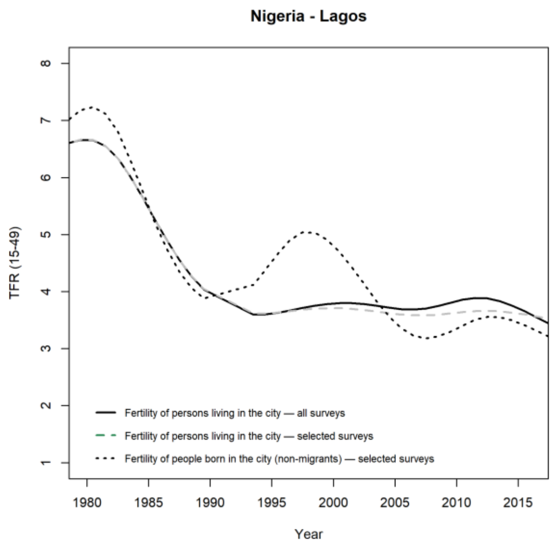
Figure A2: Trends in total fertility rate in sub-Saharan Africa capitals by migration status, 1980-2018.

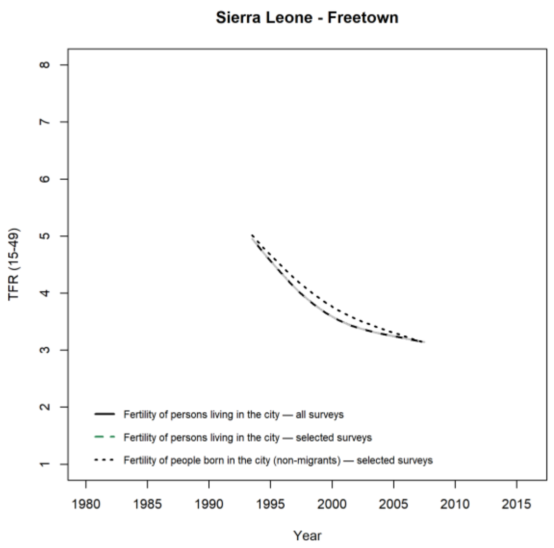


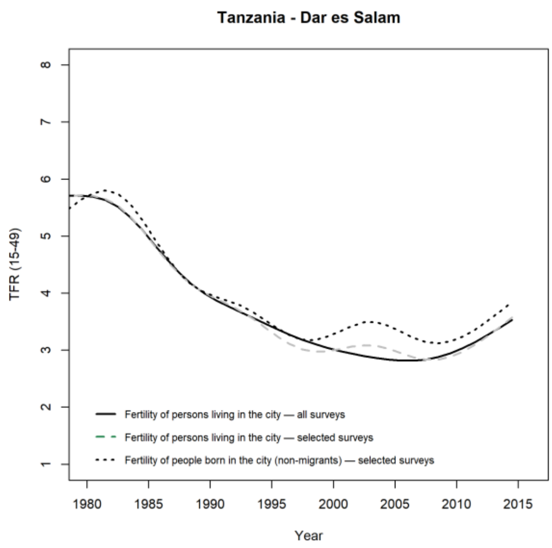

Mali - Bamako
TFR (15-49)
Year
Fertility of persons living in the city — all surveys
Fertility of persons living in the city — selected surveys
Fertility of people born in the city (non-migrants) — selected surveys

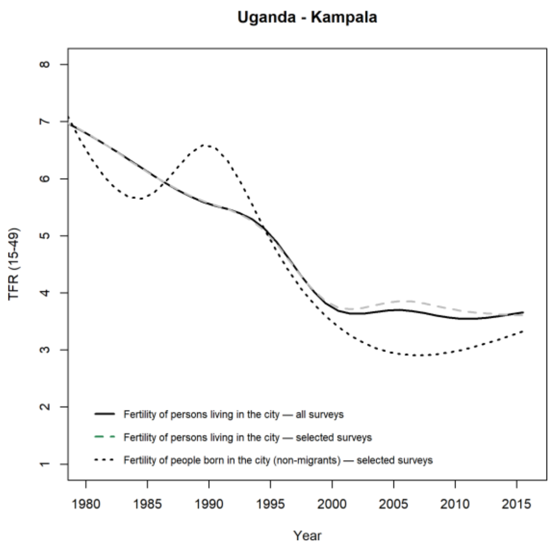

Madagascar - Antananarivo
TFR (15-49)
Year
Fertility of persons living in the city — all surveys
Fertility of persons living in the city — selected surveys
Fertility of people born in the city (non-migrants) — selected surveys

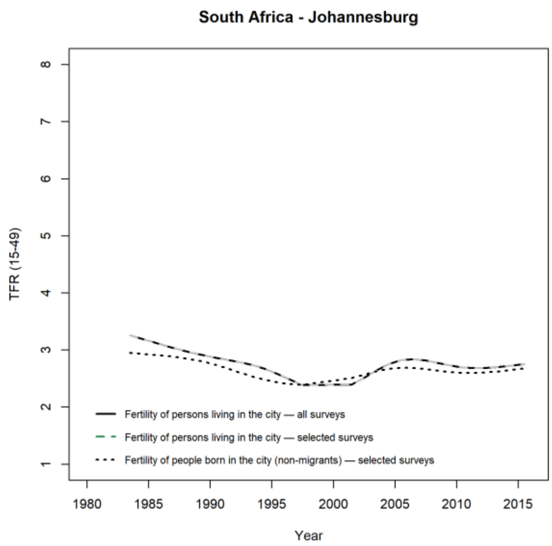

Malawi - Lilongwe
TFR (15-49)
Year
Fertility of persons living in the city — all surveys
Fertility of persons living in the city — selected surveys
Fertility of people born in the city (non-migrants) — selected surveys

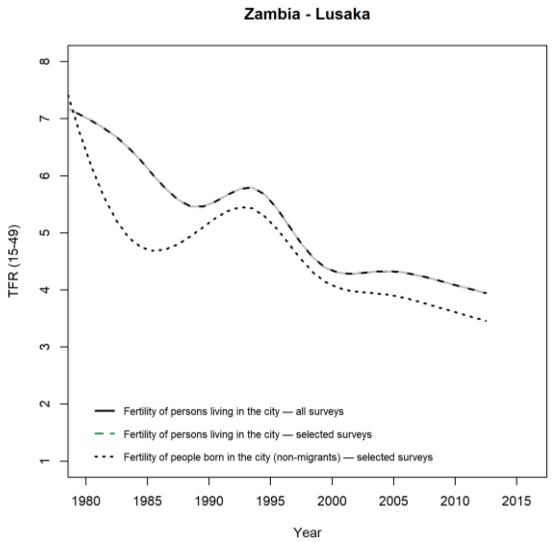

Nigeria - Lagos
TFR (15-49)
Year
Fertility of persons living in the city — all surveys
Fertility of persons living in the city — selected surveys
Fertility of people born in the city (non-migrants) — selected surveys

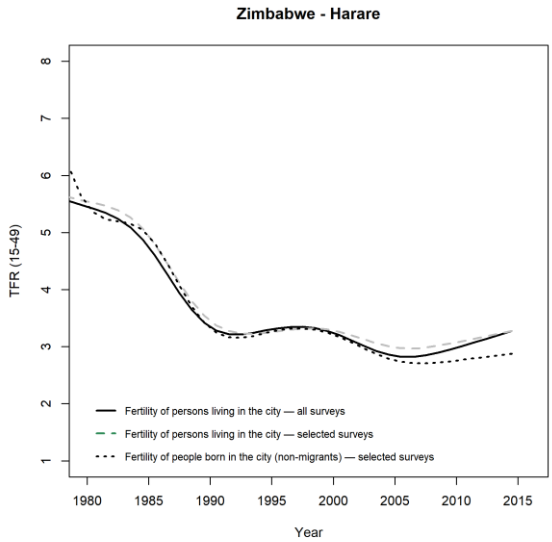

Sierra Leone - Freetown
TFR (15-49)
Year
Fertility of persons living in the city — all surveys
Fertility of persons living in the city — selected surveys
Fertility of people born in the city (non-migrants) — selected surveys


Tanzania - Dar es Salam
TFR (15-49)
Year
Fertility of persons living in the city — all surveys
Fertility of persons living in the city — selected surveys
Fertility of people born in the city (non-migrants) — selected surveys


Uganda - Kampala
TFR (15-49)
Year
1980 1985 1990 1995 2000 2005 2010 2015
1 2 3 4 5 6 7 8
Fertility of persons living in the city — all surveys
Fertility of persons living in the city — selected surveys
Fertility of people born in the city (non-migrants) — selected surveys


South Africa - Johannesburg
TFR (15-49)
Year
1980 1985 1990 1995 2000 2005 2010 2015
1 2 3 4 5 6 7 8
Fertility of persons living in the city — all surveys
Fertility of persons living in the city — selected surveys
Fertility of people born in the city (non-migrants) — selected surveys


Zambia - Lusaka
TFR (15-49)
Year
1980 1985 1990 1995 2000 2005 2010 2015
1 2 3 4 5 6 7 8
Fertility of persons living in the city — all surveys
Fertility of persons living in the city — selected surveys
Fertility of people born in the city (non-migrants) — selected surveys


Zimbabwe - Harare
TFR (15-49)
Year
1980 1985 1990 1995 2000 2005 2010 2015
1 2 3 4 5 6 7 8
Fertility of persons living in the city — all surveys
Fertility of persons living in the city — selected surveys
Fertility of people born in the city (non-migrants) — selected surveys