Research Article

Slowdowns of fertility decline:
When should we call it a 'fertility stall'?

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Abstract

BACKGROUND
The phenomenon of fertility stalls in Africa has recently received much attention in the literature yet hasn't lead to clear-cut conclusions.

OBJECTIVE
We test the robustness of past findings by comparing alternative definitions and by extending the sample to most recent years. We further propose the concept of a conditional fertility stall, identifying countries that have a relatively high level of fertility despite a relatively high level of socioeconomic development.

METHODS
We use aggregate and survey data from various sources, describe variation in fertility across countries, and relate differences using regression techniques to socioeconomic covariates. We use predicted residuals to identify deviations from expected levels and define these as conditional fertility stalls.

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RESULTS
The fertility in some countries, such as Nigeria and Uganda, is too high given their level of GDP per capita, female education, and child mortality. Here noneconomic conditions seem to hold back the transition. Other countries, such as Nepal and Bangladesh, have a continuation of the transition that seems to require further economic development: In these countries, fertility is just at or even below the level that the prevailing economic conditions predict.

CONCLUSION
Our concept shows that long-lasting unconditional fertility stalls are rare and that a slowdown of the fertility transition can in many cases be explained by a stagnation in socioeconomic development. Policy recommendations should take this distinction between unconditional and conditional fertility stalls into consideration.

CONTRIBUTION
We expand the literature on the conceptualisation and the measurement of fertility stalls.

1. Introduction

For a long time it has been assumed that the demographic transition is a stylised fact, that sooner or later all countries will experience the transition from high fertility levels to fertility at the replacement level (i.e., around two children born to each mother) (Notestein 1945; Coale 1973; Landry 1982; Chesnais 1993; Lee 2008). This transition typically starts with a decline in mortality, even though in some countries, such as France, the fertility decline seems to have preceded the mortality decline. Moreover, the demographic transition often goes hand in hand with economic development (Galor and Weil 2000; Galor 2011). Whether economic development is a necessary precondition for the demographic transition remains debated, but the literature suggests that higher incomes and education and lower mortality lead to a reduction in the number of children born (see, for example, Schultz 1997; Wolpin 1998; Breirova and Duflo 2004; Nobles, Frankenberg, and Thomas 2014; Lavy and Zablotsky 2015). While the demographic transition took more than a century in most European countries, the pace of the transition has been much faster in Asia and Latin America (see, for example, Bloom and Williamson 1998).

None of the sub-Saharan African countries has completed the fertility transition except South Africa and Mauritius, but even in these two countries fertility varies greatly across socioeconomic groups (Canning, Raja, and Yazbeck 2015). While some countries in sub-Saharan Africa have not even started the fertility transition (e.g., Chad), many have seen declines in fertility rates that came to a standstill or even increased again (e.g.,

Ghana, Nigeria). These latter phenomena are referred to as fertility stalls in the literature (Bongaarts 2006, 2008; Garenne 2008; Schoumaker 2019).

The World Population Prospects 2019 revision assumes that the total fertility rate (TFR), that is, the total number of children a woman is expected to give birth to, will be around three in 2050 in Africa (United Nations 2019). Yet, this assumption seems overly optimistic if some countries find themselves in a fertility stall. Given that youth underemployment is already a concern in most countries in the region (International Labour Organization 2020), policymakers should be concerned about a thorough understanding of population dynamics. For example, the median and the high/low fertility scenarios of the World Population Prospects for sub-Saharan Africa show huge differences with potentially strong implications for population growth and development challenges. Whereas the median scenario for 2100 predicts a total population of 4.2 billion on the African continent, the high and low variants predict a population of up to 5.9 or 'only' 3.0 billion, respectively.[5]

Given these concerns, several studies have analysed fertility stalls (Agyei-Mensah 2005, 2007; Askew, Maggwa, and Francis 2017; Bongaarts 2006, 2008, 2017; Bongaarts and Casterline 2013; Ezeh, Mberu, and Emina 2009; Garenne 2008; Garenne et al. 2015; Gerland, Biddlecom, and Kantorová 2017; Goujon, Lutz, and KC 2015; Guengant 2017; Howse 2015; Kebede, Goujon, and Lutz 2019; Machiyama 2010; Moultrie et al. 2008; Schoumaker 2009, 2019; Shapiro and Gebreselassie 2008; Shapiro and Hinde 2017). Yet, in this literature it is debated how to measure such a fertility stall: How many years of nondeclining (or slow-declining) fertility constitute a stall? Is only stagnating fertility a fertility stall, or is a slowdown in fertility decline already a fertility stall? Are stalls conditional on a country's socioeconomic development?

In this paper, we test the robustness of previous findings by comparing alternative definitions and by including countries outside Africa into the analysis. We also expand the observation period to the most recent years. Second, we propose a new definition of a fertility stall, which is also inspired by the economic theory of fertility transition (see, for example, Becker 1981; Lee 1997; Galor and Weil 1996, 2000). We call such a fertility stall a conditional fertility stall. A conditional fertility stall refers to a situation in which a country faces a relatively high fertility level despite a relatively low level of child mortality and a relatively high level of income and mothers' education, assuming that these three forces are important preconditions for fertility to decline. In other words, we believe that as long as child mortality is high and female education and incomes are low, the socioeconomic circumstances are unfavourable for a long-lasting fertility decline. In such a situation parents tend to have many children; hence, we believe it is important to differentiate between unconditional fertility stalls, as independent of the circumstances under which they occur as previous literature has done, and conditional fertility stalls,

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[5] United Nations Data 2019, https://population.un.org/wpp/.

referring to situations where fertility remains high despite progress in socioeconomic development. The policy implications of a slowdown in fertility decline because of socioeconomic stagnation or despite socioeconomic progress are quite different; and such a differentiation is important. Therefore, our analysis is related to the studies by Goujon, Lutz, and KC (2015) and Kebede, Goujon, and Lutz (2019), who show that fertility stalls are highly correlated with a lack of improvements in female education – a situation we would classify as an unconditional stall.

This paper makes two contributions to the literature. First, we revisit the list of countries with fertility stalls according to the definitions of Bongaarts (2008) and Schoumaker (2009, 2019) and test the sensitivity to alternative approaches used in the literature. In doing so, we also include low- and middle-income countries outside Africa into the analysis and take a long-term perspective by choosing a long observation window. Second, we propose a new definition of a fertility stall, which focuses on conditional fertility stalls.

Our major findings are that 10 out of 80 countries in our sample show fertility stalls (conditional or unconditional) independent of the measure used. Only about one-third of countries that have been identified as facing a fertility stall by Schoumaker (2009) or Bongaarts (2008) ten years ago would still be classified as fertility-stall countries today. The analysis by Schoumaker (2019) goes in a similar direction. He shows that at least major stalls are often not lasting: Either they fade out or they turn into slight stalls.

Moreover, there is little overlap between countries with long-lasting conditional and unconditional fertility stalls. Countries with long-lasting conditional fertility stalls (less than ten years) are the Democratic Republic of the Congo (henceforth referred to as DRC), Gabon, Kyrgyz Republic, Mali, Mauritania, Mongolia, Uganda, and Zambia. Kyrgyz Republic and Mongolia are the only countries with a long-lasting conditional stall outside Africa. Countries with long-lasting unconditional fertility stalls[6] are Benin, Cameroon, Colombia, Egypt, Ghana, Indonesia, Pakistan, Peru, Senegal, and Zimbabwe. These countries have a high level of fertility that is explained by a low level of socioeconomic development and therefore do not fall in the category of conditional fertility stalls.

Hence, our analysis has two interesting implications. First, it suggests that in many cases high fertility can be explained by low economic development. Second, it suggests that many countries with a low level of fertility should have an even lower level given the socioeconomic environment in which they happen. Thus, one should refer, more accurately, to a slow – rather than a stalled – demographic transition in many sub-Saharan African countries. In several cases, there is nothing particular about the sub-Saharan

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[6] We found these by applying the definition that declines in fertility rates are less than 0.05 children per women between two surveys as applied by New Security Beat (2013). See methodology section and also Table S5 in the Online Appendix.

African fertility transition. However, countries such as Congo (Rep.), Gabon, Kyrgyz Republic, Mali, Mauritania, Mongolia, Niger, Nigeria, Sudan, Uganda, and Zambia deserve a more detailed analysis to understand why fertility is high despite relatively high levels of income and education and low levels of child mortality.

The remainder of this paper is structured as follows: The next section presents the data and the various approaches to determine a fertility stall, including the concept of a conditional fertility stall that we propose. Section 3 presents the results. Section 4 concludes.

2. Data and methodology

2.1 Data

We use microdata from the Demographic and Health Surveys (DHS), the Multiple Indicator Cluster Surveys (MICS), the World Fertility Survey (WFS), and the World Development Indicators (WDI). The DHS are administered by ICF International, funded by USAID, and implemented by National Statistical Offices since 1984. The MICS are part of UNICEF's strategy to invest in data collection. They have been conducted since 1995 by National Statistics Offices. The WFS is used to cover the periods of the late 1970s and the beginning of the 1980s. The WFS was launched in 1972 by the International Statistical Institute and provided by the Office of Population Research at Princeton University. All three data sets are nationally representative, have been conducted several times as cross-sectional surveys, and are widely used in population studies. The DHS, MICS, and WFS are designed to collect demographic, health, and socioeconomic data from women of reproductive age, their children, and their households. Questionnaires are harmonised across countries, which allows cross-country comparisons. Our sample of countries is restricted to countries for which at least two survey rounds are available. The WDI data provides us with information on GDP per capita at the country level.

In total, we use data from 80 countries to calculate changes in fertility over time between 1992 and 2016. These countries have at least two survey rounds available. Just over half (41) of these 80 countries are in sub-Saharan Africa. The sample consists of data stemming from a total of 369 surveys. On average, four survey rounds per country are available, and we pool all surveys into one large multicountry, multiyear microdata set (see Table S1 and S2 in the Online Appendix for a list of all included countries and years). To study changes in the pace of fertility declines, we further restrict the sample to countries for which at least three surveys are available. This leaves us with a sample of 56 countries and 321 surveys.

To measure a country's fertility level, we use the total fertility rate (TFR), which is the most widely used measure of a country's period fertility (see Table 1 and S1, Online Appendix). The TFR can be defined as the average number of births a woman would have during her reproductive life if she had experienced the age-specific fertility rates observed in a specific period, often three years (Bongaarts and Feeney 1998; Myrskylä, Kohler, and Billari 2009). The TFR is available for many countries and periods, and its simplicity makes it easy to interpret.[7] To calculate the TFR by country and survey year, we use the information on retrospective birth histories of women aged 15 to 49 in the DHS, MICS, and WFS data.[8]

Table 1 shows the TFR and the pace of fertility decline by country and period for countries with at least three surveys available. Given that DHS, MICS, and WFS are not conducted in the exact same years across countries (see Table S1, Online Appendix), we follow the approach by Bongaarts (2008) and calculate changes in fertility for the periods circa 1992–1998, circa 1998–2004, and circa 2004–2010. Like Schoumaker (2019), we add the period circa 2010–2016. The pace of fertility decline by period is calculated as the unweighted annualised decline (increase) between two consecutive periods: *annualised period change = $[(TFR_t – TFR_{t–1}) / (period_t – period_{t–1})] \times (–1)$*. Hence, declines in fertility between two periods are presented as positive numbers. In particular, to annualise the pace of fertility decline, we use the effective survey years within each period (e.g., Angola 2007 for the period 2004–2010 and Angola 2011 for the period 2010–2016). This means that for the period 2004 to 2010 the effective years used to calculate the annualised period change would be four years (2007–2011).

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[7] DHS surveys are the main source of estimates of TFR in developing countries. The data of the retrospective birth histories in the DHS allows the direct estimation of the TFR. This means that the estimates of the TFR are based on the quality and accuracy of the events and dates in the birth histories. An example for a potential bias is the omission of children who died, which will result in a downward bias in fertility rates (Pullum, Assaf, and Staveteig 2017). A number of DHS reports have compared the DHS estimates of fertility with other sources of fertility estimates, and the overall quality of the DHS data to produce fertility estimates has been analysed (e.g., Schoumaker 2014; Pullum, Assaf, and Staveteig 2017; Pullum and Staveteig 2017). Although these reports point to a number of cases in which a DHS estimate was substantially higher or lower than expected, these reports conclude that most surveys have produced estimates of good quality.

[8] To calculate the TFR, we use the TFR2 Stata command. The TFR2 command produces the official DHS and WFS total fertility rates from the microdata. The command transforms the birth history data into a table of number of births and number of years of exposure. The age-specific fertility rates and TFRs are then computed applying a Poisson regression model (Schoumaker 2012). The advantage of calculating the TFR directly from the microdata is that the standard deviation and confidence intervals for the TFR can be obtained.

Table 1: **Total fertility rate and the unweighted annualised pace of fertility decline for countries with at least three surveys available**

	TFR					Pace of fertility decline			
Sub-Sahara Africa	ca 1992	ca 1998	ca 2004	ca 2010	ca 2016	ca 1992 to ca 1998	ca 1998 to ca 2004	ca 2004 to ca 2010	ca 2010 to ca 2016
(Angola)			5.8	6.3	6.2			–0.13	0.02
Benin		6.0	5.6	5.3	5.7		0.07	0.04	–0.05
Burkina Faso	6.5	6.4	5.9	6.0	5.3	0.01	0.14	–0.02	0.11
Burundi	6.9			6.4	5.8				0.14
Cameroon	5.8	4.8	5.0	5.1	4.9	0.14	–0.03	–0.02	0.07
(Chad)		6.4	6.3		6.4		0.00		
Congo (Rep.)			4.8	5.1	4.4			–0.04	0.23
Cote d'Ivoire	5.3	5.2		5.0	4.6	0.03			0.09
Ethiopia		5.5	5.4	4.8	4.6		0.02	0.10	0.05
Ghana	5.8	4.4	4.4	4.2	4.2	0.19	0.00	0.04	0.00
Guinea		5.5	5.7	5.1	4.8		–0.03	0.09	0.06
Kenya	6.0	4.7	4.9	4.6	3.8	0.19	–0.04	0.05	0.12
Lesotho			3.5	3.3	3.3			0.05	0.01
Liberia	6.7		5.2	5.4	4.5			–0.07	0.19
Madagascar	6.1	6.0	5.2	5.0	4.2	0.03	0.11	0.03	0.15
Malawi	6.7	6.3	6.2	5.5	4.7	0.05	0.02	0.12	0.21
Mali	7.1	6.7	6.7		6.2	0.04	0.00		
Mauritania				5.0	5.1				–0.04
Mozambique		5.2	5.5	6.0	5.3		–0.06	–0.07	0.10
Namibia	5.4	4.2	3.6		3.6	0.15	0.09		
(Niger)	7.0	7.2	7.0	7.6		–0.04	0.02	–0.10	
Nigeria	6.0		5.7	5.9	5.5			–0.04	0.08
Rwanda	6.2	5.8	6.1	5.0	4.2	0.05	–0.05	0.26	0.14
Senegal	6.2	5.7	5.1	5.0	4.9	0.08	0.06	0.04	0.01
Sierra Leone			5.1	4.9	4.1			0.04	0.19
Sudan	4.7			5.7	5.2				0.14
Swaziland			3.8	3.7	3.3			0.06	0.09
Tanzania	6.2	5.7	5.7	5.5	5.0	0.09	0.00	0.04	0.07
Togo	6.4	5.2			4.6	0.12			
Uganda	7.1		6.8	6.2	5.6			0.09	0.11
Zambia	6.5	6.1	5.9	6.2	5.3	0.10	0.03	–0.06	0.13
Zimbabwe	4.9	4.0	3.8	3.9	4.2	0.11	0.02	–0.03	–0.05

Table 1: **(Continued)**

	TFR					Pace of fertility decline			
	ca 1992	ca 1998	ca 2004	ca 2010	ca 2016	ca 1992 to ca 1998	ca 1998 to ca 2004	ca 2004 to ca 2010	ca 2010 to ca 2016
North Africa and not Africa									
(Armenia)		1.7	1.7	1.7	1.7		0.00	0.00	−0.01
Bangladesh	3.4	3.3	2.9	2.3	2.3	0.03	0.06	0.11	0.01
Bolivia	4.9	4.2	3.8	3.5		0.11	0.08	0.06	
Cambodia		3.8	3.4	3.0	2.7		0.07	0.07	0.08
Colombia	3.0	2.6	2.4	2.1		0.04	0.04	0.05	
Dominican Republic	3.5	2.9	3.0	2.4	2.5	0.07	−0.02	0.11	−0.01
Egypt	4.0	3.5	3.2	3.0	3.5	0.06	0.09	0.03	−0.07
Guatemala	5.5	5.1	5.0		3.1	0.05	0.02		
Guyana			2.5	2.8	2.6			−0.07	0.03
Haiti	4.8	4.7	3.9	3.5	3.0	0.02	0.13	0.06	0.13
India	4.0	2.8	2.7		2.2	0.20	0.02		
Indonesia	3.0	2.8	2.6	2.6	2.4	0.03	0.03	0.00	0.03
Iraq			4.3	4.5	3.6			−0.04	0.13
Jordan	5.6	4.4	3.6	3.8	3.1	0.17	0.09	−0.06	0.12
Kyrgyz Republic			3.4	3.6	4.0			−0.02	−0.09
Morocco	4.3		2.5						
Nepal		4.6	3.6	2.6	2.3		0.13	0.15	0.07
Pakistan	4.9		4.1	3.8	3.6			0.04	0.05
Paraguay	4.7				2.5				
Peru	3.8	3.2	2.5	2.6	2.6	0.07	0.08	−0.01	0.01
Philippines	4.1	3.7	3.5	3.3	2.9	0.07	0.04	0.05	0.06
Tunisia	4.2		2.1	2.1					0.00
Turkey	2.5	2.6	2.2			−0.02	0.08		
Yemen	7.7		6.9		4.4				

Notes: The unweighted annualised decline is calculated between each consecutive period. The annualised change per period is calculated as *annualised period change* = $[(TFR_t - TFR_{t-1}) / (period_t - period_{t-1})] (-1)$. Hence, declines are positive numbers. If more than one TFR is available per period, the average is taken before calculating the annualised change (and also the average survey year). Only countries with at least three surveys available and for which at least two growth rates of consecutive periods can be calculated are used. For a complete list of countries, see Table S1 (Online Appendix). Pre- and post-transition countries are in brackets. Post-transition country: Armenia. Pre-transition countries: Angola, Chad, Niger.
Source: DHS/MICS/WFS data; calculations by the authors.

Some periods consist of two TFRs (see Table S1, Online Appendix). In this case, we used the mean TFR and survey year to calculate the pace of fertility decline between two consecutive periods. For example, in Burundi, two surveys are available for the period 2010–2016: 2012 and 2016 with a TFR of 6.1 and 5.5, respectively. We took the average of the TFRs $((6.1 + 5.5) / 2 = 5.8)$ and the average of survey years

((2016 + 2012) / 2 = 2014) and used this TFR and survey year to calculate the annualised change between the periods 2016 and 2010.[9]

2.2 Measures of fertility stalls

The literature has used different definitions of a fertility stall, but the general idea remains the same: "a stall implies that an ongoing fertility transition is interrupted by a period of no significant change in fertility before the country reaches the end of the transition" (Bongaarts 2008: 109). Two steps are thus necessary to identify countries with stalling fertility. First, a criterion must be used to determine whether a fertility transition has started. Second, one needs to determine what constitutes an interruption of the decline in fertility.

With regard to the first criterion, Schoumaker (2009, 2019) assumes that a fertility transition has begun if either the TFR in one survey is at least 10% lower than it was in a previous survey or if the TFR in the second survey is lower than the average number of children ever born among women aged 40 to 49 in the first survey.[10] Bongaarts (2008) in turn assumes that a fertility transition is underway if the TFR has decreased by at least 10% compared to a previous survey or, alternatively, if contraceptive prevalence among married women is over 10%. The use of contraceptive prevalence is proposed on the ground that, according to Bongaarts, a 10% increase in contraceptive prevalence corresponds approximately to a 10% decrease in fertility.

Taking both definitions into account, five countries in our sample are considered as having not started the fertility transition yet: Angola, Chad, DRC, Niger, and Sudan. Countries are classified as being post-transition countries if the fertility rate has reached the replacement level (less than or equal to two). The three countries in our sample that can be classified as post-transition countries are Albania, Armenia, and Vietnam.

In this study, we use three different definitions of a fertility stall that have previously been proposed in the literature. The first measure defines countries as stalling only if the decline of the TFR has stopped (i.e., where the TFR in one survey is at least as high as the TFR in the previous survey) (Schoumaker 2009). The second definition classifies fertility as stalling if the annual fertility decline is smaller than 0.05 children born (New Security Beat 2013), thus, if countries do not show a clear decline in fertility levels over time (between two consecutive surveys). The third definition defines countries as stalling

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[9] As a robustness check we also used the most recent TFR of a period instead of the mean. However, this did not change the overall picture of countries being classified as stalling countries and would reduce our sample size.

[10] In addition, Schoumaker (2019), like Bongaarts (2008), requires that the prevalence of contraception among married women be at least 10%.

if there is a statistically significant deceleration in the pace of fertility decline (Bongaarts 2008).[11] This definition requires, however, at least three or more surveys to allow for the analysis of changes in the pace of fertility decline over two successive periods. Following Bongaarts (2008), we use the standard errors of the change in the TFR[12] and calculate the significance ($p < 0.05$) with a one-tailed t-test.[13]

Our first contribution to the literature is a comparison of these measures and an extension to countries outside Africa. As in Schoumaker (2019), we expand the observation window to the most recent years.[14] Differences between measures will, of course, be driven not only by differences in concepts but also by data accuracy and the sensitivity to specific assumptions that each concept requires (i.e., all concepts imply the determination of certain thresholds).

2.3 A new measure of conditional fertility stalls

Our second contribution is a new conceptualisation of fertility stalls. We start from the assumption that a fertility decline is typically initiated by several structural changes. We consider three forces to be particularly important: child mortality, female education, and income. Improved survival chances reduce the necessity to 'have many children' to ensure that a certain number of children survives to adulthood (Becker 1981; Schultz 1997; Wolpin 1998). Increased survival rates also increase the return on investments in children, such as education, and hence may contribute to a substitution away from many children towards few but well-educated and well-nourished children (Becker 1981). Women who are better educated have better opportunities in the labour market, and therefore education increases women's cost of time, which should also reduce the number of children parents want to have (Becker 1981; Galor and Weil 1996). In addition, higher educated mothers demand higher education for their own children and in turn will reduce the number of children born (Breierova and Duflo 2004; Chicoine 2012; Lavy and Zablotsky 2015; Pradhan and Canning 2016; Günther and Harttgen 2016) – the quantity–quality trade-off of children as described by Becker (1981). Education could also be conducive to higher female empowerment, which could in turn enable mothers to have

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[11] Note that this does not provide any information about that actual pace of fertility decline.

[12] The standard errors of the TFR by country and survey are provided by the TFR2 command (Schoumaker 2012). The sample size is directly taken from the birth history data.

[13] Similar to Bongaarts (2008), we use $p < 0.05$ as a significance cut-off. As robustness checks we also use $p < 0.1$ and $p < 0.01$. Changing the significance cut-off leads to only minor changes in the list of countries experiencing a stall (Haiti, Lesotho, and Peru are not significant at $p < 0.01$; Burkina Faso becomes significant at $p < 0.1$; see also Table S3, Online Appendix).

[14] Schoumaker (2019) also uses three different measures of (unconditional) fertility stalls: (1) whether there is no decline or even an increase in the TFR between two surveys, (2) whether the decrease in the TFR between two surveys is statistically significant, and (3) whether the pace in fertility decline is statistically significant.

more influence when it comes to the decision of how many children a couple wants to have. Since in many countries women prefer fewer children than men, this could further accelerate the fertility transition (Doepke and Tertilt 2018). Income as a more general measure of economic development (including higher urbanisation and industrialisation) will further induce parents to increasingly substitute child quantity with quality if, as assumed by Becker (1981), the income elasticity of demand for quality is higher than for quantity. Income might also be correlated with technological change, which can further enhance this substitution (Galor and Weil 2000). An extensive empirical literature has shown the strong relationship between reduced child mortality, increased female education, and increased income on the one hand and declining fertility on the other hand (see, for example, Lee 1997; Schultz 1997; Klasen 1999; Breierova and Duflo 2004; Bhalotra and Van Soest 2008; Lavy and Zablotsky 2015; Canning et al. 2013; Liu 2014; Nobles, Frankenberg, and Thomas 2014; Dang and Rogers 2015).

Of course, other forces such as improved access to contraception (see, for example, Singh, Bankole, and Darroch 2017), information campaigns (see, for example, McQueston, Silverman, and Glassman 2012), and religious and legal regulations (see, for example, Heaton 2011), among others, also have an impact on fertility levels. However, our definition of conditional fertility stalls focuses on persistently high levels of fertility despite socioeconomic development. Other forces that have been identified in the literature to reduce fertility can be directly influenced by policy. Hence, if we identify a conditional fertility stall, that means the policies are likely not in place for a further fertility reduction or social norms related to having many children seem to be strong (Canning et al. 2013). On the other hand, if the socioeconomic development stagnates, the context is not favourable for a further decline in fertility, unless parents have in the meanwhile formed strong preferences for fewer children independent of mortality, education, and income (see, for example, Canning et al. 2013) because of social interactions, diffusion effects, or social norms – which are possibly also enhanced by family planning services that may further affect preferences. It is unlikely that changes in regulations and policies will in that case lead to a further fertility reduction.

Hence, our second contribution is the concept of a conditional fertility stall, which identifies a fertility stall if fertility is much higher than what observed levels of child mortality, female education, and income would predict. This concept implies, for instance, that in very poor countries with an economic structure that is still largely based on agriculture and where female education is low and income grows little, there is no reason to expect a significant decline of fertility.

To determine whether a country experiences a conditional fertility stall, we use the data described above and merge it at the level of each country (*i*) and for each survey year (*t*) with information on female secondary education and GDP per capita drawn from

the WDI.[15] Under-five mortality can be calculated directly from the DHS, MICS, and WFS data. We pool all data and regress the TFR on under-five mortality (U5M), female education (EDU), and (log) GDP per capita:[16]

$$TFR_{it} = \alpha + \beta_1 GDP_{it} + \beta_2 U5M_{it} + \beta_3 EDU_{it} + \varepsilon_{it} \qquad (1).$$

Using the estimated coefficients, we predict for each country and survey year the TFR conditional on under-five mortality, female education, and GDP per capita. Subtracting this prediction from the observed TFR in that same year yields a residual. A large positive residual indicates that a given country in a given year has a fertility level significantly higher than what the fundamentals would predict:

$$Residual_{it} = TFR_{it} - \widehat{TFR_{it}} \qquad (2).$$

If this residual is larger than 1 standard deviation of the residuals, we consider this country to be experiencing a conditional fertility stall. In our sample, 1 standard deviation of the residuals corresponds to 0.83 children.

Using standard deviations of a variable as a threshold to determine whether a difference is large is common practice in empirical studies in social sciences. For example, children are defined as undernourished if they show an anthropometric indicator (e.g., height for age) that is below –2 standard deviations from a reference population (World Health Organization 1995). For power calculations in behavioural experimental research, 0.8 standard deviations is often considered a large effect size (see, for example, Cohen 1988). We chose a rather high level of standard deviation of 1 (and 0.83 children) as a cut-off given that the computed residuals include a measurement error in fertility and in the explanatory variables; we might therefore over- or underestimate conditional fertility stalls for certain countries if the chosen threshold was too low. Of course, the threshold can be altered and the sensitivity of the results with respect to alternative thresholds can be tested.[17] The question of defining thresholds has also been a challenge for previous definitions of unconditional fertility stalls (Bongaarts 2008).

Note that we deliberately do not control for period or country fixed effects in these regressions. Doing so would mean that we net out from our residual period- and country-specific effects unrelated to the country-specific socioeconomic fundamental forces. However, we are exactly interested in these other policies, or normative forces, which

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[15] World Development Indicators, https://datatopics.worldbank.org/world-development-indicators/.
[16] The data on TFR, U5M, and EDU are calculated from the DHS, WFS, and MICS microdata, while the GDP per capita is taken from the WDI.
[17] For example, if we altered the threshold to 0.8 standard deviations (0.66 children) – which is similar to power calculations in experimental research – the results remain fairly stable. See Table 4 for the respective residuals for each country.

should be captured by the residual. In other words, our interest is in the fertility level conditional on mortality, female education, and income but not conditional on specific country characteristics, such as, for example, subsidies for contraception or information campaigns that directly reduce fertility. Yet, for completeness and comparison we will show estimates with country and year fixed effects in the Online Appendix.

It is also important to note that we define our concept in levels and not in changes. Directly analysing changes would, of course, be an interesting alternative, but empirically there is little difference between the two concepts in the long term. A country that has a fertility level above the predicted one given its level of development has unlikely seen larger than predicted fertility declines in the past. Moreover, a country which has fertility falling faster over time than is predicted by its level of development will sooner or later also have lower fertility levels than predicted by its level of development. Conversely, countries that have a fertility level below the predicted one given its socioeconomic development but which is rising will sooner or later also enter the status of a level higher than predicted. Moreover, from a methodological perspective, focusing on levels instead of changes has two further advantages: First, levels are in relative terms less affected by measurement error than changes over time. Second, one can also estimate a conditional fertility stall for countries for which only one survey is available.

3. Results

Fertility in sub-Saharan Africa is still at a much higher level than in most other low- and middle-income countries outside Africa and has also been falling at a slower pace than in other regions of the world, especially between 1998 and 2004 (see Table 2 and Figure 1).[18] Various studies (especially those published shortly before 2010) have therefore suggested that sub-Saharan African countries have experienced fertility stalls since the beginning of the 21st century. Yet, in recent years, the absolute annual fertility decline in many, but not all, sub-Saharan African countries has caught up with non-African countries again and even outpaced the non-African countries on average (Figure 1).

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[18] Table 2 and Figure 1 are based on an unbalanced country panel since the DHS is not evenly distributed across time periods. This means that the trends shown in Table 2 and Figure 1 might be influenced by the sample of countries entering each time period. As a robustness check, we re-estimate Table 2 and Figure 1 based on a balanced panel (11 countries from sub-Saharan Africa, 8 from non-sub-Saharan Africa). Although there are some changes in the levels, the trends of Table 2 and Figure 1 based on the unbalanced panel do not change if we use a balanced panel. Results are available from the authors upon request.

Table 2:   Total fertility rates by country, region, and period

		Total		Sub-Sahara Africa			North Africa and non-Africa		
Period	N	Mean	Sd	N	Mean	Sd	N	Mean	Sd
ca. 1987	23	6.4	(1.3)	8	7.0	(0.4)	15	6.1	(1.5)
ca. 1992	54	5.1	(1.4)	25	6.1	(0.8)	27	4.1	(1.1)
ca. 1998	41	4.6	(1.4)	21	5.6	(0.8)	19	3.4	(0.9)
ca. 2004	58	4.5	(1.5)	31	5.5	(1.0)	27	3.3	(1.0)
ca. 2010	61	4.5	(1.4)	41	5.3	(0.9)	20	2.9	(0.7)
ca. 2016	84	4.3	(1.2)	59	4.9	(0.8)	25	2.9	(0.7)

Notes: N = Number of surveys. Total number of surveys: 321. Total number of countries: 56 (sub-Saharan Africa: 34, non-Africa: 22).
Only countries are used for which at least three surveys are available. For a list of countries and surveys, see Table S1 (Online Appendix).
Source: DHS/MICS/WFS data; calculations by the authors.

Figure 1:   Unweighted average pace of TFR decline
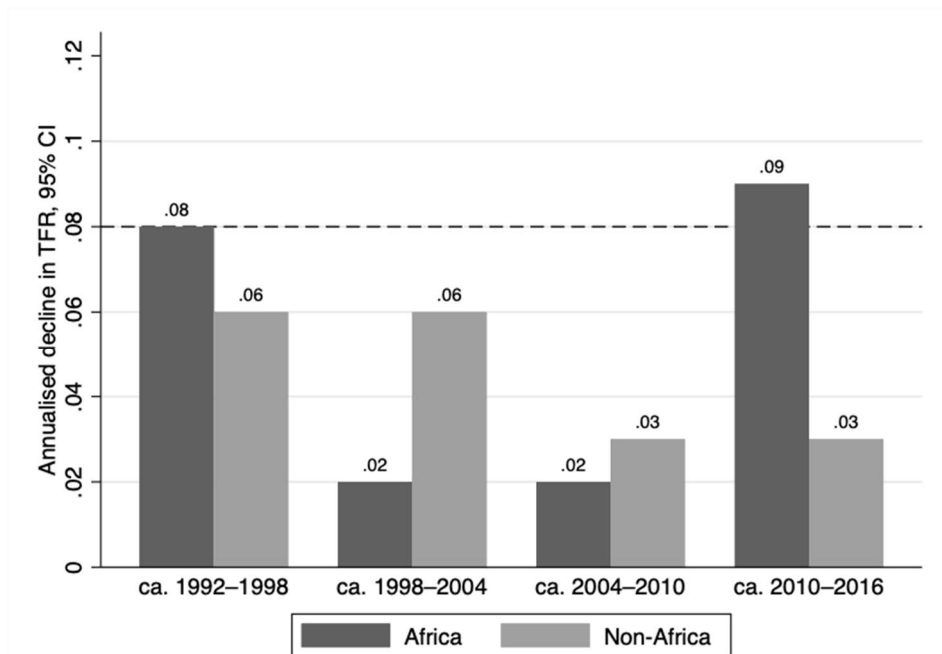
Notes: The mean annualised decline in TFR is calculated as simple unweighted averages of annualised changes in TFR per period. Number of countries: 34 (Africa), 22 (non-Africa). The horizontal dotted line = average annual decline for least developed countries 1990−2016. Only countries are used for which at least three surveys are available. Pre- and post-transition countries are excluded. For the respective growth rates for each period, see Table 1. For a list of countries, see Table S1 (Online Appendix).
S*ource*: DHS/MICS/WFS data; calculations by the authors.

3.1 Long-lasting versus temporary fertility stalls

Using three alternative variants regarding the interruption of a fertility decline (see Section 2.2), we find a similar set of countries being classified as experiencing a fertility stall (see Table S3, Online Appendix). Depending on the definition used, 13 to 27 countries experienced a recent unconditional fertility stall, most of them are located in sub-Saharan Africa.[19] Over the past two survey rounds, 12 countries in transition even showed an increase of fertility.[20] A total of 10 countries – Benin, Dominican Republic, Egypt, Guinea, Mauritania, Mozambique, Namibia, Nepal, Nigeria, and Rwanda – experienced a fertility stall for the two or three most recent surveys according to all three definitions.

However, our calculations also indicate that all definitions proposed in the literature are sensitive to the period under consideration. For example, many countries that have been classified as being in an unconditional fertility stall at the beginning of the 21st century by Schoumaker (2009) or Bongaarts (2008) (see Table S4, Online Appendix) have shown fertility declines in more recent years (see Table 1) and hence are no longer experiencing a stall. For example, Kenya experienced an increase in the TFR between 1998 and 2003 from 4.7 to 4.9, but more recently it experienced a decline from 4.6 in 2009 to 3.7 in 2015. The TFR in Cameroon increased between 1998 and 2011 from 4.8 to 5.1 but decreased slightly to 4.9 again in 2014. On the other hand, some countries that were in transition at the beginning of the 21st century are now in an unconditional fertility stall. For example, this is the case for Benin. Hence, countries move in and out of unconditional fertility stalls; long-lasting unconditional fertility stalls of ten years or more are rare. A country's status of facing a demographic transition or an unconditional fertility stall seems to change rapidly.

Figure 2 shows the number of countries that experienced a long-lasting fertility stall for the different definitions we discussed above. Using the definition based on 'no decline between two surveys (or periods),' we find that only 1 out of the 56 countries in our sample experienced a fertility stall over two consecutive periods: Zimbabwe (see also Table S5, Online Appendix). The number of countries with a long-lasting fertility stall obviously increases when less strict definitions of an unconditional fertility stall are used, that is, if a fertility stall is considered to be in place when the pace of fertility decline is lower than 0.05 and not lower than or equal to 0. According to the definition of an annual fertility decline of less than 0.05, nine countries in transition experienced a stall in two

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[19] Note that also Namibia experienced a long-lasting unconditional fertility stall when looking at the TFR in Table 1 between 2004 and 2016 (see also Table S3, Online Appendix). However, since we look at changes in the TFR between only two or three consecutive periods, Namibia is not considered in this list because no survey is available for the period 2010.

[20] Cameroon, Colombia, Egypt, Ghana, Guyana, Indonesia, Kyrgyz Republic, Lesotho, Pakistan, Peru, Senegal, and Zimbabwe.

consecutive periods. [21] According to Bongaarts' (2008) definition of a significant deceleration in the pace of fertility decline between two periods, eight countries experienced a long-lasting stall: Benin, Cote d'Ivoire, Dominican Republic, Ghana, Peru, Rwanda, Senegal, and Zimbabwe.

Hence, even within a period of more than ten years, different countries will be classified as being in a fertility transition (or out of it). This raises the question as to whether one should be concerned about temporary fertility stalls or only about long-lasting fertility stalls.

Figure 2: Comparing countries across definitions of stalls and over time
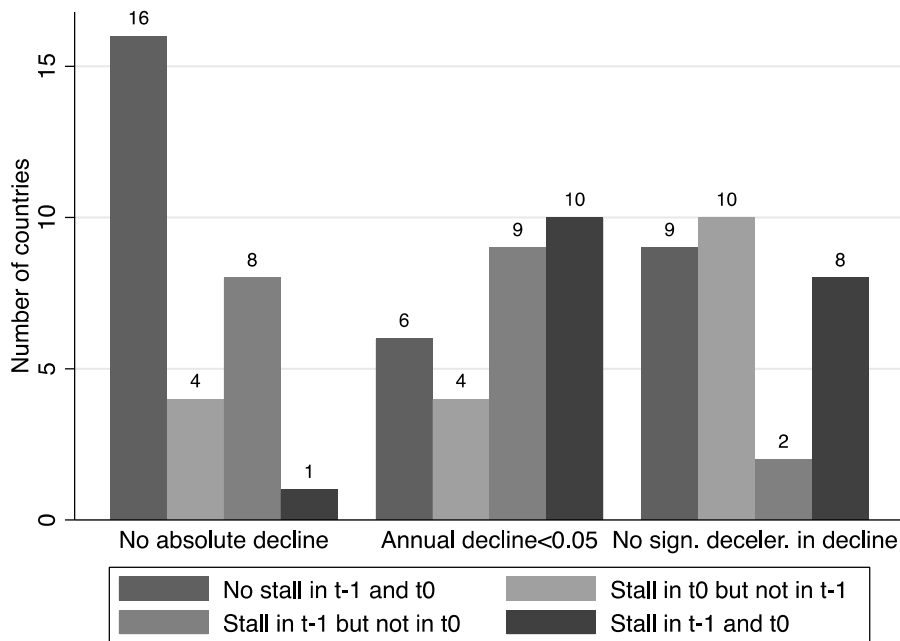
Notes: See Table S4 (Online Appendix) for the respective countries. We compare the three most recent consecutive time periods. See Table 1 for the list of countries and periods. For example, we compare changes in TFR in Benin between the periods 1998 to 2004 with the period 2001 to 2006 and the period 2001 to 2006 with 2006 to 2012. We compare three definitions of stalls: (1) Countries are classified as stalling if the TFR in one survey is at least as high as in the previous survey (Schoumaker 2009), (2) countries are classified as stalling if the annual fertility decline is less than 0.05 (New Security Beat 2013), and (3) countries are classified as stalling if there is no significant deceleration (p < 0.05) in the pace of fertility decline (Bongaarts 2008). Pre- and post-transition countries are excluded. *Source*: DHS/MICS/WFS data; calculations by the authors.

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[21] Cameroon, Colombia, Egypt, Ghana, Indonesia, Pakistan, Peru, Senegal, and Zimbabwe.

3.2 Unconditional versus conditional fertility stalls

As we argued above, we think it is important to distinguish between unconditional and conditional fertility stalls. Previous measures are all based on unconditional fertility stalls; that is, they measure whether fertility has come to a standstill after a period of fertility decline independent of whether the socioeconomic context was favourable for a further decline in fertility. We think that from a policy point of view it is important to understand whether we would expect lower levels of fertility conditional on observed levels of income, female education, and child mortality.

Table 3 shows the results of regressions of the TFR on under-five mortality, female education, and income (at the national level).[22] The dummy for sub-Saharan Africa in column 1 suggests that countries in sub-Saharan Africa have on average 1.5 more children than countries in other regions of the world. By introducing income (columns 2 and 3), child mortality (columns 4 and 5), and women's education (columns 6 and 7), we note that the under-five mortality rate leads to the largest reduction of the coefficient associated with the sub-Saharan African dummy. Hence, child mortality explains a large part of the difference in fertility between sub-Saharan African countries and other low- and middle-income countries. We also see that these three variables can explain a large share in the differences in the TFR observed across all countries and time. The R^2 in column (8), which shows if all three variables are introduced at the same time, implies that these variables explain more than 60% of the total variance in the TFR. As some of the countries in our sample may recently have changed their education system, we also checked whether the results are robust if we focus on only younger women aged between 15 and 25 (results are shown in Table S6, Online Appendix). The results do not change.

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[22] Pre-transition countries (Angola, Chad, DRC, Niger, and Sudan) and post-transition countries (Albania, Armenia, and Vietnam) are excluded.

Table 3: **Regressions of TFR on income, child mortality, and female education**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SSA (=1)	1.534		1.114		0.749		0.963		0.647
	(0.1961)		(0.2251)		(0.2074)		(0.2208)		(0.2311)
Log GDP per capita		−0.791	−0.454					−0.201	−0.0491
		(0.0936)	(0.1122)					(0.0966)	(0.1073)
Under-5 mortality rate				0.0208	0.0175			0.0138	0.0121
				(0.0012)	(0.0016)			(0.0015)	(0.0015)
% of women with						−3.839	−3.127	−1.613	−1.618
secondary education						(0.3600)	(0.4088)	(0.4263)	(0.4388)
Constant	3.649	10.75	7.458	2.769	2.620	5.953	5.136	5.542	4.115
	(0.1464)	(0.7568)	(0.9771)	(0.1555)	(0.1445)	(0.1778)	(0.2749)	(0.7487)	(0.8687)
Observations	345	345	345	345	345	345	345	345	345
R-squared	0.295	0.240	0.351	0.549	0.605	0.455	0.556	0.617	0.652

Notes: SSA = sub-Saharan Africa. Robust standard errors in parentheses. Standard errors are clustered at the country level. Child mortality is measured as the mortality rate per 1,000 children under 5 years of age. Education is measured as the percentage of women aged 15 to 25 with at least secondary education completed. Only countries are used for which at least two surveys are available. Pre-transition countries (Angola, Chad, DRC, Niger, and Sudan) and post-transition countries (Albania, Armenia, and Vietnam) are excluded. Number of countries: 72. For a list of countries, see Table S2 (Online Appendix).
Source: DHS/MICS/WFS data; calculations by the authors.

We also re-estimated these models with time and country fixed effects, interaction terms, and lags. These results are shown in Tables S7, S8, and S9 in the Online Appendix. Adding time and country fixed effects increases the sub-Saharan Africa dummy effect to more than two children compared to Table 4. The effect of GDP per capita becomes insignificant while the effects of under-five mortality and women's education remain almost the same. Including lags yields similar results, as we find in Table 4. Interestingly, the results of the interaction terms highlight the importance of socioeconomic development in sub-Saharan Africa. For all three dimensions (income, health, and education), the interaction term is statistically significant, meaning that the effect of income, health, and education are even higher in sub-Saharan African countries than in other countries.

Using the coefficients in Table 3, column 8, we calculate for each country and for each year the residual (see Section 2.3), which gives us, for each country and year, the number of children not 'explained' by child mortality, female education, and income. A (sizeable) positive residual suggests that mothers give birth to more children than the

socioeconomic circumstances would predict; a (sizeable) negative residual suggests the opposite.

The residuals are shown in Table 4 for each country for the latest DHS/MICS survey (see Table S10 in the Online Appendix for the residuals for all countries and survey years). Residuals for each country and each year are shown in Figure 3 for Uganda only, as a matter of illustration, and in Figure S1 in the Online Appendix for all countries.

Figure S2 in the Online Appendix shows the distribution of the residuals. As expected they follow a bell shape centred around 0. We also used our final specification to run a Bayesian regression model to obtain the posterior probability of experiencing a stall. Figure S3 in the Online Appendix shows the probability distribution of the residuals based on a Bayesian regression model using the model as in Table 3, column 8. Using the cut-off of 1 standard deviation of a residual, the probability of experiencing a stall is 16%.

Figure 3: **Fertility residuals by survey year: regression of fertility on GDP per capita, under-five mortality, and share of secondary education (Uganda)**
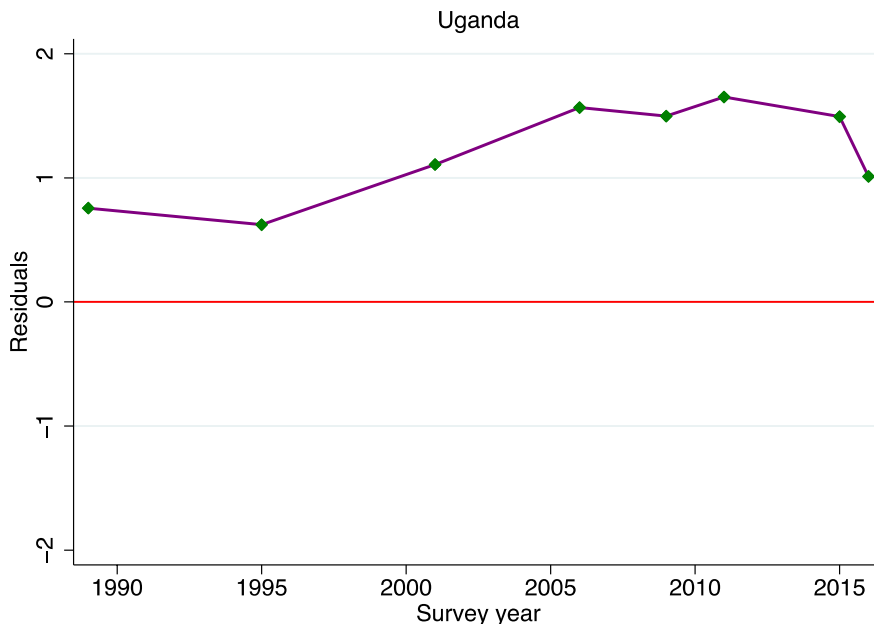
Note: The residuals are based on the regression results shown in Table 4.
Source: DHS/MICS/WFS data; calculations by the authors.

Table 4: **Fertility residuals by country: regression of fertility on GDP per capita, under-five mortality, and share of secondary education (latest survey)**

Country	Survey year	Residuals from Table 3	Residuals as % of predicted TFR		Survey year	Residuals from Table 3	Residuals as % of predicted TFR
Sub-Sahara Africa				Non-sub-Sahara Africa			
Nigeria	2017	1.19	25.6	Kyrgyz R.	2018	0.99	33.4
Zambia	2014	1.16	28.4	Mongolia	2018	0.81	30.5
Mali	2018	1.07	20.6	Tajikistan	2017	0.65	20.7
Uganda	2016	0.98	22.3	Egypt	2014	0.51	17.3
Congo (Rep.)	2015	0.97	28.1	Yemen	2013	0.49	12.3
Gabon	2012	0.92	28.8	Ecuador	1987	0.33	8.6
Mauritania	2015	0.83	19.4	Mexico	1987	0.30	8.1
Sao Tome & P.	2016	0.65	17.3	Iraq	2018	0.25	7.3
Benin	2018	0.63	12.5	Jordan	2018	0.05	2.1
Timor-Leste	2016	0.62	17.2	Bolivia	2008	−0.06	1.6
Burundi	2016	0.58	11.7	Guyana	2014	−0.13	4.9
Mozambique	2018	0.57	11.8	Trinidad & T.	1987	−0.15	4.7
Namibia	2013	0.51	16.3	Peru	2012	−0.16	5.9
Cameroon	2014	0.47	10.6	Philippines	2017	−0.29	9.7
Ghana	2016	0.43	11.4	Paraguay	2016	−0.38	13.0
Senegal	2017	0.41	9.8	Nicaragua	2001	−0.40	11.1
Zimbabwe	2015	0.34	9.3	Dominican R.	2014	−0.41	14.1
Tanzania	2017	0.33	7.4	Honduras	2012	−0.47	13.8
Burkina F.	2018	0.26	5.3	Maldives	2017	−0.53	19.9
Gambia	2018	0.03	0.6	Guatemala	2015	−0.56	15.1
Comoros	2012	−0.09	2.0	Colombia	2010	−0.56	20.7
Kenya	2015	−0.09	2.4	Sri Lanka	1987	−0.62	18.9
Rwanda	2017	−0.11	2.7	Indonesia	2017	−0.66	21.3
Swaziland	2014	−0.17	4.9	El Salvador	2014	−0.66	22.5
South Africa	2016	−0.17	6.2	Kazakhstan	1999	−0.69	25.1
Cote d'Ivoire	2016	−0.22	4.6	Brazil	1996	−0.75	22.9
Togo	2017	−0.26	5.7	Tunisia	2018	−0.88	29.9
Ethiopia	2016	−0.28	5.8	Pakistan	2018	−0.96	21.3
Guinea	2018	−0.41	7.9	Moldova	2012	−1.02	32.3
Madagascar	2016	−0.43	9.5	Cambodia	2014	−1.03	27.4
Liberia	2016	−0.44	9.5	Haiti	2016	−1.26	29.5
Malawi	2017	−0.46	9.8	Laos	2017	−1.28	31.7
Lesotho	2014	−1.01	23.6	Turkey	2003	−1.37	38.1
Sierra Leone	2017	−1.08	20.9	Morocco	2004	−1.41	36.3
				Bangladesh	2014	−1.42	38.4
				India	2015	−1.49	40.5
				Nepal	2016	−1.54	39.6

Notes: The residuals are based on the regression results shown in Table 3 (column 8). Pre-transition countries (Angola, Chad, DRC., Niger, and Sudan) and post-transition countries (Albania, Armenia, and Vietnam) are excluded. Number of countries: 72. For a list of countries, see Table S2 (Online Appendix). The dashed line refers to the cut-off of 1 standard deviation of the residuals (0.83). See Table S10 (Online Appendix) for the residuals for all countries and survey years.
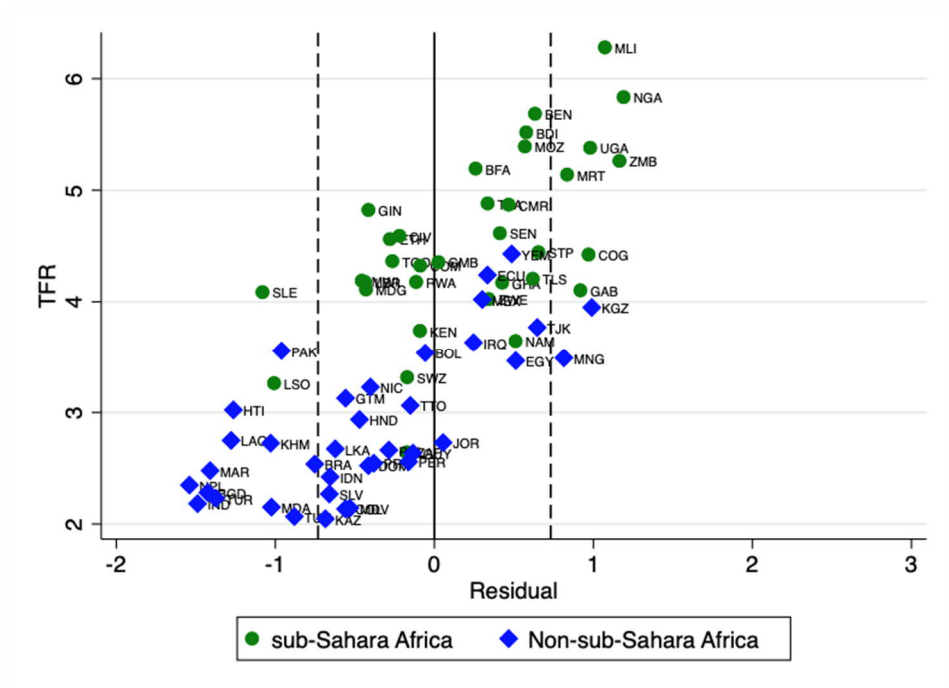*Source*: DHS/MICS/WFS data; calculations by the authors.

Defining a fertility stall as cases where the residual is larger than 1 standard deviation (0.83) of the residuals identifies the following 9 countries as being in a fertility stall for the most recent available DHS/MICS survey: Zambia, Nigeria, Mali, Uganda, Congo (Rep.), Gabon, Mauritania, Kyrgyz Republic, and Mongolia (Table 4).[23] This is graphically also shown in Figure 4, which plots residuals versus the TFR for countries in sub-Sahara Africa and other countries.

For comparison, the 16 countries that are classified to be in a stall applying the definition of Bongaarts (2008) (no significant increase in the pace of fertility decline) for the last available DHS/MICS surveys are Benin, Cote d'Ivoire, Egypt, Guinea, Mauritania, Mozambique, Namibia, Nigeria, Rwanda, Swaziland, Nepal, Pakistan, Colombia, Dominican Republic, Haiti, and Peru (Table S3, Online Appendix). There is an overlap of only two countries (Mauritania and Nigeria). This is due to the fact that for many countries (with stagnating fertility), lower fertility levels are not expected given their level of socioeconomic development. For example, fertility in Rwanda evolved as expected given the country's progress in terms of income, female education, and child mortality; that is, Rwanda constitutes an unconditional fertility stall but not a conditional stall. Moreover, our concept also pinpoints those cases that have not been classified as being in a stall by previous studies because fertility did decline, but our approach reveals that in fact fertility was still higher than what would be expected from the observed levels of income, female education, and child mortality. For instance, this is the case for Zambia and Uganda.

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[23] See Table S10 in the Online Appendix for the residuals for all countries and survey years.

Figure 4:   Residual versus TFR

We can also use the residuals to check which countries have been showing higher fertility levels than predicted over an extended period of time. This can be done using Figures 3 and S1 in the Online Appendix, where for each country residuals are plotted over time (see Table S10 in the Online Appendix for the respective residuals). In Uganda, for example, the residual is estimated to be greater than 0 for all survey years, which points to a long-term period of a fertility level that is higher given the countries socioeconomic development. Interestingly, the set of countries showing higher long-term fertility levels than predicted largely overlaps with the countries that have been identified as facing a conditional fertility stall in the latest survey. In contrast, definitions of unconditional stalls lead to countries moving in and out of being considered in a fertility stall, such as Burkina Faso, Malawi, or Kenya (see Section 3.1 and Table S5 and Figure S1 in the Online Appendix).

The demographic implications for countries with conditional stalls can be large. Even if fertility does not stop falling, the higher than predicted fertility will generate a substantial demographic momentum. For example, in a country such as Uganda, where actual fertility has been above predicted fertility by about one child per woman for the past 25 years (see Figure 3), this translates into almost 20 million more people by 2050.[24]

Obviously, the method we propose is not without limitations and hinges a lot on the data quality at hand. First, the computed residuals include measurement errors in fertility, and in the explanatory variables we might therefore over- or underestimate fertility stalls for certain countries. To limit this problem, we consider fertility stalls only where the residual is large. Users can alter this threshold and check the sensitivity of their results with respect to alternative assumptions. Second, our predicted fertility depends on the average correlation between education, income, and mortality across the world between 1980 and 2016. This implies that with our approach we can expect always about half of the country-years to show a positive residual and half a negative residual. This also suggests that one should not focus on small deviations but residuals above a certain sizeable threshold.

4. Conclusion

In this paper, we have shown that there are only a few countries which face lasting unconditional fertility stalls. For example, Zimbabwe has shown no significant fertility decline over the last 15 years. Moreover, we have shown that little overlap exists between countries that show unconditional and what we call conditional fertility stalls (i.e., low fertility despite high levels of socioeconomic development). We believe the distinction between unconditional and conditional stalls is important to understand fertility dynamics and design effective policy responses.

For countries that show conditional fertility stalls, the socioeconomic development favouring reductions in fertility seem to be in place, but other forces (e.g., limited access to family planning services or high fertility norms) keep fertility at a high level and must be addressed by policy. We identified the following countries with an ongoing conditional fertility stall: Zambia, Nigeria, Mali, Uganda, Congo (Rep.), Gabon, Mauritania, Kyrgyz Republic, and Mongolia. In these countries, fertility is too high given their level of GDP per capita, female education, and child mortality.

On the other hand, in other countries a continuation of the fertility transition seems to require policies that accelerate socioeconomic structural change, including growth of

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[24] This is estimated by comparing the high with the low variant of the UN population projections where the difference in the TFR is about 1. The high variant projects 98 million people, the low variant 81 million people in Uganda by 2050. The estimate for 2019 is 44 million (United Nations 2019).

GDP per capita, increased female education, and reduced child mortality. This is the case in Tanzania or Zimbabwe. In these countries, fertility is at the level that the prevailing economic conditions would predict.

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