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Research Article

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Abstract

BACKGROUND
Fertility stalls have been observed in numerous African and Middle Eastern countries. From the late 1990s until 2011 the fertility transition in Jordan was stalled, with the total fertility rate (TFR) well above replacement level.

OBJECTIVE
This paper demonstrates a resumption of fertility decline in Jordan since 2012 and investigates the background and proximate determinants behind the decline.

METHODS
Fertility trends among Jordanians are analyzed using the Jordan Labor Market Panel Survey (JLMPS) 2010 and 2016 waves and the Jordan Population and Family Health Survey (JPFHS) 2002 to 2017/2018 rounds. We estimate age-specific and total fertility rates over time and conduct a proximate-determinants decomposition. We also examine the evolution of fertility by age, education, and parity, testing for meaningful changes over time in a multivariate framework.

RESULTS
Fertility among Jordanians declined from a TFR of 3.8 in 2009/2010 to 3.3 in JLMPS 2016 and 2.6 in JPFHS 2017/2018. Vital statistics data are more consistent with the JLMPS estimate. Declines in fertility occurred across age groups and education levels and have parity-specific components. The proximate-determinants decomposition does not identify a clear driver of resumed fertility decline. Age at marriage increased steadily but slowly over time, yet contraceptive use among currently married women declined over time. The ideal number of children decreased less than observed fertility.

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CONTRIBUTION

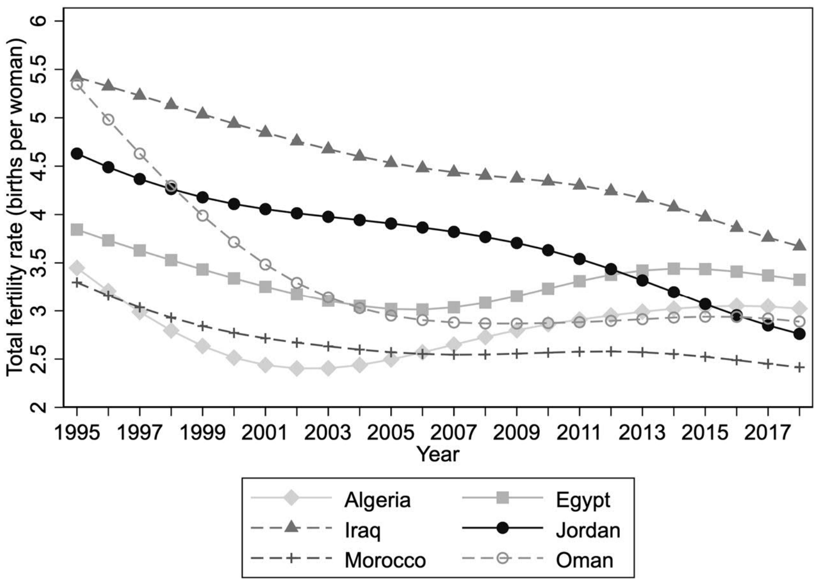
This paper discusses one of the first cases of a country in the Middle East and North Africa coming out of a fertility stall. It is an important contribution to understanding future demographic trajectories in the region.

1. Introduction

Stalls in the decline of the total fertility rate (TFR) have been documented in numerous low- and middle-income countries that have begun the fertility transition (Bongaarts 2006). Fertility stalls can have a substantial impact on population prospects and reveal important dynamics about the changing determinants of fertility in a society. However, the literature on the causes of fertility stalls is largely inconclusive. Some researchers have linked fertility stalls to a leveling off of contraceptive use and desired family size (Bongaarts 2006; Ezeh, Mberu, and Emina 2009) or flattening trends in age at marriage (Staetsky 2019). Others have argued that socioeconomic conditions have led to fertility stalls, including stagnation in women's educational attainment (Goujon, Lutz, and Samir 2015; Kebede, Goujon, and Lutz 2019; Shapiro and Gebreselassie 2013) and employment opportunities (Al Zalak and Goujon 2017; Krafft 2020), as well as persistent infant and child mortality (Shapiro and Gebreselassie 2013). Nevertheless, no consistent drivers of fertility stalls across countries and time periods have been identified.

Much of the existing literature on fertility stalls focuses on sub-Saharan Africa (Ezeh, Mberu, and Emina 2009; Goujon, Lutz, and Samir 2015; Kebede, Goujon, and Lutz 2019; Moultrie et al. 2008; Schoumaker 2019; Shapiro and Gebreselassie 2013). Yet the dynamics of the fertility transition in the Middle East and North Africa (MENA) region are also important for understanding when and why fertility stalls occur. The TFR in a number of MENA countries has stagnated or increased since the early 2000s (Figure 1). This trend has occurred in a regional context of substantial economic and political instability, which may affect fertility rates, including the occurrence of stalls (Cetorelli 2014; Grace and Sweeney 2016; Radovich et al. 2018). A better understanding of how fertility behaviors are changing in MENA is important to generate more accurate projections of the region's demographic future in this context of continued instability. In addition, in many sub-Saharan African countries, fertility stalls have been observed early in the fertility transition, at TFRs above five births per woman (Schoumaker 2019). In MENA, observed fertility stalls have primarily occurred at lower levels of TFR, in some cases less than a birth above replacement level. The MENA experience can therefore provide evidence on the causes and dynamics of stalls toward the end of the fertility transition.

Figure 1: MENA countries experiencing a fertility stall (total fertility rate, TFR, births per woman), 1995–2018



Source: Authors' construction based on World Development Indicators (World Bank 2020).
Note: The MENA countries experiencing a fertility stall in Figure 1 were identified by applying criteria from Bongaarts (2006, 2008) to fertility data extracted for the 17 Arab states from the World Development Indicators (World Bank 2020).[4]

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[4] World Development Indicator (WDI) data were used because the Demographic and Health Survey (DHS) or similar surveys that capture fertility are not available in many MENA countries. The first criterion applied from Bongaarts (2006) was that the country be mid–fertility transition, as measured by having a TFR between 2.5 and 5 in the latest data source, in this case the WDI estimate for 2018. Eight countries (Bahrain, Kuwait, Lebanon, Libya, Qatar, Saudi Arabia, Tunisia, and the United Arab Emirates) were eliminated as TFR had already fallen below 2.5 as of 2018; in all cases except Saudi Arabia, TFR has been at or below 2.5 since at least 2007. Although Bongaarts (2006) uses a second criterion for fertility stalls of no or positive change in the TFR between two successive DHS surveys, in Bongaarts (2008) a slightly less stringent criterion of a decrease in TFR of less than about 0.25 births per women between two DHS surveys is used as differences of this magnitude can be due to sampling variability. Applying this less stringent criterion and calculating the difference in TFR from five years prior as an approximation of an inter-DHS interval (given that the WDI data are annual), the six countries in Figure 1 were identified as experiencing a fertility stall. Although somewhat rough, this method indicates that Algeria has experienced a fertility stall since 2001 and Egypt since at least 2006, with a rising TFR in both countries during much of this period. Iraq experienced a mild fertility stall from about 2004–2009, with fertility continuing to decline but at a very slow rate. Jordan experienced a stall from 1999–2009, which is broadly consistent with analyses based on the DHS (Cetorelli and Leone 2012). Morocco has experienced a fertility stall since 2004, right at the 2.5 to 2.6 level of TFR, and finally Oman has experienced a stall since 2006. The only midtransition areas in the region not to have experienced a fertility stall according to this analysis are the Syrian Arab Republic, Yemen, and the West Bank and Gaza.

In this paper we focus on the dynamics of fertility stall and resumed decline in Jordan, which appears to be the first country in MENA in which a long fertility stall has recently ended. The fertility transition in Jordan was fairly rapid during the 1980s and 1990s, declining from a TFR above 6 to just under 4. Previous analyses have demonstrated that Jordan subsequently experienced a long fertility stall from 1998–2008 at a TFR above 3.5 (Cetorelli and Leone 2012). Building on this work, we present TFR estimates from multiple new data sources that demonstrate a resumption of Jordan's fertility transition between 2012 and 2017, although the data sources differ on the degree to which fertility rates have declined during this period. Our analysis indicates that the resumed decline in fertility has occurred across education levels and age groups. We then explore the possible drivers of this resumed fertility decline, focusing on the proximate determinants of fertility, including marriage, contraceptive use, and postpartum infecundability. While age at marriage has been increasing gradually in Jordan, contraceptive prevalence has, surprisingly, fallen rather than risen while fertility has resumed declining. As some of the first evidence of a MENA country coming out of a long-term fertility stall, understanding the dynamics of resumed fertility decline in Jordan has important implications for future demographic and socioeconomic trends in the country and the broader region.

2. The proximate and background determinants of fertility stall and recovery

Models of fertility change distinguish between the proximate, or biological and behavioral, determinants of fertility and the background determinants, which include sociocultural and economic factors (Bongaarts 2015). Literature on the causes of fertility stalls has explored both. Among the background determinants, particular attention has been paid to women's education. Studies have argued that fertility stalls in sub-Saharan Africa were associated with the proportion of women with no education, particularly as progress in schooling rates slowed during the 1980s (Ezeh, Mberu, and Emina 2009; Goujon, Lutz, and Samir 2015; Kebede, Goujon, and Lutz 2019). These arguments highlight how fertility stalls at the national level may be driven by certain subpopulations, such as educational (Kebede, Goujon, and Lutz 2019) or ethnic groups (Grace and Sweeney 2016), whether through differential fertility behaviors or changing composition of the population overall. In Egypt, where the literature on fertility stalls in MENA is richest, a number of studies have argued that plateauing fertility rates among more educated women have driven the stall (Al Zalak and Goujon 2017; Radovich et al. 2018; Vignoli 2006). In Jordan, by contrast, analyses have indicated that the stall occurred across all education levels (Cetorelli and Leone 2012).

Still, changes in socioeconomic conditions – including women's education – that lead to a fertility stall must act through at least one of the proximate determinants. We therefore undertake a proximate-determinants decomposition (Bongaarts 1978, 1982) and place particular emphasis on the role of age at marriage and contraceptive prevalence in Jordan's fertility stall and resumed decline.[5] Building on the literature, we disaggregate the results for marriage and contraception by women's education in order to explore the potential role of this background determinant.

Several previous analyses of fertility stalls in the MENA region, including in Jordan, have suggested that stalls were related to constant or decreasing levels of never being married (Cetorelli and Leone 2012; Staetsky 2019), whereas others have argued that changes in marriage are not a key driver of recent fertility trends (Al Zalak and Goujon 2017; Eltigani 2003). In Jordan, as in much of the MENA region, childbearing continues to take place almost exclusively within the confines of marriage, and marriage is the only socially accepted route to family formation (Dhillon, Yousef, and Dyer 2009). Changes in marriage therefore strongly affect exposure to childbearing, and stagnation in the trend toward increasing ages at marriage could drive a fertility stall. Jordan has experienced more modest increases in age at marriage than some other countries in the region. The median age at marriage increased somewhat from age 19 among women born in the 1960s but remained quite low at age 22 for those born in the 1980s (Assaad, Krafft, and Rolando 2017); we extend the trend in age at marriage with more recent data in this paper.

Use of contraception is a key predictor of fertility rates within marriage, although previous studies in MENA have not found strong evidence of changes in contraceptive prevalence driving fertility stalls (Al Zalak and Goujon 2017; Cetorelli and Leone 2012). Jordan adopted a national family planning and population strategy in the 1990s (Cetorelli and Leone 2012), and the 2013–2017 strategy sets the goal of reaching replacement fertility by 2030 (Higher Population Council [Jordan] 2013). Contraception is available through the public and private sectors. In the public sector, where about 40% of women who use contraception obtain their method, family planning services are provided free of charge to Jordanians. However, method options are somewhat limited, with less than a third of public health centers offering four or more methods as of 2012 (Higher Population Council [Jordan] 2013). There are also a range of private for- and not-for-profit actors who offer contraceptive services. Including pharmacies, this sector provided for about 56% of contraceptive demand in 2012 (Higher Population Council [Jordan] 2013).

Although contraceptive prevalence among married women remained relatively unchanged in Jordan during the period of the fertility stall from 2002–2012, at 41% to

[5] In his revised version of the proximate-determinants framework, Bongaarts (2015) replaces marriage with a union or sexual exposure more broadly. In Jordan, this adjustment is not needed due to the rarity of extramarital childbearing.

42% (Department of Statistics [Jordan] and ICF International 2013), several studies have suggested that the stall may be due in part to the limited contraceptive mix, including high rates of traditional method use and high rates of discontinuation (Al Massarweh 2013; Rashad and Zaky 2013; Spindler et al. 2017). However, the same studies also note that fertility ideals remain high in Jordan and that the desire to have another child is the most common reason for contraceptive discontinuation. Throughout the period of fertility stall, Jordanians' mean ideal number of children remained around four, which is close to the actual TFR during this period (Spindler et al. 2017). A similar dynamic of persistently high fertility ideals has been noted in Egypt during its fertility stall (Al Zalak and Goujon 2017). We examine more recent trends in fertility ideals in Jordan below.

3. Data and methods

3.1 Surveys

Our primary data sources are the Jordan Labor Market Panel Survey (JLMPS)[6] and the Jordan Population and Family Health Survey (JPFHS). The JLMPS is a nationally representative household survey that includes modules on education and fertility in addition to the main focus on the labor market. The first JLMPS wave was conducted in 2010, and a second wave of this longitudinal household survey in 2016. The 2016 wave, fielded from December 2016 through April 2017, tracked 2010 households and added a refresher sample. The JPFHS is Jordan's version of the Demographic and Health Survey (DHS).[7] JPFHS rounds were conducted in 1990, 1997, 2002, 2007, 2009, 2012, and 2017/2018. The JPFHS 2017/2018 was fielded from October 2017 to January 2018. We present descriptive statistics from the 2002 and later waves (during the stall and resumed decline). After applying sampling weights (used throughout our descriptive and multivariate analyses), all data are nationally representative.[8]

Our analysis focuses on the Jordanian national population;[9] the substantial populations of foreign migrant workers and, more recently, Syrian refugees residing in Jordan are excluded as their fertility patterns are quite different from those of Jordanians and because the composition of this population has changed over time, precluding

[6] See Krafft and Assaad (2021) for more information on the JLMPS 2016 survey. The data are publicly available from the Economic Research Forum's Open Access Micro Data Initiative (www.erfdataportal.com).
[7] See Department of Statistics (DOS) and ICF (2019) for more information on the JPFHS 2017/2018. The data are publicly available from www.dhsprogram.com.
[8] Code and documentation to replicate analyses in STATA v14.2 will be made available on one of the author's website, www.carolinekrafft.com/publications or is available upon request.
[9] Most persons of Palestinian origin in Jordan have Jordanian citizenship and so are classified as Jordanian.

consistent comparisons.[10] However, the JPFHS surveys prior to the 2007 round do not contain nationality variables perhaps because there were far fewer non-Jordanians in the country at the time and the non-Jordanians present were primarily male migrant workers (Assaad and Salemi 2019; Department of Statistics [Jordan] 2004). Thus, when we use 2002 JPFHS data for descriptive statistics, the results are not Jordanian specific. Results derived from the post-2002 JPFHS rounds and all results from the JLMPS are restricted to Jordanians.

3.2 Measuring fertility

Our key outcome of interest is fertility. Fertility outcomes are derived from the full birth history module for women who have been married in both surveys. The module covered ages 15 to 59 in the JLMPS and ages 15 to 49 in the JPFHS. The JLMPS birth history module is modeled on the DHS surveys and collects the same key fertility variables. We use the sample aged 15 to 49 at the time of the survey throughout for consistency across data sources.[11] We calculate age-specific fertility rates (ASFRs) and corresponding TFRs using the STATA tfr2 module (Schoumaker 2013).

We also consider the ideal total number of children of women who have ever been married as a measure of fertility preferences. While fertility preferences are malleable and subject to ex-post-rationalization based on actual number of births, they are an important indicator of the demand for children and often predict fertility levels quite well on the aggregate level (Bachrach and Morgan 2013; Bongaarts and Casterline 2018). Fertility intentions can therefore provide insights into possible future fertility trends.

3.3 Proximate-determinants decomposition

To understand the demographic factors behind Jordan's fertility stall and resumed decline, we examine how fertility and its proximate determinants have been changing over time since 2002. We undertake a proximate-determinants decomposition using the

[10] See, for example, Sieverding, Berri, and Abdulrahim (2019) and Department of Statistics (DOS) and ICF (2019) on the fertility patterns of Syrian refugees.
[11] The JPFHS women's questionnaire covers ages 15 to 49 and includes 6,006 Jordanian women who have been married in the 2002 round, 10,430 in 2007, 9,702 in 2009, 10,733 in 2012, and 12,390 in 2017/2018. The household roster of the JPFHS includes 11,152 women (regardless of marital status) ages 15 to 49 in the 2002 round, 19,194 in 2007, 16,923 in 2009, 19,026 in 2012, and 21,150 in the 2017/2018 round. The JLMPS dataset includes 3,602 Jordanian women who have been married aged 15 to 49 in the 2010 round and 4,254 in 2016. The JLMPS contains 6,338 Jordanian women (regardless of marital status) aged 15 to 49 in the 2010 round and 7,252 in the 2016 round, which we include in analyses such as never having been married.

model developed by Bongaarts (1978, 1982). The model focuses on four principal indices that represent potential inhibitors of fertility among women of reproductive age:

- C_m, the index of marriage, ranging from 0, no women married, to 1, all women married[12]
- C_c, the index of contraception, ranging from 0, all fecund women use 100% effective contraception, to 1 in the absence of contraception[13]
- C_a, the index of induced abortion, ranging from 0 if all pregnancies are aborted to 1 if none are aborted[14]
- C_i, the index of postpartum infecundability, ranging from 0 if the duration of postpartum infecundability is infinite to 1 if there is no postpartum lactation or abstinence[15]

The total fertility rate can then be decomposed as $TFR = C_m \times C_c \times C_a \times C_i \times TF$. Following Bongaarts (1982) the total fecundity rate (TF) in the absence of these proximate determinants is assumed to be 15.3. This model can be used to estimate a predicted TFR, given changes in the various indices. Changes not explained by the proximate determinants then contribute to a residual multiplier.

We provide additional detailed analyses of two key proximate determinants of fertility: age at first marriage and contraceptive use. Age at first marriage is available in both the JLMPS and JPFHS. We examine the proportion of women who have never married within each age group.

Contraceptive use is available only in the JPFHS for women who have been married aged 15 to 49. We examine trends in both ever and current contraception use among currently married women. Based on previous literature identifying method mix as a potentially important factor in Jordan's fertility stall (Al Massarweh 2013; Spindler et al. 2017), we also examine trends in current contraception use by modern versus traditional methods and by use of long-acting reversible contraception (LARC). In addition to infecundability as proxied by breastfeeding duration, we analyze trends in other indicators of nonsusceptibility to pregnancy in the JPFHS, including postpartum amenorrhea,[16] current pregnancy, recent sexual activity, spousal absence, and separation/divorce.

[12] Calculated as in Bongaarts (1982). Adjusted based on age 20 to 24 estimate for ages 15 to 19.
[13] Calculated as in Bongaarts (1982) but including injections and implants as 100% effective given Stover, Bertrand, and Shelton (2000).
[14] Calculated based on the total abortion rate (TAR) as in Bongaarts (1982), with the TAR estimated summing age-specific abortion rates for the five years preceding the survey among married women. Abortion is illegal in Jordan except in limited circumstances (United Nations 2014) and likely to be underreported.
[15] Based on the mean duration of breastfeeding as in Bongaarts (1982).
[16] Note that current (modern) contraceptive use includes lactational amenorrhea.

3.4 Methods

We examine key outcomes by five-year age group and education (operationalized in three levels: less than secondary, secondary, and higher education).[17] We also analyze how some outcomes depend on parity (births to date). In order to test for meaningful differences over time and determine for whom fertility is declining, we turn to multivariate models. We model age at marriage and then childbearing, conditional on being married, with annualized retrospective data from the JPFHS 2017/2018 and JLMPS 2016. We model current modern contraceptive use in each round of the JPFHS with a probit model. For all three multivariate models (fertility, marriage, and contraception) we build our models in a stepwise fashion, adding covariates in sequence to parallel our discussion of the descriptive analysis. In our multivariate work, we focus our analyses on the time period 2000–2016, which captures Jordan's fertility stall as well as the more recent period, in which fertility decline resumed.

We structure our data for age at marriage and fertility outcomes such that an observation is a person-year and cluster our standard errors on the person (woman) level. A key research question is how these outcomes are shifting over (calendar) time. We therefore include controls for each calendar year. Further, we test which years have similar coefficients, and thus can be pooled, and which years show substantially different patterns. We limit our analytical sample to women of childbearing age, ages 15 to 49, in the (time-varying) year in question.

For the marriage models, since outcomes may be right censored in that individuals may never marry or may have not yet married, we take a discrete-time survival analysis approach. The outcome is marrying in a particular year. We control for age at the year in question (the baseline hazard), with data from age 15 onward until marriage or censoring at the survey year.[18] In addition to education levels in some models, we also include controls for being in school (which is time-varying) to separate out the effects of longer periods in school from education levels.

The fertility outcomes are slightly more complex since women may have multiple births. This is a repeated event in survival analysis terms. Women are at risk for these events starting when they marry and every year thereafter until age 49. We include some time-varying controls in our fertility models, such as age at the year in question (categorically in five-year age groups, to parallel ASFRs).[19] In some models, to better understand spacing or potential stopping behavior, we measure parity and the time from

[17] Less than secondary includes those with no education or those with less than a secondary (12-year) degree (i.e., 1 to 11 years of schooling). Higher education includes two-year postsecondary institute (community college) degrees, four-year university degrees, and postgraduate degrees.

[18] We aggregate those aged less than 18 together and 32 and older together in estimating the baseline hazard.

[19] We also tested whether there was any impact of the Syrian refugee influx on marriage or fertility behavior; there was not. Nor did sibling pressures drive results for age at marriage (Krafft and Sieverding 2018).

either marriage or the preceding birth, in years, until the next birth (or censoring if there is no subsequent birth). We present descriptions for parity and interval since last birth using Kaplan-Meier failure estimators.

We estimate the multivariate marriage and fertility models with a complementary log-log model, which can be interpreted as a discrete-time proportional hazards model, where, for example, a covariate proportionately raises (or lowers) the hazard of marriage. The estimated coefficients can be exponentiated and interpreted as hazard ratios, characterizing how the hazard changes with a one-unit increase in the covariate.

3.5 Data quality: Age and date misreporting

Measurement error, particularly issues with data quality and age and date misreporting, may bias fertility estimates (Machiyama 2010; Pullum 2006; Pullum and Becker 2014; Pullum and Staveteig 2017). We therefore undertake several data quality checks around age and birth dates.[20] We assess the percentage of women who have been married aged 15 to 49 and births whose age or birth date information is imputed or incomplete. In the DHS context, misreporting of women's ages most commonly results in women aged 15 to 19 being recorded as 10 to 14 or women ages 45 to 49 being recorded as 50 to 54 years old to avoid administering the more exhaustive individual survey for women (Pullum and Staveteig 2017). Similarly, birth displacement is most likely to result in children ages 5 and under being recorded as older to avoid the children's survey (Pullum and Becker 2014). In the JLMPS heaping at age 5 may also happen to avoid administering the individual questionnaire, which starts at age 6. The JLMPS does not have a children's questionnaire; children under age 6 are captured in the household roster and as entries in the birth history for women. We present the distribution of the sample by age for ages 0 to 14 for the JLMPS and JPFHS 2012 and 2017/2018 to examine potential displacement.[21] We additionally measure the level of age heaping/digit preference in the data using the Myers' blended index for women who have been married ages 15 to 44 and births aged 0 to 29. Age heaping is most likely to result in unknown ages being estimated as ending with a 0 or 5 (Pullum 2006). As recommended by the DHS (Pullum and Staveteig 2017), when undertaking such data quality analyses we do not weight the data. As others have found for the previous rounds (Cetorelli and Leone 2012), we find that data quality for calculating fertility from the JPFHS remains high, and this holds for the JLMPS as well, so we present these results in the appendix.

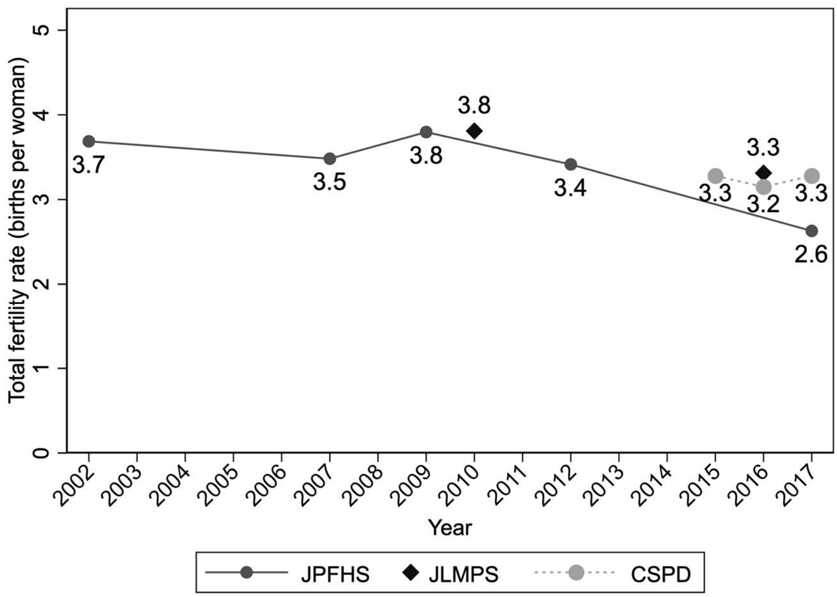
[20] Krafft and Assaad (2021) also generally validate the JLMPS sample against other data sources.
[21] We focus on the two most recent rounds of the JPFHS since past research examined data quality through 2009 (Cetorelli and Leone 2012).

4. Evidence of resumed fertility decline

This section presents evidence on changes in fertility over time, demonstrating the resumption of fertility decline in Jordan. Figure 2 shows the trend in fertility from 2002 to 2017[22] among Jordanians from the JPFHS and JLMPS surveys. Previous analyses using the JPFHS surveys through 2009 have demonstrated that Jordan's fertility stall lasted from 1998–2008 (Cetorelli and Leone 2012). With the new data, we see resumed fertility decline starting in the early 2010s. From a 2009 and 2010 TFR of 3.8, fertility fell to 3.4 in the JPFHS 2012, 3.3 in the JLMPS 2016, and 2.6 in the JPFHS 2017/2018. While JPFHS 2009 and JLMPS 2010 have the same fertility rate of 3.8, JLMPS 2016 and JPFHS 2017/2018 diverge considerably in their TFR estimates, despite being fielded less than a year apart. In order to triangulate these two estimates, we also include in Figure 2 the TFRs for 2015–2017 calculated from Jordan's Civil Status and Passports Department (CSPD) birth registration data (Civil Status and Passports Department [Jordan] 2015, 2016, 2017).[23] Calculations using CSPD data show a TFR of 3.3 in 2015, 3.2 in 2016, and 3.3 in 2017. Although we were not able to obtain the Jordanian-specific population estimates by five-year age groups for 2018 and 2019, since Jordanian-specific births were available (Civil Status and Passports Department [Jordan] 2018, 2019), we estimated TFRs with the same method as other years.[24] TFR estimates were 3.1 in 2018 and 2.9 in 2019. Estimates made by the United States Agency for International Development (USAID) Jordan based on birth registries found a similar TFR of 3.1 in 2014 (Spindler et al. 2017). While all the data sources thus point to a resumption of fertility decline since the early 2010s, the estimate of the JPFHS 2017/2018 appears to be a bit of an outlier.

[22] For ease of exposition we refer to single years through 2017 even when including the 2017/2018 round of the JPFHS but name the specific JPFHS 2017/2018 wave as 2017/2018.
[23] The annual reports with the births for Jordanians categorized by age of mother are available going back only to 2015. Using data on the population of Jordanian women aged 15 to 49 in each year, by five-year age group (from correspondence with the Department of Statistics; 2015 data was corroborated with published census reports [Department of Statistics (Jordan) 2015]) we can calculate ASFRs and TFRs.
[24] Assuming the same annual growth in each age group as for 2016–2017.

Figure 2: Total fertility rates (TFRs, births per woman), Jordanian women, 2002–2017



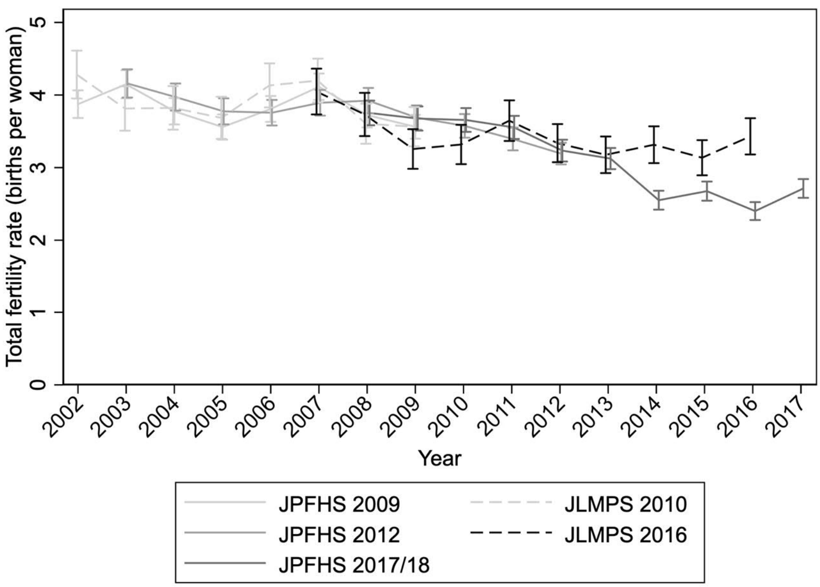
Sources: TFRs are authors' calculations based on JPFHS 2002–2017/2018; JLMPS 2010 and 2016; and CSPD 2015–2017 (population of Jordanian women by five-year age group from correspondence with the Department of Statistics).
Note: TFRs are calculated for the three years preceding the survey except for CSPD data, which are annual.

In order to better understand fertility trends and the evolving differences across the JLMPS and JPFHS, Figure 3 shows the reconstructed single-year fertility trends from both surveys. The data suggest that Jordan's fertility transition resumed around 2012, and estimates are consistent across data sources through 2013. JPFHS estimates diverge from JLMPS estimates starting in 2014. Since there are similar time trends for the earlier, but not later, years across data sources, we model results with the JPFHS 2017/2018 and JLMPS 2016 separately. We estimate a multivariate model for the annual hazard of giving birth controlling only for time-varying age group and calendar year (and thus equivalent to Figure 3 but only among those who have been married, separating out the influence of marriage patterns). Compared to a base year of 2008,[25] the surveys both show fairly consistent declines in the annual hazard of giving birth in the 2010s (Table 1, Spec.

[25] Base year of 2008 was selected because it has the closest agreement in Figure 3 and is within the fertility stall period according to previous research (Cetorelli and Leone 2012).

1). The JPFHS, which has a larger sample size and thus smaller standard errors, shows a decline starting in 2012 (p-value 0.012) and continuing through 2016 (p-value <0.001). The 2014–2016 period represents a particularly sharp decline. In the JLMPS, as was true in Figure 3, the decline starts earlier, around 2009, but is smaller until 2014 and 2015 and is also smaller, although still a decline, in 2016. Further testing led to grouping the data into three distinct periods: 2000–2011 (the fertility stall), 2012–2013 (the start of the resumed fertility decline), and 2014–2016 (the acceleration of the resumed fertility decline). Thus, the JPFHS 2017/2018 and JLMPS 2016 both corroborate the fertility stall persisted until 2011 and fertility decline resumed in 2012, with an acceleration in the decline since 2014 (Table 1, Spec. 2).[26]

Figure 3: Retrospective single-year total fertility rate (TFR) trends, Jordanian women, 2002–2017



Sources: Authors' calculations based on JPFHS 2009, 2012, and 2017/2018 and JLMPS 2010 and 2016.
Notes: Bars represent 95% confidence intervals. Jitter applied to make overlapping bars more distinct.

[26] We also pool the JLMPS 2016 and JPFHS 2017/2018 data and run a hazard model to test for differences between the two data sources. Using a pooled and interacted model to test for differences over time shows similar results across data sources in the base year of 2008 and all other single years (results not shown).

Table 1: Fertility models: Complementary log-log discrete-time proportional hazards model: hazard ratios (standard errors)

	Spec. 1		Spec. 2		Spec. 3		Spec. 4		Spec. 5		Spec. 6	
	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18
Year (2008 omit.)												
2000	0.959	1.032										
	(0.099)	(0.056)										
2001	0.893	0.873										
	(0.087)	(0.048)										
2002	0.929	0.966										
	(0.093)	(0.053)										
2003	0.952	0.968										
	(0.083)	(0.052)										
2004	0.885	0.993										
	(0.091)	(0.050)										
2005	0.875	0.976										
	(0.076)	(0.053)										
2006	0.986	0.903										
	(0.098)	(0.046)										
2007	1.088	1.035										
	(0.113)	(0.058)										
2009	0.829	1.039										
	(0.089)	(0.056)										
2010	0.933	1.010										
	(0.085)	(0.050)										
2011	0.968	0.930										
	(0.082)	(0.047)										
2012	0.891	0.883										
	(0.085)	(0.044)										
2013	0.902	0.869										
	(0.085)	(0.044)										
2014	0.821	0.721										
	(0.078)	(0.038)										
2015	0.771	0.813										
	(0.070)	(0.043)										
2016	0.870	0.719										
	(0.078)	(0.038)										
Age group (25–29 omit.)												
<20	1.364	1.708	1.359	1.703	1.187	1.711	1.459	1.795	1.401	1.988	0.828	0.880
	(0.165)	(0.095)	(0.163)	(0.095)	(0.185)	(0.109)	(0.174)	(0.102)	(0.250)	(0.137)	(0.094)	(0.058)
20–24	1.472	1.428	1.471	1.428	1.415	1.460	1.533	1.475	1.519	1.407	1.188	1.063
	(0.057)	(0.032)	(0.057)	(0.032)	(0.066)	(0.038)	(0.060)	(0.033)	(0.096)	(0.051)	(0.056)	(0.030)
30–34	0.708	0.673	0.706	0.672	0.708	0.683	0.707	0.673	0.759	0.702	0.896	0.865
	(0.027)	(0.014)	(0.027)	(0.014)	(0.035)	(0.017)	(0.028)	(0.014)	(0.046)	(0.025)	(0.043)	(0.023)

Table 1: (Continued)

	Spec. 1		Spec. 2		Spec. 3		Spec. 4		Spec. 5		Spec. 6	
	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18
35–39	0.420	0.404	0.421	0.406	0.449	0.408	0.424	0.410	0.473	0.447	0.603	0.584
	(0.022)	(0.011)	(0.021)	(0.011)	(0.027)	(0.014)	(0.022)	(0.011)	(0.039)	(0.021)	(0.040)	(0.021)
40–44	0.195	0.156	0.195	0.157	0.225	0.165	0.198	0.160	0.253	0.166	0.317	0.245
	(0.017)	(0.008)	(0.017)	(0.008)	(0.026)	(0.013)	(0.017)	(0.008)	(0.039)	(0.018)	(0.035)	(0.015)
45–49	0.039	0.019	0.040	0.019	0.043	0.018	0.040	0.019	0.054	0.026	0.077	0.033
	(0.011)	(0.004)	(0.011)	(0.004)	(0.032)	(0.005)	(0.011)	(0.004)	(0.055)	(0.009)	(0.023)	(0.008)
Years (2000–2011 omit.)												
2012–2013			0.951	0.896	0.957	0.920	1.021	0.882	0.977	0.804	1.007	1.000
			(0.045)	(0.024)	(0.076)	(0.045)	(0.063)	(0.033)	(0.125)	(0.061)	(0.091)	(0.059)
2014–2016			0.872	0.768	0.867	0.807	0.863	0.745	0.684	0.741	1.045	0.817
			(0.033)	(0.018)	(0.056)	(0.033)	(0.045)	(0.026)	(0.075)	(0.051)	(0.073)	(0.043)
Years and age group int.												
2012–2013 # <20					1.680	0.999			1.294	1.050		
					(0.482)	(0.202)			(0.450)	(0.230)		
2012–2013 # 20–24					1.140	0.926			1.292	1.152		
					(0.140)	(0.074)			(0.219)	(0.129)		
2012–2013 # 30–34					0.938	0.966			0.812	1.119		
					(0.120)	(0.071)			(0.161)	(0.125)		
2012–2013 # 35–39					0.867	1.017			1.115	1.103		
					(0.131)	(0.086)			(0.233)	(0.135)		
2012–2013 # 40–44					0.687	0.878			0.540	1.165		
					(0.155)	(0.119)			(0.148)	(0.219)		
2012–2013 # 45–49					1.333	1.181			1.614	1.076		
					(1.197)	(0.547)			(1.966)	(0.623)		
2014–2016 # <20					1.534	0.996			1.815	1.022		
					(0.394)	(0.173)			(0.536)	(0.190)		
2014–2016 # 20–24					1.100	0.911			1.454	1.066		
					(0.111)	(0.064)			(0.210)	(0.110)		
2014–2016 # 30–34					1.030	0.929			1.278	1.010		
					(0.104)	(0.057)			(0.212)	(0.102)		
2014–2016 # 35–39					0.806	0.946			1.061	0.903		
					(0.104)	(0.073)			(0.206)	(0.104)		
2014–2016 # 40–44					0.844	0.897			1.254	0.984		
					(0.149)	(0.109)			(0.294)	(0.172)		
2014–2016 # 45–49					0.791				1.239			
					(0.635)				(1.363)			
Ed. (less than sec. omit.)												
Secondary							1.075	0.995	1.132	0.963	0.929	0.928
							(0.052)	(0.028)	(0.094)	(0.044)	(0.040)	(0.025)
Higher							1.313	1.193	1.403	1.249	0.994	0.947
							(0.072)	(0.031)	(0.098)	(0.048)	(0.044)	(0.023)

Table 1: (Continued)

	Spec. 1		Spec. 2		Spec. 3		Spec. 4		Spec. 5		Spec. 6	
	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18
Years and ed. int.												
2012–2013 # Secondary							0.928	0.979	1.038	1.160		
							(0.112)	(0.069)	(0.227)	(0.159)		
2012–2013 # Higher							0.794	1.017	0.884	1.195		
							(0.091)	(0.060)	(0.155)	(0.128)		
2014–2016 # Secondary							0.996	0.923	1.426	1.007		
							(0.097)	(0.058)	(0.248)	(0.121)		
2014–2016 # Higher							0.978	1.066	1.395	1.101		
							(0.086)	(0.056)	(0.196)	(0.101)		
Ed. and age group int.												
Secondary # <20									0.639	0.702		
									(0.243)	(0.163)		
Secondary # 20–24									1.043	1.289		
									(0.121)	(0.084)		
Secondary # 30–34									0.858	0.955		
									(0.117)	(0.063)		
Secondary # 35–39									0.948	0.876		
									(0.158)	(0.086)		
Secondary # 40–44									0.663	1.108		
									(0.225)	(0.253)		
Secondary # 45–49									0.104	0.610		
									(0.115)	(0.395)		
Higher # <20									0.599	0.383		
									(0.327)	(0.128)		
Higher # 20–24									0.847	1.015		
									(0.105)	(0.066)		
Higher # 30–34									0.897	0.946		
									(0.112)	(0.054)		
Higher # 35–39									0.899	0.813		
									(0.122)	(0.061)		
Higher # 40–44									0.868	0.968		
									(0.227)	(0.163)		
Higher # 45–49									1.029	0.358		
									(1.510)	(0.277)		
Years and ed. and age group int.												
2012–2013 # Secondary # <20									3.574	1.551		
									(2.389)	(1.331)		
2012–2013 # Secondary # 20–24									0.760	0.782		
									(0.251)	(0.164)		

Table 1: (Continued)

	Spec. 1		Spec. 2		Spec. 3		Spec. 4		Spec. 5		Spec. 6	
	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18
2012–2013 # Secondary # 30–34									1.060	0.787		
									(0.366)	(0.161)		
2012–2013 # Secondary # 35–39									0.489	0.926		
									(0.220)	(0.215)		
2012–2013 # Secondary # 40–44									2.491	0.580		
									(1.544)	(0.256)		
2012–2013 # Higher # <20									2.054	1.103		
									(2.046)	(0.706)		
2012–2013 # Higher # 20–24									0.530	0.645		
									(0.162)	(0.119)		
2012–2013 # Higher # 30–34									1.371	0.812		
									(0.406)	(0.131)		
2012–2013 # Higher # 35–39									0.617	0.955		
									(0.212)	(0.180)		
2012–2013 # Higher # 40–44									1.282	0.621		
									(0.676)	(0.182)		
2012–2013 # Higher # 45–49									0.583	2.394		
									(1.027)	(2.605)		
2014–2016 # Secondary # <20									2.823	0.705		
									(2.088)	(0.646)		
2014–2016 # Secondary # 20–24									0.599	0.748		
									(0.164)	(0.140)		
2014–2016 # Secondary # 30–34									0.818	0.887		
									(0.221)	(0.158)		
2014–2016 # Secondary # 35–39									0.553	1.021		
									(0.194)	(0.224)		
2014–2016 # Secondary # 40–44									0.490	1.225		
									(0.293)	(0.413)		
2014–2016 # Higher # 20–24									0.663	0.895		
									(0.164)	(0.149)		
2014–2016 # Higher # 30–34									0.653	0.906		
									(0.154)	(0.124)		
2014–2016 # Higher # 35–39									0.707	1.241		
									(0.209)	(0.208)		
2014–2016 # Higher # 40–44									0.490	0.743		
									(0.195)	(0.205)		

Table 1: (Continued)

	Spec. 1		Spec. 2		Spec. 3		Spec. 4		Spec. 5		Spec. 6	
	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18
2014–2016 # Higher # 45–49									0.288			
									(0.470)			
Parity (Marr. omit.)												
1st											0.421	0.389
											(0.036)	(0.018)
2nd											0.186	0.133
											(0.021)	(0.009)
3rd											0.155	0.115
											(0.021)	(0.009)
4th+											0.159	0.112
											(0.020)	(0.008)
Time since last birth or marr. (1 yr. omit.)												
Two years											0.746	0.812
											(0.059)	(0.039)
Three years											0.458	0.533
											(0.053)	(0.039)
Four years											0.296	0.350
											(0.045)	(0.037)
Five years											0.299	0.194
											(0.065)	(0.030)
Six or more years											0.082	0.123
											(0.017)	(0.013)
Parity and time int.												
1st # 2012–2013											0.912	0.778
											(0.137)	(0.067)
1st # 2014–2016											0.717	0.770
											(0.081)	(0.062)
2nd # 2012–2013											0.959	0.867
											(0.139)	(0.076)
2nd # 2014–2016											0.654	0.830
											(0.079)	(0.065)
3rd # 2012–2013											0.731	0.837
											(0.116)	(0.079)
3rd # 2014–2016											0.676	0.833
											(0.091)	(0.070)
4th+ # 2012–2013											0.780	0.782
											(0.113)	(0.067)
4th+ # 2014–2016											0.621	0.876
											(0.074)	(0.071)
Parity and interval int.	No	No	No	No	No	No	No	No	No	No	Yes	Yes
N obs.	42,025	127,480	42,025	127,480	42,025	127,451	42,025	127,480	41,944	127,270	42,025	127,480
N individuals	9,289	27,626	9,289	27,626	9,289	27,626	9,289	27,626	9,288	27,626	9,289	27,626

Sources: Authors' calculations based on JPFHS 2017/2018 and JLMPS 2016.
Note: Standard errors clustered by woman.

5. Among whom has fertility declined?

We now assess among whom fertility has declined as a first step in understanding why fertility has resumed declining. In addition to the age pattern of fertility we focus on differences by women's education and parity. We present and discuss both descriptive and multivariate results.

5.1 Age-specific fertility rates

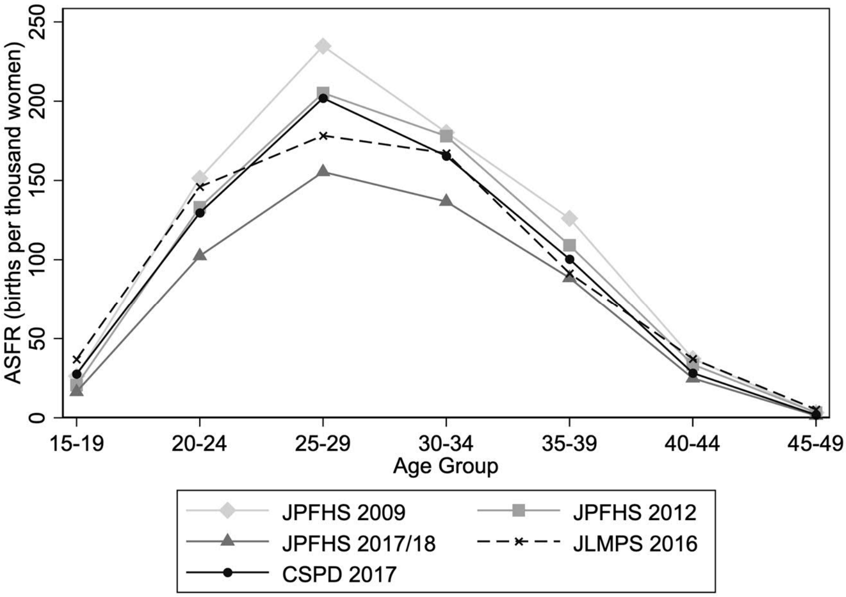
Figure 4 shows ASFRs over time from the JPFHS 2009–2017/2018 and JLMPS 2016 surveys.[27] The figure also includes the ASFRs calculated from CSPD 2017 data. From 2009 to 2012 there was a slight decrease in ASFRs at prime childbearing ages, especially ages 25 to 29 (from 235 births per thousand women in 2009 to 205 in 2012). The JLMPS 2016 suggests further decreases at 25 to 29 (down to 178) and older ages, but similar or even slightly higher ASFRs at ages 15 to 24. There is some evidence of a shift in the age structure of childbearing, in that the ASFR for ages 30 to 34 in 2016 remains close to that of 2009 and 2012. It is thus possible that Jordanian women are postponing births until later ages, which would result in a temporary dip in the TFR.[28] The JPFHS 2017/2018 shows a drop at all ages, particularly prime ages from 20 to 34, with the peak ASFR for ages 25 to 29 dropping to 155. The CSPD 2017 ASFRs are quite similar to JPFHS 2012 rates for ages 15 to 29, with the peak ASFR for ages 25 to 29 at 202. The ASFRs for later ages are similar to the JLMPS 2016, corroborating the downward trend but not the extent implied by the JPFHS 2017/2018.

We estimate multivariate models corresponding to Figure 4 among those who have been married, controlling just for age group and the three periods (2000–2011, 2012–2013, and 2014–2016) and interacting age and the three periods (see Table 1, Spec. 3). Per the models neither the JLMPS nor JPFHS exhibit differential changes over time in the childbearing hazard of particular age groups; in other words, if postponement of births is happening it is not yet detectable. This finding suggests that a common factor affecting fertility rates across all age groups may be driving the fertility decline.

[27] Here and for a number of other analyses we focus on 2009–2017 as the period of interest when fertility resumed declining and omit the JLMPS 2010 results for simplicity since, as shown in Figures 3 and 4, they are consistent with JPFHS 2009 results in terms of fertility levels.

[28] We did not, however, find any concomitant changes in the mean age at childbearing. The mean age at childbearing was 30.0 in 2017, 30.0 in 2012, 29.8 in 2009, 30.2 in 2007, and 30.0 in 2002.

Figure 4: Age-specific fertility rates (ASFRs, births per thousand women), Jordanian women, 2009–2017



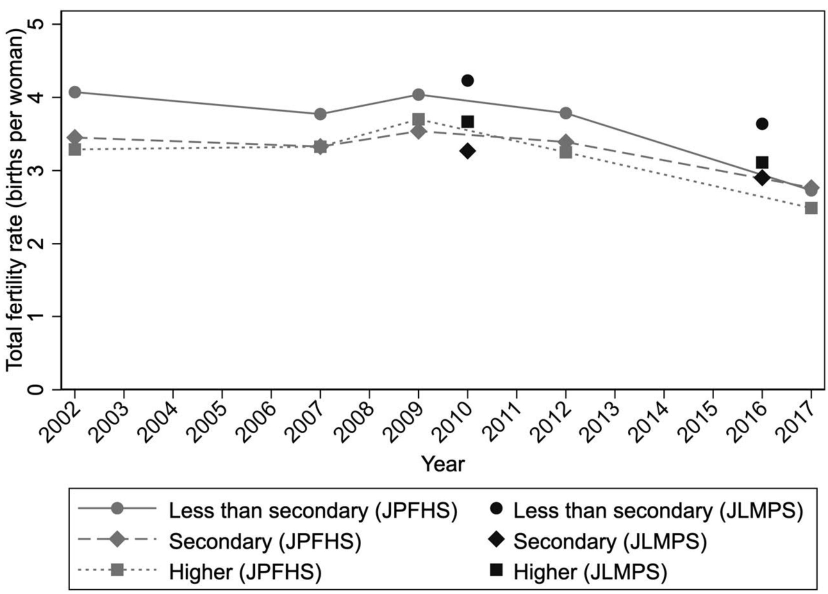
Sources: Authors' calculations based on JPFHS 2009, 2012, and 2017/2018; JLMPS 2016; and CSPD 2017 (2017 population of Jordanian women by age group from correspondence with DOS).
Note: ASFRs are calculated for the three years preceding the survey for JPFHS and JLMPS and for 2017 for CSPD 2017.

5.2 Fertility rates by education

One background determinant that could affect fertility rates across age groups is education. Figure 5 compares TFRs by education level in the 2002–2017 period. The decline in fertility has occurred across all education levels, although to varying degrees and with varying patterns across surveys. Consistent with previous analyses (Cetorelli and Leone 2012), the data show a slight U shape in fertility rates in 2009. The highest TFR was among those with less than secondary education (4.0), followed by higher education (3.7), while the lowest TFR was among those with secondary education (3.5). The JPFHS data find that this pattern had shifted by 2012, with the higher educated having the lowest fertility, a trend that continued in 2017. However, by 2017, fertility levels among women with secondary and less than secondary education were the same and were closer to those of women with higher education. The JLMPS 2016 instead finds that women with secondary education continue to have the lowest fertility, although fertility among those with secondary and higher education converged. The much lower TFR found by the JPFHS 2017/2018 compared to the JLMPS 2016 may be driven in particular by the considerably lower fertility rates among women with less than secondary education found in the JPFHS 2017/2018.

We test the role of education in resumed fertility decline in multivariate models by adding controls for education to those for period and age group and interacting the periods with education (Table 1, Spec. 4). The interaction with the largest change is for the JLMPS, where married women with higher education had a lower hazard of births in 2012–2013 (p-value 0.045), an effect that disappeared by 2014–2016 (p-value 0.801). Moreover, in multivariate models fully interacting period, age group, and education level (see Table 1, Spec. 5) no clear pattern emerges. There therefore do not appear to be any clear education-specific shifts that explain the fertility decline resuming.

Figure 5: Total fertility rates (TFRs, births per woman) by education over time, Jordanian women, 2002–2017

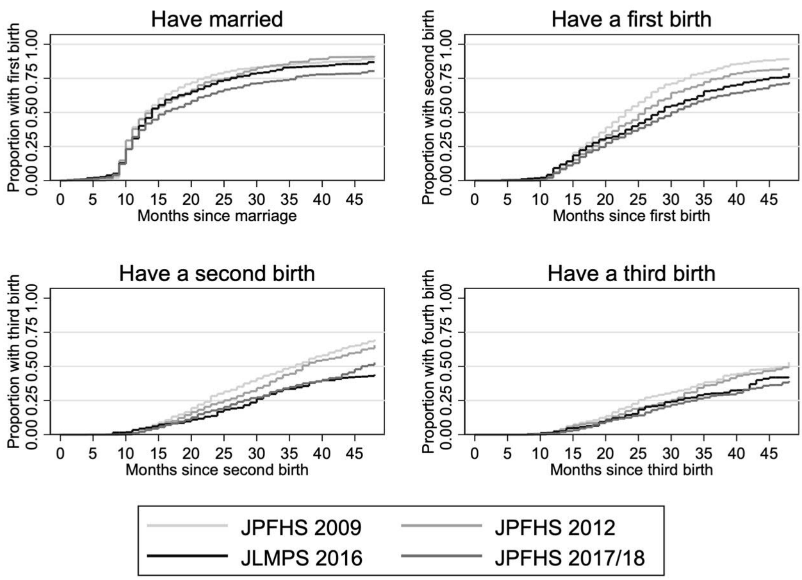


Sources: Authors' calculations based on JPFHS 2002, 2007, 2009, 2012, and 2017/2018 and JLMPS 2010 and 2016.
Note: TFRs are calculated for the three years preceding the survey.

5.3 Changes in parity progression

In Figure 6, we explore which parities may be driving the fertility decline using Kaplan-Meier failure estimators. There are slight differences in the timing of transitioning from marriage to first birth between the JPFHS 2009 and 2012 and the JLMPS 2016, but the JPFHS 2017/2018 shows notably fewer women having their first birth even within a period of 48 months after marriage. In the transition from a first to second birth, the proportion with a second birth declined steadily across all four surveys. In a context where having only one child is uncommon, this is likely to indicate greater spacing between births rather than stopping. The JLMPS 2016 and JPFHS 2017/2018 also show a similar decline at each interval for going from a second to third and a third to fourth birth. This shift may indicate either greater spacing or stopping if couples are increasingly deciding to have only two or three children.

Figure 6: Kaplan-Meier failure estimators for births by parity and months since preceding event, Jordanian women, 2009–2017



Sources: Authors' calculations based on JPFHS 2009, 2012, and 2017/2018 and JLMPS 2016.
Note: For women who became at risk of the event within the five years preceding the survey (e.g., women who married within the preceding five years for "have marriage" and at risk of first birth, women who had a first birth within the preceding five years and at risk of second birth for "have first").

Multivariate fertility models adding parity (Table 1, Spec. 6) show there are not differences over time in the hazard for having a first birth in the JLMPS, but there are for the JPFHS. Why married women in the JPFHS 2017/2018 are less likely to have first births when, as we show below, 0% use contraception before the first birth is unclear. The JLMPS and JPFHS find lower hazards of second and higher births in 2014–2016 compared to 2000–2011, and the JPFHS finds lower hazards in 2012–2013 for second and higher births as well. Both the descriptive and multivariate results suggest, at a minimum, spacing and potentially stopping.

6. The proximate determinants in Jordan's resumed fertility decline

The previous analyses demonstrated that resumed fertility decline in Jordan occurred across age groups, education levels, and parities, although there is some disagreement between the JLMPS and JPFHS in terms of whether first births are less likely to occur in the most recent years. We now turn to an examination of the proximate determinants that may be driving this across-the-board resumption of falling fertility rates. We first undertake a formal proximate-determinants decomposition and then further investigate marriage, contraception, and susceptibility to pregnancy using descriptive and multivariate methods.

6.1 Proximate-determinants decomposition

Table 2 presents the estimates of the proximate-determinants indices, the resulting predicted TFR, and the observed TFR using the JPFHS. The index of marriage remained quite stable, at 0.48 to 0.52 throughout the period. The index of contraception gradually decreased from 2002 (0.51) to 2012 (0.46), meaning that contraception was playing a slightly larger role in reducing fertility over time. However, the index rose to 0.52 in 2017/2018, meaning contraception was reducing fertility relatively less than in 2009–2012. The index of infecundability, after fluctuating between 0.74 to 0.75 over 2002–2012, rose slightly to 0.78 in 2017/2018. The index of abortion was 0.98 to 0.99 throughout the period (abortions are likely underreported).

In sum, a fairly consistent picture emerges over 2002–2012, with the predicted TFR, given the proximate determinants, ranging from 0.67 to 1.07 births lower than observed TFR and only contraception showing a slight but consistent upward trend in its role in fertility reduction. The pattern reverses in 2017/2018, with a predicted TFR around 3.0 despite an observed TFR of 2.6. The sudden drop in fertility in the JPFHS 2017/2018 cannot be explained by the trends in proximate determinants, and indeed, contraception and infecundability are trending counter to fertility decline, while abortion and marriage remain stable. We explore these puzzling results in greater detail in what follows.

Table 2: Estimates of proximate-determinants indices and TFR, Jordanian women, 2002–2017

JPFHS round:	2002	2007	2009	2012	2017/18
C_m	0.48	0.51	0.52	0.49	0.49
C_c	0.51	0.48	0.47	0.46	0.52
C_i	0.74	0.75	0.74	0.75	0.78
C_a	0.99	0.99	0.99	0.98	0.98
Predicted TFR	2.71	2.81	2.73	2.54	2.99
Observed TFR	3.69	3.48	3.80	3.41	2.63

Sources: Authors' calculations based on JPFHS 2002, 2007, 2009, 2012, and 2017/2018.

6.2 Marriage and age at marriage

In countries such as Jordan where childbearing occurs almost exclusively in the context of marriage, shifts in those who never married and marriage timing could be driving the observed decline in TFR. The percentage of Jordanian women who were never married across age groups is therefore shown in Table 3 for 2009–2017. There is some modest variation across surveys. The largest differences that might pertain to fertility trends are for ages 20 to 24, where 63% of women in the JPFHS 2009, 67% of those in JPFHS 2012 and 2017/2018, and only 59% of those in JLMPS 2016 were never married.

Table 3: Percentage of women who have never been married by age group, Jordanian women, 2009–2017

Age group	JPFHS 2009	JPFHS 2012	JLMPS 2016	JPFHS 2017/18
15–19	94	94	92	95
20–24	63	67	59	67
25–29	30	30	29	33
30–34	19	18	19	17
35–39	15	14	12	12
40–44	11	10	13	10
45–49	9	8	10	9
N	16,923	19,026	7,252	21,150

Sources: Authors' calculations based on JPFHS 2009, 2012, and 2017/2018 and JLMPS 2016.

To test for shifts in marriage that might contribute to fertility decline, we estimate multivariate models for age at marriage.[29] With the JLMPS 2016 data, estimating single-year effects (Table 4, Spec. 2), 2008 (p-value 0.047 on a hazard ratio of 0.702) and 2009 (p-value of 0.001 for a hazard ratio of 0.538) have substantially lower hazards of marriage than 2007. There are not such large differences for later years, but 2016 does have a particularly low hazard ratio (hazard ratio of 0.685 compared to 2007, p-value 0.052). With the JPFHS 2017/2018, there are lower hazards of marriage in the 2012–2016 period (hazard ratios of 0.756 to 0.800, p-values from 0.001 to 0.019). Thus, while the two data sources disagree on when exactly marriages might have been delayed, as the descriptive results suggested, delay in marriage may be one factor contributing to the observed fertility decline. The periods with declines were times of substantial global and regional economic challenges: 2008–2009 saw the global financial crisis, and in 2012–2016 Jordan faced substantial economic challenges given regional instability (e.g., conflict in neighboring Syria).

Table 4: Marriage models: Complementary log-log discrete-time proportional hazards model: hazard ratios (standard errors)

	Spec. 1		Spec. 2		Spec. 3		Spec. 4		Spec. 5	
	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18
Year (2007 omit.)										
2000	0.976	1.171	0.917	1.141						
	(0.175)	(0.123)	(0.165)	(0.119)						
2001	0.687	0.989	0.651	0.963						
	(0.127)	(0.106)	(0.122)	(0.102)						
2002	0.971	0.941	0.918	0.921						
	(0.228)	(0.102)	(0.210)	(0.099)						
2003	0.870	0.860	0.846	0.836						
	(0.156)	(0.091)	(0.152)	(0.088)						
2004	0.864	0.935	0.843	0.909						
	(0.151)	(0.095)	(0.147)	(0.092)						
2005	1.152	1.126	1.116	1.113						
	(0.202)	(0.111)	(0.195)	(0.110)						
2006	1.064	1.019	1.051	1.012						
	(0.191)	(0.100)	(0.188)	(0.099)						
2008	0.708	1.045	0.702	1.050						
	(0.126)	(0.102)	(0.125)	(0.102)						
2009	0.541	1.052	0.538	1.054						
	(0.099)	(0.108)	(0.098)	(0.108)						
2010	0.950	0.968	0.935	0.987						
	(0.156)	(0.094)	(0.152)	(0.095)						
2011	0.925	0.828	0.914	0.847						
	(0.149)	(0.083)	(0.146)	(0.085)						

[29] Taking 2007 as the reference year (since women would then be exposed to childbearing starting in 2008, the fertility models' reference year), we first model single-year effects (Table 4, Spec. 1) and then year effects controlling for age (baseline hazard; Table 4, Spec. 2). Since the results are similar, we discuss the latter.

Table 4: (Continued)

	Spec. 1		Spec. 2		Spec. 3		Spec. 4		Spec. 5	
	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18
2012	0.890	0.745	0.887	0.756						
	(0.136)	(0.077)	(0.136)	(0.077)						
2013	1.105	0.757	1.096	0.757						
	(0.169)	(0.079)	(0.168)	(0.078)						
2014	0.982	0.766	0.959	0.758						
	(0.150)	(0.074)	(0.147)	(0.073)						
2015	1.060	0.725	1.023	0.715						
	(0.160)	(0.070)	(0.155)	(0.069)						
2016	0.717	0.824	0.685	0.800						
	(0.139)	(0.079)	(0.133)	(0.076)						
Age in yr. (18 or less omit.)										
19			1.881	2.038	1.878	2.033	1.582	1.981	1.041	1.481
			(0.225)	(0.140)	(0.225)	(0.140)	(0.312)	(0.197)	(0.141)	(0.105)
20			2.630	2.575	2.643	2.582	2.392	2.602	1.388	1.903
			(0.314)	(0.178)	(0.315)	(0.179)	(0.444)	(0.258)	(0.195)	(0.137)
21			2.574	2.760	2.554	2.755	3.165	2.675	1.281	1.845
			(0.300)	(0.194)	(0.297)	(0.194)	(0.562)	(0.281)	(0.169)	(0.143)
22			3.769	3.654	3.764	3.654	3.472	3.040	1.807	2.352
			(0.424)	(0.241)	(0.422)	(0.241)	(0.662)	(0.303)	(0.239)	(0.182)
23			4.325	4.028	4.315	4.031	4.924	3.214	2.017	1.885
			(0.578)	(0.281)	(0.580)	(0.281)	(1.179)	(0.361)	(0.304)	(0.162)
24			4.188	4.000	4.156	3.996	3.395	3.094	1.932	1.811
			(0.485)	(0.302)	(0.482)	(0.301)	(0.677)	(0.352)	(0.268)	(0.161)
25			4.818	4.134	4.806	4.130	4.535	3.681	2.181	1.850
			(0.600)	(0.328)	(0.597)	(0.328)	(0.895)	(0.433)	(0.303)	(0.169)
26			3.941	3.782	3.922	3.761	3.836	3.093	1.764	1.670
			(0.530)	(0.335)	(0.526)	(0.334)	(0.833)	(0.414)	(0.261)	(0.167)
27			3.450	3.455	3.431	3.462	3.312	3.242	1.519	1.532
			(0.546)	(0.361)	(0.543)	(0.362)	(0.785)	(0.493)	(0.260)	(0.174)
28			2.775	2.366	2.762	2.372	1.878	1.814	1.208	1.050
			(0.498)	(0.268)	(0.494)	(0.268)	(0.653)	(0.336)	(0.232)	(0.129)
29			2.276	1.769	2.246	1.768	2.052	1.871	0.962	0.782
			(0.440)	(0.239)	(0.432)	(0.239)	(0.648)	(0.363)	(0.196)	(0.112)
30			2.657	2.266	2.642	2.274	2.625	1.104	1.133	1.007
			(0.552)	(0.338)	(0.547)	(0.339)	(0.834)	(0.246)	(0.245)	(0.155)
31			2.474	2.834	2.446	2.829	1.273	1.803	1.044	1.245
			(0.913)	(0.434)	(0.902)	(0.433)	(0.646)	(0.389)	(0.391)	(0.197)
32+			1.461	1.285	1.472	1.284	1.449	1.129	0.600	0.563
			(0.190)	(0.113)	(0.191)	(0.112)	(0.362)	(0.179)	(0.087)	(0.055)
Years (2000–2007 omit.)										
2008–2009					0.667	1.067	0.832	1.022	1.011	1.174
					(0.071)	(0.060)	(0.196)	(0.123)	(0.150)	(0.105)
2010–2011					1.000	0.928	0.982	0.702	1.199	0.961
					(0.088)	(0.052)	(0.193)	(0.084)	(0.155)	(0.085)
2012–2016					1.002	0.768	0.848	0.598	1.191	0.763
					(0.066)	(0.032)	(0.124)	(0.055)	(0.113)	(0.050)
Age and years int.										
2008–2009 # 19							1.643	1.028		
							(0.687)	(0.221)		

Table 4: (Continued)

	Spec. 1		Spec. 2		Spec. 3		Spec. 4		Spec. 5	
	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18
2008–2009 # 20							0.454	1.041		
							(0.200)	(0.227)		
2008–2009 # 21							0.440	0.861		
							(0.193)	(0.194)		
2008–2009 # 22							0.683	1.254		
							(0.282)	(0.271)		
2008–2009 # 23							0.531	0.972		
							(0.243)	(0.243)		
2008–2009 # 24							0.869	1.414		
							(0.387)	(0.345)		
2008–2009 # 25							0.723	0.949		
							(0.358)	(0.236)		
2008–2009 # 26							0.569	1.057		
							(0.314)	(0.288)		
2008–2009 # 27							1.016	1.161		
							(0.552)	(0.429)		
2008–2009 # 28							2.349	1.449		
							(1.520)	(0.492)		
2008–2009 # 29							0.532	0.412		
							(0.335)	(0.156)		
2008–2009 # 30							1.745	2.035		
							(1.025)	(0.925)		
2008–2009 # 31							1.640	1.290		
							(1.332)	(0.581)		
2008–2009 # 32+							0.510	0.771		
							(0.229)	(0.210)		
2010–2011 # 19							1.896	1.193		
							(0.678)	(0.258)		
2010–2011 # 20							0.631	1.154		
							(0.231)	(0.256)		
2010–2011 # 21							0.747	1.126		
							(0.271)	(0.253)		
2010–2011 # 22							1.420	1.276		
							(0.468)	(0.278)		
2010–2011 # 23							1.003	1.748		
							(0.385)	(0.382)		
2010–2011 # 24							1.161	1.751		
							(0.441)	(0.397)		
2010–2011 # 25							0.967	1.176		
							(0.384)	(0.321)		
2010–2011 # 26							0.974	2.000		
							(0.427)	(0.569)		
2010–2011 # 27							0.706	1.267		
							(0.369)	(0.417)		
2010–2011 # 28							2.348	1.686		
							(1.220)	(0.629)		
2010–2011 # 29							1.200	0.639		
							(0.767)	(0.273)		
2010–2011 # 30							0.128	4.042		
							(0.089)	(1.685)		

Table 4: (Continued)

	Spec. 1		Spec. 2		Spec. 3		Spec. 4		Spec. 5	
	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18
2010–2011 # 31							0.409	1.422		
							(0.385)	(0.631)		
2010–2011 # 32+							0.727	1.704		
							(0.355)	(0.428)		
2012–2016 # 19							1.037	1.018		
							(0.284)	(0.171)		
2012–2016 # 20							1.614	0.910		
							(0.427)	(0.152)		
2012–2016 # 21							0.717	1.151		
							(0.188)	(0.193)		
2012–2016 # 22							1.187	1.518		
							(0.313)	(0.233)		
2012–2016 # 23							0.821	1.695		
							(0.249)	(0.275)		
2012–2016 # 24							1.647	1.607		
							(0.442)	(0.287)		
2012–2016 # 25							1.295	1.430		
							(0.363)	(0.265)		
2012–2016 # 26							1.220	1.430		
							(0.369)	(0.299)		
2012–2016 # 27							1.235	1.074		
							(0.443)	(0.253)		
2012–2016 # 28							1.502	1.710		
							(0.661)	(0.458)		
2012–2016 # 29							1.387	1.191		
							(0.603)	(0.363)		
2012–2016 # 30							1.238	3.555		
							(0.573)	(1.203)		
2012–2016 # 31							4.667	3.092		
							(3.317)	(1.058)		
2012–2016 # 32+							1.328	1.333		
							(0.412)	(0.267)		
Ed. (less than sec. omit.)										
Secondary									1.267	1.200
									(0.156)	(0.095)
Higher									0.706	0.811
									(0.075)	(0.052)
Years and ed. int.										
2008–2009 # Secondary									0.530	0.992
									(0.154)	(0.152)
2008–2009 # Higher									0.463	0.941
									(0.110)	(0.119)
2010–2011 # Secondary									0.558	0.928
									(0.149)	(0.147)
2010–2011 # Higher									0.932	1.131
									(0.180)	(0.138)

Table 4: (Continued)

	Spec. 1		Spec. 2		Spec. 3		Spec. 4		Spec. 5	
	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18	JLMPS 2016	JPFHS 2017/18
2012–2016 # Secondary									0.607	0.717
									(0.105)	(0.092)
2012–2016 # Higher									1.079	1.300
									(0.164)	(0.117)
In school									0.256	0.379
									(0.031)	(0.025)
N obs.	42,785	112,481	42,785	112,481	42,785	112,481	42,785	112,481	42,785	112,481
N individuals	2,876	7,828	2,876	7,828	2,876	7,828	2,876	7,828	2,876	7,828

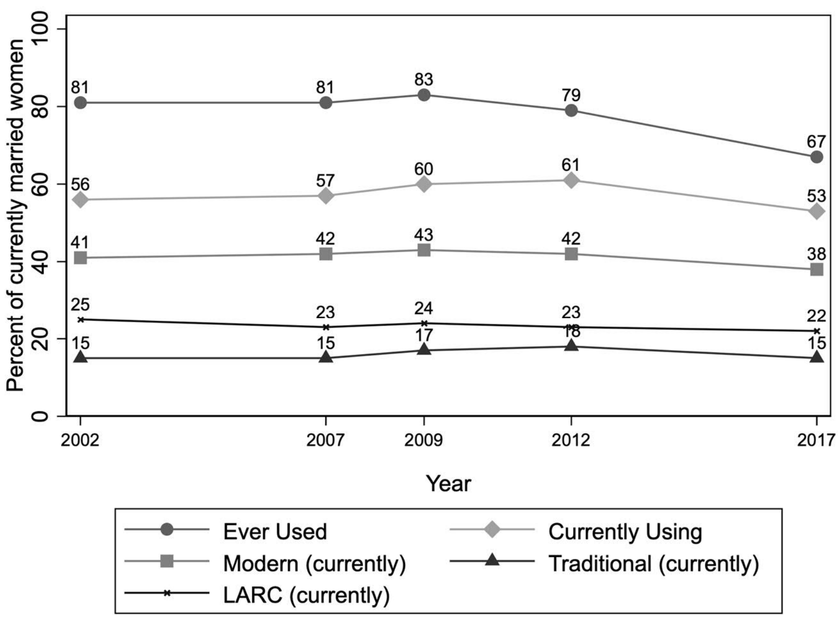
Sources: Authors' calculations based on JPFHS 2017/2018 and JLMPS 2016
Note: Standard errors clustered by woman.

To further explore shifts in marriage, we aggregated statistically distinct marriage periods of 2000–2007, 2008–2009, 2010–2011, and 2012–2016 (Table 4, Spec. 3). We tested for interactions between time and age and find no clear patterns – in other words, there are overall reduced hazards of marriage affecting all ages rather than specific age groups (Table 4, Spec. 4). We further tested models including controls for being in school (time varying) and the final education level attained, and interacted education levels and time periods (Table 4, Spec. 5). The JLMPS 2016 finds decreases in hazards of marriage for 2008–2009 for those with secondary and higher education (p-values 0.029 and 0.001), and this persists for those with secondary education for 2010–2011 and 2012–2016 (p-values 0.029 and 0.004). In the JPFHS 2017/2018 the main effect in 2012–2016 persists even after controlling for and interacting with education, but while those with a secondary education have a lower hazard of marriage with the 2012–2016 interaction, those with higher education have a higher hazard with the interaction. Thus, those with secondary education may be marrying later, contributing to any shifts in their period measures of fertility. Overall, rising ages at marriage may be one factor contributing to observed fertility declines.

6.3 Contraception

Although moderate degrees of marriage delay may be one factor contributing to resumed fertility decline, the analyses in Section 5 also demonstrated that marital fertility has declined. However, for contraception, we observe a contradictory result; fertility fell while contraceptive prevalence decreased. Figure 7 uses JPFHS data to track changes in contraceptive prevalence by method type from 2002–2017 for currently married women. The most recent data from JPFHS 2017/2018 showed sharp declines in the proportion of currently married women who have ever or were currently using contraception of any kind. Fewer women used modern methods in 2017 (38%) than in 2012 (42%), and traditional methods likewise declined from 18% to 15%. LARC use also declined slightly over time, from 24% in 2009 to 22% in 2017. We pool the JPFHS from 2002–2017 to examine whether changes over time in current modern contraceptive use are meaningful using a probit model. Compared to 2009, while all years have lower chances of contraception use, only in 2017 are differences substantial (Table 5, Spec. 1). Results remained nearly identical after controlling for age group and education level (Table 5, Spec. 2). Bietsch et al. (2020) analyze the JPFHS 2017/2018 contraceptive calendar and note some problems with the data quality, so we do not further explore the calendar data. However, health information system data on couple-years of protection from the Ministry of Health's database show a stall in it starting in 2012 and continuing through 2015 (Spindler et al. 2017) and 2018 (Bietsch et al. 2020). Although these data primarily cover the public sector, they corroborate the decline in contraceptive prevalence, given population growth.

Figure 7: Contraceptive use by method type over time (percentages), currently married Jordanian women, 2002–2017



Sources: Authors' calculations based on JPFHS 2002, 2007, 2009, 2012, and 2017/2018.

Table 5: Current modern contraception use models: Probit coefficients (standard errors)

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5
Round (2009 omit.)					
2002	–0.034	–0.030	–0.119	–0.076	–0.049
	(0.030)	(0.030)	(0.074)	(0.032)	(0.041)
2007	–0.010	–0.015	–0.230	–0.035	–0.337
	(0.030)	(0.030)	(0.076)	(0.032)	(0.344)
2012	–0.003	–0.010	–0.101	0.010	–0.290
	(0.031)	(0.031)	(0.078)	(0.033)	(0.347)
2017/18	–0.110	–0.111	–0.182	–0.028	–0.047
	(0.028)	(0.029)	(0.075)	(0.031)	(0.378)
Age group (25–29 omit.)					
15–19		–0.829	–0.978	0.323	0.341
		(0.081)	(0.180)	(0.101)	(0.102)
20–24		–0.263	–0.345	0.229	0.233
		(0.036)	(0.081)	(0.042)	(0.042)
30–34		0.136	0.024	–0.160	–0.156
		(0.030)	(0.072)	(0.034)	(0.034)
35–39		0.277	0.202	–0.170	–0.166
		(0.030)	(0.069)	(0.035)	(0.035)
40–44		0.264	0.155	–0.226	–0.221
		(0.032)	(0.073)	(0.037)	(0.037)
45–49		–0.070	–0.158	–0.574	–0.569
		(0.035)	(0.086)	(0.040)	(0.040)
Ed. (less than sec. omit.)					
Secondary		0.034	–0.072	0.116	0.115
		(0.027)	(0.064)	(0.028)	(0.028)
Higher education		–0.086	–0.082	0.154	0.154
		(0.022)	(0.051)	(0.024)	(0.024)
Round and age group int.					
2002 # 15–19			0.121		
			(0.236)		
2002 # 20–24			0.008		
			(0.111)		
2002 # 30–34			0.149		
			(0.095)		
2002 # 35–39			0.022		
			(0.096)		
2002 # 40–44			0.078		
			(0.103)		
2002 # 45–49			–0.067		
			(0.120)		
2007 # 15–19			0.340		
			(0.255)		
2007 # 20–24			0.246		
			(0.112)		
2007 # 30–34			0.246		
			(0.097)		
2007 # 35–39			0.101		
			(0.095)		

Table 5: (Continued)

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5
Round and age group int.					
2007 # 40–44			0.153		
			(0.100)		
2007 # 45–49			0.241		
			(0.117)		
2012 # 15–19			0.330		
			(0.253)		
2012 # 20–24			0.098		
			(0.117)		
2012 # 30–34			0.163		
			(0.100)		
2012 # 35–39			0.130		
			(0.098)		
2012 # 40–44			0.158		
			(0.103)		
2012 # 45–49			0.039		
			(0.118)		
2017/18 # 15–19			–0.165		
			(0.252)		
2017/18 # 20–24			0.026		
			(0.110)		
2017/18 # 30–34			0.021		
			(0.094)		
2017/18 # 35–39			0.090		
			(0.092)		
2017/18 # 40–44			0.129		
			(0.096)		
2017/18 # 45–49			0.126		
			(0.107)		
Round and ed. int.					
2002 # Secondary			0.208		
			(0.089)		
2002 # Higher education			0.032		
			(0.073)		
2007 # Secondary			0.188		
			(0.085)		
2007 # Higher education			0.091		
			(0.070)		
2012 # Secondary			0.043		
			(0.091)		
2012 # Higher education			–0.073		
			(0.071)		
2017/18 # Secondary			0.117		
			(0.082)		
2017/18 # Higher education			–0.038		
			(0.065)		

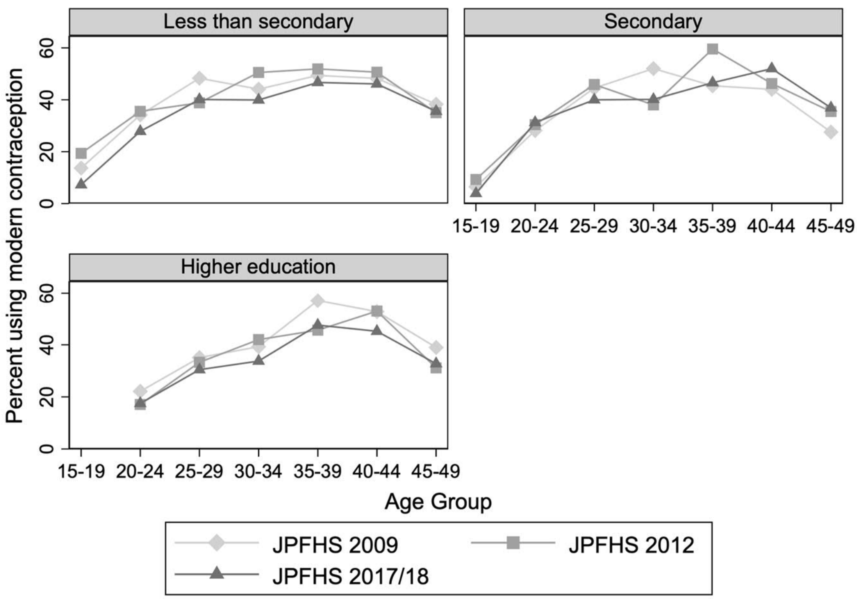
Table 5: (Continued)

	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 5
Parity (Marr. omit.)					
1st				1.879	1.716
				(0.151)	(0.274)
2nd				2.602	2.520
				(0.151)	(0.272)
3rd				2.864	2.701
				(0.153)	(0.271)
4th+				3.206	3.051
				(0.153)	(0.268)
Round and parity int.					
2002 # 1st					–0.192
					(0.117)
2002 # 2nd					–0.066
					(0.094)
2002 # 3rd					0.010
					(0.088)
2007 # 1st					0.386
					(0.361)
2007 # 2nd					0.209
					(0.354)
2007 # 3rd					0.413
					(0.352)
2007 # 4th+					0.283
					(0.347)
2012 # 1st					0.262
					(0.364)
2012 # 2nd					0.279
					(0.358)
2012 # 3rd					0.257
					(0.356)
2012 # 4th+					0.332
					(0.350)
2017/18 # 1st					0.116
					(0.391)
2017/18 # 2nd					–0.106
					(0.386)
2017/18 # 3rd					0.028
					(0.385)
2017/18 # 4th+					0.038
					(0.381)
Constant	–0.188	–0.240	–0.146	–2.908	–2.767
	(0.022)	(0.031)	(0.055)	(0.154)	(0.267)
N obs.	46,656	46,654	46,654	46,654	46,185

Note: In 2002, parity of married perfectly predicted not using contraception and the interaction between 2002 and parity 4th+ was therefore omitted.
Sources: Authors' calculations based on JPFHS 2002, 2007, 2009, 2012, and 2017/2018.

Figure 8 further investigates changes in the current use of modern contraceptive methods by education and age group for the various JPFHS, and we again observe lower rates of use in 2017, particularly for women ages 30 to 34. However, when rerunning our multivariate model for contraceptive use, with interactions for age and education with wave, there is not a clear pattern (no 2012 nor 2017 interactions are meaningfully different than 2009 reference main effects [p-values from 0.102–0.822]; Table 5, Spec. 3). Thus, there is no specific age or education group that appears to be driving the decline in contraceptive prevalence.

Figure 8: Modern contraception method current use by age and education (percentages), currently married Jordanian women, 2009–2017

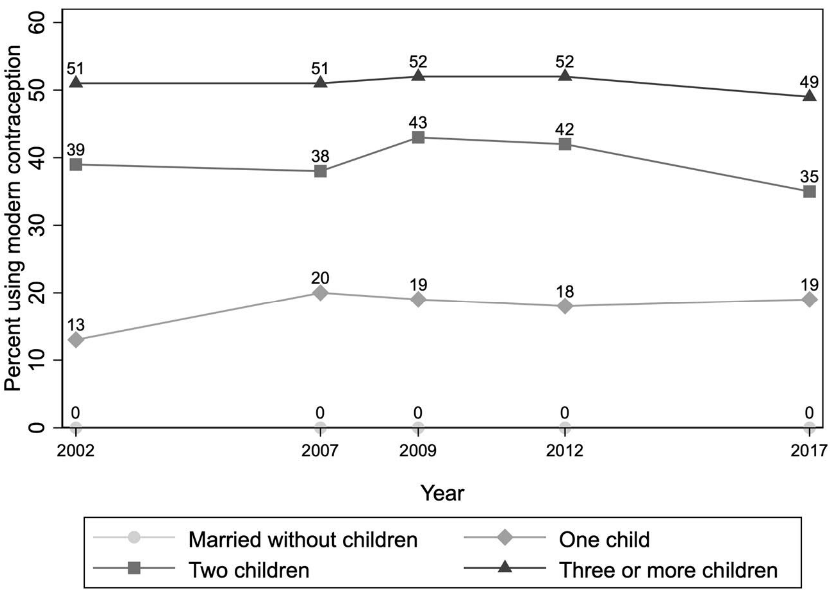


Sources: Authors' calculations based on JPFHS 2009, 2012, and 2017/2018.
Note: Very few women who have ever been married aged 15 to 19 have higher education, data suppressed.

Next, we investigated currently married women's modern contraceptive use by parity. Figure 9 shows that women in Jordan generally do not use contraception prior to their first birth (less than 1% of married women without children use contraception). There is some contraceptive use after one birth (e.g., 19% in 2017) or more commonly two (e.g., 35% in 2017), likely for spacing. Contraception is more common with three or more children (e.g., 49% in 2017), which given overall fertility rates is likely a combination of spacing and stopping.

The extent of modern contraceptive use within each parity is shown over time in Figure 9. There are no changes from 2009 to 2017 for contraceptive use at parities of zero or one. Contraceptive use fell from 43% to 35% for parities of 2 and 52% to 49% for parities of 3 or more. Moreover, when controlling for parity in our multivariate model (with age and education as well) the time period effect goes to nearly 0 (Table 5, Spec. 4). That the 2017 effect disappears after controlling for parity suggests that differences in parity – either through sampling variation or structural shifts in fertility – may have driven part of the overall contraceptive decline from 2012–2017.[30]

Figure 9: Modern contraception current use by parity (percentage), currently married Jordanian women, 2002–2017



Sources: Authors' calculations based on JPFHS 2002, 2007, 2009, 2012, and 2017/2018.

[30] There have not been meaningful changes over time in contraceptive use by parity (Table 5, Spec. 5).

6.4 Susceptibility to pregnancy

Given the contradictory trends between decline in marital fertility and lower rates of contraceptive use, we also explore changes in susceptibility to pregnancy, including current pregnancy, postpartum amenorrhea, sexual activity, spousal absence, divorce/separation, and declared infecundity (the earlier decomposition incorporated infecundability based on breastfeeding). Table 6 shows the share of currently married women who were currently pregnant and who were postpartum amenorrhoeic, and the combination of the two, by age group. The share currently pregnant was similar for each of the rounds of the JPFHS from 2009–2017 (10% to 12% overall). In fact, in the JPFHS 2017/2018 slightly more currently married women aged 25 to 29 were pregnant (19%) than in 2009 or 2012 (15% to 16%). As expected given declines in fertility, there was a declining trend in postpartum amenorrhea (e.g., the share of currently married women aged 20 to 24 who were postpartum amenorrhoeic declined from 13% in 2009 to 10% in 2012 and 8% in 2017). Thus, the shares currently not susceptible to pregnancy because they were pregnant or postpartum amenorrhoeic remained similar or decreased slightly over time, and this factor can be ruled out as a potential contributor to the fertility decline.

Table 6: Percentage of currently married Jordanian women pregnant or postpartum amenorrhoeic by age group, 2009–2017

	Pregnant			Postpartum amenorrhoeic			Total: Currently not susceptible to pregnancy		
Age group	**JPFHS 2009**	**JPFHS 2012**	**JPFHS 2017/18**	**JPFHS 2009**	**JPFHS 2012**	**JPFHS 2017/18**	**JPFHS 2009**	**JPFHS 2012**	**JPFHS 2017/18**
15–19	34	30	33	7	12	5	41	42	38
20–24	27	28	27	13	10	8	40	38	36
25–29	16	15	19	14	10	10	30	25	29
30–34	16	12	13	9	10	7	24	21	21
35–39	7	7	7	7	5	4	14	12	11
40–44	2	1	2	2	2	2	4	3	4
45–49	0	0	0	0	0	0	0	0	0
Total	12	10	11	8	6	5	19	16	16
N obs.	9,250	10,152	11,593	9,250	10,152	11,593	9,250	10,152	11,593

Sources: Authors' calculations based on JPFHS 2009, 2012, and 2017/2018.

Sexual activity, another dimension of susceptibility to pregnancy, also remained unchanged over time. Over the 2002–2017/2018 JPFHS waves, 92% to 93% of Jordanian women who had ever been married were sexually active within the four weeks preceding the survey. We explored whether there were changes in spousal absence or separation/divorce over time that might be contributing to fertility trends, but such events were rare. There was a slight increase in the share of women who had been married who were currently divorced, from 2% in 2002–2009 to 3% in 2012 and 4% in 2017. Less than 1% of women were separated in all rounds. Among currently married women aged 15 to 49, across the 2007–2017 JPFHS surveys, only 2% to 3% reported that they were not currently residing with their husband. One factor that did show a slight increase was declared infecundity. While in 2012, 3% of women who had been married declared themselves infecund, in 2017/2018 this had risen to 7%, with increases at all ages but particularly large relative increases at ages 25 to 39. Increases were also substantial among women with zero, one, and two children ever born, not just at higher parities. Given that the level of declared infecundability was still low, this is unlikely to be the driver of fertility trends. However, it may help explain some of the drop in contraceptive prevalence (Bietsch et al. 2020).

7. Future fertility prospects: Ideal number of children

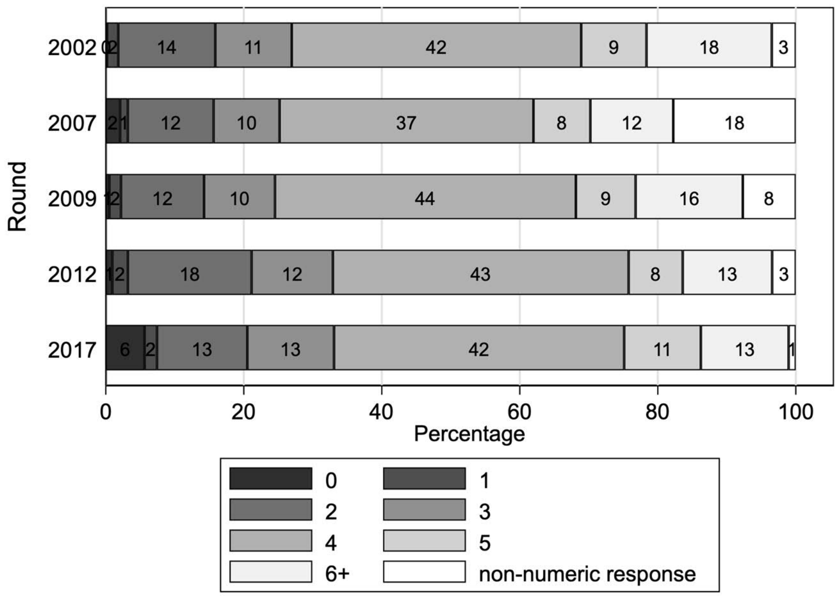
Finally, as one indicator of how fertility trends in Jordan may continue to develop, Figure 10 examines the ideal number of children of women who have been married using the JPFHS surveys. Although there was some fluctuation in the percentage of women giving nonnumeric responses (e.g., “as God wills it”) versus numeric ones, in general the ideal number of children was quite stable from 2002–2009, with a mode of four children (37% to 44%). This mode persisted in 2012 and 2017 (42% to 43%) but fewer women (13%) wanted six or more children as compared to 2002 (18%) or 2009 (16%). Moreover, more women wanted zero, one, or two children. In 2012 wanting two children increased (18% compared to 12% in 2009), while in 2017 the share wanting zero children rose from the past 0% to 2% up to 6%.

We also calculate a mean ideal number of children, imputing nonnumeric responses with the mean of the numeric responses. The mean ideal number of children was consistent during the period of fertility stall: 4.2 in 2002, 4.0 in 2007, and 4.2 again in 2009. The ideal number of children then fell somewhat to 3.9 in 2012 and 3.8 in 2017. Shifts in ideal numbers of children occurred across age groups, but nevertheless in 2017 remained at or above 3.4 children for all age groups. Additional analyses by education level showed decreases in ideal number of children across all levels over time and a fairly consistent ordering, with women with less than secondary education having the highest ideal number of children (3.9 in 2017), then those with higher education (3.7 in 2017), and lastly those with secondary education (3.6 in 2017). This pattern is consistent with the slight U shape in actual TFR observed by education in 2009, although not in the most recent JPFHS.

It is notable that the total drop in ideal fertility from 2009 (4.2) to 2017 (3.8) is a decrease of 0.4 births. The observed drop in TFR from 2009 to the JPFHS 2012 of 0.4

children tracked quite closely the decline in the ideal number of children (0.3) during the same period. The decline in TFR between the JLMPS 2010 and 2016 was also similar, at 0.5 children, to the decline in ideal number of children between 2009 and 2017. However, as compared to 2009, the observed drop in the TFR found in the JPFHS 2017/2018 of 1.2 children (from 3.8 to 2.6) is considerably greater than the decline in the reported ideal number of children. Particularly since all age groups in 2017/2018 reported an ideal number of children of at least 3.4, this suggests that the sharp decline in TFR in the most recent JPFHS may be a temporary phenomenon and that women's completed family size may converge toward ideals.

Figure 10: Ideal number of children, Jordanian women who have been married, 2002–2017



Sources: Authors' calculations based on JPFHS 2002, 2007, 2009, 2012, and 2017/2018.

8. Discussion and conclusions

Fertility stalls in countries that have begun their demographic transition can substantially alter population prospects. There is not a single clear cause of stalls in the literature; stalls may be driven by changes in a variety of proximate and background determinants. Jordan's fertility stall began in the late 1990s, and previous research had confirmed the stall continued, with TFR above 3.5, until at least 2008 (Cetorelli and Leone 2012). This paper updates our knowledge of fertility in Jordan, showing that while the stall continued until 2011, fertility decline in Jordan has resumed since 2012. This is the first evidence of a MENA country coming out of a fertility stall. Although our data sources disagree on the exact extent of the decline, they corroborate a clear decline in fertility across age groups, education levels, and parities.

As in other contexts, however, the causes of Jordan's fertility stall and resumed decline remain ambiguous. Our examination of the proximate determinants provides evidence of gradually rising ages at marriage and slight increases in the share of never being married at various ages. Yet there has not been a structural shift in marriage that would explain the resumption of fertility decline. The fairly stable ages at first marriage in Jordan may be due in part to the fact that the cost of marriage pressures are not as strong as in other countries in MENA; Jordan has a relatively active housing rental market that facilitates new couples obtaining housing (Assaad, Krafft, and Rolando 2017), and the real costs of marriage have declined over time (Salem 2012; Sieverding, Berri, and Abdulrahim 2019). However, it is notable that observed delays in marriage were specific to periods of economic downturn in our models.

Changes in susceptibility to pregnancy and abortion – to the extent that data on the latter are available – also cannot explain the recent decline in fertility. Most perplexingly, the decline in fertility has occurred despite a concurrent decline in contraceptive prevalence. While contraceptive mix was identified as a potential factor contributing to the fertility stall (Al Massarweh 2013; Spindler et al. 2017), there has been no shift toward more effective or longer-lasting methods as fertility has resumed declining, which suggests that method mix may not have played as important a role in the stall as previously hypothesized. Other countries, such as India, have recently registered a decline in TFR without an increase in contraceptive prevalence (International Institute for Population Sciences [IIPS] and ICF 2017). Our findings thus contribute to an emerging demographic puzzle that deserves further exploration.

An important dimension of the contraceptive use–resumed fertility decline puzzle in Jordan may be related to parity. We find evidence of lower hazards of transitioning to the next parity over time, which on the aggregate indicate longer average birth intervals. If Jordanian women are postponing births, this could cause a decline in TFR, particularly if some of these births become perpetually postponed (Timæus and Moultrie 2008). Although we did not find substantial shifts in the age structure of childbearing that would be indicative of a potentially temporary decline in TFR as women shift their childbearing to older ages, as was observed in numerous Western countries (Bongaarts and Sobotka 2012), it is possible that postponement is emerging as a factor in Jordanian fertility, and the TFR may recover if these births are later compensated for. Yet how births are being postponed in the absence of an increase in contraceptive prevalence continues to be a part of the puzzle. The decline in the hazard of a first birth in the JPFHS 2017/2018 is particularly perplexing and unusual in the regional context, given the near-zero rates of contraception prior to first birth. Yet as contraceptive patterns are highly parity driven overall, with low rates until after at least two births, shifts in parity may explain some of the observed decline in contraception overall through compositional effects.

Given these ambiguous results regarding the causes of Jordan's fertility stall and resumed decline, perhaps the best indication of future fertility trajectories in Jordan comes from data on fertility desires. Women's mean ideal number of children has declined somewhat since the 2000s but remains above realized fertility even when using the higher TFR estimates produced by the JLMPS and CSPD data. Fertility preferences at the individual level, particularly among young people, have been shown to be malleable and to respond both upward and downward to different forms of uncertainty (Trinitapoli and Yeatman 2018). This may be an important factor in Jordan, where young people face high unemployment rates and substantial economic uncertainty (Assaad, Krafft, and Keo 2019); indeed, where our data show delays in marriage, these corresponded with years of particular economic upheaval. Yet on the aggregate, fertility preferences tend to be a strong predictor of fertility levels, and widespread change in desired family size is an important precursor to fertility decline (Bongaarts and Casterline 2018). Our analyses and others' (Spindler et al. 2017) show that observed TFR has tracked closely with the ideal number of children in Jordan since the early 2000s. With the majority of women in 2017 still stating that they want four or more children, it is difficult to see the lower estimates of TFR, at or below three children per woman, persisting.

Anticipating Jordan's future fertility trends is further complicated by the lack of literature on fertility intentions in this or other MENA contexts. Expressed fertility intentions, in addition to being malleable, may reflect different underlying phenomena at different points in the life course. Whereas at some points in life women may have formed concrete fertility intentions, at others their survey responses regarding ideal number of children may be more reflective of general norms regarding family size (Bachrach and Morgan 2013). It is difficult to assess the degree to which the apparent three-to-four child norm in Jordan may be changing because little is known about how Jordanian women form and change their fertility intentions. This is an important area for future research in Jordan and other countries in the region that have experienced fertility stalls; projections of further fertility decline in these contexts may prove unrealistic if desired family size remains fairly constant. Additional data and research over the next several years should also shed further light on trends in contraceptive use, whether the current fertility trend represents postponement or stopping and ultimately whether resumed fertility decline in Jordan is a long-term trend.

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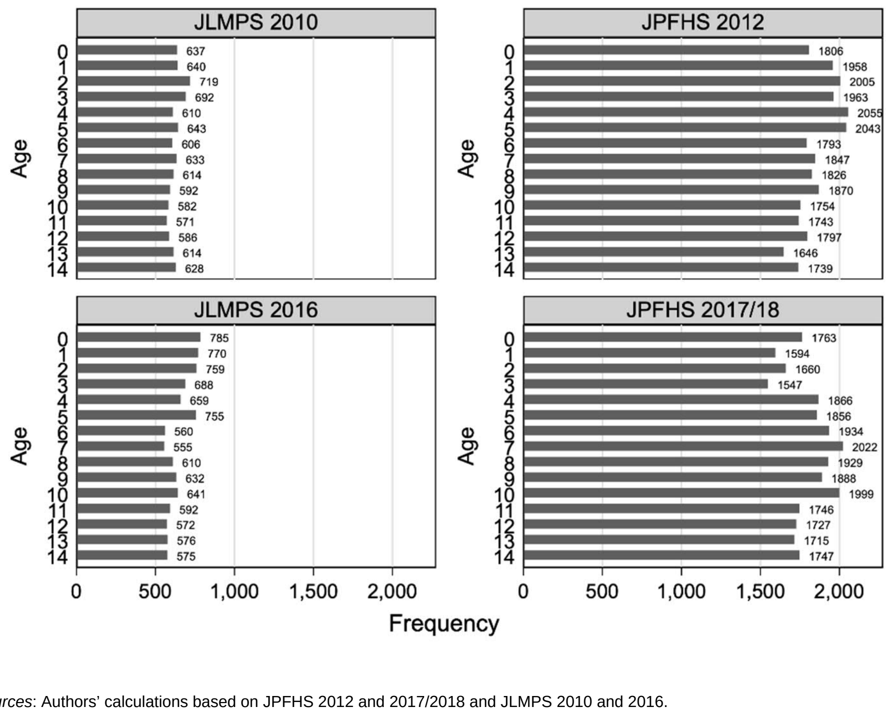
Appendix

Data quality

Claiming the existence of a fertility stall (and resumed decline, in our case) requires reliable and high-quality age and birth data. In Figure A-1, we show the frequency by single year of age of Jordanians ages 0 to 14 as a measure of age displacement, using the two most recent rounds of the JLMPS and JPFHS surveys. We do not observe substantial displacement of ages. The number of 5-year-old Jordanians in the JLMPS 2016 (N = 755) is relatively high compared to 4-year-olds (N = 659), but not by a magnitude that would substantially erode the quality of these data.

Figure A-1: Frequency of single years of age, Jordanians aged 0 to 14, JLMPS 2010, JLMPS 2016, JPFHS 2012, JPFHS 2017/2018



Sources: Authors' calculations based on JPFHS 2012 and 2017/2018 and JLMPS 2010 and 2016.
Note: Unweighted frequencies.

Next, we measure the level of birth date incompleteness and digit preference across rounds of the two surveys and present the results in Table A-1. Birth date incompleteness generally fell over time in the JPFHS; however, the birth date incompleteness of women who have been married doubled from 0.05% in 2012 to 0.10% in 2017/2018, admittedly a small decrease in data quality. Conversely, the JLMPS birth date incompleteness rose from 2010 to 2016 for both women and births but remained less than 2%. Digit preference, estimated using the Myers' blended index, is shown in Table A-1. The Myers' index can be interpreted as the percentage of women or births that would have to be shifted from one age to another to achieve a uniform age distribution (Pullum 2006). Across the board, digit preference was low, a Myers' index of 2% to 3% for women who have been married aged 15 to 44 and 1% to 2% for births aged 0 to 29.

Table A-1: Birth date incompleteness (percentage) and digit preference (Myers' index) for women who have been married and births, Jordanians

	Birth date incompleteness		Digit preference	
Survey	**Ever-married women (%)**	**Births (%)**	**Myers' index ever-married women 15–44**	**Myers' index births 0–29**
JPFHS 2002	**3.80**	**1.66**	**1.82**	**1.59**
JPFHS 2007	**0.82**	**0.49**	**2.64**	**1.07**
JPFHS 2009	**0.27**	**0.36**	**2.64**	**1.55**
JPFHS 2012	**0.05**	**0.04**	**2.81**	**1.19**
JPFHS 2017/18	**0.10**	**0.01**	**3.21**	**1.00**
JLMPS 2010	**0.38**	**0.32**	**2.14**	**0.83**
JLMPS 2016	**1.16**	**1.44**	**2.32**	**1.30**

Sources: Authors' calculations based on the JPFHS individual and birth data files and JLMPS 2010 and 2016.
Notes: Unweighted frequencies. For birth date incompleteness, women who have married are ages 15 to 49 and births are all births.